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SYNTHETIC FUEL LOAN GUARANTEES

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HEARINGS

BEFORE THE

SUBCOMMITTEE ON ENERGY AND POWER

OF THE

COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE

HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS

SECOND SESSION

ON

H.R. 12112

A BILL TO PROVIDE ADDITIONAL ASSISTANCE TO THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION FOR THE ADVANCEMENT OF NONNUCLEAR ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION

MAY 25, 26, 27, JUNE 6, AND AUGUST 30, 1976

Serial No. 94–151

Printed for the use of the
Committee on Interstate and Foreign Commerce

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Atlantic Richfield Co., Hollis M. Dole, Washington representative.
British Gas Corp., George Percival, U.S. resident director of International Gas Consultancy, Ltd., a subsidiary.
Brookings Institute, Barry Bosworth, Ph. D., research associate.
Colorado Open Space Council, Carolyn Ruth Johnson, chairman, mining workshop.
Dillon, Read & Co., Inc.:
- McClurg, Michael R., vice president.
- Willott, D. Laird, senior vice president.

Energy Research and Development Administration:
- Fri, Robert W., Deputy Administrator.
- Johnson, Harry, Ph. D., Director, Planning Staff.
- LaGassie, Roger W. A., Ph. D., Assistant Administrator for Planning and Analysis.
- McCormick, William T., Ph. D., Director, Office of Commercialization.
- Rawicz, Leonard, Deputy General Counsel.
- Rial, George, Director, Division of Demonstration Projects.
- Topper, Leonard, Ph. D., Office of Commercialization.
- White, Philip C., Ph. D., Assistant Administrator for Fossil Energy.
- Zahradnik, Raymond, Ph. D., Director, Division of Coal Conversion.

Environmental Policy Center, John L. McCormick, Washington representative.
Federal Energy Administration, John A. Hill, Deputy Administrator.
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- Smith, Commissioner Don S.
- Wahrhaftig, Leon, manager, Systems Operation Division, Bureau of Natural Gas.

Fertilizer Institute, The, Edwin M. Wheeler, president.
Fusion Energy Corp., Princeton, N.J., Marilyn Romans, director of corporate planning.
Koppers Co.:
- Byrom, Fletcher L., chairman of the board.
- Keeling, Thomas, vice president and director.

Public Interest Research Group, Gary DeLoss, attorney.
Seattle, Wash., City of, Kathy C. Shreve, acting project director, Solid Waste Ammonia Project, Office of Management and Budget.
Stanford Research Institute, Edward G. Cazalet, Ph. D., manager, Decision Analysis—Energy.
Stanford Western Energy Policy Center, Thomas B. Neville, director.
Sunoco Energy Development Co., Robert McClements, Jr., president.
Texas Eastern Transmission Corp., J. E. Bixby, vice president and chief financial officer.
U.S. General Accounting Office:
- Canfield, Monte, Jr., Director, Division of Energy and Minerals.
- Carlone, Ralph, Assistant Director, Audit, ERDA site.
- Hughes, Phillip S., Assistant Comptroller of the United States.
- McGee, William, Audit Manager, ERDA site.

Wisconsin, State of, Charles J. Cicchetti, Director, Office of Emergency Energy Assistance.

SYNTHETIC FUEL LOAN GUARANTEES

TUESDAY, MAY 25, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D.C.

The subcommittee met at 1:30 p.m., pursuant to notice, in room 2123, Rayburn House Office Building, Hon. John D. Dingell, chairman, presiding.

Mr. DINGELL. The subcommittee will come to order.

This is the beginning of the hearings of the Subcommittee on Energy and Power on H.R. 12112, legislation to provide loan guarantees for production of synthetic fuels. This matter has been sequentially referred by the Speaker to the committee as well as to the Committee on Banking and Currency.

This afternoon the subcommittee will hear from government witnesses and from private citizens regarding the content of the legislation.

The subcommittee intends to try and gather the facts necessary to arrive at judgments which will enable us to make proper recommendations to the House with regard to content, technical drafting, and jurisdictional concerns.

The Chair's more lengthy statement will, without objection, be inserted into the record.

[Chairman Dingell's prepared statement follows:]

OPENING STATEMENT OF HON. JOHN D. DINGELL, CHAIRMAN, SUBCOMMITTEE ON ENERGY AND POWER

This afternoon the Subcommittee on Energy and Power is beginning three days of hearings on H.R. 12112, dealing with loan guarantees for the demonstration and commercialization of new energy technologies.

This bill, after being reported out of the Science and Technology Committee was then sequentially referred to both this Committee and to the Committee on Banking, Currency and Housing. Under the terms of this referral, we must report back to the House on this legislation not later than June 10, 1976. I believe we have our work cut out for us.

As Chairman of the Energy and Power Subcommittee, I have spent a good part of these last two years examining this Nation's energy situation and, while I share in the general enthusiasm for broadening our energy resource base, I must admit that I have some questions concerning how we go about it. Utilizing the mechanism of Federal subsidy to engage these problems is of great interest to me particularly when, as indicated in testimony by Dr. Robert Seamans, the ERDA Administrator, this is only the beginning of a much larger program. I think it is of vital importance to make sure that we get off on the right foot and thus avoid perpetuating any first errors.

Secondary and tertiary recovery of oil and gas, solar and geothermal energy technologies and intensified conservation efforts have much to offer to this Na-

tion's energy resource pool. Do we know how sound our present system of priorities for each of these activities is? How then should we evaluate the effectiveness of the huge sums we are talking about in H.R. 12112?

I should like to note at this time, some of the questions brought up in the "Dissenting Views" of the Science and Technology Committee Report on this bill. My Colleagues, Messrs. Ottinger, Hechler, Blouin and Hayes have expressed some concern as to the shape this loan guarantee program has taken. In this dissenting views they have called this program uneconomic and declared that it would distort energy priorities in favor of high capital, high risk options to the detriment of conservation and renewable resources. They a'so expressed concern that this is merely another camel's nose under the tent with regard to the Rockefeller $100 billion Energy Independence Authority, particularly since the House voted down a similar program offered as Section 103 of H.R. 3474 last year. These are all important questions which, I trust, will receive consideration during our present set of hearings.

I should like to offer one thought before we begin hearing testimony. This country and its economy were in a large part founded on the idea of risk and reward. In the special case of the synfuels loan guarantee program, we ought to keep in mind that the public is one of the parties at risk and that a successful venture ought to attempt to benefit the taxpayer as well as the large companies which have recently registered record profits and whose loans would, in this case, be guaranteed by the taxpayer.

With that thought, let us begin the task at hand. This afternoon we have both public and Administration witnesses. Gentlemen, let me welcome you all.

[The text of H.R. 12112, together with departmental reports thereon, follow:]

94TH CONGRESS
2D SESSION

H. R. 12112

[Report No. 94–1170, Part I]

IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 25, 1976

Mr. TEAGUE introduced the following bill; which was referred to the Committee on Science and Technology

MAY 15, 1976

Reported with an amendment, referred to the Committee on Banking, Currency and Housing and to the Committee on Interstate and Foreign Commerce for a period ending not later than June 10, 1976, for concurrent consideration of such provisions of the bill as fall within the jurisdictions of those committees under Rule X, clause 1(d) and clause 1(l), respectively, and ordered to be printed

[Strike out all after the enacting clause and insert the part printed in italic]

JUNE 1, 1976

Referral to the Committee on Banking, Currency and Housing and to the Committee on Interstate and Foreign Commerce extended for an additional period ending not later than June 18, 1976, and referred to the Committee on Ways and Means for a period ending not later than June 18, 1976, for concurrent consideration of such provisions of the bill as fall within the jurisdiction of that committee under Rule X, clause 1(v)

A BILL

To provide additional assistance to the Energy Research and Development Administration for the advancement of nonnuclear energy research, development, and demonstration.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, ~~That section 7(a) of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5906) is amended—~~

~~(1) by striking out "and" after the semicolon at the end of paragraph (5),~~

~~(2) by striking out the period at the end of paragraph (6) and inserting in lieu thereof "; and", and~~

~~(3) by adding at the end thereof the following new paragraph:~~

~~"(7) Federal loan guarantees and commitments thereof as provided in section 17.".~~

~~(b) The Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5901 et seq.) is further amended by adding at the end thereof the following new section:~~

~~"LOAN GUARANTEES FOR COMMERCIAL DEMONSTRATION FACILITIES~~

~~"SEC. 17. (a) It is the purpose of this section—~~

~~"(1) to assure adequate Federal support to foster a commercial demonstration program to produce synthetic fuels from coal, oil shale, and other domestic resources, to employ biomass and renewable and geothermal energy sources to produce synthetic fuels and other desirable forms of energy on a commercial scale, and to assure the availability of energy efficient industrial equipment and facilities;~~

~~"(2) to authorize loan guarantees for the construction and startup and related costs of commercial demonstration facilities (A) for the conversion of domestic coal, oil shale, biomass, and other domestic resources into synthetic fuels; (B) for the commercial demonstra-~~

~~tion of synthetic fuels and other desirable forms of energy from renewable and geothermal sources; and (C) for the commercial demonstration of energy efficient industrial equipment and facilities; and~~

~~"(3) to gather information about the technological, economic, environmental, and social costs, benefits, and impacts of such commercial demonstration facilities.~~

~~"(b) (1) The Administrator is authorized, in accordance with such rules and regulations as he shall prescribe after consultation with the Secretary of the Treasury, to guarantee and to make commitments to guarantee, in such manner and subject to such conditions (not inconsistent with the provisions of this Act) as he deems appropriate, the payment of interest on, and the principal balance of, bonds, debentures, notes, and other obligations issued by or on behalf of any borrower for the purpose of (A) financing the construction and startup costs of commercial demonstration facilities for the conversion of domestic coal, oil shale, biomass, and other domestic resources into synthetic fuels, including, but not limited to, such synthetic fuels from coal as high Btu gaseous fuels compatible for mixture and transportation with natural gas by pipeline; gaseous, liquid, and solid fuels suitable for boiler use in compliance with applicable environmental requirements; liquid fuels for transportation uses; and petrochemicals: *Provided*, That no oil shale commercial demonstration facility receiving a loan guarantee under this section~~

~~shall be larger than is necessary, in the judgment of the Administrator, to demonstrate the commercial viability of the process, taking into account such considerations as water usage, profitability levels, environmental effects, waste disposal, labor conditions, health and safety, and the socioeconomic impacts on local communities; (B) financing the construction and startup costs of commercial demonstration facilities to generate desirable forms of energy (including synthetic fuels) in commercial quantities from direct solar, wind, ocean thermal gradient, bioconversion, or other renewable energy resources; (C) financing the purchase, construction, installation, and startup costs of energy-efficient industrial equipment and facilities for commercial demonstration; and (D) further implementing the financing of geothermal resource development under the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101 et seq.). The outstanding indebtedness guaranteed and committed to be guaranteed under clauses (A), (B), and (C) of this paragraph (shall at no time exceed $2,000,000,000 or the amount approved in subsequent authorization acts). With regard to such limitation the Administrator shall make no new commitments for loan guarantees after June 30, 1987, and shall furnish no guarantees after June 30, 1990.~~

~~Loan guarantees for geothermal resource development under clause (D) of this paragraph shall be carried out pursuant to the authority~~ and provisions of the ~~Geothermal Energy Research, Development, and Demonstration Act of 1974: *Provided*, That paragraphs (2) and (4) of this subsection, and subsections (g)(2), (h), (j), (n), and (v), of this section, shall also apply to such guarantees: *Provided further*, That the limitations in section 201(c) of the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1141(c)) shall not apply to such guarantees.~~

~~"(2) An applicant for any guarantee under this section shall provide information to the Administrator in such form and with such content as the Administrator deems necessary.~~

~~"(3) Prior to issuing any guarantee under this section the Administrator shall obtain the concurrence of the Secretary of the Treasury with respect to the timing, interest rate, and substantial terms and conditions of such guarantee.~~

~~"(4) The full faith and credit of the United States is pledged to the payment of all guarantees issued under this section with respect to principal and interest.~~

~~"(c) The Administrator, with due regard for the need for competition, shall guarantee or make a commitment to guarantee any obligation under subsection (b) only if—~~

"(1) the Administrator is satisfied that the financial assistance applied for is necessary to encourage financial participation;

"(2) the amount guaranteed does not exceed 75 per centum of the total cost of the commercial demonstration facility, as determined by the Administrator: *Provided*, That the amount guaranteed may not exceed 90 per centum of the total cost of the commercial demonstration facility during the period of construction and startup;

"(3) the Administrator has determined that there will be a continued reasonable assurance of full repayment;

"(4) the obligation is subject to the condition that it not be subordinated to any other financing;

"(5) the Administrator has determined, taking into consideration all available forms of assistance under this section and other Federal statutes, that the impacts directly resulting from the proposed commercial demonstration facility have been fully evaluated by the borrower, the Administrator, and others, and that effective steps have been taken or are planned to be taken in a timely manner to finance community planning and development costs directly resulting from such facility

~~under this section, under other provisions of law, or by other means; and~~

~~"(6) the maximum maturity of the obligation does not exceed thirty years, or 90 per centum of the projected useful economic life of the physical assets of the commercial demonstration facility covered by the guarantee, whichever is less, as determined by the Administrator.~~

~~"(d) Prior to submitting a report to Congress pursuant to subsection (m) of this section on each guarantee, the Administrator shall request from the Attorney General written views, comments, and recommendations concerning the impact of such guarantee or commitment on competition and concentration in the production of energy and give due consideration to views, comments, and recommendations received: *Provided*, That if the Attorney General within sixty days recommends against making such guarantee or commitment, the Administrator shall not do so unless he determines in writing that such guarantee or commitment is in the national interest.~~

~~"(e) (1) As soon as the Administrator knows the geographic location of a proposed facility for which a guarantee or a commitment to guarantee is sought under this section, he shall inform the Governor of the State, and officials of each political subdivision and Indian tribe, as appropriate, in~~

which the facility would be located or which would be impacted by such facility. The Administrator shall not guarantee or make a commitment to guarantee under subsection (b) of the Governor of the State in which the proposed facility would be located recommends that such action not be taken unless the Administrator finds that there is an overriding national interest in taking such action in order to achieve the purpose of this section. If the Administrator decides to guarantee or make a commitment to guarantee despite a Governor's recommendation not to take such action, the Administrator shall communicate, in writing, to the Governor reasons for not concurring with such recommendation. The Administrator's decision, pursuant to this subsection, shall be final unless determined upon judicial review to be arbitrary and capricious. Such review shall take place in the United States court of appeals for the circuit in which the State involved is located, upon application made within ninety days from the date of such decision. The Administrator shall, by regulation, establish procedures for review of, and comment on, the proposed facility by States, local political subdivisions, and Indian tribes which may be impacted by such facility, and the general public.

"(2) The Administrator shall review and approve the plans of the applicant for the construction and operation of any commercial demonstration and related facilities con-

~~structed or to be constructed with assistance under this section. Such plans and the actual construction shall include such monitoring and other data gathering costs associated with such facility as are required by the comprehensive plan and program under this section. The Administrator shall determine the estimated total cost of such demonstration facility, including, but not limited to, construction costs, startup costs, costs to political subdivisions and Indian tribes by such facility, and costs of any water storage facilities needed in connection with such demonstration facility, and determine who shall pay such costs.~~

~~"(f) Except in accordance with reasonable terms and conditions contained in the written contract of guarantee, no guarantee issued or commitment to guarantee made under this section shall be terminated, canceled, or otherwise revoked. Such a guarantee or commitment shall be conclusive evidence that the underlying obligation is in compliance with the provisions of this section and that such obligation has been approved and is legal as to principal, interest, and other terms. Subject to the conditions of the guarantee or commitment to guarantee, such a guarantee shall be incontestable in the hands of the holder of the guaranteed obligation, except as to fraud or material misrepresentation on the part of the holder.~~

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"(g) (1) If there is a default by the borrower, as defined in regulations promulgated by the Administrator and in the guarantee contract, the holder of the obligation shall have the right to demand payment of the unpaid amount from the Administrator. Within such period as may be specified in the guarantee or related agreements, the Administrator shall pay to the holder of the obligation the unpaid interest on and unpaid principal of the guaranteed obligation as which the borrower has defaulted, unless the Administrator finds that there was no default by the borrower in the payment of interest or principal or that such default has been remedied. Nothing in this section shall be construed to preclude any forebearance by the holder of the obligation for the benefit of the borrower which may be agreed upon by the parties to the guaranteed obligation and approved by the Administrator.

"(2) If the Administrator makes a payment under paragraph (1) of this subsection or section 202(b) of the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1142(b)), the Administrator shall be subrogated to the rights of the recipient of such payment as specified in the guarantee or related agreements including, where appropriate, the authority (notwithstanding any other provision of law) to complete, maintain, operate, lease, or otherwise dispose of any property acquired pursuant to such guarantee or related agreements, or to per-

mit the borrower, pursuant to an agreement with the Administrator, to continue to pursue the purposes of the commercial demonstration facility if the Administrator determines that this is in the public interest.

"(3) In the event of a default on any guarantee under this section, the Administrator shall notify the Attorney General, who shall take such action as may be appropriate to recover the amounts of any payments made under paragraph (1) (including any payment of principal and interest under subsection (h) from such assets of the defaulting borrower as are associated with the commercial demonstration facility, or from any other security included in the terms of the guarantee.

"(4) For purposes of this section, patents and technology resulting from the commercial demonstration facility shall be treated as project assets of such facility in accordance with the terms and conditions of the guarantee agreement. Furthermore, the guarantee agreement shall contain a provision specifying that patents, technology, and other proprietary rights which are necessary for the completion or operation of the commercial demonstration facility shall be available to the Government and its designees on equitable terms, including due consideration to the amount of the Government's default payments.

"(h) With respect to any obligation guaranteed under this section, the Administrator is authorized to enter into a contract to pay, and to pay, holders of the obligation, for and on behalf of the borrower, from the fund established by this section or from the Geothermal Resources Development Fund, as applicable, the principal and interest payments which become due and payable on the unpaid balance of such obligation if the Administrator finds that—

"(1) the borrower is unable to meet such payments and is not in default; it is in the public interest to permit the borrower to continue to pursue the purposes of such demonstration facility; and the probable net benefit to the Federal Government in paying such principal and interest will be greater than that which would result in the event of a default;

"(2) the amount of such payment which the Administrator is authorized to pay shall be no greater than the amount of principal and interest which the borrower is obligated to pay under the loan agreement; and

"(3) the borrower agrees to reimburse the Administrator for such payment on terms and conditions, including interest, which are satisfactory to the Administrator.

"(i) Regulations required by this section shall be issued within one hundred and eighty days after enactment of this

section, except as provided in subsection (t) of this section. All regulations under this section and any amendments thereto shall be issued in accordance with section 553 of title 5, of the United States Code.

"(j) The Administrator shall charge and collect fees for guarantees of obligations authorized by clauses (A) (except with respect to community planning and development), (B), (C), and (D) of subsection (b) (1), in amounts sufficient in the judgment of the Administrator to cover the applicable administrative costs and probable losses on guaranteed obligations, but in any event the portion of the fee attributable to providing for probable losses shall not exceed 1 per centum per annum of the outstanding indebtedness covered by the guarantee.

"(k) (1) In accordance with such rules and regulations as the Administrator in consultation with the Secretary of the Treasury shall prescribe, and subject to such terms and conditions as he deems appropriate, the Administrator is authorized, for the purpose of financing essential community development and planning which directly result from, or are necessitated by, one or more commercial demonstration facilities assisted under this section to—

"(A) guarantee and make commitments to guarantee the payment of interest on, and the principal balance

of, obligations for such financing issued by eligible States, political subdivisions, or Indian tribes,

"(B) guarantee and make commitments to guarantee the payment of taxes imposed on such commercial demonstration facilities by eligible non-Federal taxing authorities which taxes are earmarked by such authorities to support the payment of interest and principal on obligations for such financing, and

"(C) require that the applicant for assistance for a commercial demonstration facility under this section advance sums to eligible States, political subdivisions, and Indian tribes to pay for such financing of such development and planning: *Provided*, That the State, political subdivision, or Indian tribe agrees to provide tax abatement credits over the life of the facilities for such payments by such applicant.

"(2) Prior to issuing any guarantee under this subsection, the Administrator shall obtain the concurrence of the Secretary of the Treasury with respect to the timing, interest rate, and substantial terms and conditions of such guarantee.

"(3) The total amount guaranteed under paragraph (1) of this subsection shall not exceed $350,000,000 which shall be included in the limitation on outstanding indebtedness set forth in subsection (b) (1) of this section.

"(4) In the event of any default by the borrower in the payment of taxes guaranteed by the Administrator under this subsection, the Administrator shall pay out of the fund established by this section such taxes at the time or times they may fall due, and shall be subrogated to the rights of such taxing authority.

"(5) If after consultation with the State, political subdivision, or Indian tribe, the Administrator finds that the financial assistance programs of paragraph (1) of this subsection will not result in sufficient funds to carry out the purposes of this subsection, then the Administrator may—

"(A) make direct loans to the eligible States, political subdivisions, or Indian tribes for such purposes: *Provided*, That such loans shall be made on such reasonable terms and conditions as the Administrator shall prescribe: *Provided further*, That the Administrator may waive repayment of all or part of a loan made under this paragraph, including interest, if the State or political subdivision or Indian tribe involved demonstrates to the satisfaction of the Administrator that due to a change in circumstances there will be net adverse impacts resulting from such demonstration facility that would probably cause such State, subdivision, or tribe to default on the loan; or

"~~(B) require that any community development and planning costs which are associated with, or result from, such commercial demonstration facility and which are determined by the Administrator to be appropriate for such inclusion shall be included in the total costs of the commercial demonstration facility.~~

"~~(6) The Administrator is further authorized to make grants to States, political subdivisions, or Indian tribes for studying and planning for the potential economic, environmental, and social consequences of commercial demonstration facilities.~~

"~~(7) At any time the Administrator may, with the concurrence of the Secretary of the Treasury, redeem, in whole or in part, out of the fund established by this section, the debt obligations guaranteed or the debt obligations for which tax payments are guaranteed under this subsection.~~

"~~(8) When one or more States, political subdivisions, or Indian tribes would be eligible for assistance under this subsection but for the fact that construction and operation of the commercial demonstration facilities occurs outside its jurisdiction, the Administrator is authorized to provide, to the greatest extent possible, arrangements for equitable sharing of such assistance.~~

"~~(9) Such amounts as may be necessary for direct loans and grants pursuant to this subsection shall be available as~~

~~provided in annual authorization Acts and shall be requested in fiscal year 1977, and in subsequent fiscal years.~~

~~"(10) The Administrator, if appropriate, shall provide assistance in the financing of up to 100 per centum of the costs of the required community development and planning pursuant to this subsection.~~

~~"(l) (1) The Administrator is directed to submit a report to the Congress within one hundred and eighty days after the enactment of section setting forth his recommendations on the best opportunities to implement a program of Federal financial assistance with the objective of demonstrating production and conservation of energy.~~

~~"(2) The report submitted under paragraph (1) of this subsection shall include a comprehensive plan and program to acquire information and evaluate the environmental, economic, social, and technological impacts of the demonstration program under this section. In preparing such a comprehensive plan and program, the Administrator shall consult with the Environmental Protection Agency, the Federal Energy Administration, the Department of Housing and Urban Development, the Department of the Interior, and the Department of Agriculture.~~

~~"(3) The comprehensive plan and program described in paragraph (2) shall include, but not be limited to—~~

"(A) information about potential commercial demonstration facilities proposed in the program under this section;

"(B) any significant adverse impacts which may result from any activity included in the program;

"(C) proposed regulations required to carry out the purposes of this section;

"(D) a list of Federal agencies, governmental entities, and other persons that will be consulted or utilized to implement the program; and

"(E) methods and procedures by which the information gathered under the program will be analyzed and disseminated.

"(4) The report required under paragraph (1) of this subsection shall be updated and submitted to the Congress at least annually for the duration of the program under this section.

"(m) Prior to issuing any guarantee or commitment to guarantee pursuant to subsection (b) of this section, the Administrator shall submit to the Committee on Science and Technology of the House of Representatives and the Committee on Interior and Insular Affairs of the Senate a full and complete report on the proposed commercial demonstration facility and such guarantee. Such guarantee or commitment to guarantee shall not be finalized under the au-

thority granted by this section prior to the expiration of sixty calendar days (not including any day on which either House of Congress is not in session because of an adjournment of more than three calendar days to a day certain) from the date on which such report is received by such committees: *Provided*, That, where the cost of such commercial demonstration facility exceeds $500,000 such guarantee or commitment to guarantee shall not be finalized if prior to the close of such ninety day period either House passes a resolution stating in substance that such House does not favor the making of such guarantee or commitment.

"(n) (1) There is hereby created within the Treasury a separate fund (hereafter in this section called the 'fund') which shall be available to the Administrator without fiscal year limitation as a revolving fund for the purpose of carrying out the program authorized by clauses (A), (B), and (C) of subsection (b) (1) and subsections (g), (h), and (k) of this section. The Geothermal Resources Development Fund established by the Geothermal Energy Research, Development, and Demonstration Act of 1974 shall be available for the purpose of carrying out the geothermal loan guarantee program as established by that Act and as further implemented by this section.

"(2) There are authorized to be appropriated to the fund from time to time such amounts as may be necessary

~~to carry out the purposes of the applicable provisions of this section, including, but not limited to, the payments of interest and principal and the payment of interest differentials and redemption of debt. All amounts received by the Administrator as interest payments or repayments of principal on loans which are guaranteed under this section, fees, and any other moneys, property, or assets derived by him from operations under this section shall be deposited in the fund or in the Geothermal Resources Development Fund, as applicable.~~

~~"(3) All payments on obligations, appropriate expenses (including reimbursements to other government accounts), and repayments pursuant to operations of the Administrator under this section shall be paid from the fund subject to appropriations or from the Geothermal Resources Development Fund, as applicable. If at any time the Administrator determines that moneys in the fund exceed the present and reasonably foreseeable future requirements of the fund, such excess shall be transferred to the general fund of the Treasury.~~

~~"(4) If at any time the moneys available in the fund or in the Geothermal Resources Development Fund are insufficient to enable the Administrator to discharge his responsibilities as authorized by subsections (b)(1), (g), (h), and (k) of this section, or the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C.~~

~~1101), as the case may be, the Administrator shall issue to the Secretary of the Treasury notes or other obligations in such forms and denominations, bearing such maturities, and subject to such terms and conditions as may be prescribed by the Secretary of the Treasury. Redemption of such notes or obligations shall be made by the Administrator from appropriations or other moneys available under paragraph (2) of this subsection for loan guarantees authorized by clauses (A), (B), and (C) of subsection (b) (1) and subsections (g), (h), and (k) of this section, and from appropriations or other moneys available under section 204 of the Geothermal Energy Research, Development, and Demonstration Act of 1974 for loan guarantees described in clause (D) of subsection (b) (1) of this section. Such notes or other obligations shall bear interest at a rate determined by the Secretary of the Treasury, which shall be not less than a rate determined by taking into consideration the average market yield on outstanding marketable obligations of the United States of comparable maturities during the month preceding the issuance of the notes or other obligations. The Secretary of the Treasury shall purchase any notes or other obligations issued hereunder and for that purpose he is authorized to use as a public debt transaction the proceeds from the sale of any securities issued under the Second Liberty Bond Act; and the purpose for which securities may~~

be issued under that Act are extended to include any purchase of such notes or obligations. The Secretary of the Treasury may at any time sell any of the notes or other obligations acquired by him under this subsection. All redemptions, purchases, and sales by the Secretary of the Treasury of such notes or other obligations shall be treated as public debt transactions of the United States.

"(5) The provisions of this subsection do not apply to direct loans or planning grants made under subsection (k) of this section.

"(o) For the purposes of this section, the term—

"(1) 'State' means any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the Virgin Islands, American Samoa, or any territory or possession of the United States;

"(2) 'United States' means the several States, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa, and

"(3) 'borrower' or 'applicant' shall include any individual, firm, corporation, company, partnership, association, society, trust, joint venture, joint stock company, or other non-Federal entity.

"(p) (1) An applicant seeking a guarantee under subsection (b) of this section must be a citizen or national of the United States. A corporation, partnership, firm, or associa-

tion shall not be deemed to be a citizen or national of the United States unless the Administrator determines that it satisfactorily meets all the requirements of section 802 of title 46, United States Code, for determining such citizenship, except that the provisions in subsection (a) of such section 802 concerning (1) the citizenship of officers or directors of a corporation, and (2) the interest required to be owned in the case of a corporation, association, or partnership operating a vessel in the coastwise trade, shall not be applicable.

"(2) The Administrator, in consultation with the Secretary of State, may waive such requirements in the case of a corporation, partnership, firm, or association, controlling interest in which is owned by citizens of countries which are participants in the International Energy Agreement.

"(q) No part of the program authorized by this section shall be transferred to any other agency or authority, except pursuant to Act of Congress enacted after the date of enactment of this section.

"(r) Inventions made or conceived in the course of or under a guarantee authorized by this section shall be subject to the title and waiver requirements and conditions of section 9 of this Act.

"(s) With respect to any obligation which is issued after the enactment of this section by, or in behalf of, any State, political subdivision, or Indian tribe and which is either guar-

anteed under, or supported by taxes levied by said issuer which are guaranteed under, this section, the interest paid on such obligation and received by the purchaser thereof (or the purchaser's successor in interest) shall be included in gross income for the purposes of chapter 1 of the Internal Revenue Code of 1954, as amended: *Provided*, That the Administrator shall pay to such issuer out of the fund established by this section such portion of the interest on such obligations, as determined by the Secretary of the Treasury to be appropriate after taking into account current market yields (1) on obligations of said issuer, if any, or (2) on other obligations with similar terms and conditions, the interest on which is not so included in gross income for purposes of chapter 1 of said Code, and in accordance with such terms and conditions as the Secretary of the Treasury shall require.

"(t) (1) Each officer or employee of the Energy Research and Development Administration who—

"(A) performs any function or duty under this section; and

"(B) (i) has any known financial interest in any person who is applying for or receiving financial assistance for a commercial demonstration facility under this section; or

"(ii) has any known financial interest in property from which coal, natural gas, oil shale, crude oil, or other

~~energy resources are commercially produced in connection with any commercial demonstration facility receiving financial assistance under this section,~~

~~shall, beginning on February 1, 1977, annually file with the Administrator a written statement concerning all such interests held by such officer or employee during the preceding calendar year. Such statement shall be available to the public.~~

~~"(2) The Administrator shall—~~

~~"(A) act within ninety days after the date of enactment of this Act—~~

~~"(i) to define the term 'known financial interest' for purposes of paragraph (1) of this subsection; and~~

~~"(ii) to establish the methods by which the requirement to file written statements specified in paragraph (1) will be monitored and enforced, including appropriate provisions for the filing by such officers and employees of such statements and the review by the Administrator of such statements; and~~

~~"(B) report to the Congress on June 1 of each calendar year with respect to such disclosures and the actions taken in regard thereto during the preceding calendar year.~~

~~"(3) In the rules prescribed in paragraph (2) of this subsection, the Administrator may identify specific positions within the Administration which are of a nonpolicymaking nature and provide that officers or employees occupying such positions shall be exempt from the requirements of this subsection.~~

~~"(4) Any officer or employee who is subject to, and knowingly violates, this subsection shall be fined not more than $2,500 or imprisoned not more than one year, or both.~~

~~"(u) Nothing in this section shall be construed as affecting the obligations of any borrower receiving a guarantee pursuant to this section to comply with Federal and State environmental, land use, water, and health and safety laws and regulations or to obtain applicable Federal and State permits, licenses, and certificates.~~

~~"(v) The information maintained by the Administrator under this section shall be made available to the public, subject to the provisions of section 552 of title 5, United States Code, and section 1905 of title 18, United States Code, and to other Government agencies in a manner that will facilitate its dissemination: *Provided*, That upon a showing satisfactory to the Administrator by any person that any information, or portion thereof obtained under this section by the Administrator directly or indirectly from such person would, if made public, divulge (1) trade secrets or (2)~~

other proprietary information of such person, the Administrator shall not disclose such information and disclosure thereof shall be punishable under section 1905 of title 18, United States Code: *Provided further*, That the Administrator shall, upon request, provide such information to (A) any delegate of the Administrator for the purpose of carrying out this Act, and (B) the Attorney General, the Secretary of Agriculture, the Secretary of the Interior, the Federal Trade Commission, the Federal Energy Administration, the Environmental Protection Agency, the Federal Power Commission, the General Accounting Office, other Federal agencies, or heads of other Federal agencies, when necessary to carry out their duties and responsibilities under this and other statutes, but such agencies and agency heads shall not release such information to the public. This section is not authority to withhold information from Congress, or from any committee of Congress upon request of the chairman. For the purposes of this subsection, the term 'person' shall include the borrower.

"(w) Notwithstanding any other provision of this section, the authority to make guarantees or commitments to guarantee under subsection (b) (1), the authority to make guarantees or commitments to guarantee, or to make loans or grants, under subsection (k), the authority to make contracts under subsection (h), the authority to charge and

~~collect fees under subsection (n) of this section shall be effective only to the extent provided, without fiscal year limitation, in appropriation Acts enacted after the date of enactment of this section.".~~

That section 7(a) of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5906) is amended—

(1) by striking out "and" after the semicolon at the end of paragraph (5),

(2) by striking out the period at the end of paragraph (6) and inserting in lieu thereof "; and", and

(3) by adding at the end thereof the following new paragraph:

"(7) Federal loan guarantees and commitments thereof as provided in section 18.".

(b) The Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5901, et seq.) is further amended by adding at the end thereof the following new section:

"LOAN GUARANTEES FOR DEMONSTRATION FACILITIES

"SEC. 18. (a) It is the purpose of this section—

"(1) to assure adequate Federal support to foster a demonstration program to produce synthetic fuels from coal, oil shale, and other domestic resources, to employ biomass and renewable and geothermal energy sources to

produce synthetic fuels and other desirable forms of energy, and to assure the availability of energy-efficient industrial equipment and facilities;

"(2) to authorize loan guarantees for the construction and startup and related costs of demonstration facilities (A) for the conversion of domestic coal, oil shale, biomass, and other domestic resources into synthetic fuels; (B) for the demonstration of synthetic fuels and other desirable forms of energy from renewable and geothermal sources; and (C) for the demonstration of energy-efficient industrial equipment and facilities; and

"(3) to gather information about the technological, economic, environmental, and social costs, benefits, and impacts of such demonstration facilities.

"(b)(1) Except as provided in paragraph (5) of this subsection, the Administrator is authorized, in accordance with such rules and regulations as he shall prescribe after consultation with the Secretary of the Treasury, to guarantee and to make commitments to guarantee, in such manner and subject to such conditions (not inconsistent with the provisions of this Act) as he deems appropriate, the payment of interest on, and the principal balance of, bonds, debentures, notes, and other obligations issued by, or on behalf of, any borrower for the purpose of (A) financing the construction and startup costs of demonstration facilities for the conversion

of domestic coal, oil shale, biomass, and other domestic resources into synthetic fuels, including, but not limited to, such synthetic fuels from coal as high-Btu gaseous fuels compatible for mixture and transportation with natural gas by pipeline; gaseous, liquid, and solid fuels suitable for boiler use in compliance with applicable environmental requirements; liquid fuels for transportation uses; and petrochemicals: Provided, That no loan guarantee for a full sized oil shale facility shall be provided under this section until after successful demonstration of a modular facility producing between six and ten thousand barrels per day, taking into account such considerations as water usage, environmental effects, waste disposal, labor conditions, health and safety, and the socioeconomic impacts on local communities: Provided further, That no loan guarantee shall be available under this clause for the manufacture of component parts for demonstration of facilities eligible for assistance under this clause; (B) financing the construction and startup costs of demonstration facilities to generate desirable forms of energy (including synthetic fuels) from direct solar, wind, ocean thermal gradient, bioconversion, or other renewable energy resources; (C) financing the purchase, construction, installation, and startup costs of energy-efficient industrial equipment and facilities for demonstration by small business concerns and others for general use; and (D) further im-

plementing the financing of geothermal resource development under the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101, et seq.). The amount of obligations authorized for any guarantee or commitment to guarantee under this subsection is $2,000,000,000 for each of the following fiscal years, 1977 and 1978: Provided, That the indebtedness guaranteed or committed to be guaranteed which may be outstanding at any time in any fiscal year shall not exceed the aggregate of the total amount authorized pursuant to this section for that fiscal year and all preceding fiscal years. With regard to such limitation the Administrator shall make no new commitments for loan guarantees after September 30, 1984, and shall furnish no guarantees after September 30, 1986. The authorized indebtedness to be guaranteed under clauses (A), (B), and (C) of this paragraph shall be allocated by the Administrator so that no more than 50 per centum is for high-Btu coal gasification, no more than 30 per centum for other fossil-based synthetic fuels, and no more than 50 per centum for renewable energy resources, including biomass, urban and other waste, direct solar, wind, ocean thermal gradient, bioconversion, and for industrial energy conservation. All guarantees or commitments to guarantee authorized by this section shall be made only for demonstration facilities constructed within the United States or in waters contiguous

to its territory. None of the amounts authorized for guarantee under this section shall be committed until the studies already initiated by the Administrator concerning the synthetic fuels demonstration program authorized by this subsection are completed and a report of each such study is submitted to the Speaker of the House of Representatives and the House Committee on Science and Technology and the President of the Senate and the Senate Committee on Interior and Insular Affairs. Loan guarantees for geothermal resource development under clause (D) of this paragraph shall be carried out pursuant to the authority and provisions of the Geothermal Energy Research, Development, and Demonstration Act of 1974: Provided, That paragraphs (2) and (4) of this subsection, and subsections (g)(2), (h), (j), (n), (s) and (v) of this section, shall also apply to such guarantees: Provided further, That the limitations in section 201(e) of the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1141(e)) shall not apply to such guarantees.

"(2) An applicant for any financial assistance under this section shall provide information to the Administrator in such form and with such content as the Administrator deems necessary.

"(3) Prior to issuing any guarantee under this section the Administrator shall obtain the concurrence of the Secre-

tary of the Treasury with respect to the timing, interest rate, and substantial terms and conditions of such guarantee. The Secretary of the Treasury shall insure to the maximum extent feasible that the timing, interest rate, and substantial terms and conditions of such guarantee will have the minimum possible impact on the capital markets of the United States, taking into account other Federal direct and indirect securities activities.

"(4) The full faith and credit of the United States is pledged to the payment of all guarantees issued under this section with respect to principal and interest.

"(5)(A) The Administrator is authorized, in the case of a facility for the conversion of oil shale to synthetic fuels which is determined by the Administrator pursuant to the proviso in paragraph (1)(A) of this subsection, to be constructed at a modular size, to enter into a cooperative agreement with the applicant in accordance with section 8 of this Act and the other provisions of this Act to share the estimated total design and construction costs, plus operation and maintenance costs, of such modular facility. The Federal share shall not exceed 75 per centum of such costs. All receipts for the sale of any products produced during the operation of the facility shall be used to offset the costs incurred in the operation and maintenance of the facility. The provisions of subsections (d), (e), (k), (m), (p), (s), (t),

(u), (v), (w), (x), (y), and (z) shall apply to any such modular facility. The provisions of this section shall apply to any loan guarantee for such modular facility.

"(B) After successful demonstration of the modular facility, as determined by the Administrator, the facility is eligible for financial assistance under this section for purposes of expansion to a full sized facility and the applicant may purchase the Federal interest in the modular facility as represented by the Federal share thereof by means of (i) a cash payment to the United States, or (ii) a share of the product or sales resulting from such expanded operation, as determined by the Administrator. If expansion of such facility is determined not to be warranted by the Administrator, he may, at the option of the applicant, dispose of the modular facility to the applicant at not less than fair market value, as determined by the Administrator as of the date of the disposal, or otherwise dispose of it, in accordance with applicable provisions of law, and distribute the net proceeds thereof, after expenses of such disposal, to the applicant in proportion to the applicant's share of the costs of such facility.

"(6) To the extent possible, loan guarantees shall be issued on the basis of competitive bidding among guarantee applicants in a particular technology area.

"(c) The Administrator, with due regard for the need

for competition, shall guarantee or make a commitment to guarantee any obligation under subsection (b) only if—

"(1) the Administrator is satisfied that the financial assistance applied for is necessary to encourage financial participation;

"(2) the amount guaranteed does not exceed 75 per centum of the total cost of the demonstration facility, as determined by the Administrator: Provided, That the amount guaranteed may not exceed 90 per centum of the total cost of the demonstration facility during the period of construction and startup;

"(3) the Administrator has determined that there will be a continued reasonable assurance of full repayment;

"(4) the obligation is subject to the condition that it not be subordinated to any other financing;

"(5) the Administrator has determined, taking into consideration all reasonably available forms of assistance under this section and other Federal and State statutes, that the impacts resulting from the proposed demonstration facility have been fully evaluated by the borrower, the Administrator, and the Governor of the affected State, and that effective steps have been taken or will be taken in a timely manner to finance community planning and development costs resulting from such fa-

cility under this section, under other provisions of law, or by other means;

"(6) the maximum maturity of the obligation does not exceed thirty years, or 90 per centum of the projected useful economic life of the physical assets of the demonstration facility covered by the guarantee, whichever is less, as determined by the Administrator;

"(7) the Administrator has determined that, in the case of any demonstration or modular facility planned to be located on Indian lands, the appropriate Indian tribe, with the approval of the Secretary of the Interior, has given written consent to such location.

"(d) Prior to submitting a report to Congress pursuant to subsection (m) of this section on each guarantee and cooperative agreement, the Administrator shall request from the Attorney General and the Chairman of the Federal Trade Commission written views, comments, and recommendations concerning the impact of such guarantee or commitment or agreement on competition and concentration in the production of energy and give due consideration to views, comments, and recommendations received: Provided, That if either official, within sixty days after receipt of such request or at any time prior to the Administrator submitting such report to Congress, recommends against making such guarantee or commitment or agreement, the Administrator shall not do so unless he

determines in writing that such guarantee or commitment or agreement is in the national interest.

"(e)(1) As soon as the Administrator knows the geographic location of a proposed facility for which a guarantee or a commitment to guarantee or cooperative agreement is sought under this section, he shall inform the Governor of the State, and officials of each political subdivision and Indian tribe, as appropriate, in which the facility would be located or which would be impacted by such facility. The Administrator shall not guarantee or make a commitment to guarantee or enter into a cooperative agreement under subsection (b) of this section, if the Governor of the State in which the proposed facility would be located recommends that such action not be taken, unless the Administrator finds that there is an overriding national interest in taking such action in order to achieve the purpose of this section. If the Administrator decides to guarantee or make a commitment to guarantee or enter into a cooperative agreement despite a Governor's recommendation not to take such action, the Administrator shall communicate, in writing, to the Governor reasons for not concurring with such recommendation. The Administrator's decision, pursuant to this subsection, shall be final unless determined upon judicial review initiated by the Governor to be unlawful by the reviewing court pursuant to 5 U.S.C. 706(2) (A) through (D). Such review shall take place

in the United States court of appeals for the circuit in which the State involved is located, upon application made within ninety days from the date of such decision. The Administrator shall, by regulation, establish procedures for review of, and comment on, the proposed facility by States, local political subdivisions, and Indian tribes which may be impacted by such facility, and the general public.

"(2) The Administrator shall review and approve the plans of the applicant for the construction and operation of any demonstration and related facilities constructed or to be constructed with assistance under this section. Such plans and the actual construction shall include such monitoring and other data-gathering costs associated with such facility as are required by the comprehensive plan and program under this section. The Administrator shall determine the estimated total cost of such demonstration facility, including, but not limited to, construction costs, startup costs, costs to political subdivisions and Indian tribes by such facility, and costs of any water storage facilities needed in connection with such demonstration facility, and determine who shall pay such costs. Such determination shall not be binding upon the States, political subdivisions, or Indian tribes.

"(3) There is hereby established a panel to advise the Administrator on matters relating to the program authorized by this section, including, but not limited to, the impact

of the demonstration facilities on communities and States and Indian tribes, the environmental and health and safety effects of such facilities, and the means, measures, and planning for preventing or mitigating such impacts, and other matters relating to the development of synthetic fuels and other energy sources under this section. The panel shall include such Governors or their designees as shall be designated by the Chairman of the National Governors Conference. Representatives of Indian tribes, industry, environmental organizations, and the general public shall be appointed by the Administrator. The Chairman of the panel shall be selected by the Administrator. No person shall be appointed to the panel who has a financial interest in any applicant applying for assistance under this section. Members of the panel shall serve without compensation. The provisions of section 106(e) of the Energy Reorganization Act of 1974 (42 U.S.C. 5816(e)) shall apply to the panel.

"(f) Except in accordance with reasonable terms and conditions contained in the written contract of guarantee, no guarantee issued or commitment to guarantee made under this section shall be terminated, canceled, or otherwise revoked. Such a guarantee or commitment shall be conclusive evidence that the underlying obligation is in compliance with the provisions of this section and that such obligation has been approved and is legal as to principal, interest, and other

terms. Subject to the conditions of the guarantee or commitment to guarantee, such a guarantee shall be incontestable in the hands of the holder of the guaranteed obligation, except as to fraud or material misrepresentation on the part of the holder.

"(g)(1) If there is a default by the borrower, as defined in regulations promulgated by the Administrator and in the guarantee contract, the holder of the obligation shall have the right to demand payment of the unpaid amount from the Administrator. Within such period as may be specified in the guarantee or related agreements, the Administrator shall pay to the holder of the obligation the unpaid interest on, and unpaid principal of, the guaranteed obligation as to which the borrower has defaulted, unless the Administrator finds that there was no default by the borrower in the payment of interest or principal or that such default has been remedied. Nothing in this section shall be construed to preclude any forebearance by the holder of the obligation for the benefit of the borrower which may be agreed upon by the parties to the guaranteed obligation and approved by the Administrator.

"(2) If the Administrator makes a payment under paragraph (1) of this subsection or section 202(b) of the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1142(b)), the Administrator shall be subrogated to the rights of the recipient of

such payment (and such subrogation shall be expressly set forth in the guarantee or related agreements), including the authority to complete, maintain, operate, lease, or otherwise dispose of any property acquired pursuant to such guarantee or related agreements, without regard to the provisions of the Federal Property and Administrative Services Act of 1949, as amended, except section 207 of that Act (40 U.S.C. 488), or any other law, or to permit the borrower, pursuant to an agreement with the Administrator, to continue to pursue the purposes of the demonstration facility if the Administrator determines that this is in the public interest.

"(3) In the event of a default on any guarantee under this section, the Administrator shall notify the Attorney General, who shall take such action as may be appropriate to recover the amounts of any payments made under paragraph (1) including any payment of principal and interest under subsection (h) from such assets of the defaulting borrower as are associated with the demonstration facility, or from any other security included in the terms of the guarantee.

"(4) For purposes of this section, patents, including any inventions for which a waiver was made by the Administrator under section 9 of this Act, and technology resulting from the demonstration facility, shall be treated as project assets of such facility. The guarantee agreement shall include such detailed terms and conditions as the Administrator deems

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appropriate to protect the interests of the United States in the case of default and to have available all the patents and technology necessary for any person selected, including, but not limited to, the Administrator to complete and operate the defaulting project. Furthermore, the guarantee agreement shall contain a provision specifying that patents, technology, and other proprietary rights which are necessary for the completion or operation of the demonstration facility shall be available to the United States and its designees on equitable terms, including due consideration to the amount of the United States default payments. Inventions made or conceived in the course of or under such guarantee, title to which is vested in the United States under this Act, shall not be treated as project assets of such facility for disposal purposes under this subsection, unless the Administrator determines in writing that it is in the best interests of the United States to do so.

"(h) With respect to any obligation guaranteed under this section, the Administrator is authorized to enter into a contract to pay, and to pay, holders of the obligation, for and on behalf of the borrower, from the fund established by this section or from the Geothermal Resources Development Fund, as applicable, the principal and interest payments which become due and payable on the unpaid balance of such obligation if the Administrator finds that—

"(1) the borrower is unable to meet such payments and is not in default; it is in the public interest to permit the borrower to continue to pursue the purposes of such demonstration facility; and the probable net benefit to the Federal Government in paying such principal and interest will be greater than that which would result in the event of a default;

"(2) the amount of such payment which the Administrator is authorized to pay shall be no greater than the amount of principal and interest which the borrower is obligated to pay under the loan agreement; and

"(3) the borrower agrees to reimburse the Administrator for such payment on terms and conditions, including interest, which are satisfactory to the Administrator.

"(i) Regulations required by this section shall be issued within one hundred and eighty days after enactment of this section, except as provided in subsection (t) of this section. All regulations under this section and any amendments thereto shall be issued in accordance with section 553 of title 5, of the United States Code.

"(j) The Administrator shall charge and collect fees for guarantees of obligations authorized by clauses (A), (B), (C), and (D) of subsection (b)(1), in amounts sufficient in the judgment of the Administrator to cover the applicable

administrative costs and probable losses on guaranteed obligations, but in any event the portion of the fee attributable to providing for probable losses shall not exceed 1 per centum per annum of the outstanding indebtedness covered by the guarantee. Nothing in this subsection shall be construed to apply to community planning and development assistance pursuant to subsection (k) of this section.

"(k)(1) In accordance with such rules and regulations as the Administrator in consultation with the Secretary of the Treasury shall prescribe, and subject to such terms and conditions as he deems appropriate, the Administrator is authorized, for the purpose of financing essential community development and planning which directly result from, or are necessitated by, one or more demonstration facilities assisted under this section to—

"(A) guarantee and make commitments to guarantee the payment of interest on, and the principal balance of, obligations for such financing issued by eligible States, political subdivisions, or Indian tribes,

"(B) guarantee and make commitments to guarantee the payment of taxes imposed on such demonstration facilities by eligible non-Federal taxing authorities which taxes are earmarked by such authorities to support the payment of interest and principal on obligations for such financing, and

"(C) require that the applicant for assistance for a demonstration facility under this section advance sums to eligible States, political subdivisions, and Indian tribes to pay for the financing of such development and planning: Provided, That the State, political subdivision, or Indian tribe agrees to provide tax abatement credits over the life of the facilities for such payments by such applicant.

"(2) Prior to issuing any guarantee under this subsection, the Administrator shall obtain the concurrence of the Secretary of the Treasury with respect to the timing, interest rate, and substantial terms and conditions of such guarantee. The Secretary of the Treasury shall insure to the maximum extent feasible that the timing, interest rate, and substantial terms and conditions of such guarantee will have the minimum possible impact on the capital markets of the United States, taking into account other Federal direct and indirect securities activities.

"(3) The amount of obligations authorized for any guarantee and commitment to guarantee under paragraph (1) of this subsection is $150,000,000 for each of the following fiscal years 1977 and 1978: Provided, That such obligations guaranteed or committed to be guaranteed which may be outstanding at any time in any fiscal year shall not exceed the aggregate of the total amount authorized pursuant

to this subsection for that fiscal year and all preceding fiscal years, and shall be included in the limitation on outstanding indebtedness set forth in subsection (b)(1) of this section.

"(4) In the event of any default by the borrower in the payment of taxes guaranteed by the Administrator under this subsection, the Administrator shall pay out of the fund established by this section such taxes at the time or times they may fall due, and shall have by reason of such payment a claim against the borrower for all sums paid plus interest.

"(5) If after consultation with the State, political subdivision, or Indian tribe, the Administrator finds that the financial assistance programs of paragraph (1) of this subsection will not result in sufficient funds to carry out the purposes of this subsection, then the Administrator may—

"(A) make direct loans to the eligible States, political subdivisions, or Indian tribes for such purposes: Provided, That such loans shall be made on such reasonable terms and conditions as the Administrator shall prescribe: Provided further, That the Administrator may waive repayment of all or part of a loan made under this paragraph, including interest, if the State or political subdivision or Indian tribe involved demonstrates to the satisfaction of the Administrator that due to a change in

circumstances there will be net adverse impacts resulting from such demonstration facility that would probably cause such State, subdivision, or tribe to default on the loan; or

"(B) require that any community development and planning costs which are associated with, or result from, such demonstration facility and which are determined by the Administrator to be appropriate for such inclusion shall be included in the total costs of the demonstration facility.

"(6) The Administrator is further authorized to make grants to States, political subdivisions, or Indian tribes for studying and planning for the potential economic, environmental, and social consequences of demonstration facilities, and for establishing related management expertise.

"(7) At any time the Administrator may, with the concurrence of the Secretary of the Treasury, redeem, in whole or in part, out of the fund established by this section, the debt obligations guaranteed or the debt obligations for which tax payments are guaranteed under this subsection.

"(8) When one or more States, political subdivisions, or Indian tribes would be eligible for assistance under this subsection, but for the fact that construction and operation of the demonstration facilities occurs outside its jurisdiction, the

Administrator is authorized to provide, to the greatest extent possible, arrangements for equitable sharing of such assistance.

"(9) (A) Such amounts as may be necessary for direct loans and grants pursuant to this subsection shall be available as provided in annual authorization Acts and shall be requested in fiscal year 1977, and in subsequent fiscal years.

"(B) There is hereby authorized to be appropriated for the fiscal year ending June 30, 1976, and the transition period, $2,000,000 for grants to be used to carry out the purposes of this subsection.

"(10) The Administrator, if appropriate, shall provide assistance in the financing of up to 100 per centum of the costs of the required community development and planning pursuant to this subsection.

"(11) In carrying out the provisions of this subsection, the Administrator shall provide that title to any facility receiving financial assistance under this subsection shall vest in the applicable State, political subdivision, or Indian tribe, as appropriate, and in the case of default by the borrower on a loan guarantee made or committed under subsection (b) of this section, such facility shall not be considered a project asset for the purposes of subsection (g) of this section.

"(l)(1) The Administrator is directed to submit a report to the Congress within one hundred and eighty days after

the enactment of this section setting forth his recommendations on the best opportunities to implement a program of Federal financial assistance with the objective of demonstrating production and conservation of energy. Such report shall be updated and submitted to Congress at least annually for the duration of the program authorized by this section and shall include specific comments and recommendations by the Secretary of the Treasury on the methods and procedures set forth in subparagraph (B)(viii) of this subsection, including their adequacy, and changes necessary to satisfy the objectives stated in this subsection. This report shall include—

"(A) a study of the purchase or commitment to purchase by the Federal Government, for use by the United States, of all or a portion of the products of any synthetic fuel facilities constructed pursuant to this program as a direct or an alternate form of Federal assistance, which assistance, if recommended, shall be carried out pursuant to section 7(a)(4) of this Act; and

"(B) a comprehensive plan and program to acquire information and evaluate the environmental, economic, social, and technological impacts of the demonstration program under this section. In preparing such a comprehensive plan and program, the Administrator shall consult with the Environmental Protection Agency, the Federal Energy Administration, the Department of

Housing and Urban Development, the Department of the Interior, the Department of Agriculture, and the Department of the Treasury, and shall include therein, but not be limited to, the following:

"(i) information about potential demonstration facilities proposed in the program under this section;

"(ii) any significant adverse impacts which may result from any activity included in the program;

"(iii) the extent to which it is feasible to commercialize the technologies as they affect different regions of the Nation;

"(iv) proposed regulations required to carry out the purposes of this section;

"(v) a list of Federal agencies, governmental entities, and other persons that will be consulted or utilized to implement the program;

"(vi) the methods and procedures by which the information gathered under the program will be analyzed and disseminated;

"(vii) a plan for the study and monitoring of the health effects of such facilities on workers and other persons, including, but not limited to, any carcinogenic effect of synthetic fuels; and

"(viii) the methods and procedures to insure

that (1) the use of Federal assistance for demonstration facilities is kept to the minimum level necessary for the information objectives of this section, (2) the impact of loan guarantees on the capital markets of the United States is minimized, taking into account other Federal direct and indirect securities activities, and any economic sectors which may be negatively impacted as a result of the reduction of capital by the placement of guaranteed loans, and (3) the granting of Federal loan guarantees under this Act does not impede movement toward improvement in the climate for attracting private capital to develop synthetic fuels without continued direct Federal incentives.

"(2) The Administrator shall annually submit a detailed report to the Congress concerning—

"(A) the actions taken or not taken by the Administrator under this section during the preceding fiscal year, and including, but not be limited to (i) a discussion of the status of each demonstration facility and related facilities financed under this section, including progress made in the development of such facilities, and the expected or actual production from each such facility, including byproduct production therefrom, and the distribution of such products and byproducts, (ii) a detailed statement of the financial conditions of each such demon-

stration facility, (iii) data concerning the environmental, community, and health and safety impacts of each such facility and the actions taken or planned to prevent or mitigate such impacts, (iv) the administrative and other costs incurred by the Administrator and other Federal agencies in carrying out this program, and (v) such other data as may be helpful in keeping Congress and the public fully and currently informed about the program authorized by this section; and

"(B) The activities of the funds referred to in subsection (n) of this section during the preceding fiscal year, including a statement of the amount and source of fees or other moneys, property, or assets deposited into the funds, all payments made, the notes or other obligations issued by the Administrator, and such other data as may be appropriate.

"(3) The annual reports required by this subsection shall be a part of the annual report required by section 15 of this Act, except that the matters required to be reported by this subsection shall be clearly set out and identified in such annual reports. Such reports and the one-hundred-and-eighty-day report required in paragraph (1) of this subsection shall be transmitted to the Speaker of the House of Representatives and the House Committee on Science and Technology and to

the President of the Senate and the Committee on Interior and Insular Affairs of the Senate.

"(m) Prior to issuing any guarantee or commitment to guarantee or cooperative agreement pursuant to subsection (b) of this section, the Administrator shall submit to the Committee on Science and Technology of the House of Representatives and the Committee on Interior and Insular Affairs of the Senate a full and complete report on the proposed demonstration facility and such guarantee or agreement. Such guarantee or commitment to guarantee or cooperative agreement shall not be finalized under the authority granted by this section prior to the expiration of ninety calendar days (not including any day on which either House of Congress is not in session because of an adjournment of more than three calendar days to a day certain) from the date on which such report is received by such committees: Provided, That, where the cost of such demonstration facility exceeds $200,000,000, such guarantee or commitment to guarantee or cooperative agreement shall not be finalized if prior to the close of such ninety-day period both Houses pass a resolution stating in substance that the Congress does not favor the making of such guarantee or commitment or agreement.

"(n)(1) There is hereby created within the Treasury a separate fund (hereafter in this section called the 'fund')

which shall be available to the Administrator without fiscal year limitation as a revolving fund for the purpose of carrying out the program authorized by clauses (A), (B), and (C) of subsection (b)(1) and subsections (g), (h), and (k) of this section. The Geothermal Resources Development Fund established by the Geothermal Energy Research, Development, and Demonstration Act of 1974 shall be available for the purpose of carrying out the geothermal loan guarantee program as established by that Act and as further implemented by this section.

"(2) There are hereby authorized to be appropriated to the fund for administrative expenses for the fiscal year ending June 30, 1976, $1,000,000, and for the period beginning July 1, 1976 and ending September 30, 1976, $1,000,000, and from time to time such other amounts as may be necessary to carry out the purposes of the applicable provisions of this section, including, but not limited to, the payments of interest and principal and the payment of interest differentials and redemption of debi. All amounts received by the Administrator as interest payments or repayments of principal on loans which are guaranteed under this section, fees, and any other moneys, property, or assets derived by him from operations under this section shall be deposited in the fund or in the Geothermal Resources Development Fund, as applicable.

"(3) All payments on obligations, appropriate expenses (including reimbursements to other government accounts), and repayments pursuant to operations of the Administrator under this section shall be paid from the fund subject to appropriations or from the Geothermal Resources Development Fund, as applicable. If at any time the Administrator determines that moneys in the fund exceed the present and reasonably foreseeable future requirements of the fund, such excess shall be transferred to the general fund of the Treasury.

"(4) If at any time the moneys available in the fund or in the Geothermal Resources Development Fund are insufficient to enable the Administrator to discharge his responsibilities as authorized by subsections (b)(1), (g), (h), and (k) of this section, or the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101), as the case may be, the Administrator shall issue to the Secretary of the Treasury notes or other obligations in such forms and denominations, bearing such maturities, and subject to such terms and conditions as may be prescribed by the Secretary of the Treasury. Redemption of such notes or obligations shall be made by the Administrator from appropriations or other moneys available under paragraph (2) of this subsection for loan guarantees authorized by clauses (A), (B), and (C) of subsection (b)(1) and subsections (g), (h), and (k) of this section, and from appropriations

or other moneys available under section 204 of the Geothermal Energy Research, Development, and Demonstration Act of 1974 for loan guarantees described in clause (D) of subsection (b)(1) of this section. Such notes or other obligations shall bear interest at a rate determined by the Secretary of the Treasury, which shall be not less than a rate determined by taking into consideration the average market yield on outstanding marketable obligations of the United States of comparable maturities during the month preceding the issuance of the notes or other obligations. The Secretary of the Treasury shall purchase any notes or other obligations issued hereunder and for that purpose he is authorized to use as a public debt transaction the proceeds from the sale of any securities issued under the Second Liberty Bond Act; and the purposes for which securities may be issued under that Act are extended to include any purchase of such notes or obligations. The Secretary of the Treasury may at any time sell any of the notes or other obligations acquired by him under this subsection. All redemptions, purchases, and sales by the Secretary of the Treasury of such notes or other obligations shall be treated as public debt transactions of the United States.

"(5) The provisions of this subsection do not apply to direct loans or planning grants made under subsection (k) of this section.

"(o) For the purposes of this section, the term—

"(1) 'State' means any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the Virgin Islands, American Samoa, or any territory or possession of the United States,

"(2) 'United States' means the several States, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa, and

"(3) 'borrower' or 'applicant' shall include any individual, firm, corporation, company, partnership, association, society, trust, joint venture, joint stock company, or other non-Federal entity.

"(p)(1) An applicant seeking a guarantee or cooperative agreement under subsection (b) of this section must be a citizen or national of the United States. A corporation, partnership, firm, or association shall not be deemed to be a citizen or national of the United States unless the Administrator determines that it satisfactorily meets all the requirements of section 802 of title 46, United States Code, for determining such citizenship, except that the provisions in subsection (a) of such section 802 concerning (1) the citizenship of officers or directors of a corporation, and (2) the interest required to be owned in the case of a corporation, association, or partnership operating a vessel in the coastwise trade, shall not be applicable.

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"(2) The Administrator, in consultation with the Secretary of State, may waive such requirements in the case of a corporation, partnership, firm, or association, controlling interest in which is owned by citizens of countries which are participants in the International Energy Agreement.

"(q) No part of the program authorized by this section shall be transferred to any other agency or authority, except pursuant to Act of Congress enacted after the date of enactment of this section.

"(r) Inventions made or conceived in the course of or under a guarantee authorized by this section shall be subject to the title and waiver requirements and conditions of section 9 of this Act.

"(s) With respect to any obligation which is issued after the enactment of this section by, or in behalf of, any State, political subdivision, or Indian tribe and which is either guaranteed under, or supported by taxes levied by said issuer which are guaranteed under, this section, the interest paid on such obligation and received by the purchaser thereof (or the purchaser's successor in interest) shall be included in gross income for the purposes of chapter 1 of the Internal Revenue Code of 1954, as amended: Provided, That the Administrator shall pay to such issuer out of the fund established by this section such portion of the interest on such obligations, as determined by the Secretary of the Treasury to be appropri-

ate after taking into account current market yields (1) on obligations of said issuer, if any, or (2) on other obligations with similar terms and conditions, the interest on which is not so included in gross income for purposes of chapter 1 of said Code, and in accordance with such terms and conditions as the Secretary of the Treasury shall require.

"(t)(1) Each officer or employee of the Energy Research and Development Administration who—

"(A) performs any function or duty under this section; and

"(B)(i) has any known financial interest in any person who is applying for or receiving financial assistance for a demonstration facility under this section; or

"(ii) has any known financial interest in property from which coal, natural gas, oil shale, crude oil, or other energy resources is produced in connection with any demonstration facility receiving financial assistance under this section,

shall, beginning on February 1, 1977, annually file with the Administrator a written statement concerning all such interests held by such officer or employee during the preceding calendar year. Such statement shall be available to the public.

"(2) The Administrator shall—

"(A) act within ninety days after the date of enactment of this Act—

"(i) to define the term 'known financial interest' for purposes of paragraph (1) of this subsection; and

"(ii) to establish the methods by which the requirement to file written statements specified in paragraph (1) will be monitored and enforced, including appropriate provisions for the filing by such officers and employees of such statements and the review by the Administrator of such statements; and

"(B) report to the Congress on June 1 of each calendar year with respect to such disclosures and the actions taken in regard thereto during the preceding calendar year.

"(3) In the rules prescribed in paragraph (2) of this subsection, the Administrator may identify specific positions within the Administration which are of a nonpolicymaking nature and provide that officers or employees occupying such positions shall be exempt from the requirements of this subsection.

"(4) Any officer or employee who is subject to, and knowingly violates, this subsection shall be fined not more than $2,500 or imprisoned not more than one year, or both.

"(u) Nothing in this section shall be construed as affecting the obligations of any person receiving financial assistance

pursuant to this section to comply with Federal and State environmental, land use, water, and health and safety laws and regulations or to obtain applicable Federal and State permits, licenses, and certificates.

"(v) The information maintained by the Administrator under this section shall be made available to the public, subject to the provisions of section 552 of title 5, United States Code, and section 1905 of title 18, United States Code, and to other Government agencies in a manner that will facilitate its dissemination: Provided, That upon a showing satisfactory to the Administrator by any person that any information, or portion thereof obtained under this section by the Administrator directly or indirectly from such person would, if made public, divulge (1) trade secrets or (2) other proprietary information of such person, the Administrator shall not disclose such information and disclosure thereof shall be punishable under section 1905 of title 18, United States Code: Provided further, That the Administrator shall, upon request, provide such information to (A) any delegate of the Administrator for the purpose of carrying out this Act, and (B) the Attorney General, the Secretary of Agriculture, the Secretary of the Interior, the Federal Trade Commission, the Federal Energy Administration, the Environmental Protection Agency, the Federal Power Commission, the General Accounting Office, other Federal

agencies, or heads of other Federal agencies, when necessary to carry out their duties and responsibilities under this and other statutes, but such agencies and agency heads shall not release such information to the public. This section is not authority to withhold information from Congress, or from any committee of Congress upon request of the chairman. For the purposes of this subsection, the term 'person' shall include the borrower.

"(w) Notwithstanding any other provision of this section, the authority provided in this section to make guarantees or commitments to guarantee or enter into cooperative agreements under subsection (b)(1), to make guarantees or commitments to guarantee, or to make loans or grants, under subsection (k), to make contracts under subsection (h), to use fees and receipts collected under subsections (b) and (j) of this section, and the authorities provided under subsection (n) of this section shall be effective only to the extent provided, without fiscal year limitation, in appropriation Acts enacted after the date of enactment of this section.

"(x) No person in the United States shall on the grounds of race, color, religion, national origin, or sex, be excluded from participation in, be denied benefits of, or be subjected to discrimination under any program or activity funded in whole or in part with assistance made available under this section: Provided, That Indian tribes are exempt from the operation of this subsection: Provided further, That such

exemption shall be limited to the planning and provision of public facilities which are located on reservations and which are provided for members of the affected Indian tribes as the primary beneficiaries.

"(y) In carrying out his functions under this section, the Administrator shall provide a realistic and adequate opportunity for small business concerns to participate in the program to the optimum extent feasible consistent with the size and nature of each project.

"(z)(1) Recipients of financial assistance under this section shall keep such records and other pertinent documents, as the Administrator shall prescribe by regulation, including, but not limited to, records which fully disclose the disposition of the proceeds of such assistance, the cost of any facility, the total cost of the provision of public facilities for which assistance was used, and such other records as the Administrator may require to facilitate an effective audit. The Administrator and the Comptroller General of the United States or their duly authorized representatives shall have access, for the purpose of audit, to such records and other pertinent documents.".

"(2) All laborers and mechanics employed by contractors or subcontractors in the performance of construction work financed in whole or in part wiith assistance under this section shall be paid wages of rates not less than those prevailing on similar construction in the locality as determined by the

Secretary of Labor in accordance with the Davis-Beacon Act, as amended (40 U.S.C. 276a—276a-5). The Secretary of Labor shall have, with respect to such labor standards, the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 F.R. 3176; 64 Stat. 1267) and section 2 of the Act of June 13, 1934, as amended (48 Stat. 948; 40 U.S.C. 276(c)).".

FEDERAL TRADE COMMISSION,
Washington, D.C., July 1, 1976.

HON. HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your request for the Federal Trade Commission's views upon H.R. 12112, 94th Congress, 2d Session, a bill "To provide additional assistance to the Energy Research and Development Administration for the advancement of non-nuclear energy research, development, and demonstration."

H.R. 12112 would amend the Federal Non-Nuclear Energy Research and Development Act of 1974, (42 U.S.C. sec. 5901 et seq.), to provide federal loan guarantees in support of a demonstration program to produce synthetic fuels from coal, oil shale, and other domestic resources, to employ biomass and renewable and geothermal energy sources to produce synthetic fuels and other desirable forms of energy, and to assure the availability of energy-efficient industrial equipment and facilities.

The Commission offers no views on the need for this legislation or on the underlying question whether private capital markets have been shown to be unable to assess the risks of these ventures. Nor are we able to comment on the question whether adequate incentives are established by the legislation to discourage subsidies for unpromising or economically infeasible projects. In short, the Commission renders no opinion on the overall merits of this legislation.

Subsection (m) requires the Administrator of the Energy Research and Development Administration to submit to the Congress a full and complete report on any proposed demonstration facility and any guarantee, commitment to guarantee, or cooperative agreement relating to that facility prior to issuing any such guarantee, commitment to guarantee, or cooperative agreement. Prior to submitting this report to Congress, subsection (d) requires the Administrator to request from the Attorney General and the Chairman of the Federal Trade Commission their written views, comments, and recommendations concerning the impact of such guarantee, commitment, or agreement upon competition and concentration in the production of energy. The Administrator must give due consideration to views, comments, and recommendations received. If either the Attorney General or the Chairman of the Federal Trade Commission recommends against making such guarantee, commitment, or agreement within sixty days after receipt of such request or at any time prior to the Administrator's submitting such report to Congress, the Administrator may not approve such guarantee, commitment or agreement unless he determines in writing that such action is in the national interest.

The latter provision differs from that applicable to objections of a governor of a state under subsection (e)(1) of the bill. In the event of an objection from the governor of the state in which the proposed facility would be located, the administrator may approve the loan guarantee only if he finds that there is an overriding national interest in taking such action in order to achieve the purposes of the bill. The Commission believes that the same standard shou'd apply to objections of the Attorney General and the Chairman of the Commission, *i.e.*, that approval of the guarantee, commitment, or agreement in either case must be necessitated by the "overriding" national interest.

Subsection (d) would also technically permit the Administrator to submit his report to Congress prior to receipt of the views, comments, and recommendations of the Attorney General and the Chairman of the Federal Trade Commission or the elapse of sixty days. Since such a result does not appear to reflect the intent of the drafters of this provision, it should be amended to make clear that ERDA may on'y submit its report to Congress under subsection (m) after it has either received the views of the Attorney General and the Chairman of the Federal Trade Commission or has given both officials sixty days to submit their views.

The Commission has certain additional amendments of a technical and clarifying nature to subsection (d). On page 36, line 14, the word "proposed" should be inserted immediately following the word "each," and the words ", commitment to guarantee," should be inserted immediately following the word "guarantee".

Subsection (r) requires that inventions made or conceived in the course of or under a guarantee authorized by the bill be subject to the title and waiver requirements and conditions of section 9 of the Act, (42 U.S.C. Sec. 5908). Section 9 anticipates that the Government will take title to most inventions except in

special circumstances wherein the government decides to waive its rights. The Commission questions whether a title policy such as that expressed in section 9 should be favored in a loan guarantee program, particularly in situations in which an applicant pays all of the costs of the demonstration project. Strict adherence to a title policy may discourage qualified companies from participating in the program. Although section 9 provides the Administrator with discretion to waive the title rights of the Government where necessary to secure the participation of a particular contractor, this provision was specifically drafted to cover government contracts and not loan guarantees and may be too restrictive for a loan guarantee program.

Finally, the Commission supports subsection (v) which permits the Administrator to disclose trade secrets or other proprietary information regarding proposed guarantees to the Commission.

The Commission appreciates this opportunity to assist your Committee in its legislative function.

By direction of the Commission.

JAMES A. TOBIN,
Acting Secretary.

DEPARTMENT OF JUSTICE.
Washington, D.C., June 14, 1976.

Hon. HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your request for the views of the Department of Justice on H.R. 12112, a bill to provide additional assistance to the Energy Research and Development Administration (ERDA) for the advancement of nonnuclear energy research, development and demonstration. The Department of Justice stated its position on an earlier version of H.R. 12112 in a letter, dated April 14, 1976, to the Honorable Olin G. Teague, Chairman, Committee on Science and Technology, a copy of which is enclosed herein. While the views expressed in our previous letter remain those of the Department of Justice, some changes from the earlier version of H.R. 12112 require our further comment.

We would note that in the earlier version of the bill the administrator of ERDA could make no new commitments for loan guarantees after June 30, 1987, and no guarantees would be furnished after June 30, 1990. Subsection (b) (1) of proposed section 18 changes these dates to September 30, 1984, for commitments for loan guarantees, and to September 30, 1986, for furnishing guarantees.

Further, the earlier version of the bill required the Administrator to seek the views of the Attorney General on the impact of government guarantees or commitment on competition and concentration in the production of energy and to give due consideration to the views received. Subsection (d) of the proposed section 18 retains this requirement, and in addition, requires the Administrator to request the views of the Chairman of the Federal Trade Commission.

As we explained in our previous letter, the Department of Justice has no objection in principle to the provision requiring reports by the Attorney General on the impact of proposed loan guarantees on competition and concentration in the production of energy. We would like to stress once more, however, that requiring the views of the Attorney General in every instance may severely tax the limited resources of the Department.

We therefore urge the committee to follow the suggestion made in our April 14, 1976, letter that the Attorney General be required to report only in applications involving more than $1,000,000.

While we defer to the Federal Trade Commission regarding its participation in these matters, we would point out that requiring both the Department and the Commission to render an opinion in every case may result in needless duplication of effort.

Subsection (m) of proposed section 18 would authorize both Houses of Congress, by passing a resolution, to prevent the Administrator from finalizing any guarantee or commitment to guarantee or cooperative agreement where the cost of the proposed demonstration facility exceeds $200,000,000. If the "resolution" is to be a concurrent resolution, this arrangement would violate the provisions of Article I, section 7, of the Constitution which set forth the procedure by which

the Congress enacts legislation and which provide that the veto power of the President applies to all actions of Congress which would have the force of law. The Congress cannot, by passing resolutions, evade the specified legislative procedure.

The Office of Management and Budget has advised that there is no objection to the submission of this report from the standpoint of this Administration's program.

Sincerely,

MICHAEL M. UHLMANN,
Assistant Attorney General.

OFFICE OF THE GENERAL COUNSEL,
DEPARTMENT OF THE TREASURY,
Washington, D.C., June 30, 1976.

Hon. HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives,
Washington, D.C.

DEAR MR. CHAIRMAN: Reference is made to your request for the views of this Department on H.R. 12112, "To provide additional assistance to the Energy Research and Development Administration for the advancement of nonnuclear energy research development and demonstration."

H.R. 12112 would provide Federal guarantees for synthetic fuels production, energy conservation, renewable energy resources, and geothermal development. Our comments will focus on the synthetic fuel areas of the legislation.

The development of synthetic fuels is one of the key measures to help achieve energy independence and reduce our vulnerability to the OPEC cartel, proposed by the President in his January 15, 1975 State of the Union Message. In proposing his program, the President specifically endorsed the use of Federal financial incentives where necessary to encourage commercialization. The importance of this activity was reaffirmed in the President's Energy Message on February 26 of this year.

The program of Federal loan guarantees proposed in H.R. 12112 would direct capital from other areas of our economy into synthetic fuels production. The magnitude of the impact of such diversion on capital markets will depend upon the amount and time-span of the investment. H.R. 12112 calls for $4 billion in loan guarantees spread over a 8–10 year period as plants are constructed. Given the fact that the annual U.S. investment rate in 1975 was over $200 billion, the proposed program is not likely to have a major impact on the cost or the availability of capital. Further, FEA estimates that as much as $600 to $800 billion will be invested in the energy sector over the next 10 years.

H.R. 12112 would prevent non-U.S. citizens from obtaining guarantees under the program, except that the Administrator of ERDA has some discretion to grant guarantees to citizens of participants in the International Energy Agreement. In Treasury's view, the Government should maximize the opportunity for obtaining capital and technology from whatever source and should allow all foreign investors who otherwise meet ERDA qualifications to be eligible for guarantees under the program.

This Department does not see the proposed incentive program as a substitute for needed regulatory reform. Energy prices should reflect the real costs of producing energy if we are to achieve the needed increases in energy supplies and to discourage the wasteful uses of energy. However, we recognize that improvements in the regulatory environment will take time and that there is currently a need for a well chosen and carefully implemented range of incentives in order to assure the private financing of demonstration facilities in the interim.

Therefore, this Department strongly supports enactment of H.R. 12112 and urges that the Committee's consideration of the bill take account of the points discussed above.

We note that the borrowing authority provided for the Geothermal Resources Development Fund is section 18(n)(14) should be made subject to review by the appropriations committees, as required by section 401 of the Congressional Budget Act of 1974.

The Department has been advised by the Office of Management and Budget that there is no objection from the standpoint of the Administration's program to the submission of this report to your Commitee.

Sincerely yours,

HENRY C. STOCKELL, Jr.,
Acting General Counsel.

Mr. DINGELL. At this time we are most pleased to welcome Mr. Robert W. Fri, Deputy Administrator, Energy Research and Development Administration. Mr. Fri, we are pleased that you could be with us. If you will identify yourself fully for the purposes of the record and also your associate at the witness table, we would be pleased to receive your statement.

STATEMENT OF ROBERT W. FRI, DEPUTY ADMINISTRATOR, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, ACCOMPANIED BY WILLIAM T. McCORMICK, JR., PH. D., DIRECTOR, OFFICE OF COMMERCIALIZATION

Mr. FRI. Thank you, Mr. Chairman. I am Robert Fri, Deputy Administrator, Energy Research and Development Administration. Accompanying me today is Dr. William McCormick, who is Director of our Office of Commercialization.

Mr. Chairman, I have a prepared statement. With your permission, it might be useful for me to submit that for the record and take a few minutes to give you some of the background for this bill and some of the reasons that we think the program is important.

Mr. DINGELL. Without objection, the full statement will be inserted in the record and we will recognize you for proper summary and other comments.

Mr. FRI. Thank you, Mr. Chairman. Behind this bill is really a question about the long-term energy future of the country. We are not really looking at the next 5 or 10 years, but where we are likely to be at the end of this century.

In studies that ERDA has done and that Dr. McCormick ran with his OMB task force early last year and others, they have all suggested that there is a high probability that we could need in the neighborhood of 10 million barrels of synthetic fuels each day by the year 2000. Whether that is an exact number is, of course, difficult to say, but most studies do conclude that the amount is large.

Those studies—certainly ours and Dr. McCormick's—are based on the assumption that we are able to get as much as we can out of our existing natural sources of gas and oil, and, therefore; those studies assume, before computing the 10 million barrel per day or so we need by the year 2000—these studies assume that the price of natural gas has been deregulated, the price of oil has been decontrolled, that offshore drilling has been successful, that gas and oil are coming down from Alaska, and the like.

Now, if we are to meet a need of that magnitude in the relatively long term by the end of this century, then there are two things we can be sure of. One is that a synthetic fuels industry would have to grow very rapidly, something in the neighborhood of at least 15 to 20 percent a year between now and the year 2000, which is a very rapid rate indeed, and it is occasioned primarily by the large size of demand

at the end of the century and the fact that it takes a long time to build a synthetic fuels plant.

In addition to that, we can be sure that there will be a significant impact from the construction of these plants. They will require substantial development in the West, as well as some additional development in the East. They can have socioeconomic impacts, particularly on small towns that suddenly have large plants put up in them, and the like.

Now, it is not really possible, despite this need and these implications, to start the process of commercializing or the commercial development of these plants today, and that is because there are two kinds of uncertainty which plague the initiation of construction of these plants.

From a purely market standpoint, there is uncertainty about price of alternative fuels and also about the cost of product of the plants that have not yet been constructed, but, as importantly, there is uncertainty about how the environmental and socioeconomic and institutional consequences of building these plants will be managed by regulation and otherwise at the Federal, State, and local levels.

Now, with the program that underlies the legislation that has been referred to this committee, we are not attempting to resolve the long-term economic uncertainties that make it difficult to start commercial development of these plants now, but we can learn and we believe we should learn how to deal with the impacts, environmental, socioeconomic, institutional, and others, that may accompany the construction of such plants, and, therefore, the primary purpose of this program—and I think, Mr. Chairman, it is important to focus on this purpose—is to gather information on these impacts across a wide range of technology: Shale, high-Btu gas, low-Btu gas, biomass, and the like; so that we can establish a sound basis for the future commercial development of a synthetic fuels industry.

We have the opportunity to begin to establish that basis before the pace of commercial development begins to pick up, rather than to do it in the course of that development.

Whether at some point the Government needs to go beyond this kind of an information program to deal directly with the broad question of commercial development is a decision that is not part of the program we advocate and it may be debated in other forums and very possibly at some future date.

Now, in light of this objective to develop this information, it is our view that the bill that has been referred to this committee, H.R. 12112, is a sound piece of legislation. Certainly it has had very substantial deliberation and consideration during this session of Congress.

It is a bill of broad scope. It covers all of the technologies that are likely to be employed in the future. Its approach is prudent. For example, in the case of oil shale, it requires modular development. It also places in the way of the program a number of hurdles over which we must jump: Approval by the Governors, the Indian tribes that might be involved, compliance with environmental laws, Federal and State laws, and the like. And I would submit, Mr. Chairman, that it is entirely proper that these hurdles be placed in the way of this program because the purpose of the program is to see how those hurdles can be surmounted, to get the information about them so we

can look back and say that we have learned everything we need to understand in order to decide whether to proceed with any of these technologies, and, if so, how, so that we will have a sound and complete basis for future commercial development.

H.R. 12112 also provides a good deal of protection as we go through the program, both for the environmental aspects of it, as well as a substantial grant program to alleviate potential socioeconomic impacts that may inure to the construction of these plants.

In short, Mr. Chairman, I believe that in the case of this legislation we have the opportunity to do a program frontward for a change and not in a crisis atmosphere, to learn about the impacts of a few—a limited number of initial plants and to build a sound basis for the future.

If we do not take this opportunity, then it seems to me that we are left with two options. One is to wait until the economic uncertainties clarify, as I think they will in the future, only to discover that the institutional problems have not been resolved and that we are unable to produce quantities of synthetic fuels that we ought to have in this country.

Or, conversely, to become so convinced that we need these synthetic fuels that we engage in a crash program sometime in the 1980's which is grossly disruptive of the environment, the social and economic fabric, particularly in the West.

Neither option seems to me to be a particularly attractive one, and that is our reason for supporting this limited initial effort to find out what we have to do to make this a satisfactory industry.

I know, Mr. Chairman, that this committee is under a great time pressure in this sequential referral. We are delighted you are willing to step up to the task of going through this fairly complicated piece of legislation.

I want to assure you that ERDA and the Administration will offer you any assistance that we can in your work. Thank you.

[Mr. Fri's prepared statement follows:]

STATEMENT OF ROBERT W. FRI, DEPUTY ADMINISTRATOR, U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Mr. Chairman and Members of the Committee: I am pleased to appear before you today as this Committee begins its consideration of H.R. 12112 which would provide to ERDA loan guarantee authority and authorization for synthetic fuel and other full-scale energy demonstration projects.

Mr. Chairman, the President strongly supports the early enactment of this legislation and believes it essential that the Congress move promptly and decisively on this proposal. In this regard, we at ERDA stand ready to assist you in whichever ways you desire in order that the Committee may rapidly become familiar with the important proposals contained in this legislation.

I would like to note at the outset, that there have been few energy legislative proposals which have been studied so thoroughly and received such detai'ed scrutiny. Last year, following the President's proposal for a synthetic fuels program, a 50-man, 13-Agency Federal Task Force under the aegis of the Energy Resources Council completed a 2,200 page comprehensive study which resulted in a recommendation to the President for a 350,000 bbl/d commercial demonstration program. Last year, and again this year the House Science and Technology Committee completed 16 days of hearings on the loan guarantee and other aspects of this proposal and received testimony from more than 70 leaders representing Federal and state government, the financial community, industry, universities, environmental groups, Indians, labor, and consumers. The Science and Technology Committee and its staff have worked over the past two months to fashion, what I believe, is one of the most innovative, thoughtful and potentially effective

pieces of new energy legislation. I would like to emphasize that this new loan guaranty legislation is different in several important respects from last year's bill and contains a number of significant improvements which are summarized in Attachment 1. As this Committee begins its consideration of H.R. 12112, I am hopeful that you also will become convinced of the soundness of this legislation and the important contribution it can make to addressing our Nation's serious energy problems.

Mr. Chairman, we believe sufficient studies have clearly shown the need for this program and it is now time for positive and decisive action on this proposal so that we can begin laying the foundation for reducing our Nation's reliance on conventional supplies of oil and gas. Today, we are importing 40 percent of our petroleum supplies compared with 36 percent two years ago shortly before the Arab oil embargo. Our domestic gas production has been steadily declining for the past three years. I submit that it does not require a sophisticated understanding of energy matters to see the clear trend of increased reliance on imports, and I for one believe this Country must reverse it.

As you know, the President has proposed a comprehensive set of near-term energy supply and conservation measures that include Alaska and OCS development, use of our Naval Petroleum Reserves, auto fuel economy standards, appliance efficiency labeling, strategic oil storage, natural gas deregulation and others. But even if all of these measures were adopted immediately, U.S. domestic production of oil and gas is projected to resume again its decline in the late 1980s. This means that just to maintain oil imports at the current level of about 6 million barrels per day, synthetic fuels will have to be produced in substantial quantities early in the 1990s. In fact, ERDA projects that the demand for synthetic fuels will rise to 5 million barrels per day in 1995 and 10 million barrels per day in the year 2000 even assuming increased supplies resulting from gas deregulation and other supply measures and decreased demand from conservation. In order to achieve this production capacity, our synthetic fuel industry would have to grow from 1 million barrels per day in 1985 at a compounded annual rate of about 17 percent per year—a very optimistic target for such a capital intensive industry. Because of the long lead-times in constructing these plants and the regulatory uncertainties involved, we must begin now to establish the information and the experience necessary for growth of this industry in the late 1980s and early 1990s.

We cannot, however, expect the private sector to meet this need in a timely fashion without positive Government assistance. There are a number of serious obstacles now inhibiting private investment in this new and complex field. Uncertainties in both the future OPEC determined price of world oil, and in the price of synthetic fuels produced from the first few plants, are important factors discouraging private investment. If world oil prices were to fall substantially, large plant investments could not be paid off from the revenues generated from synthetically-produced fuels. Adding to this risk are other uncertainties including those related to environmental impacts, socio-economic impacts, financing of synthetic fuels facilities, availability of skilled labor and critical materials and public acceptance. These uncertainties must be identified and resolved in the near future if this Nation is going to achieve levels of private investment needed to finance the production of several million barrels per day of synthetic fuels early in the 1990s.

Mr. Chairman, this is the reason the proposed legislation is needed now—to enable the Federal Government to offer needed incentives to build and operate over the next five years a limited number of large scale plants to produce clean synthetic fuels from coal, oil shale and other domestic resources. Such a program (a possible project mix is illustrated in Attachment 2) will provide vital information concerning the commercial viability and environmental acceptability of each of the major synthetic fuels types in contributing to our Nation's future energy supplies.

Without such a program of Federal assistance we, as a Nation, run the risk of either seriously delaying the time when synthetic fuels can be available in the U.S. and thus substantially increasing our level of imports, or of inviting a crash synthetic fuels program five to ten years from now. The latter would entail a precipitious effort that undoubtedly would result in inadequate consideration of environmental, socio-economic and other local impacts that should be carefully provided for early in the commercialization process. Mr. Chairman, I do not think we want to run the risk of repeating the experience we have recently been through in the nuclear power area, where many of the environmental, regulatory and other

governmental policy uncertainties, not having been fully resolved prior to wide commercialization, are now slowing the growth of this important energy source. We should learn from this experience and, in the synthetic fuels area, address and resolve any potential problems at the outset.

I would now like to make several general comments on the proposed legislation, H.R. 12112. It should be clearly understood that, in the case of the loan guaranties, the actual cost of this program to the government is expected to be only a fraction of the required loan guaranty authorization. We estimate, at a maximum, the budget authority needed to cover the $4 billion in loan guaranties for the projects authorized by H.R. 12112 would be about $1.0 billion or $500 million each for FY 1977 and 1978. Because we do not expect any major plant defaults, we do not even expect that this amount will be needed, but it is required in order to make the guaranties credible to potential lenders. Attachment 3 provides estimates of credit authority, budget authority and budget outlays for the proposed program.

H.R. 12112, along with ERDA's existing authorities and other applicable laws, also includes the necessary safeguards to ensure that this program is carried out with minimum environmental and socio-economic impacts and with maximum overall benefit to the Nation. Examples of such key provisions are:

A comprehensive $300 million program for assisting local communities to finance essential public facilities needed as a result of the siting of a synthetic fuels plant.

Environmental monitoring of each plant along with full compliance with the National Environmental Policy Act including site-specific Environmental Impact Statements.

Review and approval, by the Governor of the potentially affected State, of each proposed demonstration project.

Compliance with all applicable Federal and state environmental laws and regulations.

Preparation of an assessment of water availability and the impact on water supplies of each proposed project.

Review by the Attorney General and the Chairman of the Federal Trade Commission of all proposed guarantees to ensure no adverse impacts on competition or concentration in the energy industry.

Encouragement of maximum participation in the program by small business.

A statutory advisory panel to provide input into the program by affected states, Indian tribes, industry, environmental organizations and the general public.

Acquisition of title by the government to inventions conceived in the course of demonstration projects with provisions for waiver in the cases it is desirable.

Dissemination of information generated from the program to all interested parties, except for proprietary information and trade secrets.

In summary, Mr. Chairman, the proposed legislation is essential, it is responsible and I urgently request the Congress to act quickly and favorably on it.

Finally, I would like to note for the Committee that about two months ago, for the first time in our Nation's history, we actually imported more oil than we produced during a given day. Inasmuch as it would take us at least five to six years to build the first plants to replace these natural fuels from coal or shale, it would seem the height of national imprudence not to provide legislative means to proceed with such construction as quickly as possible. Our energy fuel clock is ticking away steadily. It is running down on an irreversible course and it is not going to wait for political considerations or resolution of all market uncertainties.

Thank you, Mr. Chairman. I will be pleased to answer any question you or any other member of the Committee may have at this time. We have provided the members of the Committee a detailed program fact book which is included as Attachment 4 to my testimony. [See p. 585.]

ATTACHMENT 1

KEY MODIFICATIONS BY HOUSE SCIENCE AND TECHNOLOGY COMMITTEE TO SYNTHETIC FUELS PROGRAM

Reduced original $6 billion guaranty limit to $4 billion for synthetic fuels, renewable resource and energy conservation projects.

Provides that up to 50 percent (but no less than 20 percent) be used to demonstrate renewable energy resources and energy conservation technologies.

Limits oil shale projects to "commercial modules" rather than full-scale commercial plants and authorizes "cost-sharing" agreements.

Encourages maximum participation in program by small business.

Stipulates that all demonstration projects be located within the United States.

Establishes stringent conflict of interest requirements for ERDA officials administering program including public disclosure.

Mandates ERDA Annual Reports to Congress on all major aspects of the program including any significant potential adverse impacts which may result and all funds received and disbursed under program.

Requires that all proposed projects costing over $200 million be subject to Congressional review and possible veto.

Establishing a statutory advisory panel to ensure adequate consideration of views of affected States, Indian tribes, industry, environmental organizations, and the general public on the impact of the program.

Requires competitive bidding procedures for ERDA awards.

ATTACHMENT 2

POSSIBLE $4,000,000,000 PROGRAM

Fuel category and plant type	Number of plants	Guarantee amount needed (millions)	Percent by category
High Btu gas	2	1,600	40
Other fossil		1,200	30
Shale conversion (single module)	2	400	
Utility and industrial fuels (low, medium Btu gas, methanol, SRC)	4	800	
Biomass, renewables, conservation, etc		800	20
Biomass (municipal, wood, agricultural, industrial waste)	6	300	
Renewables (direct waste utilization, solar, etc)	5–10	300	
Industrial conservation	5–10	200	
Impact assistance		300	7
Contingency		100	3
Total		4,000	

ATTACHMENT 3

SYNTHETIC FUELS COMMERCIAL DEMONSTRATION PROGRAM BUDGET

EXHIBIT 4.—5-YEAR BUDGET PROJECTIONS FOR 200,000 BBL/DAY PROGRAM

	Fiscal year—						
	1976 and Transition quarter	1977 [1]	1978 [1]	1979 [1]	1980 [1]	1981 [1]	1982 [1]
Net budget outlays	2	12	14	1	−5	−15	−17
Administration	1	13	18	15	15	15	15
Loan guarantee [2]	0	0	0	0	0	0	0
Price guarantee [2]	0	0	0	0	0	0	0
Construction grants or cost sharing [3]	0	0	0	0	0	0	0
Planning grants	1	2	2	0	0	0	0
Loan guarantee fees collected	0	−3	−6	−14	−20	−26	−32
New budget authority	4	518	515	15	15	15	15
Loan guarantees	0	500	500	0	0	0	0
Price guarantees [4]	0	0	0	0	0	0	0
Construction grants or cost shering	0	0	0	0	0	0	0
Planning grants [3]	2	3	0	0	0	0	0
Administration	2	15	15	15	5	15	15
New credit authority	0	2,000	2,000	0	0	0	0
Loan guarantees	0	2,000	2,000	0	0	0	0
Price guarantees	0	0	0	0	0	0	0

[1] Funding for fiscal year 1977 and beyond are shown for illustrative purposes as if these programs were funded in ERDA. If, however, EIA is created in fiscal year 1977, the synthetic fuels program would be transferred to it.

[2] No payments for either loan guarantee defaults or price supports are anticipated during this period.

[3] Specific authorization and appropriation will be requested on a case-by-case basis under the Non-Nuclear Act if determined to be required.

[4] Specific authorization and appropriation will be requested at a future data under the Non-Nuclear Act if determined to be required.

Mr. DINGELL. Mr. Fri, the subcommittee thanks you for your kindness to us and for your testimony. The Chair will recognize the members of the subcommittee. The Chair recognizes first the gentleman from Indiana, Mr. Sharp.

Mr. SHARP. Thank you, Mr. Chairman. I just want to ask, Mr. Fri, if you could indicate how much more is involved in this than in projects you are already undertaking in the synthetic area.

Mr. FRI. Well, the projects that ERDA is presently undertaking in the synthetic area are demonstration projects of advanced technologies. For example, in the oil shale area, almost the entire focus of our program is in so-called in situ technology rather than aboveground technologies. Similarly, in gasification projects, there are advanced techniques which are more effective, we think—and we are able to demonstrate it—than some of the present-day ones.

The main purpose of this program is not, however, for technology development. We would plan to use existing technologies, because the objective of the exercise is to get information about the impacts of the construction of full-sized plants, or, in the case of shale, full-sized modules and plants, to determine what the socioeconomic and environmental, institutional and large-scale systems type engineering consequences are.

One point, I think, that is often not discussed about this program is these two areas. That is, this information program and the technology demonstration program, the advanced program, tend to come together in the early 1980's, so that what will be available to industry for commercial development at that time, when we think the economic uncertainties will be largely cleared up, will be both an advanced technology base, as well as an understanding of the environmental and other arrangements that need to be handled, so that you have got the whole thing pretty well built as a basis for then commercial development.

Mr. SHARP. Do I understand that you mean that what we would guarantee through our efforts to develop commercial plants of existing technology?

Mr. FRI. It would be full-scale plants or modules of existing technology in this program. The R. & D. program that ERDA has already undertaken is the development of advanced technologies, and the results of the two programs, the information gained out of both, tend to come together in the early 1980's, according to present plans, so that real commercial development of this industry is laid in place. Both the technological and nontechnological information is needed on which to base a future commercial industry.

Mr. SHARP. So in the original planning, were the two interrelated, or is this just one development onto the other?

Mr. FRI. Well, I suspect that it would be too much to say that there was, back in the days of the Office of Coal Research a couple or 3 years ago, you know, this kind of foresight, although it may have been in the minds of some of the people. The tracks developed differently and the genesis somewhat differently, although, when it became obvious that there were two kinds of things that needed to be done, we did give some consideration to making sure there was some meshing out in the future.

Mr. SHARP [presiding]. Thank you. My time has expired. The gentleman from Ohio, Mr. Brown, is recognized for 5 minutes.

Mr. BROWN. Thank you, Mr. Chairman. The arguments have been made, Mr. Fri, that the establishment of this $4 billion program will be a drain on the capital available to the energy industry. In other words, as they advance in the loan guarantee program, the energy industry will be tempted to get into this, tilt their capital utilization toward the synthetic fuel program and away from such projects, say, as the Alaskan gas pipeline or the development of other oil deposits on the Outer Continental Shelf. What is your response to that?

Mr. FRI. Well, the purpose of the program is to make something happen that might not otherwise happen, and that is to build a limited number of full-scale or full-scale modular facilities. We are talking about $4 billion worth of loan guarantees for this limited purpose.

Now, $4 billion compares to a couple of hundred billion dollars a year of total business investment or $600 billion a year or something in that neighborhood of energy investments over the next 10 years. Almost any way you compare it, it is a very small fraction of the total investment, so that, if there is a diversion involved, it would be an awfully small one.

In fact, our energy R. & D. program is in a sense a diversion of resources to something that wouldn't otherwise happen, and we are going along at a clip of $2 billion-plus a year devoting resources to that kind of thing already.

So this is, I think, a relatively——

Mr. BROWN. I guess the basic question though is: Are you diverting resources from the energy industry, or some entrepreneur who is not now in the energy industry who might get into the development of more conventional sources? Are you diverting funds away from those conventional sources into these more exotic and more distant kinds of things?

Mr. FRI. I don't think we are. Certainly, if there is such a diversion, it is, in my judgment, inconsequential. We are in effect talking here about projects, most of which are already well into the planning stages, for which resources would be allocated by private sector firms when the economics shape up in the next 4 or 5 years anyway, so I don't think we are diverting it from other options. We are not creating new options.

Mr. BROWN. You are suggesting that this is an option that we have to take in any event?

Mr. FRI. I believe it is an option we have to take in any event, but the plain fact is that a number of these projects are already on the drawing boards. They are stymied for a lot of considerations, and the companies involved in pursuing these options are already devoting their resources to them and not to the Alaska pipeline or something else.

Mr. BROWN. As I understand it, the purpose of this loan guarantee program is to construct and operate 10 to 12 synthetic fuels plants in various fuel disciplines or synthetic disciplines to obtain information as to the environmental, socioeconomic impacts and others and to determine what the commercialization problems of the prospective plants are and to avoid some of the problems we have had in the nuclear area, that is, launching a project really before we know what the delays and the problems involved with the construction might be.

At what point then does the Government get out of such a program? How do you know when enough is enough and not too much or not insufficient to push the project finally to a practical application?

Mr. FRI. Let me try to answer the question this way. We have been calculating the dozen or so synthetic fuels plants that are in the basic program, although there is opportunity to use this for some others—renewable resources as well, which we will have to pursue. We are just looking to shale and coal for a second.

We just think we have designed a dozen or so plants, the correct mix to get the information on the technologies in the locations where we need it, and for the purpose of getting this program—that is, of getting information.

We don't really see the need to have additional plants. This is it. This is enough.

Mr. BROWN. But at what point on the plants that you undertake do you back away, or do you complete the plant and let it operate and then that gives you enough technology and socioeconomic impact information?

Mr. FRI. You complete the plant, and, if it is successful, it runs and it just keeps on running. If it is successful, economically successful, the things turns out to be commercially viable, then, you know, it keeps on going.

There is a provision in H.R. 12112 for oil shale modules, which creates a possibility of buy-back by the private partner in the event of a successful arrangement, but basically the loan guarantees and other devices that are necessary to get this show on the road, and, if it operates successfully, it essentially operates successfully and the Government's obligation at that point is very limited because you have a commercially viable——

Mr. BROWN. I want to get one more question in before my time is up. I have been concerned about the fact that we are, on the one hand, regulating the price, keeping it low, on the existing fuel sources we have, natural gas and oil, and, on the other hand, we are taking Federal funds and guaranteeing, if necessary—of course, a guarantee has to be called—putting them into the development of synthetic fuels.

Now, that seems to me to be a little illogical, and I wonder if you could rationalize that logic for me. In other words, what regulatory decisions are going to be necessary for synthetic fuels to at some future date be competitive with the conventional fuels we have, or are we going to keep the price down, stimulate the consumption of the present fuel sources, and then from, say, 50 cent gasoline to $3 gasoline.

Mr. FRI. Well, the basis for estimating the need for synthetic fuels on which this program is predicated assumes that there would be deregulation of natural gas prices, decontrol of oil prices, and the like, in order to use economically all of the available naturally occurring resource, and, even if you do that, there is still a need of substantial magnitude by the end of this century. That is 25 years away, but that is a time frame we have to think in, in a new major capital-intensive industry. There is still a need for the synthetic fuels, so I guess there are a couple of ways of answering your question.

I agree with you. My own view is that we ought to get toward gas deregulation as well as oil decontrol, and, if we don't, this program—the need for synthetic fuels is likely to get worse rather than better.

Mr. BROWN. Explain it.

Mr. FRI. Well, if you don't, one of two things happens, depending on what point of view you believe. If, for example, we do not exploit more costly natural gas deposits because of an artificially low price and suddenly don't have the gas available to us, then, if that price is maintained artificially low, we just run out sooner and the need for synthetic gas would be higher earlier, and that would just mean we would have to move this industry along faster than I think is wise.

Mr. BROWN. Or you have to change your whole system of energy production, and maybe that is a more logical approach. Why don't we just go to solar energy and be done with the transitional synthetic fuels that are to replace the conventional fuels that we now have?

Mr. FRI. Well, we need liquid and gaseous fuels because the infrastructure is based on liquid and gaseous fuels. It is going to take a long time, and you need them, and the only way you get them over the next 25 years is through synthetics.

Mr. BROWN. That is to intimidate me and not you.

Mr. FRI. It works both ways, Mr. Brown.

Mr. DINGELL. The Chair recognizes the gentleman from New York, Mr. Ottinger.

Mr. OTTINGER. Thank you, Mr. Chairman. Dr. Fri, we meet again on this issue as we did in the Science and Technology Committee. Before that committee, Dr. Seamans testified that this was the first step in the same $6 billion program essentially that was proposed before, that there would be contemplated to complete this program $6 billion in loan guarantees, $4.5 billion in price supports, $600 million in construction grants. Are you altering that, or is that still the case?

Mr. FRI. I guess I have got two answers to that question, Mr. Otinger. First, on the loan guarantee part of it—and I think the Science and Technology Committee has fashioned a program which is—which fits within the $4 billion loan guarantee requirement—attached to my testimony is our understanding of how that works.

The other aspect to your question is: Would we propose to use price supports or construction grants to accomplish the purposes of this program, and the answer is "Yes." ERDA has, we believe, the authority for both. We have to approach the Congress for project-by-project authorization, which we are prepared to do. We think we need the flexibility of all three tools in order to come up with arrangements that are most compatible with the financial situation of the projects and also to create a program that has the least exposure, financial exposure, for the Government.

Mr. OTTINGER. So, in short, your answer is "Yes"?

Mr. FRI. You asked a very complicated question.

Mr. OTTINGER. I don't think it is that complicated. In fact, the authorization, H.R. 12112, calls for $2 billion in the first year, $2 billion in the second year, and such sums as may be required in future years. And the testimony was that it is going to be essentially the same program, only apparently at an accelerated rate, because the original program called for $6 billion over an indefinite period which was estimated to be 10 years.

There was also, as the administration support testified—there was submitted in the testimony of ERDA a letter from Vice President Rockefeller to the effect that this was the first step in establishing the energy independence authority, that he contemplated that this pro-

gram would be folded into the $100 billion loan guarantee program that was proposed, should that be passed. Dr. Seamans' testimony confirmed that. Is that essentially correct?

Mr. FRI. I think you know, Mr. Ottinger, the administration's position is that we need this program and we would like to get the energy independence authority. If the energy independence authority is established, then the administrative loan guarantee aspects of this program would be consistently placed in the energy independence authority.

I think the point I would like to make though is that, while the progress of history could work out in that fashion, it could also conceivably work out that the energy independence authority is not created by the Congress, in which case this is a step to exactly what we say it is a step for, and that is, to get the information that we need to determine how to make this industry commercially viable, if at all. You can have one without the other, though we advocate both.

Mr. OTTINGER. Now, on that question, we received testimony from Dr. Morton B. Zimmerman of MIT, who was part of a task force on this subject, which says—and I quote:

> The second possible reason for synfuel subsidies is the knowledge that will be gained from such a program.

This is what you say the reason for this program is.

> It is asserted that knowledge will be gained that will reduce the future cost of synthetic fuels. In my opinion, these benefits are overestimated. In the first place, many of the learning effects have already been included in the estimates of present generation plant costs. These costs are derived under the optimistic assumption that plants operate under full capacity beginning from the start-up year. According to engineers, a good deal of learning will be required to develop operating procedures with as high a rate of capacity utilization to be realized. Furthermore, for many of these technologies, there is experience elsewhere to draw on.

He cites some cases in South Africa.

> If knowledge were the goal of the program, the emphasis would be much different. The commercialization program is not officially designed to increase our knowledge. Commercialization, either through loans or subsidies, would emphasize the more developed technologies, precisely those where learning will be least.

Then he goes on to conclude:

> Any program is bound to produce information. The question is: How much information do we obtain, and at what cost? I should also add that the Task Force study concluded that the costs of commercialization were greater than the benefits, even allowing for significant learning effects.

This leads one to wonder, first of all, you know: Is this truly to get knowledge or is it to finance the major energy companies in commercial production of these fuels? Second, if the cost/benefit ratios are indeed so adverse, wouldn't we be better steering capital elsewhere?

Mr. FRI. Well, Mr. Ottinger, the purpose of the program in the minds of the people who are proposing the program is unequivocally to gain information. Now, Dr. Zimmerman's views, I think, are narrowly focused on the technological information, if I understood what he said in the statement that you read, and, while we do believe that there is something to be learned about the engineering problems of putting up full-scale systems, including the coal handling and other problems, we think the really important part of this program is the

nontechnological data that we gain on socioeconomic and environmental impact.

Mr. OTTINGER. Why can't that be done on a pilot project basis which are already provided for in the $416 million given to ERDA for that purpose?

Mr. FRI. Because we want to put up—in order to find out what the true impacts of full-scale development, full-scale plants, are, you have got to put up a full-scale plant, and you have to stimulate as closely as possible the process of industry doing that, and building a small pilot plant with primarily or exclusively Government funding simply isn't that animal.

Mr. OTTINGER. Well, there is, I take it, a substantial dispute on that with respect to the technical experts. Dr. Zimmerman indicates quite clearly you get more knowledge by financing a greater variety of pilot operations.

Mr. FRI. Dr. Zimmerman was, if I understand your statement, referring to the knowledge about the operations of the plant itself, and, of course, you are going to learn a little more if you put up—about operations if you put up 15 small-scale pilot plants.

As I say, while the operating data that we will get will be useful to us, the primary information we get out of this program is nontechnological, and, having sat through a number of discussions in the West about what people are worried about, the folks out there as well as in other parts of the country are less worried about how you run that plant than what happens to my community or my environment if you put a full-scale thing up.

Unless we can resolve those problems adequately to people's satisfaction, then I think we face the very real probability of not having a viable synthetic fuels industry, if it turns out this country needs one, as I think it will.

Mr. DINGELL. The Chair thanks the gentleman. The time of the gentleman has expired. The Chair recognizes the gentleman from Ohio.

Mr. BROWN. I do have just a couple of questions. May I ask, Mr. Fri, what are the lead times necessary for the projects involved in this operation?

Mr.FRI. From the start of detailed design to construction, end of construction, is in the neighborhood of 6 years.

Mr. BROWN. Can you give me some idea what delays have been experienced? You mentioned earlier, when I asked a question, what delays have been experienced in certain corporations or nonprofit groups undertaking the establishment of pilot plants.

For instance, I am aware of the fact that the Batelle Memorial Institute has done some work in coal gasification. Are there specific pilot projects that have been delayed for lack of coal guarantee—of the loan guarantee program, and in what fields?

Mr. FRI. Well, there are specific projects with the construction of full-scale facilities or, in the case of shale oil, modules which have been delayed because of the economic and regulatory uncertainties. We have available a booklet which we will be happy to provide to the committee which gives in some detail the history of all of the projects we know about. They all tend to suffer from the same problem.

Mr. BROWN. But my question really is: Are there projects ready to go at this moment——

Mr. FRI. Yes.

Mr. BROWN [continuing]. That have been delayed for lack of this program being implemented by the Federal Government?

Mr. FRI. Yes.

Mr. BROWN. Can you cite to me what they are and in what fields they may be?

Mr. FRI. Well, there are the Colony project in shale; the Occidental project in shale, which is going ahead at some degree; the Tosco project; the Union Oil project in shale.

Mr. BROWN. Could you give me a location for any of these? Are they identified by location?

Mr. FRI. If I can find it. Colorado for Union. Utah for Tosco. Colony is in Colorado. In the case of high Btu gas, there is the so-called ANG project, which would be physically located in North Dakota and pumping gas into the Michigan-Wisconsin pipeline. The El Paso project, which would physically be located in New Mexico, supplying gas to the El Paso pipelines. Panhandle Eastern——

Mr. BROWN. Perhaps you could provide those for us in detail at this point in the record.

Mr. FRI. We would be delighted to provide all this.

Mr. DINGELL. Would you very specifically identify the projects and the area, and indicate which projects are ready to go right now, which are not, and why they are not, if you please, for purposes of the record.

Mr. FRI. We certainly will, and we will include in that, since I only got through part of the list, the industrial and utility fuels and the biomass or waste fuels.

[The following material was received for the record:]

PROJECT STATUS, SUMMARY OF FINDINGS

Synfuel product and project name	Synfuel produced	Plant size	Location	Technology used	Beginning of construction/beginning of operation	Funds expended to date	Project cost	Project status
Shale oil:								
Colony Development.	Shale oil	47M B/D	Garfield County, Colo.	Underground mining, Tosco II retorting.	1977–80 (contingent on incentives).	204.1MM	1.1B	Suspended state; P. & D. of commercial plant completed.
Occidental Petroleum.	do	40M B/D	do	Modified in-situ retorting.	1977–80 (estimate—firm dates contingent on demonstration).	30MM	400–600MM	In-situ commercial size demo. started December 1975; full commercial expansion contingent on demo. perform.
Rio Blanco	do	50M B/D	Piceance Creek Basin, Colo.	Open pit or underground mining, Tosco II retorting.	1977–80	5MM	1.0B	DDP to be submitted in March 1976, site develcpment to start in April 1977 contingent on DDP.
Superior Oil	Shale oil, minerals.	50M B/D	do	Underground mining, prop. retorting process.	1978–82	Not available	600MM	Schedule contingent on land e change; EIA underway.
Tosco Sand Wash	Refined shale oil	75M B/D	Uintah Basin, Utah.	Underground mining, Tosco II retorting.	1983–85	1.0MM	1.5B	Planning and feasibility studies; mine exploration.
Tract C–b	Shale oil	50M B/D	Piceance Creek Basin, Colo.	do	1979–83	117.8MM (or committed).	923MM	DDP prepared; site development contingent on DDP.
Union Oil	do	50M B/D	Garfield County, Colo.	Underground mining, Union "B" retorting.	1977–79 (7,000 B/D).	Not available	110MM (7,000 B/D).	Project construction is pending financing, (7,000 B/D 1st module).
White River Shale project.	do	50–100M B/D	Uintah County, Utah.	Underground mining, Tosco II and Paraho retorting.	1977–79 (4,700 B/D module).	87MM (or committed).	900MM–1.6B	DDP being prepared; site development to start in 1977 contingent on DDP.
High Btu gas:								
ANG Coal Gasification Co.	SNG	250MM CFD (40M B/D).	Beulah, N. Dak.	Surface mining, Lurgi gasifier with methanation.	1977–81	16MM (or committed).	1.1B	Construction pending financing and FPC certification.
Dunn Center (National Gas Pipeline).	SNG	250MM CFD (40M B/D).	Dunn County, N. Dak.	do	1978–82	7MM	1.3B	FPC filing in 1976; construction pending FPC certification.
El Paso (Burham).	SNG	288MM CFD (40M B/D).	San Juan County, N. Mex.	do	1977–80	12MM (or committed).	1.0B	Construction pending financing and FPC certification; coal lease being renegotiated.
Panhandle Eastern.	SNG	250MM CFD (40M B/D).	Converse County, Wyo.	do	1978–82	22MM	1.2B	Construction pending final financing plan and FPC certification.
Wesco	SNG	250MM CFD (40M B/D).	San Juan County, N. Mex.	do	1977–80	20.0MM	1.0B	Preliminary plant engineering completed.

PROJECT STATUS, SUMMARY OF FINDINGS—Continued

Synfuel product and project name	Synfuel produced	Plant size	Location	Technology used	Beginning of construction/beginning of operation	Funds expended to date	Project cost	Project status
Utility/industrial fuels:								
Columbia Coal Gas Corp.	300 Btu gas	218 Btu/D (3,750 CBE/D).	Coatesville, Pa	Koppers-Totzek	Operational 50 mos after go-ahead.	Not available	114MM	Preliminary study completed.
Consolidated Natural Gas—3 projects.	300 Btu gas	70B–100B Btu/D (4,900–7,000 CBE/D).	Cleveland; Ohio River/W. Va.; Pa.	Koppers-Totzek; Babcock & Wilcox; Texaco partial oxidation; or Lurgi.	1977–80	250MM	120MM (initial plant).	Exploratory studies.
Consumers Power	300 Btu gas	188MM CFD (12,000 CBE/D).	Bay City, Mich	Riley Stoker or Kopper-Totzek.	1977–80	20M	178MM	Preproposal.
Lampco	140 Btu gas	115 MWe (5,000 CBE/D).	Baldwin, La	Texaco partial oxidation.	1977–80	Not available	62MM	Economic and engineering reports finalized and documented.
UGI	Methanol	2,500 T/D (9,500 CBE/D).	Pennsylvania or Ohio.	Texaco	1978–81	500M	300MM	Planning.
Wheelabrator-Frye	Boiler grade fuel, naphtha.	46M B/D boiler fuel, 4M.	North Central Alabama.	SRC process	1977/80 (Plant No. 1).	28MM	100MM (Plant No. 1).	Feasibility study.
Panhandle East. People Gas.	300 Btu gas	94MM CFD (6,000 CBE/D).	Chicago, Ill	Koppers-Totzek	Operational 38 mos after go-ahead.	115M	120MM	Feasibility study completed; start of construction suspended.
Biomass:								
Baltimore, Md	Pyrolysis gas	1,000 CBE/D	Baltimore, Md	Monsanto Landgard	1974–78	16.0MM (or committed).		Halt in operation to add additional pollution control equipment.
Minneapolis-St. Paul, Minn.	Pyrolysis gas and oil, char.	360 CBE/D	St. Paul, Minn	MWCC-Rust	Not scheduled	75M	20.0MM	Feasibility study.
New York Metropolitan Area.	Pyrolysis gas	100MM CFD	New York City	Union Carbide Purox.		Not available	Not determined yet.	Do.
Brooklyn Navy Yard.					1980–81			
Fountain Avenue.					1982–84			
Northern Queens.					1981–83			
San Diego, Calif	Pyrolysis oil	110 CBE/D	San Diego County, Calif.	Flash pyrolysis	1974–77	3.5MM	14.4MM	Under construction.
Seattle, Wash	Ammonia (from low Btu gas).	550M tons NH, per year.	Seattle, Wash	Union Carbide Purox.	1977–80	Not available	101.6MM	Preliminary engineering study to begin in 1976.

Mr. DINGELL. Have any assurances of Government financing been made to any of these projects by any Government agency?

Mr. FRI. Not that I know of.

Mr. DINGELL. Was anyone authorized to make those kinds of assurances?

Mr. FRI. Not until we get legislation.

Mr. BROWN. I am sure you will be generous and gentle, Mr. Chairman.

Mr. DINGELL. The Chair is always gentle. You mentioned the oil shale projects. Those are all bottomed on leases that were issued on public lands, were they not?

Mr. FRI. I believe most of them are. The Union project is on privately owned land. About half, Mr. McCormick informs me, are on private land, and a number have been on public leases.

Mr. DINGELL. Would you identify the leases please for purposes of the record? Would you also inform us whether at the time that the leases were made there was any assurance made to any person or by any person, within or without the Federal Government, that these leases would be bottomed on some kind of a Federal loan guarantee or assistance. Was there anything of that sort at the time these leases were issued?

Mr. FRI. We will provide the detailed information, but the answer to your last question is "No." As far as we know, there were no assurances of that kind expressed or implied.

Mr. DINGELL. What I am trying to get at is: Have there been any assurance made upon which these individuals have relied, that they would receive Federal assistance from any source?

Mr. FRI. No. As a matter of fact, I think it is important to recognize, you know, there are six or seven or eight oil shale projects here. If what we wanted to do was fund everybody's oil shale project, we wouldn't be saying that all we need is two to get the kind of environmental and socioeconomic information that we need. And, if you assume that these eight—or whatever it is—projects are the candidate projects for this program, for the sake of argument, there might be some others that are put together. There are two winners and six losers in here, so we are certainly not, you know, supporting everything that is possible by any means. That is not the purpose of the program.

[The following information was received for the record:]

No commitments for Federal loan guarantees or other Federal assistance were made at the time of issuing the oil shale leases. The leases follow:

Tract	Estimated recoverable resource [1] (30 gal/ton or more	Successful bidder and price
Colorado:		
C-a	1,857	Gulf, Standard Oil (Indiana), $210,300,000.
C-b	1,012	Arco, Tosco Ashland, Shell, $117 8,000,000.
Utah:		
U-a	342	Sun, Phillips, $75,000,000.
U-b	372	Sohio, Sun, Phillips, $45,100,000.

[1] Million tons in mineable beds.

Mr. DINGELL. Thank you. The Chairman thanks the gentleman from Ohio.

Mr. BROWN. It might be difficult to tell the losers from the winners though because, if the Government guarantees the loan to the first two projects and the projects proceed and you find out through that guaranteed loan all the mistakes they make—and I guess that is part of the purpose of this, isn't it, by actually doing—you know, learning to ride the bicycle by doing it. You fall off a couple of times and get your knees skinned and maybe other parts. Then the third, fourth, fifth, and sixth projects undertaken by some private or nonprofit enterprise might in fact learn from what you had put out a loan guarantee on and might have a more viable project.

Is that a proper statement of the circumstances?

Mr. FRI. Sure. The idea here is to learn about these impacts so that, when we are approaching full-scale—and I would hope, fully privately funded development—that we know exactly what we are doing. We are going to make mistakes. The purpose of this program is to clear these hurdles, and, in doing that, we will probably stub our toes.

You are absolutely right in saying that some of these organizations, to use your simile, own part of the bicycle.

Mr. BROWN. The first guy makes some mistakes and the second guy learns from them. I have two other quick questions. What do your studies show with respect to demand for synthetic fuels in the 1990's or in whatever time frame you might have done a study on, in terms of volume of fuels that will be needed that would properly qualify as synthetic?

Mr. FRI. We estimate that synthetic fuels from shale and coal by the year 1995 will be in the neighborhood of 5-million barrels a day, and, by the year 2000, in the neighborhood of 10 million barrels a day. We would be pleased to provide you some supplementary information on other dates.

Mr. BROWN. What percentage of our internal combustion engine and current heating furnaces and so forth is that?

Mr. FRI. I would have to——

Mr. BROWN. Would you supply that for the record please?

[The following material was received for the record:]

FUTURE CONSUMPTION PROJECTIONS

End products from synthetic crude processes (either oil shale or coal) can be refined, with approximately similar cost increases as experienced in the petroleum industry across the entire range of refined petroleum products. Synthetic high Btu gas will be commingled with natural gas in the interstate pipelines. For both these fuels consumption patterns will be similar to that of the naturally occurring resource. Low Btu gas by its nature will most likely substitute directly for pipeline gas in industrial and electric generating applications.

It should be kept in mind that consumption of synthetic fuels by any one sector will free up fuel for consumption by other sectors. In other words, from a national perspective synthetic fuels should be viewed as direct substitutes for natural gas and petroleum. Therefore, while consumption of a significant portion of synthetic fuel production may occur in the producing region in a limited number of applications, such a situation reduces the producing region's consumption of the naturally occurring resources and increasing the available supplies of such energy to other regions of the U.S.

In 1995 and 2000 the following discussion highlights the pattern of energy consumption that is expected in consuming sectors that could be supplied by a synthetic fuels industry.

Current consumption of energy in the operation of automobiles is in the neighborhood of 10 quads annually or the equivalent of 5 million barrels of oil per day. Automobiles therefore consume about as much energy today as is anticipated

to be produced in the form of synthetic fuels in 1995. Total consumption of energy by all modes of transportation based on the internal combustion engine currently equals about 15 quads. In the year 2000 that total is estimated to reach 24 quads according to the long term trend and 17 quads with increased efficiencies (greater MPG and use of electricially powered engines).

With regard to space heating, approximately 13 quads of primary energy input are currently consumed for this purpose. Projecting this total out to the year 2000 indicates space heating would require an additional 3 quads. On the other hand, conservation and increased use of solar heating and heat pumps in the year 2000 would reduce energy consumption for space heating by about 3 quads below current levels to around 10 quads.

The other major demand categories for synthetic fuels are industrial process heating and petrochemicals. Together they consumed about 18 quads of primary energy in 1975. By 2000 these sources of energy demand are estimated to account for between 35 and 40 quads. These and other estimates above are based on research done by the Brookhaven National Laboratory which was published in December 1975 in its "Source For Energy Assessment" (BNL 50483).

Mr. BROWN. Finally, why is solar not—or is it a viable alternative at this moment? You began to answer that question, and I thought we weren't getting the full response that I would like to elicit from you. You answered that question initially with the comment that we are on an internal combustion engine transportation trucking economy to a large extent, that we are on a system of heating, that is, the present furnace system that we have. And I looked into solar energy when we had to replace the heating system in our house not long ago, and I found that I could get the equivalent of about a $4,000 to $5,000 gas furnace arrangement for something in the neighborhood of $30,000 and up in solar heating.

So I think one of the answers might be economic, but what is the prospect for solar energy? Why don't we skip the synthetic fuel undertaking and go directly to solar energy?

Mr. FRI. Primarily because solar energy does not in most cases produce a direct substitute for liquid and gaseous fuels, if I can just take a second to explain that. Solar heating and cooling, which we think has an opportunity to make a real dent in the market fairly quickly, does substitute potentially for liquid and gaseous fuels, but in primarily the residential and commercial building sector of the market, which itself is only a part of the total energy picture.

Mr. BROWN. Not at $30,000 versus $2,000.

Mr. FRI. The economics have to improve some. The other application of solar is predominantly to generate electricity, and to substitute for liquid and gaseous fuels particularly in the transportation sector, which is about the largest consumer of energy, you have to convert that sector over to, in effect, electric cars. You have to electrify the economy, and that is a very long-term proposition. Our calculations underlying this demand I have given you for synthetic fuels does assume by the year 2000, I believe, in the neighborhood of 1 million-plus electric automobiles, for example.

Mr. BROWN. Has anybody got an electric autmobile now that I can plug into my Christmas lighting outdoor outlet?

Mr. FRI. Is there one today? Yes. We have three of them down at the office that work, but you can——

Mr. BROWN. What price are they? How far can I go? And what is their speed?

Mr. FRI. Gee, I don't know. The one I am familiar with is a fairly large car which itself costs about $8,000 or $10,000, but the trailer that comes with it to supply the power costs another $6,000 or $7,000.

But in small units like little postal trucks and whatnot, golf carts—we are testing those today. It is a relatively slow process to make a dent in the very large number of vehicles that are powered almost exclusively by oil. The process is beginning, but the economics have to improve. Just the possibility of market penetration, you know, is a slow sort of thing.

Mr. BROWN. Could I write to ERDA, for instance, and ask for something on the electric automobile and get back a description of what currently is available, the cost, the speed, some of the specifications? Similarly, could I get that kind of information on solar energy? Have you got that compiled in some way so that the guy who thinks he has a bright idea could learn roughly where we stand now and whether his thing has already been invented?

Mr. FRI. You certainly can on solar. We publish a catalog of the available solar equipment, and in fact, if you go down to our solar exhibit on the Mall, we have a computer—you give it your ZIP code—that will spew out the folks in your area that sell solar equipment and what they have got. We can provide that. Sure.

[The catalog referred to, "Solar Energy Heating and Cooling Products," may be found in the committee files.]

Mr. BROWN. But you think that is too far off or not technologically adaptable to our present energy systems to not have the synthetic fuels come in?

Mr. FRI. In order to replace liquids and gases, OK, which is what we are talking about here, solar energy and geothermal energy or anything else that produces electricity—new technology—has to surmount two hurdles. One is getting the basic thing to work economically, and the second is the electrification of the economy so that we can run things electrically rather than through some kind of an internal combustion engine.

Mr. BROWN. Thank you, Mr. Chairman.

Mr. FRI. Both are difficult.

Mr. DINGELL. The Chair thanks the gentleman. The Chair recognizes the gentleman from New York.

Mr. OTTINGER. With respect to this last colloquy, I think part of the reason that solar isn't contributing as much as it might, according to studies that were made by various Government agencies, is that there hasn't been the same kind of push behind them as there has been for nuclear energy and these synthetics, which are high technology developments that are being developed by the large energy companies that have a lot of clout with the present administration.

I have no question that solar can take the far larger role. That is what most of the architects and engineers believe, if the same kind of energy were applied.

With respect to electric cars, I drove one 8 years ago and demonstrated it. It went 60 miles an hour. It went 200 miles on a charge. We tried to get the Federal Government to create a market for these cars. That was the silver zinc battery. Very expensive. You had to buy one, but it could be rented out. It took a large amount of silver. We could not get it done. Again, no real push has been put behind this effort.

Where the real push comes in programs like this—as you well know, that is one of my major criticisms of ERDA, but the thing that Mr. Brown, I think, to pursue further—solutions in the near term, where the real savings are possible, the real fast advanced energy independ-

ence is feasible in accordance with virtually all the studies that are done, and the place where GAO criticized this program, is in the field of conservation.

There, we are using three times as much energy per capita as the other industrial nations in the world, like West Germany and Sweden. We could really be making very vast progress toward energy independence.

ERDA has now declared verbally that they are going to put equal emphasis on this. I certainly have not seen any action and push behind it and requests for money behind it that would indicate that they really meant what they were saying. I think the words are in the right direction.

As you know, I very devoutly wish that you would put that kind of push behind conservation, if you can without significant environmental problems, without having to displace large amounts of capital, can get real returns. It just mystifies me totally why that isn't being done.

Mr. FRI. Well, I guess—let me respond to that in two ways. First of all, this legislation, which we support, says that the total amount of this loan guarantees shall be allocated so that no more than 50 percent is for high Btu gas, no more than 80 percent for fossil-based synthetics, and no more than 50 percent is for renewal, including biomass, et cetera, and for industrial energy conservation.

So the thrust of this program as shaped by the House Science and Technology Committee, a shaping which we are certainly prepared to support, no longer makes this an altogether synthetics fuels program.

ERDA has, in fact, stated not only verbally, but in writing, the priority that we assign to conservation. And, in calculating what we think we will need for this program by the year 2000, the need for synthetic fuels by the year 2000, we have taken into account substantial use of conservation.

I don't think this is the place to argue whether the degree of Government involvement in getting that degree of conservation, because, more than any other area in there, it is responsive to price. Therefore, the Government role vis-a-vis the private is probably less than in some other areas.

But I guess I would have to assert that this is not a program that is sort of based on how much synthetic fuels do we think we need, and isolate it only to that. It is a broader program. It is a program that is based on the assumption that a lot of different technologies work and make a degree of market penetration that is pretty substantial, and you still need it, and our studies are quite convincing to me on that point.

Mr. OTTINGER. In supplying the statistics that Mr. Brown requested earlier, I hope that you will include in that the bases on which you make your conclusions for needs for synthetics fuels for the future, including specifically your projection of how much you can bend the demand curve down through conservation efforts.

Mr. FRI. We will be happy to do that. I guess, you know, so that you don't have to wait necessarily for us to supply the answer, I refer you to ERDA 48, which goes through all the calculations that result in this. It shows you what assumptions we have made about conservation, solar, and everything else.

Mr. OTTINGER. Well, I am familiar with those projections. They show a very feeble effort in the conservation area compared to what other studies indicate as to what might be done.

Mr. FRI. That is not a point on which we agree.

[The following material was received for the record:]

NEEDS FOR SYNTHETIC FUELS

Virtually all energy experts agree that a technological breakthrough which would make the United States energy independent is highly speculative. In the absence of such a major technological breakthrough that would result in the production of a relatively cheap, mass consumed source of energy, most energy studies that project beyond 1990 conclude that U.S. dependence of foreign sources of oil will continue to increase after 1990 if synthetic fuels are not produced in substantial quantities. Even taking into account the development of Alaskan and OCS oil and gas, improved conservation, the expansion of nuclear power capacity and direct coal burning, imports of oil are more likely to increase than decrease provided synthetic fuels are not produced commercially after 1985.

With respect to the sensitivity of the demand for synthetic fuels to increased conservation, the 1975 Synfuels Interagency Task Force concluded that imports would respond more to demand changes than the synthetic fuels because they require less planning and are less capital intensive. In Volume II of its report the Task Force included an estimate of the impact on synthetic fuels of high, nominal and low demand for total energy in the year 2000. For the low demand case where total U.S. energy consumption is estimated to equal about 130 quads (compared with 157 quads for the nominal case and 225 quads for the high demand case), total synthetic fuels production is estimated to equal about 8 quads (or 4 million barrels of oil equivalent) even though conservation is accelerated. This compares with 11 quads for the nominal case and 13.5 quads for high demand case.

Mr. OTTINGER. Last fall, the Federal Power Commission, Commissioner Donald Smith, suggested that legislation require that loan guarantees be conditioned for coal gasification projects upon the applicant obtaining a Federal certificate of public convenience and necessity as is now required for the transportation and sale of natural gas under section 7 of the Natural Gas Act. The FPC now certifies the transportation and sale of synthetic natural gas after it is mixed with natural gas in interstate commerce, so that is a matter peculiarly within the jurisdiction of this committee.

I wonder whether you feel that such provision should be added to H.R. 12112.

Mr. FRI. Mr. Ottinger, I am simply not an expert on that point. Could I supply an answer for the record?

[The following material was received for the record:]

Subject to the condition noted, ERDA would not object to a provision in H.R. 12112 requiring that availability of loan guarantees or coal gasification projects be subject to the applicant obtaining a FPC certificate of public convenience and necessity as is now required for the transportation and sale of natural gas under section 7 of the Natural Gas Act.

ERDA believes that such certification would dispel skepticism regarding continuity of tariffs and revenues under future Commissions by bringing the gas plants into the rate base.

The requirement for such certification, however, should be conditioned on the continued regulation of natural gas prices, and should lapse upon general deregulation of natural gas.

Mr. OTTINGER. The chairman advises me that my time has run out again, which is certainly accurate, and I know we have a number of witnesses.

Mr. DINGELL. The Chair would not be so brisk on observing the gentleman's time, were it not for the fact that a vote now pends on the floor. For that reason, I think it is prudent that the subcommittee do recess. The subcommittee will recess until we get back from the vote, which will be in 15 minutes.

[Brief recess.]

Mr. DINGELL. The subcommittee will come to order. The Chair would like to ask some questions. Mr. Fri, can you give us a list of the other programs that ERDA has regarding energy development in synfuels and how they would be duplicated or not duplicated by the proposal now before us?

Mr. FRI. I would be happy to supply a complete list for the record. Basically, they are research and development programs into advanced technologies, and they are not duplicative of this program.

[The material referred to, "Fossil Energy Research Program," ERDA 76-63, April 1976, may be found in the committee files.]

Mr. DINGELL. Now, your testimony indicates that the real need for synthetic fuels will occur in the late 1980's and 1990's. My question is as follows: Do you believe that the plants built in the early years will provide information that will be useful in that period of time? And do you believe that plants built in the 1980's and 1990's will utilize the coal gasification processes which are candidates for existence under the bill? It is a two-pronged question.

Mr. FRI. The second part of your question—the answer is that the plants actually constructed beginning in the 1980's and into the 1990's will probably use more advanced technologies, and primarily technologies that will produce a slightly less costly product.

The information gained under this limited number of plants, 12 or so, will be heavily in the environmental, socioeconomic, institutional areas, to answer the kinds of questions that we need and States need and localities need to understand and manage the impacts of these plants. And I think that information will be good as a basis for regulating these plants over the next decade or so. Obviously, we will learn a little more, but this is where the information gap is today, and it is not terribly technology-intensive.

Mr. DINGELL. Are you telling us then you have all the information you need on technology?

Mr. FRI. No, sir.

Mr. DINGELL. What are your comments on that? You have indicated your main concerns lie in the area of production of information with regard to environment and socioeconomic effects. What about technology?

Mr. FRI. The main concern addressed by this program is in information of that type: Socioeconomic, environmental, and so forth. The technology programs that we already have in ERDA ore the R. & D. programs that are aimed at the development of improved technologies which will be used in the future for construction of these plants, but you need both. You need the basic technology——

Mr. DINGELL. I don't quarrel with that, but I gather from your comments that this bill is to provide information on the socioeconomic and the environmental effects of these plants and not on technical processes and technical information. Now, is that a correct impression?

Mr. FRI. Yes. That is predominantly the case. There is information one learns from the construction of a full-scale facility. For example, in the case of high Btu gas plants, in such problems as coal handling, engineering of full-scale systems, and the like, that we don't have and would be learned from this program, but it won't tell us anything about the gasifier itself. That is of paramount value.

Mr. DINGELL. I am curious how the environmental effects of first-generation technology will inform you of the environmental effects of second-generation technology, and also of the rather large-scale application as opposed to the narrow-scale applications you would be applying here.

Mr. FRI. Well, there are two kinds of effects that occur. One—several kinds of effects. One is the emissions from the plants. The new technologies are more efficient ways of doing essentially the same process of gasification. For example, in the nature of the emission, in terms of its chemical composition and whatnot, it is going to be essentially the same. So, for example, for purpose of setting a new source performance standard, you get information that you would need for air effects, water requirements similarly, and the socioeconomic effects, the boom/bust effects, particularly in the West, are effects that are essentially independent of technology. They are dependent on the fact that you bring in thousands of construction people to build a plant and then they go away, and it creates quite a strain on the social and economic fabric of certain parts of the world.

Mr. DINGELL. I am curious why you have to build a plant to gather that information.

Mr. FRI. Well, I guess I don't know how to gather it without actually going through the experience and, you know, working with the States and localities and regional institutions in dealing with the problems, because the Federal agencies and State and local and regional institutions are all going to have to deal with the problem, and we won't really understand how to deal with it until we deal with it, and that means you have got to build some plants, in my judgment.

Mr. DINGELL. Isn't that same information available from large undertakings which are going to take place? Why is it necessary to build gasification plants to develop that same information you could get from the large coal developments that are going to take place in the area?

Mr. FRI. There are some large coal developments, but we are talking, first of all, about areas of the country, such as North Dakota, where I don't believe there have been such developments. We are talking about different processes, different rates of feed——

Mr. DINGELL. But won't there be——

Mr. FRI. There may be in the future.

Mr. DINGELL. Pardon?

Mr. FRI. There may be in the future. They would presumably be not funded by the Federal Government. There would be no socioeconomic loan guarantee program available to the States and localities to ameliorate the effects of those plants because of—there would not be the same kind of systematic governmental—and, by that, I mean all levels of government—involvement in the monitoring of what is going on.

I suspect rather that what will happen is that what we learn from this program will contribute to an understanding of those kinds of developments, rather than the other way around.

Mr. OTTINGER. Will the gentleman yield on that point? Are there not large-scale coal gasification plants operating in other countries from which this data could be derived?

Mr. FRI. I am sorry, Mr. Ottinger. Was that a statement or a question?

Mr. OTTINGER. There are large-scale coal gasification plants operating in other countries from which it would appear, if we are going to go and get the experience from them, they could get this information.

Mr. FRI. You can learn something from them, of course, but those plants don't have to get a Montana State water permit, you know.

Mr. DINGELL. They use water though.

Mr. FRI. Yes.

Mr. DINGELL. They use water. They emit pollutants. They disconcert and upset people. They cause populations to move around. You have dislocations of major dimensions going on with regard to strip mining of coal in the Ruhr Valley in Germany, and there is an abundance of records and data and information on that. Have you made any inquiry into these matters at all?

Mr. FRI. Sure.

Mr. DINGELL. What have you gleaned from them?

Mr. FRI. Well, a lot of what we have gleaned is represented in the draft environmental impact statement which suggests the kinds of gross emissions we can expect from this plant.

I guess, Mr. Chairman, that where we are with this thing is that, you know, you have this problem in bringing a technology from the sort of technology demonstration stage to the real large, there it is in your backyard stage, and that is that it is fine to gather data on what happened in Germany or South Africa or whatever, but you sit down with the people out there who are saying: "Look, I am sitting on a big resource base," whether it be shale or coal, and that is going to be exploited, "and I want to know how it is going to fit with my social fabric, my economy, and my environment. You can tell me all you want to about the data that you have collected someplace else, but I want to see it happen first of all in a controlled way in my backyard so that I can believe that we can safely exploit this resource for the benefit of the country and not——

Mr. DINGELL. Are you saying you are going to have to do this in every State to find out what the environmental and socioeconomic impact is in each State? Because obviously South Dakota and North Dakota are different.

Mr. FRI. The hope is that we will be able to set this thing up with plants at representative locations, representing different types of resources, different types of geography, different types of standards, different types of environments, put together a group—groups of States, first of all, through the advisory committee structure that is provided for in the bill, as well as through a fairly detailed process we have worked out with the Governors, so that everyone is involved in this program as we go along. Although it is a real experiment, it can be done at essentially representative locations with the involvement of all.

Mr. DINGELL. Can you list for us please the communications and studies which have been made of environmental, socioeconomic impacts in connection with these programs in this country and elsewhere please?

Mr. FRI. Certainly.

[Testimony resumes at p. 122.]

LIST OF ORGANIZATIONS CONTACTED REGARDING ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS OF SYNTHETIC FUELS FACILITIES

U.S. FEDERAL AGENCIES

Advisory Council on Historic Preservation.
Department of Agriculture: Forest Service, Soil Conservation Service, Agricultural Stabilization and Conservation Service.
Nuclear Regulatory Commission.
Energy Research and Development Administration.
Department of Commerce.
Department of Defense.
Environmental Protection Agency.
Federal Power Commission.
General Service Administration.
Department of Health, Education, and Welfare.
Department of Housing and Urban Development.
Council on Environmental Quality.
Interstate Commerce Commission.
Department of Labor.
Office of Economic Opportunity.
Department of Transportation: U.S. Coast Guard, Federal Aviation Administration, Federal Highway Administration.
Department of State.
Department of the Interior: Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, Geological Survey, National Park Service, Bureau of Reclamation, Bureau of Outdoor Recreation, Bureau of Mines, Office of Energy Conservation, Office of Land Use and Water Planning, Office of Water Resources Research, Office of Minerals Policy Development.
Federal Energy Administration.
Department of the Army, Corps of Engineers.
National Aeronautics and Space Administration.
Tennessee Valley Authority.
Department of Treasury.
Department of Justice.
Water Resources Council.

STATE AGENCIES

Office of the Governor of the following states:

Alabama
Arizona
Colorado
Illinois
Indiana
Kentucky
Maryland
Montana
New Mexico
North Dakota
Ohio
Pennsylvania
South Dakota
Tennessee
Utah
Virginia
West Virginia
Wyoming

OTHER ORGANIZATIONS

Academy of Natural Sciences.
Air Pollution Control Association.
American Gas Association.
American Mining Congress.
American Park and Recreation Society.
American Petroleum Institute.
American Right of Way Association, Inc.
American Rivers Conservation Council.

American Society of Agricultural Engineers.
American Society of Planning Officials.
American Water Resources Association.
Appalachian Regional Commission.
Bureau of National Affairs, Inc.
Center for Natural Areas.
Center for Science in the Public Interest.
Citizens Committee on Natural Resources.
Concern, Inc.
Conservation Law Foundation.
Crow Tribe.
Defenders of Wildlife.
Defenders of Outdoor Heritage.
Ecological Society of America.
Energy Policy Project.
Environmental Action.
Environmental Defense Fund.
Environmental Law Institute.
Environmental Policy Center.
Federation of American Scientists.
Federation of Rocky Mountain States.
Forest Farmers Association.
Friends of the Earth.
Geological Society of America.
Industrial Forestry Association.
Institute of Ecology.
Interstate Natural Gas Association of America.
National Association of Conservation Districts.
National Association of State Foresters.
National Audubon Society.
National Coal Association.
National Congress of American Indians.
National Parks Association.
National Parks and Conservation Association.
National Petroleum Refiners Association.
National Reclamation Association.
National Recreation and Park Association.
National Wildlife Federation.
Nature Conservancy.
Natural Resource Council of America.
Natural Resources Defense Council.
Navajo Tribe.
Northern Cheyenne Tribe.
Northern Plains Resource Council.
Resources for the Future.
Rocky Mountain Center on the Environment.
Sierra Club.
Society for American Archeology.
Society of American Foresters.
Society for Range Management.
Soil Conservation Society of America.
Sport Fishing Institute.
Water Pollution Control Federation.
Western Forestry and Conservation Association.
Western Oil and Gas Association.
Western Wood Products Association.
Wilderness Society.
Wildlife Management Institute.

We are transmitting two lists of environmental and socio-economic impact studies that have been made in connection with synthetic fuel demonstration plants and directly related developments. These lists appear in the references of:

"Synthetic Fuels Commercialization Program: Draft Environmental Statement" (ERDA-1547), December 1975.
"Resources and Land Investigations (RALI) Program: An Approach to Environ-

mental Assessment with Application to Western Coal Development" (MTR-6988), The MITRE Corporation, McLean, Virginia, August 1975.

References

Anderson, L. L. 1972. Energy Potential from Organic Wastes: A Review of the Quantities and Sources. Information Circular 8549, U.S. Department of the Interior, Bureau of Mines, Washington, D.C.

Atomic Energy Commission. 1974. Draft Environmental Statement: Liquid Metal Fast Breeder Reactor Program. Washington, D.C.

Atomic Energy Commission. 1972. The Nation's Energy Future: A Report to Richard M. Nixon, President of the United States. Washington, D.C.

Ayres, E., and C. A. Scarlett, 1952. "Energy Sources, the Wealth of the World." McGraw-Hill, New York, New York.

Baratz, B. 1974. "More Efficient Utilization of Energy. Solid Waste: An Agony Turned Ecstasy. Paper presented at the League of Women Voters Energy Conservation Conference, November, 1974.

Battelle, Columbus, and Pacific Northwest Laboratories. 1972. Environmental Considerations in Future Energy Growth, Vol. I: Fuel/Energy Systems: Technical Summaries and Associated Environmental Burdens. For the Office of Research and Development, Environmental Protection Agency, Columbus, Ohio.

Baumeister, T. (ed.) 1958. Mechanical Engineer's Handbook, 6th ed. McGraw-Hill, New York.

Berg, C. A. 1973. "Energy Conservation through Effective Utilization." Reprinted in Energy Conservation and S. 2176, Hearings before the Committee on Interior and Insular Affairs, U.S. Senate 93rd Cong., 1st Sess., pp. 552–561. Washington, D.C.

Bisselle, C., M. Kornreich, M. School, and P. Spewak. 1975. Urban Trash Methanation—Background for a Proof-Of-Concept Experiment. MTR-6856, NSF-RA-N-75-002, The Mitre Corporation, McLean, Virginia.

Blumer, M. 1971. "Scientific Aspects of the Oil Spill Problem." Environmental Affairs. 1(1) :54–74.

Braddock, Dunn and McDonald, Inc. 1974. Study of Alternate Strategies and Methods of Conserving Energy. First Interim Technical Status Report, Vienna, Virginia.

Bravard, J. C. et al. 1972. Energy Expenditures Associated with the Production and Recycle of Metals. ORNI-NSF-EP-24. Oak Ridge Natural Laboratory. Oak Ridge, Tennessee.

Bureau of Land Management. 1973. Energy Alternatives and Their Related Environmental Impacts. Washington, D.C.

Burgess, D. S., J. N. Murphy and M. G. Zabetakis, 1970. Hazards Associated with Spillage of Liquefied Natural Gas on Water. Bureau of Mines Report of Investigation 7448. U.S. Government Printing Office. Washington, D.C.

Cherry, W. R. 1972. "The Generation of Pollution-Free Electrical Power from Solar Energy." Trans. ASME, T. Eng. Power 94(A) :78–82.

Dupree, W. G., Jr., and A. West. 1972. United States Energy Through the Year 2000. U.S. Department of the Interior, Washington, D.C.

Eggers, A. T., Jr. 1973. Solar Energy Program. National Science Foundation, Washington, D.C.

Eldridge, F. R. 1974 Wind Energy Conversion Systems. Draft Report to the National Science Foundation. The Mitre Corporation, McLean, Virginia.

Enger, T. 1972. "Rapid Phase Transformation During LNG Spillage on Water." Paper presented at the Fluid International Conference and Exhibition on Liquefied Natural Gas, September, 1972.

Enger, T. and W. Hartman. 1972. "Mechanism of LNG-Water Interactions." Paper presented at AGA Distribution Conference, Atlanta, Georgia. May 8, 1972.

Federal Council for Science and Technology. 1972. Extraction of Energy Fuels. U.S. Bureau of Mines open file report 30–73. Washington, D.C.

Federal Council on Science and Technology, Committee on Energy Research. 1974. A Technical Basis for Energy Conservation. Technology Review 76. Washington, D.C.

Federal Energy Administration. 1974. Project Independence Report. Washington, D.C.

Federal Energy Administration. 1975. Draft Environmental Impact Statement, Energy Independence Act of 1975 and Related Tax Proposals. DES-75-2. Washington, D.C.

Federal Power Commission. 1972. National Gas Supply and Demand 1971–1900. Staff Report No. 2. Washington, D.C.

Federal Power Commission. 1973. Supply Technical Advisory Task Force Report; Liquefield Natural Gas. U.S. Government Printing Office. Washington, D.C.

Federal Power Commission. 1974. Liquefied Natural Gas Applications Filed with the FPC. Washington, D.C.

Ford Foundation. 1973. Energy Study Draft Report. Washington, D.C.

Frost, C. M. et al. 1974. Production of Synthetic Crude From Crude Shale Oil Produced by In Situ Combustion Retorting. Presented at 167th National Meeting. American Chemical Society, Division of Fuel Chemistry at Los Angeles, California, April 1–5, 1974.

Geffen, T. 1973. "Improved Oil Recovery Could Help Ease Energy Shortage." World Oil 177 : 84–88.

Gosh, S. and D. Klass. 1973. "Biogasification of Solid Wastes." Research Proposal to NSF, January 1973.

Golueke, C. G. and P. H. McGauhey. 1970. Comprehensive Studies of Solid Waste Management. University of California for U.S. Department of Health, Education, and Welfare, Washington, D.C.

Gustavson, M. R. 1971. Dimensions of World Energy. M71–71, The Mitre Corporation, McLean, Virginia.

Hamilton, D. H. and R. L. Muchan. 1971. "Ground Rupture in the Baldwin Hills." Science 172 : 333–344.

Hauer, C. R. 1974. Solar Energy Projects Funded by the National Science Foundation. Ninth Intersociety Energy Conversion Engineering Conference Proceeding, San Francisco, California, August 26–30, 1974.

Healy, T. H., W. W. Rubey, D. T. Griggs, and C. B. Raleigh. 1968. "The Denver Earthquakes." Science 161 : 1301–1310.

Healy, T. H., R. M. Hamilton, and C. B. Raleigh. 1970. "Earthquakes Induced by Fluid Injection and Explosion." Tektono Physics 9 : 205–214.

Hickel, W. T. 1972. Geotheral Energy : A Special Report. University of Alaska, Fairbanks.

Hittman Associates. 1974. Environmental Impacts, Efficiency and Cost of Energy Supply and End Use, Volume I. HIT–593. Columbia, Maryland.

Hittman Associates. 1975. Environmental Impacts, Efficiency and Costs of Energy Supply and End Use. Volume I. HIT–593. Columbia, Maryland.

Interagency Task Force on Solar Energy. 1974. Project Independence Blueprint Final Task Force Report. Washington, D.C.

Löf, G. 1973. Hearing before the Subcommittee on Energy of the Committee on Science and Astronautics, U.S. House of Representatives, June 7, 1973.

Lowe, R. A. 1975. The Quality and Composition of Post-Consumer Solid Waste (draft) SW–125, U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, Washington, D.C.

McCaull, T. 1973. "Windmills." Environment 15(1) : 6–16.

Mitre Corporation, 1973. Systems Analysis of Solar Energy Programs. MTR–6513, McLean, Virginia.

Muffler, L. D. P., and D. E. White, 1973. Geothermal Energy Resources of the U.S. USGS Circular 650, Washington, D.C.

Nathenson, M. and L. P. Muffler. 1975. Assessment of Geothermal Resources of the United States. Geological Survey Circular 726, D. E. White and D. L. Williams (editors). U.S. Department of the Interior, Geological Survey. Washington, D.C.

National Center for Resource Recovery. 1973. "Municipal Solid Waste—A Source of Energy.'" NCRR Bulletin Reprint, Vol. 3, No. 3, Summer, 1973.

National Petroleum Council. 1972. U.S. Energy Outlook, A Report of the National Petroleum Council's Committee on U.S. Energy Outlook. Washington, D.C.

National Center for Resource Recovery. 1973. "Municipal Solid Waste—A Source of Energy." NCRR Bulletin Reprint, Vol. 3, No. 3, Summer, 1973.

National Petroleum Council. 1972. U.S. Energy Outlook, A Report of the National Petroleum Council's Commitee on U. S. Energy Ooutlook. Washington, D.C.

NSF–NASA Solar Energy Panel. 1972. "An Assessment of Solar Energy as a National Resource." Washington, D.C.

Office of Emergency Preparedness. 1972. The Potential for Energy Conservation. U.S. Government Printing Office. Washington, D.C.

Papadopolus et al., 1975. Assessment of Geothermal Resources of the United States. Geological Survey Circular 726, D. E. White and D. L. Williams (editors). U.S. Department of the Interior, Geological Survey. Washington, D.C.

Poland, T. F., and G. H. Davis. 1969. "1969 Land Subsidence Due to Withdrawal of Fluid." Geological Society of America Reviews in Engineering, Geology II.

Rex, R. W. and D. T. Howell. 1973. "Assessment of U.S. Geothermal Resources." pp. 59–68 in Paul Kruger and Carel Otte (eds.) "Geothermal Energy: Resources Production, Stimulation." Stanford University Press, Stanford, California.

Rice, S. D. 1973. "Toxicity and Avoidance Tests with Prudhoe Bay Oil and Pink Salmon Fry," In: Proceedings, Joint Conference on Prevention and Control of Oil Spills. March 13–15, 1973, Washington, D.C.

Savino, T. M. (ed.) 1973. "Report of the Committee on Energy Storage and Energy Conversion Systems." Wind Energy Conversion Systems Workshop Proceedings, Report NSF/RA/W–73–006: 218–222.

Seidel, M. R., S. E. Plotkin, and R. O. Reck, 1973. Energy Conservation Strategies, U.S. Environmental Protection Agency. Washington, D.C.

Senate Committee on Interior and Insular Affairs. 1973. Energy Conservation and S. 2176, Hearings. 93rd Congress, 1st session.

Shell Oil Company, 1973. The National Energy Problem: Potential Energy Savings. Shell Oil Company, Houston, Texas.

Smith, F. A., 1974. (unpublished) Post-Consumer Solid Waste Generation Estimates: 1973 and 1975. U.S. Environmental Protection Agency. Office of Solid Waste Management, Washington, D.C.

Swedmark, M. et al. 1971. "Biological Effects of Surface Active Agents on Marine Animals." Marine Biology. 9(3) :183–201.

Tagatz, M. E., 1961. "Reduced Oxygen Tolerance and Toxicity of Petroleum Products to Juvenile American Shad." Chesapeake Science 2: 65–71.

Tillman, D. A. 1975. "Fuels from Recycling Systems". Environmental Science and Technology. 9(5) : 418–422.

U.S. Army Corps of Engineers, 1972. U.S. Deepwater Port Study. Institute for Water Resources Report 72–8, Alexandria, Virginia.

U.S. Coast Guard. 1972. Marine Transportation Systems of the Trans-Alaska Pipeline. Washington, D.C.

U.S. Department of Commerce. 1973. Offshore Terminal System Concepts. Washington, D.C.

U.S. Department of the Interior. 1972. Final Environmental Impact Statement, Trans-Alaska Pipeline, Washington, D.C.

U.S. Department of the Interior. 1973. Final Environmental Statement for the Geothermal Leasing Program. Washington, D.C.

U.S. Department of the Interior. 1974. Final Environmental Impact Statement, Deepwater Ports, Washington, D.C.

U.S. Geological Survey. 1974. Final Environmental Statement, Proposed Plan of Development Santa Ynez Unit, Santa Barbara Channel, Off California. FES–20. Washington, D.C.

University of Oklahoma, 1974. A Methodology and Documentation for Consistent Analysis of Energy Alternatives for Environmental Impact Statements. The Science and Public Policy Program. The University of Oklahoma. Norman, Oklahoma.

Wallo, A., and R. Reale. 1975. "Refuse as Fuel for Power Demonstration Program." The Mitre Corporation, McLean, Virginia (In preparation). MTR–7027.

Warner, M. L. et al. 1975. Final Report on Energy from Coal: Guidelines for the Preparation of Environmental Impact Statements. Battelle Columbus Laboratories, Columbus, Ohio.

Weller, E. C. 1973. "Oil: Its Properties and Environmental Effects." In Assessing the Social Inputs of Oil Spills. Proceedings of an Invitation Symposium cosponsored by the Institute on Man and Science and the U.S. Environmental Protection Agency, September 25–28, 1973, Rensselaervillle, New York.

White, D. E. 1973. "Characteristics of Geothermal Resources." pp. 69–94 in Paul Kruger and Carel Otte (eds.). "Geothermal Energy: Resources, Production, Stimulation." Stanford University Press, Stanford, California.

Wilson, N. E. 1973. The Oregon State University Wind Studies. University of Oregon. Eugene, Oregon.

Wolf, M. 1973. "Solar Energy—An Endless Supply." Consulting Engineering 40(3) :171–179.

ZoBell, C. E. 1962. "The Occurence Effects and Fate of Oil Polluting the Sea," International Journal of Air and Water Pollution 7 :173–193.

AAA, 1972: American Automobile Association, Northwestern Tour Book, Falls Church, Virginia, 1972.

AAA, 1975: American Automobile Association, Northwestern Tour Book, Falls Church, Virginia, 1975.

Adams, 1968: Adams, K.L., "Equipment Maintenance Versus Replacement," in Pfleider, 1968, pp. 671–677.

AEC, 1972b: U.S. Atomic Energy Commission, "1000 MWe Central Station Power Plants Investment Cost Study," Volume III, Coal-Fired Fossil Plant, WASH–1230, June 1972.

AEC, 1973a: U.S. Atomic Energy Commission, "Davis-Besse Nuclear Power Station," Docket No. 50–346, March 1973.

AEC, 1973b: U.S. Atomic Energy Commission, "Final Environmental Statement—Grand Gulf Nuclear Station Units 1 and 2," Docket No. 50–416 and 417, Washington, D.C., 1973.

Ahmed, 1973: Ahmed, S. B., (Ed.), "Input-Output Analysis in Environmental Modeling," Special Issue of IEEE Transactions on Systems, Man and Cybernetics, Vol. SMC–3 No. 6, November 1973.

Aiken and Wohbier, 1968: Aiken, G. E. and R. H. Wohbier, "Continuous Excavators (Bucket Wheel and Chain Diggers)," in Pfleider, 1968, pp. 478–502.

Amos, 1969: Amos, W. H., "Limnology—An Introduction to the Fresh Water Environment," LaMotte Chemical Products Co., Chestertown, Maryland, June 1969.

APHA, 1971: American Public Health Association, American Water Works Association, and Water Pollution Control Federation, "Standard Methods for the Examination of Water and Wastewater," 13th edition, American Public Health Association, Washington, D.C., 1971.

APHA, 1974: American Public Health Association, American Water Works Association, and Water Pollution Control Federation," Standard Methods for the Examination of Water and Wastewater," American Public Health Association, Wastewater, Washington, D.C. 1974.

AREA, 1972: American Railway Engineering Association, "Manual for Railway Engineering (Fixed Properties)," in two volumes, AREA, Chicago, Illinois, Current to March 9, 1972.

Atchison, 1968: Atchison, T. C., "Fragmentation Principles," in Pfleider, 1968, pp. 355–372.

Ash, 1968: Ash, R. L., "The Design of Blasting Rounds," in Pfleider, 1968, pp. 373–397.

Aude, et al., 1971: Aude, T. C., et al., "Slurry Piping Systems," Chemical Engineering, Vol. 4 No. 123, June 28, 1971.

Austin, 1972: Austin, M. E., "Land Resource Regions and Major Land Resource Areas of the United States," U.S. Department of Agriculture, Washington, D.C., 1972.

AWWA, 1971: American Water Works Association, Inc., "Water Quality and Treatment, McGraw Hill, New York, 1971.

Babcock and Bone, 1940: Babcock, J. B. and A. J. Bone, "Railway Highway and Airport Engineering," Civil Engineering Handbook, L. C. Urquhart (Ed.), Second Edition, McGraw Hill, New York, 1940.

Babcock and Bone, 1959: Babcock, J. B. and A. J. Bone, "Railway, Highway and Airport Engineering," Civil Engineering Handbook, L. C. Urquhart (Ed.), Fourth Edition, McGraw Hill, New York, 1959.

Babcock and Wilcox, 1972: The Babcock and Wilcox Co., "Steam: Its Generation and Use," 38th edition 1972.

Babcock and Wilcox, 1975: The Babcock and Wilcox Co., news release dated March 1975.

Bailly, 1968: Bailly, P. A. "Exploration Methods and Requirements," in Pfleider, 1968, pp. 19–42

Barrett and Waddell, 1973: Barrett, L. B. and T. E. Waddell, "Cost of Air Pollution Damage: A Status Report, The U.S. Environmental Protection Agency, National Environmental Research Center, Research Triangle Park, Raleigh, North Carolina, 1973.

Bartok, et al., 1971: Bartok, W., et al., "Systematic Field Study of NO_x Emission Control Methods for Utility Boilers," Esso Research and Engineering Co., December 1971.

Bear, 1972: Bear, J., "Dynamics of Fluids in Porous Media," American Elsevier Publishing Co., New York, 1972.

Bechtel, 1974: Bechtel Corporation, "Draft Environmental Impact Report, Coal Slurry Pipeline," Prepared for Energy Transportation Systems, Inc., August 8, 1974.

Bhutani, et al., 1975: Bhutani, J., et al., "Impact of Hydrologic Modification on Water Quality," The Mitre Corporation, MTR–6887, McLean, Virginia, 1975.

Billings, 1970: Billings, W. D., "Plants, Man and the Ecosystem," Second Edition, Wadsworth Publishing Company, Inc., Belmont, California, 1970.

Bishop, 1968: Bishop, T. S., "Trucks," in Pfleider, 1968, pp. 553–588.

Bisselle, 1972: Bisselle, C. A., "Bioenvironmental Alternatives for Insect Control," The Mitre Corporation, M7265, McLean, Virginia, May 1972.

Bisselle, 1973: Bisselle, C. A., "Strategic Environmental Assessment System: Radiation Residuals," The Mitre Corporation, MTR-6511, McLean, Virginia, 1973.

Bisselle, 1974: Bisselle, C. A., "Strategic Environmental Assessment System; Air and Water Pollution Indicators," The Mitre Corporation, McLean, Virginia, MTR-6565, April 1974.

Bisselle and Goldstein, 1971: Bisselle, C. A. and S. N. Goldstein, "Developing an Index of Erosion Potential," The Mitre Corporation, M7155, McLean, Virginia,, September 1971.

Bituminous Coal Res., 1969: Bituminous Coal Research, Inc., "Sulfide Treatment of Acid Mine Drainage," Prepared for the Federal Water Pollution Control Administration, Department of the Interior, Washington, D.C., November 1969.

Blakely, 1974: Blakely, J. W., "Ayrshire Mine Geared to Produce 3 Million typ," Coal Mining and Processing, Vol. 11 No. 7, p. 34, July 1974.

Blakeslee and Burbach, 1972: Blakeslee, C. E. and H. E. Burbach, "Controlling NO_x Emissions from Steam Generators," Paper presented at Air Pollution Control Association 65th Annual Meeting, Miami Beach, Florida, June 1972.

BLM, 1972b: Bureau of Land Management, Missouri River Basin Study, "Land Inventory of the Public Domain, A Summary," U.S. Department of the Interior, Washington, D.C., 1972.

BLM, 1947c: Bureau of Land Management, "Facts Concerning Proposed Coal Slurry Pipeline from Wyoming to Arkansas," Eastern Powder River Task Force, Cheyenne, Wyoming, April 1974.

BLM, 1974d: Bureau of Land Management, "Summary Decker-Birney Resource Study," U.S. Department of the Interior, April 1974.

BLM, 1975: Bureau of Land Management, "The Need for a National System of Transportation and Utility Corridors across Federal Lands—A Study Report," Vol. 1, Prepared under provision of Public Law 93-153 of November 16, 1973, U.S. Department of the Interior, July 1, 1975.

Bodle and Vyas, 1974: Bodle, W. W. and K. C. Vyas, "Clean Fuels from Coal," The Oil and Gas Journal, pp. 73–88, August 28, 1974.

Boeker and Nickerson, 1973: Boeker, E. L. and P. R. Nickerson, "Raptor Electrocutions," U.S. Fish and Wildlife Service, unpublished memorandum, 1973.

Bonneville Power Administration, 1974: Bonneville Power Administration, "General Construction and Maintenance Program," Final Environmental Statement, U.S. Department of the Interior, FES 74-48, August 19, 1974.

Booz, Allen and Hamilton, 1974: Booz, Allen and Hamilton, Inc., "A Procedures Manual for Assessing the Socio-Economic Impact of the Construction and Operation of Coal Utilization Facilities in the Old West Region," Prepared for The Old West Regional Commission, Washington, D.C., June 18, 1974.

Boucher, 1974: Boucher, W. I., "An Annotated Bibliography on Cross-Impact Analysis," Report No. 128-01-14, The Futures Group, Glastonberry, Connecticut, Revised February 1974.

Boulding, 1974: Boulding, R., "Environmental Who's Who for Northern Great Plains Energy Development," Environmental Defense Fund, Denver, Colorado, June 1974.

Boulter, 1968: Boulter, G., "Cyclical Methods—Draglines and Clamshells," in Pfleider, 1968, pp. 445–462.

Brauns, 1973: Brauns, J. W., "Surface Haulage and Storage," SME Mining Engineering Handbook, I. A. Given (Ed.), Society of Mining Engineers of The American Institute of Mining, Metallurgical and Petroleum Engineers, Inc., New York, 1973.

Brauns and Orr, 1968: Brauns, J. W. and D. H. Orr, Jr., "Railroad," in Pfleider, 1968, p. 531.

Brown, et al., 1954: Brown, A., et al., "Strippable Coal in Custer and Powder River Counties, Montana," U.S. Government Printing Office, Washington, D.C., 1954.

BuRec, 1974a: Bureau of Reclamation, "Draft Environmental Statement Western Gasification Company (WESCO) Coal Gasification Project and Expansion of Navajo Mine by Utah International, Inc.," New Mexico, Prepared by Upper Colorado Region, Bureau of Reclamation, for the U.S. Department of the Interior, 1974.

BuRec, 1974b: Bureau of Reclamation, "Draft Environmental Statement for El Paso Coal Gasification Project, New Mexico," Prepared by Upper Colorado Region, Bureau of Reclamation, for the U.S. Department of the Interior, July 16, 1974.

Business Week, 1975: "The Mountain States, Cooling the Boom," Business Week, January 27, 1975.

Buys and Havener, 1968: Buys, V. W. and R. E. Havener, "Communications," in Pfleider, 1968, pp. 744–749.

Byer, 1974: Byer, H. R., "History of Weather Modification," in Hess, 1974.

Calaman and Rolseth, 1968: Calaman, J. J. and H. C. Rolseth, "Jet Piercing," Pfleider, 1968, pp. 325–337.

Caruccio, 1972: Caruccio, F., "Trace Element Distribution in Reactive and Inert Pyrite," Paper presented before the Fourth Symposium on Coal Mine Drainage Research, Mellon Institute, Pittsburgh, Pennsylvania, April 26–27, 1972.

Casali, 1975: Casali, J. T., "Heat Drying Sludge from Ponds," Mining Congress Journal, pp. 34–37, January 1975.

CEQ, 1974: Council on Environmental Quality, "Evaluation of Municipal Sewage Treatment Alternative," Washington, D.C., February 1974.

CFR, 1969: Code of Federal Regulations, Title 10, Chapter 1, Part 20, December 10, 1969.

CFR, 1974a, Code of Federal Regulations, Title 40 "Protection of the Environment," Part 128 "Pretreatment Standards," as of July 1, 1974.

CFR, 1974b: Code of Federal Regulations, Title 40 "Protection of the Environment," Part 128.131 "Prohibited Wastes," as of July 1, 1974.

CFR, 1974c: Code of Federal Regulations, Title 40 "Protection of the Environment," Part 423.15, as of July 1, 1974.

CFR, 1974d: Code of Federal Regulations, Title 40 "Protection of the Environment," Part 60.42 through 60.44, as of July 1, 1974.

Chesler and Goeller, 1973: Chesler, L. G. and B. F. Goeller, "The Star Methodology for Short-Haul Transportation: Transportation System Impact Assessment," The Rand Corporation, for the U.S. Department of Transportation, December 1973.

Christiansen, 1974: Christiansen, B., "Coal Development Information Packet," Montana Energy Advisory Council, December 1974.

Clark, 1968: Clark, G. B., "Explosives," in Pfleider, 1968, pp. 341–354.

Clark, 1974a: Clark, J., "Coastal Ecosystems—Ecologic Considerations for Management of the Coastal Zone," The Conservation Foundation, Washington, D.C., 1974.

Coffman and von Hake, 1973: Coffman, J. L. and C. A. von Hake, "Earthquake History of the United States (through 1970)," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1973.

Collison, 1975: Collison, K. M., "A Practical Guide to Site Selection," *Appalachia*, Appalachian Regional Commission, Washington, D.C., pp. 31–36, December 1974–January 1975.

Colorado, Inc., 1974: Colorado, Inc., "Draft Environmental Impact Statement for the Proposed COLOWYO Mine of Colowyo Coal Company," Division of W. R. Grace and Co., Prepared by Colorado, Inc., Denver, June 1974.

Coutant, et al., 1975: Coutant, R. W., et al., "Determination of Trace Elements in a Combustion System," Final Report to Electric Power Research Institute, by Battelle, Columbus, Ohio, January 1975.

Craig and Turelle, 1964: Craig, D. G. and J. W. Turelle, "Guide for Wind Erosion Control on Cropland in the Great Plains States," Soil Conservation Service, U.S. Department of Agriculture, July 1964.

Dasmann, 1972: Dasmann, R. F., Environmental Conservation, John Wiley and Sons, New York, 1972.

Davison, et al., 1974: Davison, R. L., et al., "Trace Elements in Fly Ash," Environmental Science and Technology, Vol. 8 No. 13, pp. 1107–13, December 1974.

Decker Coal Co., 1973: Decker Coal Company, Range Survey Report. Decker, Montana, 1973.

de Lorenzi, 1955: de Lorenzi, O., (Ed.) Combustion Engineering, Combustion Engineering, Inc., 1955.

Department of Commerce, 1968: U.S. Department of Commerce, Environmental Data Service, Climate Atlas of the United States, U.S. Government Printing Office, Washington, D.C., 1968.

Department of Commerce, 1970: U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, U.S. Government Printing Office, Washington, D.C., 1970.

Department of Commerce, 1971: U.S. Department of Commerce, Bureau of the Census, County and City Data Book, U.S. Government Printing Office, Washington, D.C., 1971.

Department of Commerce, 1972: U.S. Department of Commerce, Bureau of the Census, County and City Data Book, U.S. Government Printing Office, Washington, D.C., 1972.

Department of Commerce, 1973a: U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, U.S. Government Printing Office, Washington, D.C., 1973.

Department of Commerce, 1973b: U.S. Department of Commerce, Bureau of the Census, County and City Data Book, U.S. Government Printing Office, Washington, D.C., 1973.

Dethier and Stellar, 1964: Dethier, U. G., and E. Sellar, "Animal Behavior," Second Edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Dice, 1943: Dice, L. R., "The Biotic Provinces of North America," University of Michigan Press, Ann Arbor, Michigan, 1943.

DOI, 1938: U.S. Department of Agriculture, "Soils and Men," Yearbook of Agriculture, Washington, D.C., 1938.

DOI, 1971: U.S. Department of the Interior, Bureau of Mines, "Strippable Reserves of Bituminous Coal and Lignite in the United States," Washington, D.C., 1971.

DOI, 1972: The Department of the Interior, "Southwest Energy Study—Summary Report," Prepared by Study Management Team, November 1972.

DOI, 1973e: The Department of the Interior, "Threatened Wildlife of the United States," Fish and Wildlife Service, Bureau of Sports Fisheries and Wildlife Resource Publication 114, Washington, D.C., 1973.

DOI, 1974a: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol. 1 (of 6), October 18, 1974.

DOI, 1974b: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol 2 (of 6), October 18, 1974.

DOI, 1974c: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol. 3 (of 6), October 18, 1974.

DOI, 1974d: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol. 4 (of 6), October 18, 1974.

DOI, 1974e: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol. 5 (of 6), October 18, 1974.

DOI, 1974f: The Department of the Interior, "Final Environmental Impact Statement for Proposed Development of Coal Resources in the Eastern Powder River Coal Basin of Wyoming," Vol. 6 (of 6), October 18, 1974.

DOI, 1974g: The Department of the Interior, "Final Environmental Statement, Proposed Plan of Mining and Reclamation, Big Sky Mine, Peabody Coal Company, Coal Lease M–15965, Colstrip, Montana," Vol. 1 (of 2), U.S. Geological Survey, 1974.

DOI, 1974h: The Department of the Interior, "Final Environmental Statement, Proposed Plan of Mining and Reclamation, Big Sky Mine, Peabody Coal Company, Coal Lease M–15965, Colstrip, Montana," Vol. 2 (of 2), U.S. Geological Survey, 1974.

DOI, 1974l: The Department of the Interior, "United States List of Endangered Fauna," Fish and Wildlife Service, Office of Endangered Species and International Activities, May 1974.

DOI, 1975b: The Department of the Interior, "Proposed Plan of Mining and Reclamation, Belle Ayr South Mine Amax Coal Company, Coal Lease W–0317682, Campbell County, Wyoming," Draft Environmental Statement, DES 75–14, U.S. Geological Survey, March 24, 1975.

DOT, 1972: "Department of Transportation, Federal Railroad Administration," **Accident Bulletin No. 141, Washington, D.C. 1972.**

Dunbar and Rogers, 1957: Dunbar, C. O. and J. Rogers, "Principles of Stratiggraphy," John Wiley and Sons, New York, 1957.

Duncan, et al., 1973: Duncan, L. J., et al., "Selected Characteristics of Hazardous Pollutant Emissions," The Mitre Corporation, MTR–6401, McLean, Virginia, May 1973.

Duvall and Devine, 1968: Duvall, W. I. and J. F. Devine, "Avoiding Damage by Air Blasts and Ground Vibrations from Blasting," in Pfleider, 1968, pp. 398–412.

Eardley, 1962: Eardley, A. J., "Structural Geology of North America," Second Edition, Harper and Row, New York, New York, 1962.

Ecology and Environment, Inc., 1974, Ecology and Environment, Inc., "Environment Assessment—Northern Border Project," Vol. 1, Prepared for Northern Border Pipeline Co., April 15, 1974.

Ehrlich and Ehrlich, 1970: Ehrlich, P. and A. Ehrlich, "Population Resources and Environment," W. H. Freeman and Co., San Francisco, California, 1970.

Eisenbud, 1973: Eisenbud, M., Environmental Radioactivity, Second Edition, Academic Press, 1973.

Eisenbud and Petrov, 1964: Eisenbud, M. and H. G. Petrov, "Radioactivity in the Atmospheric Effluents of Power Plants that Use Fossil Fuels," Science, Vol. 14, pp. 288–289, April 17, 1964.

Elliot, 1974: Elliot, R. D., "Experience of the Private Sector," in Hess, 1974.

Environmental Information Center, 1973: Environmental Information Center, Environmental Regulation Handbook, Special Studies Division, New York, New York, 1973.

EPA, 1971: U.S. Environmental Protection Agency, "Air Quality Criteria for Nitrogen Oxides," Report Number AP–84, January 1971.

EPA, 1972a: U.S. Environmental Protection Agency, Water Quality Criteria, 1972, Washington, D.C., 1972.

EPA, 1972b: U.S. Environmental Protection Agency, Noise Pollution, GPO 5500–0072, Washington, D.C., August 1972.

EPA, 1972c: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Turbidity," Washington, D.C., August 1972.

EPA, 1972d: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Temperature," Washington, D.C., August 1972.

EPA, 1972e: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Bacteria," Washington, D.C., August 1972.

EPA, 1972f: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Dissolved Oxygen," Washington, D.C., August 1972.

EPA, 1972g: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Acidity/Alkalinity," Washington, D.C., August 1972.

EPA, 1972h: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Dissolved Solids," Washington, D.C., August 1972.

EPA, 1972i: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Settleable Solids," Washington, D.C., August 1972.

EPA, 1972j: U.S. Environmental Protection Agency, "Water Quality Standards Criteria Digest, A Compilation of Federal/State Criteria on Nitrates," Washington, D.C., August 1972.

EPA, 1972k: U.S. Environmental Protection Agency, National Emissions Report, Washington, D.C., 1972.

EPA, 1973a: U.S. Environmental Protection Agency, "Processes, Procedures and Methods to Control Pollution from Mining Activities," Washington, D.C., October 1973.

EPA, 1973b: U.S. Environmental Protection Agency, "Environmental Impact Statement Guidelines Region X," Washington, D.C., April 1973.

EPA, 1973c: U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors," Second Edition, April 1973.

EPA, 1974–a: U.S. Environmental Protection Agency, "The Bioenvironmental Impact of Air Pollution from Fossil-Fuel Power Plants," National Ecological Research Laboratory, National Environmental Research Center, August 1974.

EPA, 1974b: U.S. Environmental Protection Agency, "The Bioenvironmental Impact of a Coal-Fired Power Plant," First Interim Report, National Ecological Research Laboratory, National Environmental Research Center, Corvallis, Oregon, December 1974.

EPA, 1974c: U.S. Environmental Protection Agency, "Accomplishment Plan Oil Shale," Rocky Mountain Prairie Region, October 1974.

EPA, 1974f: U.S. Environmental Protection Agency, "Application of Combustion Modifications to Control NO_x Emissions from Utility Boilers," EPA-650/2-74-066, June 1974.

EPA, 1974g: U.S. Environmental Protection Agency, "What's a Scrubber?" Environmental Facts, Washington, D.C., October 1974.

Erskine and Stryker, 1974: Erskine, G. and S. Stryker, "Measurement Program for Coal Gasification Processes," MTR-6738, The Mitre Corporation, McLean, Virginia, August 1974.

Evans and Duvel, 1974: Evans, R. J. and Duvel, W. A., "Disposal of Solid Waste from Post Combustion Desulfurization," Pollution Engineering, pp. 44–45, October 1974.

Evans and Miller, 1972: Evans, L. S. and P. R. Miller, "Ozone Damage to Ponderosa Pine: A Histological and Histochemical Appraisal," American Journal of Botany, Vol. 59, pp. 297–304, 1972.

Evans and Miller, 1975: Evans, L. S. and P. R. Miller, "Histological Comparison of Single and Additive O_3 and SO_2 Injuries to Elongating Ponderosa Pine Needles," American Journal of Botany, Vol. 62, pp. 416–421, 1975.

Fair, et al., 1971: Fair, G. M., et al., "Elements of Water Supply and Wastewater Disposal," Second Edition, John Wiley and Sons, Inc., 1971.

Fed. Reg. 1972: Federal Register, Vol. 37, No. 212, p. 22319, November 2, 1972.

Fed. Reg., 1973: Federal Register, Vol. 38, No. 178, pp. 25697–25703, September 14, 1973.

Fed. Reg., 1974a: Federal Register, Vol. 39, No. 196, pp. 36186-36207, October 8, 1974.

Fed. Reg., 1974b: Federal Register, Vol. 39, No. 196, pp. 36176 et seq., October 8, 1974.

Fertig and Edmonds, 1969: Fertig, D. S. and V. W. Edmonds, "The Physiology of the House Mouse," Scientific American, Vol. 226, pp. 103–110, October 1969.

Flawn, 1970: Flawn, P. T., "Environmental Geology—Conservation, Land-Use Planning, and Resource Management," Harper and Row, New York, 1970.

Flaxman, 1972: Flaxman, E. M., "Predicting Sediment Yield in Western U.S.," Journal of Hydraulics Division, Proceedings of American Society of Civil Engineers (ASCE), Vol. 98, No. H412, Proc. Paper 9432, pp. 2073–2085, 1972.

FPC, 1971: "1970 National Power Survey," Vol. 1, Federal Power Commission, Washington, D.C., 1971.

FWPCA, 1968: Federal Water Pollution Control Administration, Water Quality Criteria, U.S. Department of the Interior, Washington, D.C., 1968.

Freudenthal, et al., 1974: Freudenthal, D., et al., "Coal Development Alternatives, an Assessment of Water Use and Economic Implications," Prepared by The Wyoming Department of Economic Planning and Development for the Wyoming Legislative Special Subcommittee on Consumptive Water Use, December 1974.

Frydman, et al., 1972: Frydman, M., et al., "Oxidant Measurements in the Vicinity of Energized 765 Kv Lines," IEEE Transaction Paper, T-72-551-0, 1972.

Gary, et al., 1973: Gary, M., et al (Eds.), Glossary of Geology, American Geological Institute, Washington, D.C., 1973.

General Electric, 1974: General Electric Company, "Assessment of Energy Parks vs. Dispersed Electric Power Generating Facilities," Interim Report Prepared for National Science Foundation, by Center for Energy Systems, General Electric, Washington, D.C., October 1974.

Giambusso, 1970: Giambusso, A., "Four Decommissioning Case Histories," Nuclear News, pp. 39–58, June 1970.

Golden and Pagano, 1973: Golden, J. and R. Pagano, "Criteria Used by Federal Agencies in Identifying Actions which Require an Environmental Impact Statement," MTR-6533, The Mitre Corporation, McLean, Virginia, November 1973.

Golden, et al., 1973: Golden, J., et al., "Environmental Threshold Assessment as Applied to Proposed Railroad Abandonment Authorization," The Mitre Corporation, MTR-6581 Rev. 1, McLean, Virginia, December 1973.

Goldman, 1972: Goldman, M. I., "Ecology and Economics," Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1972.

Goodman, 1968: Goodman, W. I. (Ed.), "Principles and Practice of Urban Planning," International City Managers' Association, Washington, D.C., 1968.

Govindjee and Govindjee, 1974: Govindjee and R. Govindjee, "The Absorption of Light in Photosynthesis," Scientific American, December 1974.

Grad, et al., 1975: Grad, F. P., et al., "The Automobile and the Regulation of

Its Impact on the Environment," University of Oklahoma Press, Norman, Oklahoma, 1975.

Graf-Webster, et al., 1974: Graf-Webster, E., et al., "Resource and Land Investigations (RALI) Program: Methodologies for Environmental Analysis, Volume II, Utility Corridor Selection," MTR-6740, The Mitre Corporation, McLean, Virginia, August 1974.

Gray and Helmer, 1974: Gray, P. and O. Helmer, "California Futures Study—Analysis of Impacts for Transportation Planning," Center for Futures Research, University of Southern California, Los Angeles, Report to the Division of Transportation Planning, California Department of Transportation (CALTRANS), November 1974.

Grim and Hill, 1974: Grim, E. C. and R. D. Hill, "Environmental Protection in Surface Mining of Coal," U.S. Environmental Protection Agency, EPA-670/2-74-093, October 1974.

Hagen and Abbott, 1968: Hagen, H. D. and G. W. Abbott, "Land and Water Acquisitions," in Pfleider, 1968, p. 43.

Hammond and Sorenson, 1957: Hammond, P. B. and D. K. Sorenson, "Recent Observations of the Course and Treatment of Bovine Lead Poisoning," Journal of the American Veterinary Medical Association, Vol. 130 No. 1, pp. 23-5, 1957.

Hanson, 1964: Hanson, E. D., "Animal Diversity," Second Edition, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Hartman, 1968: Hartman, H. L., "Principles of Drilling," in Pfleider, 1968, pp. 269-282.

Hawthorne, 1968: Hawthorns, A. L., "Preventive and Breakdown Maintenance," in Pfleider, 1968, pp. 651-658.

Heath, 1971: Heath, R. L., "Table of the Isotopes," Handbook of Chemistry and Physics, 52nd Edition, 1971-1972, The Chemical Rubber Company, 1971.

Heck, 1973: Heck, W. W., "Air Pollution and the Future of Agricultural Production," in Naegele, 1973.

Hellman, 1974: Hellman, R. D., "Working Document of Transmission Line Construction Characteristics," U.S. Department of the Interior Memorandum to John O. Hooson, November 19, 1974.

Helmer, 1974: Helmer, O., Interdisciplinary Modeling, Center for Futures Research, University of Southern California, Los Angeles, Report No. M13, May 1974.

Hess, 1974: Hess, W. N., (Ed.), "Weather and Climate Modification," John Wiley and Sons, New York, 1974.

Hittman, 1974c: Hittman Associates, Inc., "Environmental Impacts, Efficiency Cost of Energy Supply and End Use," Vol. 1, Sponsored by Council on Environmental Quality, National Science Foundation, and Environmental Protection Agency, November 1974.

Hittman, 1975: Hittman Associates, Inc., "Environmental Impacts, Efficiency and Cost of Energy Supply and End Use," Vol. 2, Council of Environmental Quality, National Science Foundation, and Environmental Protection Agency, January 1975.

House and Tyndall, 1974: House, P.W. and G. R. Tyndall, "Models and Policy Making," in A Guide to Models in Governmental Planning and Operations, U.S. Environmental Protection Agency, Washington, D.C., August 1974.

Huff and Changnon, 1973: Huff, F. A. and S. A. Changnon, "Precipitation Modification by Major Urban Areas," Bulletin of American Meteorological Society, Vol. 54, 1973.

IARC, 1973: International Agency for Research on Cancer, "Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, Vol. 2, Symposium held October 7 and November 29-December 4, 1972, Lyon, 1973.

Imhoff and Fair, 1956: Imhoff, K. and G. M. Fair, "Sewage Treatment," Second Edition, John Wiley and Sons, Inc., New York, 1956.

Innis and Miskimins, 1973: Innis, G. S. and R. Miskimins, Ranges I, "Grassland Simulation Model, Regional Analysis of Grassland," Environmental Systems Report 8, Colorado State University, Fort Collins, Colorado, 1973.

Isard, et al., 1972: Isard, W., et al., "Ecologic-Economic Analysis for Regional Development," The Free Press, New York, 1972.

Israel and Israel, 1974: Israel, H. and G. W. Israel, "Trace Elements in the Ionosphere," Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1974.

Jain, 1974: Jain, R. K., "Environmental Impact Analysis Research and Development," Construction Engineering Research Laboratory, September 1974.

Johnson, 1968: Johnson, E. R., "Crushing and Ore Loading," in Pfleider, 1968, pp. 725–735.

Jurinak and Santillan-Medrano, 1974: Jurinak, J. J. and J. Santillan-Medrano, "The Chemistry and Transport of Lead and Cadmium in Soils," Utah State University, Agricultural Experiment Station Research Report No. 18, Prepared for U.S. Department of the Interior, Office of Water Resources Research, June 1974.

Kane, 1972: Kane, J., "A Primer for a New Cross-Impact Language—KSIM," Tech. of Forecast Soc. Chg., Vol. 4 No. 2, pp. 120–142, 1972.

Kendeigh, 1974: Kendeigh, S. C., "Ecology with Special Reference to Animals and Men," Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1974.

Kepferle and Culbertson, 1955: Kepferle, R. C. and W. C. Culbertson, "Strippable Lignite Deposits, Slope and Bowman Counties, North Dakota," U.S. Department of the Interior, Geological Survey, Washington, D.C., 1955.

Kerber, 1974: Kerber, M. J., "Your Government and the Environment—A Supplemental Environmental Reference, Volume 2, Output Systems Corporation, Arlington, Virginia, 1973/1974.

Killebrew, 1968: Killebrew, C. E., "Tractor Shovels, Tractor Dozers, Tractor Scrapers," in Pfleider, 1968, pp. 463–477.

Koenig and Bhumralkar, 1974: Koenig, L. R. and C. M. Bhumradlkar, "On Possible Undesirable Atmospheric Effects of Heat Rejection from Large Electric Power Centers," The Rand Corporation, Santa Monica, California, K–1628–RC, December 1974.

Kondratyev, 1969: Kondratyev, K. Y., "Radiation in the Atmosphere," Academic Press, New York, 1969.

Kornreich, 1975: Kornreich, M. R., "A Preliminary Assessment of the Problem of Carcinogens in the Atmosphere," The Mitre Corporation, MIR–6874, McLean, Virginia, April 1975.

Krebs, 1972: Krebs, C. J., "Ecology," Harper and Row, New York, 1972.

Kruzic, 1974: Kruciz, P. G., "Cross-Impact Simulation in Water Resource Planning," Stanford Research Institute, Menlo Park, California, Report to the Institute of Water Resources, U.S. Army Corps of Engineers, November 1974.

Kurry, 1968: Kurry, K. J., "Research in Methods and Equipment," in Pfleider, 1968, pp. 791–801.

Landplan Systems, 1974a: "Landplan Systems, EHV Transmission Line Routing Manual for Overhead Facilities—Minnesota," Landplan Systems Division, Commonwealth Assoc., Inc., February 1974, Revised June 1, 1974.

Landplan Systems, 1974b: Landplan Systems, "Ontario Hydro 500 Kv Transmission Line Right of Way Lennox-Oshawa Environmental Report," Landplan Systems Division, Commonwealth Assoc., Inc., 1974.

Landsberg, 1974: Landsberg, H., "Inadvertent Atmospheric Modification Through Urbanization, "Weather and Climate Modification," W. N. Hess, (Ed.), John Wiley and Sons, New York, 1974.

Landscapes Ltd., 1972: Landscapes Limited, "Permits Methodology," Landscapes Limited, Madison, Wisconsin, 1972.

Leet and Judson, 1971: Leet, D. L. and S. Judson, "Physical Geology," Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1971.

Leontif, 1970: Leontif, W., "Environmental Repercussions and the Economic Structure: An Input-Output Approach," Rev. Econ. Stat., Vol. 52 No. 3, pp. 262–271, August 1970.

Leopold, et al., 1971: Leopold, L. B., et al., "A Procedure for Evaluating Environmental Impact," U.S. Geological Survey Circular 645, Washington, D.C., 1971.

Linstone and Turoff, 1975: Linstone, H. A. and M. A. Turoff, (Eds.), "The Delphi Method; Techniques and Applications," Addison Wesley, Reading, Mass., 1975.

Long, 1968: Long, G., "Road and Property Maintenance," in Pfleider, 1968, pp. 678–682.

Longwell, et al., 1969: Longwell, C. R., et al., Physical Geology, John Wiley and Sons, Inc., New York, 1969.

Lowry, 1945: Lowry, H. H., (Chairman), "Chemistry of Coal Utilization," National Research Council, Committee on Chemical Utilization of Coal, John Wiley and Sons, New York, 1945.

Machta and Telegadas, 1974: Machta, L. and K. Telegadas, "Inadvertent Large-Scale Weather Modification," in Hess, 1974.

Marley, 1969: "Cooling Tower Fundamentals and Application Principles," The Marley Company, 1969.

Martin, et al., 1969: Martin, J. E., et al., "Comparison of Radioactivity from Fossil Fuel and Nuclear Power Plants," Environmental Effects of Producing Electric Power, Hearings before the Joint Committee on Atomic Energy, 91st Congress, pp. 773–809, October-November 1969.

Marwitz, 1975: Marwitz, J. D., "Possibilities of Climate Modification by Large Power Plants," Paper presented at the 35th Annual Meeting of the Montana Academy of Sciences and the Fort Union Coal Field Symposium, Eastern Montana College, Billings, Montana, April 25, 26, 1975.

Matson and Blumer, 1973: Matson, R. E. and J. W. Blumer, Quality and "Reserves of Strippable Coal, Selected Deposits, Southeastern Montana," State of Montana, Bureau of Mines and Geology, Bulletin 91, December 1973.

McFadden, 1968: McFadden, D. H., "Pit Planning and Design—Coal Mines," in Pfleider, 1968, pp. 211–223.

McGraw Hill, 1973: Keystone Coal Industry Manual, McGraw Hill, Inc., New York, 1973.

McGraw-Hill, 1974: Keystone Coal Industry Manual, McGraw-Hill, Inc., New York, 1974.

McIndoo and Woodle, 1968: McIndoo, R. N. and M. G. Woodle, "Maintenance Facilities for Surface Mine Operations," in Pfleider, 1968, pp. 683–722.

McIntosh, 1974: McIntosh, R. P., "Plant Ecology, 1947–1972," Annals of the Missouri Botanical Garden, 25 Years of Botany, Vol. 61, No. 1, St. Louis, Missouri, 1974.

McKee and Wolf, 1963: McKee, J. C. and H. W. Wolf, "Water Quality Criteria," Second Edition, Resources Agency of California, State Water Quality Control Board Publication No. 3–A, 1963.

McKeever, 1968: McKeever, J. R., (ED), The Community Builder's Handbook, Prepared by the Urban Land Institute Community Builders' Council, Washington, D.C., 1968.

McKelvey and Brook, 1959: McKelvey, K. K. and M. E. Brook, "The Industrial Cooling Tower," Elsevier, Amsterdam, 1959.

Miller, 1974: Miller, S. G., "Environmental Impacts of Alternative Conversion Processes for Western Coal Development," Thomas E. Carroll Associates, Washington, D.C., Prepared for Old West Regional Commission, October 25, 1974.

Miller and Evans, 1974: Miller, P. R. and L. S. Evans, "Histopathology of Ozone, Ambient Oxidant Injury and an Unidentified Necrotic Needle Fleck on Western Pines," Phylopathology, Vol. 64, pp. 801–806, 1974.

Missouri Basin Interagency Committee, 1971: Missouri Basin Interagency Committee, "The Missouri River Basin Comprehensive Framework Study," Vol. 1–6, 1971.

Mitchell, 1971: Mitchell, J. M., "The Effects of Atmospheric Aerosols in Climate with Special Reference to Temperature Near the Earth's Surface," Journal of Applied Meteorology, Vol. 10, 1971.

Montana, 1971: Montana Water Resources Board, "A Groundwater Report of Montana," Helena, Montana, 1971.

Montana, 1973b: Montana Agricultural Experiment Station, "Preliminary Range Resource Analysis—Young's Creek Study Area," Montana State University, Bozeman, 1973.

Montana, 1973c: Montana Agricultural Experiment Station, "Preliminary Wildlife Survey of the Tongue River Area Adjacent to the Decker Coal Mine," Montana State University, Bozeman, 1973.

Montana, 1974a: Montana State Department of Natural Resources and Conservation, "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume One, Summary," Helena, Montana, November 1974.

Montana, 1974b: Montana State Department of Natural Resources and Conservation, "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume Two, Methodology, Need and Alternatives," Helena, Montana, November 1974.

Montana, 1974c: Montana State Department of Natural Resources and Conservation, "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume 3–A, Power Plant," Helena, Montana, November 1974.

Montana, 1974d: Montana State Department of Natural Resources and Conservation, "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume 3–B, Power Plant," Helena, Montana, November 1974.

Montana, 1974e: Montana State Department of Natural Resources and Conservation, "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume 4, Transmission Lines," Helena, Montana, November 1974.

Montana State U., 1975: Montana State University, "Anticipated Effects on Major Coal Development on Public Services, Costs and Revenues in Six Selected Counties," Final Report for the Northern Great Plains Resources Program, Research Report Number 82, April 1975.

Montfort and Wasp, 1974: Montfort, J. G. and E. J. Wasp, "Coal Transportation Economics," Bechtel, Inc., May 1974.

Muller, 1963: Muller, W. H. "Botany, A Functional Approach," Macmillan Co., New York; 1963.

Myers, 1970: Myers, E. T., "Line Change Shortens BN Main Route," Modern Railroads, November 1970.

NAA, 1973: "Ash at Work," National Ash Association, Vol. V No. 3, 1973.

Naegele, 1973: Naegele, J. A. (Ed.), "Air Pollution Damage to Vegetation," American Chemical Society, Washington, D.C., 1973.

NAPCA, 1969: National Air Pollution Control Administration, "Air Quality Criteria for Particulate Matter," Washington, D.C., January 1969.

NAPCA, 1970a: National Air Pollution Control Administration, "Air Quality Criteria for Carbon Monoxide," Washington, D.C., 1970.

NAPCA, 1970b: National Air Pollution Control Administration, "Air Quality Criteria for Hydrocarbons," Washington, D.C., 1970.

NAS, 1969: National Academy of Sciences, "Euthophication: Causes, Consequences, Corrections," Washington, D.C., 1969.

NAS, 1972: National Academy of Sciences," Particulate Polycyclic Organic Matter," Washington, D.C., 1972.

NAS, 1974: National Academy of Sciences, Committee on the Potential for Rehabilitating Land Surface Mined for Coal in the Western United States, "Rehabilitation Potential of Western Coal Lands," Ballinger Publishing Company, Cambridge, Massachusetts, 1974.

National Academy of Engineering, 1974: National Academy of Engineering," U.S. Energy Prospects: An Engineering Viewpoint," Washington, D.C., 1974.

Natusch, et al., 1974: Natusch, D. F. S., et al., "Toxic Trace Elements: Preferential Concentrations in Respirable Particles," Science, Vol. 183, pp. 202–4, 1974.

NCA, 1973: National Coal Association, "Research and Applied Technology Symposium on Mined-Land Reclamation," Pittsburgh, Pa., March 7–8, 1973 .

NCA, 1974a: National Coal Association, "Second Research and Applied Technology Symposium on Mined-Land Reclamation," Louisville, Kentucky, October 22–24, 1974.

Nemerow, 1971: Nemerow, N. L., "Liquid Waste of Industry Theories, Practices and Treatment," Syracuse University, 1971.

NE Utilities Service Co., 1974: Northeast Utilities Service Company, Overhead Transmission Policies and Practices, 1974.

New York, 1973: "Prevention and Control of Environmental Noise Pollution," New York State Department of Environmental Conservation, August 1973.

NGPRP, 1974a: Great Northern Plains Resource Program, "Surface Resources Work Group—Regional Profile," Discussion Draft, February 1974.

NGPRP, 1974b: Northern Great Plains Resource Program, "Surface Resources Work Group—Constraints," Discussion Draft, March 1974.

NGPRP, 1974f: Northern Great Plains Resource Program, "Socio-Economic and Cultural Aspects Work Group Report," Discussion Draft, June 1974.

NGPRP, 1974g: Northern Great Plains Resource Program, Interim Report, Draft Report, September 1974.

NGPRP, 1974h: Northern Great Plains Resource Program, "Declaration of Indian Rights to the Natural Resources in the Northern Great Plains States," Native American Natural Resources Development Federation of the Northern Great Plains, June 1974.

NGPRP, 1974i: Northern Great Plains Resource Program, "Shallow Ground Water in Selected Areas in the Fort Union Coal Region," Groundwater Subgroup of Water Work Group, Open File Report 74–78, Helena, Montana, 1974.

NGPRP, 1974j: Northern Great Plains Resource Program, "Possible Development of Water from Madison Group and Associated Rock in Powder River Basin, Montana-Wyoming," Frank A. Swenson, (author), Denver, Colorado, July 1974.

NGPRP, 1975: Northern Great Plains Resource Program, "Effects of Coal Development in the Northern Great Plains," Denver, Colorado, April 1975.

Nisbet, 1975: Nisbet, Ian C.T., "Ecological Magnification," Technical Review, p. 6, March/April 1975.

Odum, 1959: Odum, E.P., "Fundamentals of Ecology," Second Edition, W.B. Saunders Company, Philadelphia, Pa., 1959.

Odum, 1969: Odum, E. P., "The Strategy of Ecosystem Development," Science, Vol. 164, pp. 263–270, April 18, 1969.

Odum, 1971: Odum, E. P., "Fundamentals of Ecology," Third Edition, W. B. Saunders Company, Philadelphia, Pa., 1971.

Office of Emergency Preparedness, 1972: Office of Emergency Preparedness, "Disaster Preparedness," Executive Office of the President, Report to the Congress, January 1972.

Old West, 1975: Old West Regional Commission, "Coal Development in the Old West—Existing and Proposed," January 1975.

Ortolano, 1974: Ortolano, L., "A Process for Federal Water Planning at the Field Level," Water Resources Bulletin, Vol. 10 No. 4, pp. 766–778, August 1974.

Osterhoudt, 1974: Osterhoudt, F. H., "Social and Economic Impacts of Potential Coal Development in the Northern Great Plains," Paper presented at the Second Research and Applied Technology Symposium on Mined Land Reclamation, Sponsored by the National Coal Association, Louisville, Kentucky, October 22–24, 1974.

Patterson, et al., 1971: Patterson, W. D., et al., "The Capacity of Cooling Ponds to Dissipate Heat," Proceedings of the American Power Conference, Illinois Institute of Technology, Technology Center, Chicago, Illinois, 1971.

Penn. Dept. of Health, 1969: Pennsylvania Department of Health, "Dust," Harrisburg, Pennsylvania, 1969.

Perry, 1974: Perry, H., "The Gasification of Coal," Scientific American, Vol. 230, No. 3, pp. 19–25, March 1974.

Pfleider, 1968: Pfleider, E. P. (Ed.), "Surface Mining," Seeley W. Mudd Series, The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, N.Y. 1968.

Phillips and Keenan, 1968: Phillips, E. H. and A. F. Keenan, "Percussion Drilling," in Pfleider, 1968, pp. 283–299.

PIB, 1974a: Interagency Task Force on Coal, U.S. Department of the Interior, "Project Independence," November 1974.

PIB, 1974b: Federal Energy Administration, Project Independence Blueprint—Final Task Force Report, "Project Independence—Labor Report," U.S. Department of Labor, November 1974.

PIB, 1974c: Federal Energy Administration, Project Independence Blueprint—Final Task Force Report, "Project Independence—Facilities," U.S. Department of Labor, November 1974.

PIB, 1974d: Interagency Task Force on Oil Shale, "Project Independence Blueprint Final Task Force Report," U.S. Department of the Interior, November 1974.

PIB, 1974e: "Project Independence Blueprint: Availabilities Requirements and Constraints on Materials, Equipment and Construction," Final Task Force Report, U.S. Department of the Interior, November 1974.

Pimentel, 1971: Pimentel, D., "Ecological Effects of Pesticides on Non-Target Species," Office of Science and Technology, Washington, D.C., June 1971.

Polzin, 1974: Polzin, P. E., "Water Use and Coal Development in Eastern Montana," Completion Report No. 27, Montana University Joint Water Resources Research Center, Bozeman, Montana, November 1974.

Power, 1974d: "Four Key Equipment Designs Curb Stack Dust Emissions," Power, pp. 57–64, April 1974.

Public Health Service, 1970: U.S. Public Health Service, "Community Water Supply Study, Analysis of National Survey Findings," Department of Health Education and Welfare, July 1970.

Putnam, 1964: Putnam, W. C., "Geology," Oxford University Press, New York, 1964.

Railway Age, 1970: "Welded Rail Goes in Fast on MoPac," Railway Age, June 8, 1970.

Rien, 1968: Rien, E. C., "Electrical Apparatus for Surface Mining Operations," in Pfleider, 1968, pp. 736–743.

Robbins, 1970: Robbins, R.C., "Inquiry into the Economic effects of Air Pollution on Electrical Contacts," Stanford Research Institute, Menlo Park, California, 1970.

Robinson, 1968: Robinson, E., "Effects of Air Pollution on the Physical Properties of the Atmosphere," in Stern, 1968a.

Rochester Gas and Electric and Niagra Mohawk, 1974: Rochester Gas and Electric and Niagra Mohawk Corp., "Application to the State of New York

Public Service Commission for Certificate of Environmental Compatibility and Public Need," January 1974.

Rocky Mountain Assoc. of Geologists, 1972: Rocky Mountain Association of Geologists, "Geologic Atlas of the Rocky Mountain Region, United States of America," Denver, Colorado, 1972.

Roffman and Van Vleck, 1974: Roffman, A. and L. D. Van Vleck, "The State of the Art of Measuring and Predicting Cooling Tower Drift and Its Disposition," Journal of the Air Pollution Control Association, Vol. 24 No. 9, pp. 855–859, September 1974.

Rosenberg, et al., 1975: Rosenberg, H. S., et al., "Processing: The Status of SO_2 Control Systems," Chemical Engineering Progress, Vol. 71 No. 5, pp. 66–71, May 1975.

Ross, 1974: Ross, J. H., "Quantitative Aids to Environmental Impact Assessment," Environment Canada, Lands Directorate, April 1974.

Rossie, et al., 1972: Rossie, J. P., et al., "Cost Comparison of Dry-Type and Conventional Cooling Systems for Representative Nuclear Generating Plants," Prepared for U.S. Atomic Energy Commission, R. W. Bech and Assoc., Denver, Colorado, March 1972.

Rossie, et al., 1973: Rossie, J. P., et al., "Economics of the Use of Surface Condensers with Dry-Type Cooling Systems for Fossil-Fueled and Nuclear Generating Plants," Prepared for U.S. Atomic Energy Commission, by R. W. Beck and Assoc., Denver, Colorado, December 1973.

Rumfelt, 1968 Rumfelt H., "Cyclical Methods—Shovels and Backhoes," in Pfleider, 1968, pp. 427–444.

Rumker, et al., 1974: Rumker, R. von, et al., "Production, Distribution, Use and Environmental Impact Potential of Selected Pesticides," Midwest Research Institute, Kansas City, Missouri, 1974.

Sarnoff, 1971: Sarnoff, P., Encyclopedic Dictionary of the Environment," 1971.

Sawyer and McCarty, 1967: Sawyer, C. N. and P. L. McCarty, "Chemistry for Sanitary Engineers," Second Edition, McGraw-Hill, New York, 1967.

Schlesinger, 1975: Schlesinger, B., "Development of a Long-Range Environmental Impacts Forecasting Procedure," A Thesis in preparation for submission to the Department of Industrial Engineering, Stanford University, Menlo Park, California, 1975.

Schlesinger and Daetz, 1975: Schlesinger, B. and D. Daetz, "Development of a Long-Range Environmental Impacts Forecasting Procedure: A Research Summary," Paper to be presented at the IEEE Conference on Cybernetics and Society, September 1975.

Science, 1975b: "Energy Conservation: Better Living through Thermodynamics," Science, Vol. 188, pp. 820–821, May 23, 1975.

Sernco 1974: Sernco, "Applicants Environmental Assessment for a Proposed Gasification Project in Campbell and Converse Counties, Wyoming," Prepared for Wyoming Coal Gas Company and Rochelle Coal Company, October 1974.

Shannon and Fine, 1974: Shannon, D. C. and L. O. Fine, "Cation Solubilities of Lignite Fly Ashes," Environmental Science and Technology, Vol. 8 No. 12, pp. 1026–28, November 1974.

Shantz, 1938: Shantz, H. H., "Plants as Soil Indicators," in DOI, 1938, pp. 835–860.

Shefford, 1963: Shefford, V., "The Ecology of North America," University of Illinois Press, Urbana, Illinois, 1963.

Shilling and Adams, 1968: Shilling, R. W. and B. W. Adams, "Inclined Skip Hoisting in Surface Mining," in Pfleider, 1968, pp. 610–621.

Simpson and Dennis, 1971: Simpson, J. and A. S. Dennis, "Cumulus Clouds and Their Modification," Journal of Applied Meteorology, Vol. 10, 1971.

Smith, et al., 1972: Smith, J. B., et al., "Stripable Coal Reserves of Wyoming, Location, Tonnage, and Characteristics of Coal and Overburden," Intermountain Field Operation Center, Denver, Colorado, Prepared for U.S. Department of the Interior, Bureau of Mines Circular 8538, 1972.

Smithsonian, 1974: "Report on Endangered and Theatened Plant Species of the United States," Presented to the U.S. Congress by the Smithsonian Institution, House Document No. 94–81, Washington, D.C., December 15, 1974.

Sorensen, 1971: Sorensen, J. C., "A Framework for Identification and Control of Resource Degradation and Conflict in the Multiple Use of the Coastal Zone," Thesis, Department of Landscape Architecture, University of California, Berkeley, June 1971.

Sorensen and Moss, 1973: Sorensen, J. C. and M. L. Moss, "Procedures and Programs to Assist in the Environmental Impact Statement Process," University of California, Berkeley, April 1973.

Springer and Patterson, 1973: Springer, G. and D. Patterson, "Engine Emissions Pollutant Formation and Measurement," Plenum Press, New York, 1973.

Stern, 1968a: Stern, A. C., "Air Pollution, Vol. I, Air Pollution and Its Effects," Second Edition, Academic Press, New York, 1968.

Stern, 1968b: Stern, A. C., "Air Pollution, Vol. III, Sources of Air Pollution and Their Control," Second Edition, Academic Press, New York, 1968.

Stroup and Townsend, 1974: Strop, R. L. and S. B. Townsend. "Water Use and Coal Development in Eastern Montana: Water Availability and Demands," Project C-5258 MONT, Report No. 59, Montana University Joint Water Resources Center, December 1974.

Stubbins, 1968: Stubbins, J., "Dewatering and Flood Control," in Pfleider, 1968, pp. 750–761.

Taylor, 1973: Taylor, O. C., "Acute Responses of Plants to Aerial Pollutants," in Air Pollution Damage to Vegetation, J. A. Naegele (Ed.), Advances in Chemistry Series, American Chemical Society, 1973.

Thompson, 1975: Thompson, L. M., "Weather Variability, Climatic Change, and Grain Production," Science, Vol. 188, pp. 535–41, May 9, 1975.

Thor, 1974: Conversations between E. Thor, U.S. Pacific Southwest Forest and Range Experiment Station, Berkeley, California, and B. Schlesinger, 1974.

Thurlow, 1974: Thurlow, E. E., "Western Coal," Mining Engineering, Vol. 26, No. 5, pp. 30–33, May 1974.

Todd, 1970: Todd, D. K. (Ed), "The Water Encyclopedia," Water Information Center, Port Washington, New York, 1970.

Treshow, 1970: Treshow, M., "Environment and Plant Response," McGraw Hill Book Company, New York, 1970.

Turner, 1970: Turner, D. B., "Workbook of Atmospheric Dispersion Estimates," U.S. Department of Health, Education, and Welfare, Public Health Service Publication No. 999–AP–26, 1970.

Turner, 1970: Turner, D. B., "Workbook of Atmospheric Dispersion Estimates," U.S. Department of Health, Education, and Welfare, Washington, D.C. 1970.

Turoff, 1972: Turoff, M., "An Alternative Approach to Cross-Impact Analysis," Technical Forecasting and Social Change, Vol. 3, No. 3, American Elsevier Publishing Company, Inc., New York, 1972.

U. Montana, 1974b: University of Montana, Institute for Social Science Research, "A Comparative Case Study of the Impact of Coal Development on the Way of Life of People in the Coal Areas of Eastern Montana and Northeastern Wyoming," Prepared for Northern Great Plains Resource Program, June 30, 1974.

USBM, 1972: "Cost Analyses of Model Mines for Strip Mining of Coal in the United States," U.S. Bureau of Mines Information Circular 8535, Department of the Interior, 1972.

USBM, 1975: U.S. Bureau of Mines, Department of the Interior, Mineral Industry Surveys, Natural Gas Monthly, February 24, 1975.

USDA, 1957: U.S. Department of Agriculture, "Soil—The Yearbook of Agriculture," 85th Congress, First Session House Document No. 30, 1957.

USDA, 1975. U.S. Department of Agriculture, "Anatomy of a Mine from Prospect to Production," Surface Environment and Mining Program, Forest Service, Ogden, Utah, 1975.

USDA, undated: U.S. Department of Agriculture, "Powerline Contacts by Eagles and Other Large Birds," Rural Electrification Administration, REA Bulletin 61–10, undated.

USGS, 1970: U.S. Department of the Interior, Geological Survey, "The National Atlas of the United States of America," Washington, D.C., 1970.

USGS, 1971a: U.S. Department of the Interior, Geological Survey, "Water Resources Data for Montana, Part 2, Water Quality Records," Washington, D.C., 1971.

USGS, 1971b: U.S. Department of the Interior, Geological Survey, "Water Resources Data for Wyoming, Part 2, Water Quality Records," Washington, D.C., 1971.

USGS, 1974a: U.S. Geological Survey, "Landslides," Pamphlet No. INF–74–11, 1974.

USGS, 1974b: U.S. Geological Survey, "Natural Steam for Power," Pamphlet No. 1974, 0-548-685, 1974.

U.S. Senate, 1972: "Report of the President and Congress on Noise," by the Administrator of the Environmental Protection Agency, Washington, D.C., February 1972.

U.S. Senate, 1975: "Air Quality and Stationary Source Emission Control," Prepared for the Committee on Public Works, U.S. Senate, By Commission of Natural Resources and National Academy of Sciences, March 1975.

U. Texas, 1973: "Oil Pipeline Construction and Maintenance," Vol. II in the series of Oil Pipeline Transportation Practices, Second Edition, University of Texas, 1973.

Van Kleunen, 1968: Van Kleunen, J. P., "Belt Conveyors," in Pfleider, 1968, pp. 589-609.

Velz, 1970: Velz, C. J., "Applied Stream Sanitation," Wiley-Interscience, John Wiley and Sons, New York, 1970.

Vernberg and Vernberg, 1970: Vernberg, J. F. and W. B. Vernberg, "The Animal and the Environment," Holt, Rinehart and Winston, Inc., New York, 1970.

Waldbott, 1973: Waldbott, G., "Health Effects of Environmental Pollutants," C. V. Mosley Company, St. Louis, 1973.

Walters, 1974: Walters, C., "An Interdisciplinary Approach to Development of Watershed Simulation Models," Tech. Forecast Soc. Chg., Vol. 6, pp. 299-323, 1974.

Walton, 1970: Walton, W. C., "Groundwater Resource Evaluation," McGraw Hill Book Company, New York, 1970.

Wasp and Thompson, 1973: Wasp, E. J. and T. L. Thompson, "Slurry Pipelines, Energy Movers of the Future," Paper (V Rep-74-2) Presented at Interpipe 1973 Conference, Houston, Texas, 1973.

Wasp, et al., 1971: Wasp, E. J., et al., "The Era of Slurry Pipelines," Chemical Technology, pp. 552-562, September 1971.

Watkins, undated: Watkins, R. K., "Reinforced Soil Bridge," Engineering Experiment Station, Utah State University, undated.

Watson, et al., 1974: Watson, J., et al., "A Preliminary Study of A Concept for Categorizing Benefits," MTR-6569, The MITRE Corporation, January 1974.

Weaver and Clements, 1938: Weaver, J. E. and F. E. Clements, "Plant Ecology," New York, 1938.

Weimer, 1968: Weimer, W. H., "Production Engineering in Surface Coal Mines," in Pfleider, 1968, pp. 224-246.

Weimer and Weimer, 1973: Weimer, W. H. and W. A. Weimer, "Surface Coal Mines," in Cummins and Given, 1973, pp. 17-122—17-151.

Weiss, et al., 1972: Weiss, D., et al., "Lead Content of Human Hair (1871-1971)," Science, Vol. 178, pp. 69-70, October 6, 1972.

Westinghouse, 1964: Westinghouse Central Station Engineers, "Electrical Transmission and Distribution Reference Book," Westinghouse Corp. East, Pittsburgh, Pa., 1964.

Whittaker, 1970: Whittaker, R. H., "Communities and Ecosystems," The Macmillan Co., New York, 1970.

Wiebelzhal, 1974: Wiebelzahl, G., "A New Look at High Backpressure Operation of Reheat Units," Power Engineering, August 1974.

Williamson, 1968: Williamson, T. N., "Rotary Drilling," in Pfleider, 1968, pp. 300-324.

Wilmoth, 1974: Wilmoth, R. C., "Limestone and Limestone-Lime Neutralization of Acid Mine Drainage," EPA 670/2-74-051, National Environmental Research Center, U.S. Environmental Protection Agency, Cincinnati, Ohio, June 1974.

Wischmeier and Smith, 1965: Wischmeier, W. H. and D. D. Smith, "Rainfall-Erosion Losses from Cropland East of the Rocky Mountains," U.S. Department of Agriculture Handbook No. 282, May 1962.

Wyoming, 1971: Wyoming State Engineer's Office, "Water and Related Land Resources of Northeastern Wyoming," Cheyenne, Wyoming, 1971.

Wyoming, 1972b: Wyoming State Engineer's Office, "Water and Related Land Resources of the Bighorn River Basin, Wyoming," Cheyenne, Wyoming, 1972.

Wyo. Coal Gas and Rochelle Coal, 1974: Wyoming Coal Gas Company and Rochelle Coal Company, "Applicant's Environmental Assessment for a Proposed Gasification Project in Campbell and Converse Counties," Wyoming, October 1974.

Bibliography

AEC, 1972a: U.S. Atomic Energy Commission, "Environmental Statement Wagon Wheel Gas Stimulation Project, Sublette County, Wyoming," April 1972.

AEC, 1974: U.S. Atomic Energy Commission, "Coal Processing, Gasification, Liquefaction, Desulfurization: A Bibliography 1930–74," TID–3349, October 1974.

AGA, undated: American Gas Association, "Bi-Gas Process for Production of Pipeline-Quality Gas from Coal," undated pamphlet.

Agarwal, et al., 1975: Agarwal, J. C., et al., "Chemical Desulfurization of Coal," Mining Congress Journal, pp. 40–43, March 1975.

AIF, 1973: Atomic Industrial Forum, Inc., "Study No. 2 General Environmental Siting Guidelines for Nuclear Power Plants," National Environmental Studies Project Interim Report, New York, New York, 1973.

Alden, 1973: Alden, H. R., "Scenic and Recreation Resources, Kerwin Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

Axtmann, 1974: Axtmann, R. C., "An Environmental Study of the Wairakei Power Plant," Physics and Engineering and Laboratory, DSIR Report No. 445, A. R. Shearer, Government Printer, Lower Hut, New Zealand, December 1974.

Babcock and Rapp, 1952: Babcock, H. M. and J. R. Rapp, "Reconnaissance of the Geology and Ground-Water Resources of the Horse Creek-Bear Creek Area, Laramie and Goshen Counties, Wyoming," U.S. Geological Survey Circular 162, Washington, D.C., 1952.

Balzer, et al., 1975: Balzer, J. L., et al., "A Venture into Reclamation," Mining Congress Journal, pp. 24–29, January 1975.

Baxter, 1973: Baxter, G. T., "Fisheries, Kerwin Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

Bennington, et al., 1974: Bennington, G., et al., "Resource and Land Investigations (RALI) Program: Methodologies for Environmental Analysis Vol. I Environmental Assessment," The Mitre Corporation, McLean, Virginia, MTR–6740, August 1974.

Berg, et al., 1974: Berg, N. A., et al., "Proceedings of a Workshop on Revegetation of High-Altitude Disturbed Lands," Environmental Resources Center, Colorado State University, July 1974.

Berryhill, et al., 1950: Berryhill, H. L., et al., "Coal Resources of Wyoming," U.S. Geological Survey Circular 81, September 1950.

Bickert, Browne, and Coddington and Assoc., 1973: Bickert, Browne, and Coddington and Associates, Inc., "Attitudes and Opinions Related to the Development of an Oil Shale Industry," Prepared for the Oil Shale Regional Planning Commission and the Colorado West Area Council of Governments, July 1973.

BLM, 1972a: Bureau of Land Management, "Final Environmental Statement for the Jim Bridger Thermal-Electric Generation Project," April 28, 1972.

BLM, 1974a: Bureau of Land Management, "Draft Environmental Impact Statement Proposed Federal Coal Leasing Program," Vol. II, U.S. Dept. of the Interior, 1974.

BLM, 1974b: Bureau of Land Management, "Draft Environmental Impact Statement Proposed Federal Coal Leasing Program," Vol. I, U.S. Dept. of the Interior, 1974.

Boberschmidt, et al., 1973: Boberschmidt, L., et al., "Final Environmental Statement—Grand Gulf Nuclear Station Units 1 and 2," MTR–6488, The Mitre Corporation, McLean, Virginia, August 1973.

Boule, 1974: Boule, K. D., "The Determination, Assessment, and Design of 'In-Stream Value' Studies for the Northern Great Plains Region," Final Report, U.S. Environmental Protection Agency Region 8, Denver, Colorado, September 1974.

Box, 1974: Box, T. W., "Land Rehabilitation: Prompt Passage of Federal Reclamation Law Recommended by Ford Foundation Study," Coal Age, pp. 108–118, May 1974.

Boyd, 1974: Boyd, N. F., "Coal Conversion Processes Loom Big as a Source of Hydrocarbon Fuels," Mining Engineering, pp. 34–41, September 1974.

Brew, 1974: Brew, D. A., "Environmental Impact Analysis: The Example of the Proposed Trans-Alaska Pipeline," U.S. Geological Survey Circular 695, Department of the Interior, 1974.

BuRec, 1972: Bureau of Reclamation, "Montana-Wyoming Aqueducts," U.S. Department of the Interior, April 1972.

BuRec, 1975: Bureau of Reclamation, "A Scientific and Policy Review of the Final Environmental Statement for the Initial Stage, Garrison Diversion Unit (North Dakota), "Prepared by Environmental Impact Assessment Project of the Inst. of Ecology, for the U.S. Department of the Interior, January 1975.

Capes, et al., 1974: Capes, C. E., et al., "Rejection of Trace Metals from Coal During Beneficiation by Agglomeration," Environmental Science and Technology, Vol. 8 No. 1, pp. 35–38, January 1974.

Carter, 1973: Carter Oil Company, Supplemental Mining and Reclamation Plan for United States Coal Lease W–5036, Campbell County, Wyoming," 1973.

Carter, 1975: Carter, L. J., "Gov. Hathaway: Interior Nominee's 'Quality Growth' is Going Sour," Science, May 2, 1975.

Cassidy, 1973: Cassidy, S. M., "Elements of Practical Coal Mining," American Institute of Mining, Metallurgical and Petroleum Engineers, Inc., New York, 1973.

CEQ, 1973: The Council on Environmental Quality, "Energy and the Environment: Electric Power," Superintendent of Documents, Washington, D.C., Report No. 4111–00019, August 1973.

Cirello, 1975: Cirello, J., "Check List Analysis," Environmental Impact News, Vol. 1 No. 4, pp. 7–10, April 1975.

Cirello, undated: Cirello, J., "Methodologies of Evaluation and Forecasting," Environmental Impact News, undated.

Civil Engineering-ASCE, 1974: "Environmentally Acceptable Coal Strip Mining," Civil Engineering-ASCE, Vol. 44 No. 12, pp. 58–59, December 1974.

Clague, 1972: Clague, E., "Coal Manpower Projections," 1970–80, Final Report by Leo Kramer, Inc., Washington, D.C., prepared for Bureau of Mines, Open File Report 21–73, December 1972.

Coal Age, 1974a: "How Do You Keep Dust Down on the Mine? With a Chemical Dust Retardant, Of Course!" Coal Age, p. 124, April 1974.

Coal Age, 1974b: "The 50 Biggest Bituminous Mines in 1973," Coal Age, Compiled by Keystone Coal Industry Manual, p. 42, April 1974.

Coal Age, 1974c: "Operating Ideas: Reclamation Factors to Keep in Mind When Planning a Surface Mine Operation," Coal Age, p. 87, November 1974.

Collier, et al., 1970: Collier, C. R., et al., "Influences of Strip Mining on the Hydrologic Environment on Parts of Beaver Creek Basin, Kentucky, 1955–66," U.S. Geological Survey Professional Paper 427–C, U.S. Government Printing Office, Washington, D.C., 1970.

Cook, 1974: Cook, C. W., "Surface Rehabilitation of Land Disturbances Resulting from Oil Shale Development," (Executive Summary), Environmental Resources Center, Fort Collins, Colorado, June 1, 1974.

Cook, et al., 1974: Cook, C. W., et al., "Revegetation Guidelines for Surface Mined Areas," Range Science Series No. 16, Colorado State University, December 1974.

Cook, 1975: Cook, C. F., "Review of Federal Surface Mining Legislation," Mining Congress Journal, pp. 91–95, February 1975.

Coomber and Biswas, 1973: Coomber, N. H. and A. K. Biswas, "Evaluation of Environmental Intangibles," Genera Press, Bronxville, New York, 1973.

Cooper and Anderson, 1974: Cooper, D. K. and J. C. Anderson, "Coal Preparation—1974," Mining Congress Journal, pp. 86–89, February 1975.

Cornforth, 1975: Cornforth, C., "Reclamation Forges Ahead Throughout the Land," Coal Mining and Processing, Vol. 12 No. 1, pp. 50–53, 72, 74, January 1975.

Council of State Gov'ts, 1974: The Council of State Governments, Lexington, Kentucky, "Land Use Management," Proceedings of the National Symposium on Resource and Land Information, November 7–9, 1973, Reston, Virginia, November 1974.

Council of State Gov'ts, 1975; The Councill of State Governments, "Land, State Alternatives for Planning and Management," A Task Force Report, Lexington, Kentucky, April 1975.

Council on Economic Priorities, 1974: Council on Economic Priorities, "Leased and Lost, A Study of Public and Indian Coal Leasing in the West," Vol. 5 No. 1, 1974.

Cummins and Given, 1973: Cummins, A. B. and I. A. Given, SME Mining Engineering Handbook, Vol. 2, American Institute of Mining, Metallurgical and Petroleum Engineers, Inc. Port City Press, Baltimore, Maryland, 1973.

Dalsted and Leistritz, 1974: Dalsted, N. L. and F. L. Leistritz, "A Selected Bibliography of Coal Energy Development of Particular Interest to the Western States," Agricultural Economics Miscellaneous Report No. 16, April, 1974.

Dalsted, et al., 1974: Dalsted, N. L. et al., "Energy Resources Development in the Northern Great Plains: A Summary of Economic" Impacts, Final Report, Prepared for Northern Great Plains Resources Program, Department of Agricultural Economics, North Dakota State University, Fargo, June 1974.

Dames and Moore, 1974: Dames and Moore, Inc., "Environmental Assessment of Proposed Mining of the Husky No. 1 Phosphate Deposit Southeastern Idaho," Prepared for International Minerals and Chemical Corporation, November 1974.

Davis and Wood, 1974: Davis, G. H. and L. A. Wood, "Water Demands for Expanding Energy Development," U.S. Geological Survey Circular 703, 1974.

Dickson, et al., 1974: Dickson, K. L., et al., "Effects of Intermittently Chlorinated Cooling Tower Blowdown on Fish and Invertebrates," Environmental Science and Technology, Vol. 8 No. 9, pp. 845–9, September 1974.

Diem, 1973: Diem, H. L., "Wildlife, Kerwin Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

Dix and Beidleman, 1969: Dix, R. L. and R. G. Beidleman, (Eds.), "The Grasslands Ecosystem: A Preliminary Synthesis," Range Science Series No. 2, Colorado State University, Fort Collins, 1969.

DOI, 1969: The Department of the Interior, Federal Water Pollution Control Administration, A Primer on Waste Water Treatment, Report No. 0–335–309, Washington, D.C., 1969.

DOI, 1970: The Department of the Interior, "Environmental Report River of Life, Water: The Environmental Challenge, Washington, D.C., 1970.

DOI, 1973a: The Department of the Interior, "Final Environmental Statement for the Geothermal Leasing Program," Vol. 1 (of 4), Washington, D.C. 1973.

DOI, 1973b: The Department of the Interior, "Final Environmental Statement for the Geothermal Leasing Program," Vol. 2 (of 4), Washington, D.C., 1973.

DOI, 1973c: The Department of the Interior, "Final Environmental Statement for the Geothermal Leasing Program," Vol. 3 (of 4), Washington, D.C., 1973.

DOI, 1973d: The Department of the Interior, "Final Environmental Statement for the Geothermal Leasing Program," Vol. 4 (of 4), Washington, D.C., 1973.

DOI, 1974i: The Department of the Interior, Planning Support Group, Bureau of Indian Affairs, "Final Environmental Statement, Crow Ceded Area Coal Lease Westmoreland Resources Mining Proposal," Billings, Montana, 1974.

DOI, 1974j: The Department of the Interior, "Report on Water for Energy in the Northern Great Plains Area with Emphasis on the Yellowstone River Basin," Water for Energy Management Team, October 1974.

DOI, 1974k: The Department of the Interior, "Final Environmental Impact Statement Proposed Deregulation of Natural Gas Prices," Washington, D.C., June 1974.

DOI, 1974m: The Department of the Interior, "Energy Research Program of the U.S. Department of the Interior," Office of Research and Development, Washington, D.C., March 1974.

DOI, 1974n: The Department of the Interior, "Report on Water for Energy in the Upper Colorado River Basin," Water for Energy Management Team, July 1974.

DOI, 1974o: The Department of the Interior, "Garrison Diversion Unit-Initial Stage," Final Environmental Statement, Pick-Sloan Missouri Basin Program, INT FES 74–3, January 10, 1974.

DOI, 1974p: The Department of the Interior, "Strip-Mine Environment Study Started by Forest Service, Mines Bureau and TVA," News Release by U.S. Bureau of Mines, December 26, 1974.

DOI, 1975a: The Department of the Interior, "Report on Water Energy in the Northern Great Plains Area with Emphasis on the Yellowstone River Basin," Water for Energy Management Team, January 1975.

Doran, et al., 1974: Doran, R. K., et al., "Social-Economic Impacts of Proposed Burlington Northern and Chicago Northwestern Rail Line in Campbell-Converse Counties, Wyoming," University of Denver Research Institute, May 1974.

Dusek and McCann, 1974: Dusek, G. L., "Bull Mountains Coal Field Study Progress Report," Research Conducted by Montana Department of Fish and Game and Consolidation Coal Sompany, Montana, June 1974.

Engineering and Mining Journal, 1975: "Johns-Manville Finds Good Platinum-Palladium Values in Montana's Stillwater," Engineering and Mining Journal, p. 36, February 1975.

EPA, 1974d: U.S. Environmental Protection Agency, "Northern Great Plains Resources Program Accomplishment Plan Region VIII," Rocky Mountain Prairie Region, June 1974.

EPA, 1974e: U.S. Environmental Protection Agency, "Process Design Manual for Upgrading Existing Wastewater Treatment Plants," October 1974.

Falkie, 1975: Falkie, T. V., "A Philosophy of Coal Mining Research," Coal Mining and Processing, pp. 57–58, January 1975.

Fed. of Rocky Mt. States, 1974: Federation of Rocky Mountain States, Inc., Resource City, Rocky Mountains, 1974.

Ferretti, 1974: Ferretti, E. J., "Slurry and Dry Feeds Involve Unique Problems," Coal Mining and Processing, pp. 38–40, 52, October 1974.

Fletcher and Baldwin, 1973: Fletcher, K. and M. F. Baldwin (Eds.), "A Scientific and Policy Review of the Final Environmental Impact Statement for the Prototype Oil Shale Leasing Program of the Department of the Interior," Environmental Impact Assessment Project, The Institute of Ecology, October 29, 1973.

Fletcher, 1974: Fletcher, K. (Ed.), "A Scientific and Policy Review of the Draft Environmental Impact Statement for the Proposed Federal Coal Leasing Program of the Bureau of Land Management, Department of the Interior." Environmental Impact Assessment Project, The Institute of Ecology, Washington, D.C., 1974.

Ford Foundation, 1974: The Ford Foundation, "Exploring Energy Choices: A Preliminary Report," Energy Policy Project, 1974.

Foster Associates, 1974a: Foster Associates, Inc., "Prospective Regional Markets for Coal Conversion Plant Products Projected to 1980 and 1985, Volume I: Market Analysis," Prepared for Office of Coal Research, U.S. Department of the Interior, Final Report No. 102, September 1974.

Foster Associates, 1974b: Foster Associates, Inc., Prospective Regional Markets for Coal Conversion Plant Products Projected to 1980 and 1985, Volume II, Current and Projected Demand Supply and Price of Energy in the United States," Prepared for the Office of Coal Research, U.S. Department of the Interior, November 1974.

Galey, 1975: Galey, G. G., "Pipelines Versus Unit Trains," Coal Mining and Processing, Vol. 12 No. 1, pp. 64–5, 81, January 1975.

Gill, 1972: Gill, T. H., "Coal Development Potential in Eastern Montana," State of Montana Environmental Quality Council, Box 215, Capital Station, Helena, Montana, Revised December 1, 1972.

Gilmore and Duff, 1973: Gilmore, J. S. and M. K. Duff, "Policy Analysis for Rural Development and Growth Management in Colorado," Denver Research Institute, March 1973.

Gilmore, et al., 1973: Gilmore, J. S., et al., "Estimate of Local Service Employment and Diversification Potential Related to Development of a Single Oil Shale Plant in Garfield County and an Eight Plans Regional Complex," University of Denver Research Institute, September 1973.

Gilmore and Duff, 1974: Gilmore, J. S. and M. K. Duff, "A Growth Management Case Study: Sweetwater County, Wyoming," University of Denver Research Institute, Prepared for Rocky Mountain Energy Company, Denver, Colorado, December 1974.

Gladstone and Witherspoon, 1974: Gladstone, R. and R. Witherspoon, "Environmental Impact Statements: A Current Overview," Environmental Comment, Newsletter of the ULI—The Urban Land Institute, pp. 5–8, June 10, 1974.

Gold, et al., 1974: Gold, H., et al., "Western Water Needs for Energy Conversion and Processing with Environmental Constraints," Water Purification Associates, Cambridge, Massachusetts, National Science Foundation Grant, June 1, 1974–August 31, 1974.

Goodier, et al., 1973: Goodier, J. T., et al., 1973 Wyoming Mineral Yearbook, State Department of Economic Planning and Development, 1973.

Griffith, et al., 1966: Griffith, F. E., et al., "Demonstration and Evaluation of Five Methods of Secondary Backfilling of Strip Mine Areas," U.S. Bureau of Mines, 1966.

Harris, et al., 1974: Harris, et al., "Federal and Indian Lands, Coal, Phosphate, Potash, Sodium, and Other Mineral Production, Royalty Income, and Related Statistics, 1920 through 1973, Fiscal Year 1973," U.S. Department of the Interior, May 1974.

Hittman, 1974a: Hittman Associates, Inc., "General Environmental Guidelines for Evaluating and Reporting the Effects of Nuclear Power Plant Site Preparation, Plant and Transmission Facilities Construction," Prepared for Atomic Industrial Forum, February 1974.

Hittman, 1974b: Hittman Associates, Inc., "Environmental Effects, Impacts and Issues Related to Large Scale Coal Refining Complexes," Quarterly Report, Prepared for the Office of Coal Research, U.S. Department of the Interior, October 1974.

Holberger, et al., 1975: Holberger, R., et al., "Considerations in Evaluating Utility Line Proposals," Final Draft, The MITRE Corporation, McLean, Virginia, MTR-6948, June 30, 1974.

Honkala, 1974: Honkala, R. A., "Surface Mining and Mined Land Reclamation, A Selected Bibliography," The Old West Regional Commission, Washington, D.C., October 1974.

Howland, 1975: Howland, J. W., "Three New Tools for Improving Land Reclamation Efficiency," Mining Congress Journal, pp. 20–21, March 1975.

ICMA, 1968: International City Managers Association, "Principles and Practice of Urban Planning," Published for the Institute for Training in Municipal Administration, Washington, D.C., 1968.

IIEQ, 1973: Illinois Institute for Environmental Quality, "Environmental Impact Statements: A Handbook for Writers and Reviewers," IIEQ Document No. 73-8, Prepared by Department of Landscape Architecture, University of Illinois—Urbana-Champaign, August 1973.

IPA, 1974: Institute of Public Administration, "Criteria for Evaluation of Social Impacts of Flood Management Alternatives," Prepared for New England River Basins Commission, Phase I Report, March 1974.

Jain, et al., 1973: Jain, R. K., et al., "Environmental Impact Assessment Study for Army Military Programs," Construction Engineering Research Construction Engineering Research Laboratory, December 1973.

Johnson, 1973: Johnson, W. M., "Vegetation, Kerwin Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

Johnston, et al., 1974 Johnston, M. J. S., et al., "Earthquakes—Can They Be Predicted or Controlled?" Industrial Research, pp. 30–37, November 15, 1974.

Jordan, 1974: Jordan, P. R., "Clean Coal Through Technology," The Science Teacher, Vol. 41, No. 8, November 1974.

Kaiparowits, 1974: "Kaiparowits Transmission System," Environmental Report, August 1974.

Katell and Hemingway, 1974: Katell, S. and E. L. Hemingway, "Basic Estimated Capital Investment and Operating Costs for Coal Strip Mines," Process Evaluation Group, Morgantown, West Virginia, Prepared for U.S. Bureau of Mines, 1974.

Kutak, et al., 1974a: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Vol. 1, Responding to Rapid Population Growth," Old West Regional Commission, Washington, D.C., 1974.

Kutak, et al., 1974b: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Volume 2, Land Use Planning and Growth Control: Statutory Responses from Outside the Region," Old West Regional Commission, Washington, D.C., 1974.

Kutak, et al., 1974c: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Volume 3, Summary of Montana, North Dakota and Wyoming Statutes: Financing and Population Issues, Bibliographies," Old West Regional Commission, Washington, D.C., 1974.

Kutak, et al., 1974d: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Montana Statutes Relating to Rapid Population Growth, Volume 4," Old West Regional Commission, Omaha, Nebraska, 1974.

Kutak, et al., 1974e: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Volume 5, North Dakota Statutes Relating to Rapid Population Growth," Old West Regional Commission, 1974.

Kutak, et al., 1974f: Kutak, et al., "A Legal Study Relating to Coal Development—Population Issues, Volume 6, Wyoming Statutes Relating to Rapid Population Growth," Old West Regional Commission, 1974.

Landrum and Brown, 1974: Landrum and Brown, "Old West Regional Airport Study," Phase I: Airport Feasibility Final Report, Booz, Allen and Hamilton, Inc., September 1974.

Lehman and Werner, 1974: Lehman, E. I. and K. G. Werner, "Coal Gasification, A Bibliography with Abstracts," U.S. Department of Commerce, May 1974.

Leopold and Marchand, 1968: Leopold, L. B. and M. O. Marchand, "On the Quantitative Inventory of the Riverscape," Water Resources Research, Vol. 4 No. 4, pp. 709–717, U.S. Geological Survey, August 1968.

Littleton, 1950a: Littleton, R. T., "Reconnaissance of the Ground-Water Resources of the Wheatland Flats Area, Wyoming," U.S. Geological Survey Circular 70, Washington, D.C., April 1950.

Littleton, 1950b: Littleton, R. T., "Ground-Water Conditions in the Vicinity of Gillette, Wyoming," U.S. Geological Survey Circular 76, Washington, D.C., October 1950.

Littleton, 1950c: Littleton, R. T., "Reconnaissance of the Geology and Ground-Water Hydrology of the Laramie Basin, Wyoming," U.S. Geological Survey Circular 80, Washington, D.C., November 1950.

Ludwigson, 1974: Ludwigson, J. O., "Two Nations, One Lake—Science in Support of Great Lakes Management," Canadian National Committee for International Hydrological Decade, Ontario, Canada, Available from IFYGL Centre, Ontario, Canada, May 1974.

Luken, 1974: Luken, R. A., "Economic and Social Impacts of Coal Development in the 1970's for Mercer County, North Dakota," Thomas E. Carroll Associates, Washington, D.C., Prepared for Old West Regional Commission, October 25, 1975.

Lyle and von Wodtke, 1974: Lyle, J. and M. von Wodtke, "An Information System for Environmental Planning," American Institute of Planners Journal, Vol. 40 No. 6, November 1974.

Maneval, 1975: Maneval, D. R., "Reclaiming Land for Recreational Development," Coal Mining and Processing, pp. 84–86, April 1975.

Mathematica, 1974: Mathematica, Inc. and Ford, Bacon, and Davis, Inc., "Design of Surface Mining Systems in Eastern Kentucky, Volume 1, Summary," Department for Natural Resources and Environmental Protection, January 1974.

Matson and Studer, 1974: Matson, R. A. and J. B. Studer, "Energy Resources Development in Wyoming's Powder River Basin: An Assessment of Potential Social and Economic Impacts," Water Resources Research Institute, University of Wyoming, Prepared for the Northern Great Plains Resources Program, April 1974.

Mawson and Godfrey, 1971: Mawson, J. C. and P. J. Godfrey, "Diverse—A Fortran IV Program to Calculate Diversity Indices of Stream Bottom Organisms," Water Resources Research Center, University of Massachusetts—Amherst, 1971.

McBride and Silverman, 1973: McBride, J. R. and A. Silverman, "Forty Percent of the Nation's Coal: Development of the Northern Plains," Montana Public Affairs Report No. 16, Bureau of Government Research, University of Montana, September 1973.

McDowell Wellman, undated: McDowell Wellman, "Wellman-Galusha Gas Producers," undated advertising pamphlet.

McWhorter, et al., 1974: McWhorter, D. B., et al., "Water Pollution Potential of Mine Spoils on the Rocky Mountain Region," Departments of Agricultural Engineering and Chemistry, Colorado State University, Fort Collins, Prepared for U.S. Environmental Protection Agency, 1974.

Michaelson, 1974: Michaelson, S. D., "Wanted: New Systems for Surface Mining," Engineering and Mining Journal, Vol. 175 No. 10, pp. 63–9, October 1974.

Mining Congress Journal, 1975: "Open Pit Mining," Mining Congress Journal, pp. 124–131, February 1975.

Montana, 1973a: Montana Department of Natural Resources and Conservation, "Coal Development in Eastern Montana," A Situation Report of the Montana Coal Task Force, January 1973.

Montana State U., 1973b: Montana State University, Bozeman, "Surface Mined Land Reclamation Research in Montana," Montana Agricultural Experimet Station Research Report 40, April 1973.

Monfort, 1972: Monfort, J. G., "Black Mesa Coal Slurry Line is Economic and Technical Success," Pipe Line Industry, May 1972.

Morrill, 1973: Morrill, R. A., "Comprehensive Resource and Environmental Management Planning," Bureau of Reclamation, U.S. Department of the Interior, June 1973.

Munshower, et al., 1974: Munshower, F. F., et al., "The Effect of Stack Emissions on the Range Resource in the Vicinity of Colstrip Montana, Progress Report 1972–74, Montana Agricultural Experiment Station, July 31, 1974.

NAS, 1970: National Academy of Sciences, Bureau of Solid Waste Management, "Policies for Solid Waste Management," U.S. Department of Health, Education, and Welfare, Public Health Service, 1970.

NAS, 1971: National Academy of Sciences, Committee on Technologies and Water, "Potential Technological Advances and Their Impact on Anticipated

Water Requirements, "A Report to the National Water Commission, Washington, D.C., June 1971.

NCA, 1974b: National Coal Assocation, "Draft Conference Committee Report," S. 425–H.R. 11500, October 7, 1974.

NCA, 1974c: National Coal Association, "Glossary of Surface Mining and Reclamation Technology," Compiled by Bituminous Coal Research, Inc., for the Coal and Environment Conference and Exposition, Louisville, Kentucky, October 22–24, 1974.

NCA, 1974d: National Coal Association, "Papers Presented Before the Second Research and Applied Technology Symposium on Mined-Land Reclamation," Coal and the Environment Technical Conference, Louisville, Kentucky, October 22–24, 1974, Washington, D.C., 1974.

N. Central Power, 1971a: Coordinating Committee of the North Central Power Study, "North Central Power Study, Report of Phase I, Vol. I., October 1971.

N. Central Power, 1971b: Coordinating Committee of the North Central Power Study, North Central Power Study, Report Phase I, Vol. II, October 1971.

Newsweek, 1975: "How Weeds Clean Water," Newseek, pp. 85–6, April 14, 1975.

NGPRP, 1974c: Northern Great Plains, Resource Program, "Surface Resources Work Group—Impact Analysis," Discussion Draft, March 1974.

NGPRP, 1974d: Northern Great Plains Resource Program, "National and Regional Energy Considerations Work Group Report," Discussion Draft, February 1974.

NGPRP, 1974e: Northern Great Plains Resource Program," Mineral Resources Work Group Report," Discussion Draft, February 1974.

Nickeson, 1973: Nickeson, F. H., "Stripping with a Variety of Equipment," Coal Mining and Processing, pp. 28–31, February 1973.

OCR, 1974a: Office of Coal Research, U.S. Department of the Interior, "Coal Technology: Key to Clean Energy," Annual Report 1973–4.

OCR, 1974b: Office of Coal Research, Department of the Interior, "Office of Coal Research Technical Reports—April, 1962–December, 1974," 1974.

OCR, 1974c: Office of Coal Research, U.S. Department of the Interior, "Clean Energy From Coal Technology," 1974.

Oltoosan, undated: Oltoosan, J., "Permits Methodology," Landscapes Limited, Prepared in Conjunction with Bonneville Power Administration, undated.

Osborn, 1974: Osborn, E. F., "Clean Synthetic Fluid Fuels from Coal—Some Prospects and Projections," Mining Engineering, pp. 31–33, September 1974.

Packer, 1974: Packer, P. E., "Rehabilitation Potentials and Limitations of Surface-Mined Land in the Northern Great Plains," USDA Forest Service Technical Report INT–14, Intermountain Forest and Range Experiment Station, Ogden, Utah, July 1974.

Penn., 1973: Commonwealth of Pennsylvania, "Proceedings, Pennsylvania Coal Conference," April 4, 1973.

Pennak, 1973: Pennak, R. W., "Limnology, Kerwin Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

Phelps, 1975: Phelps, E. R., "Federal Coal Leasing Policy," Mining Congress Journal, pp. 14–16, January 1975.

Phillips, 1972: Phillips C., "Ecology/Economics," Wyoming Wildlife, Vol. 36, No. 4, pp. 22–25, April 1972.

Pigford, et al., 1973: Pigford, T. H., et al., "Fuel Cycles for Electrical Power Generation Phase I Towards Comprehensive Standards: The Electric Power Case," Teknekron, Inc., Berkeley, California, January 1973.

Power, 1974a: "Coal Facts—Learn the Physical and Chemical Properties of Coal," Power, pp. 5–10, February 1974.

Power, 1974b: "Fuel Selection—Detailed Analysis of Coal is Key to Meaningful Specification," Power, pp. 2–4, February 1974.

Power, 1974c: "Handling Equipment—Flexible System Design Should be Your Primary Goal," Power, pp. 11–24, February 1974.

Rapp, 1953: Rapp, J. R., "Reconaissance of the Geology and Ground-Water Resources of the LaPrele Area Converse County, Wyoming," U.S. Geological Survey Circular 243, Washington, D.C., 1953.

Rapp and Babcock, 1953: Rapp. J. R. and H. M. Babcock, "Reconaissance of the Geology and Ground-Water Resources of the Glendo-Wendover Area Platte County, Wyoming," U.S. Geological Survey Circular 163, Washington, D.C., 1953.

Reese, 1973: Reese, R. L. (Ed.), "Public Forum—Montana Coal and Energy Development," Helena, Montana, February 3–4, 1973.

Reid and Streebin, 1972: Reid, G. W. and L. E. Streebin, "Evaluation of Waste Waters from Petroleum and Coal Processing," Oklahoma University, Prepared for Environmental Protection Agency, 1972.

RMCOE 1973a: Ubright Water Engineers, Inc., "Hydrogen Kerwin-Environmental Study," Rocky Mountain Center on Environment, Denver, Colorado, July 1973.

RMCOE, 1973b: Rocky Mountain Center on Environment, "Summary Report Kerwin Environmental Study for American Metal Climax, Inc. (AMAX)," Denver, Colorado, July 1973.

Roberts, 1974: Roberts, F. S., National Science Foundation, "Weighted Diagraph Models for Energy Use and Air Pollution in Transportation Systems," The Rand Corporation, Santa Monica, California, December 1974.

Robinson and Robbins, 1968: Robinson, E. and R. C. Robbins, "Sources Abundance and Fate of Gaseous Atmospheric Pollutants," Stanford Research Institute, Menlo Park, California, 1968.

Sawyer and Crowl, 1968: Sawyer, L. E. anw J. M. Crowl, "Land Reclamation," in Pfleider, 1968, pp. 247–266.

Schoenthal, undated: Schoenthal, N., "Loose-leaf Series of Fact Sheets on Montana Grasses," Bookstore, Eastern Montana College, undated.

Science, 1975a: "Strip Mining Legislation: The Tug of War Continues," *Science*, Vol. 188, pp. 813–15, May 23, 1975.

Shaw, et al., 1974: Shaw, H., et al., "Evaluation of Pollution Control in Fossil Fuel Conversion Processes; Gasification; Section I: Lurgi Process," Prepared for Office of Research and Development by Exxon Research and Engineering Company, Linden, New Jersey, July 1974.

Sindelar, et al., 1974: Sindelar, B. W., et al., "Surface Mined Land Reclamation at Colstrip Montana," Progress Report 1973–74, Prepared for Western Energy Company, By Montana Agricultural Experiment Station, Montana State University, Bozeman, Report No. 69, 1974.

Smith, 1975: Smith, H. H., "The Wringing of the West," The Washington Post, Sunday, February 16, 1975, pp. B–1–4.

Sorensen, undated: Untitled Computer Printout on the Impact on Aquatic Systems, Department of Landscape Architecture, University of California, Berkeley, undated.

Stefanko, et al., 1973: Stefanko, R., et al., "An Analysis of Strip Mining Methods and Equipment Selection," Research and Development Report No. 61, Interim Report No. 7, Prepared by Coal Research Section, The Pennsylvania State University, for the U.S. Department of the Interior, May 29, 1973.

Stuart, 1974: Stuart, R. W., "Surface Mining and Wildlife," North Dakota Outdoors, Vol. 37, No. 5, pp. 2–7, November 1974.

Super, et al., 1973: Super, A. B., et al., "Air Pollution Potential Determination Program for Colstrip, Montana," Final Report, Part 1, Department of Earth Sciences, Montana State University, Bozeman, April 1973.

THK, 1973: THK Associates, Inc., "Off-Site (Socio-Cultural) Impact, Kerwin Environmental Study," Rocky Mountain Center on Environmental, Denver, Colorado, July 1973.

Thomas, 1973: Thomas, L. F., "An Introduction to Mining," John Wiley and Sons, Inc., Halsted Press, New York, 1973.

Thompson and Wasp, 1974: Thompson, T. L. and E. J. Wasp, "Liquid Coal: Vital to U.S. Energy," Pipe Line Industry, pp. 42–45, September 1974.

Thronson, 1973: Thronson, R. E., "Comparative Costs of Erosion and Sediment Control, Construction Activities," Prepared for U.S. Environmental Protection Agency, July 1973.

TIE, 1973: Institute of Ecology, "A Scientific and Policy Review of the Draft Environmental Impact Statement Crow Ceded Area Coal Lease Westmoreland Resources Mining Proposal of the Bureau of Indian Affairs," U.S. Department of the Interior, November 29, 1973.

U. Denver, 1975a: University of Denver Research Institute, "The Social, Economic and Land Use Impacts of a Fort Union Coal Processing Complex," Interim Report, Prepared for Energy Research and Development Administration, January 1975.

U. Denver, 1975b: University of Denver Research Institute, "The Social, Economic, and Land Use Impacts of a Fort Union Coal Processing Complex," Interim Report, Prepared for Energy Research and Development Administration, May 1975.

U. Montana, 1972: "A Hazardous Enterprise," The Report of the Seminar on the Northern Plains Coalfield Development, University of Montana, Missoula, Student Environmental Research Center, Fall Quarter, 1972.

U. Montana, 1974a: "Western Wildlands, A Natural Resource Journal," Vol. 1 No. 4, Montana Forest and Conservation Experiment Station, University of Montana, August 1974.

U. Montana, undated: "Biological Monitoring and Baseline Data Gathering for Colstrip Units #3 and #4," Prepared by Personnel of the Environmental Studies Laboratory, University of Montana, Prepared for Montana State Department of Natural Resources and Conservation, undated.

United Engineers, 1972: United Engineers and Constructors, Inc., "Volume III Coal-Fired Fossil Plant 1000 MWe Central Station Power Plants Investment Cost Study," U. S. Atomic Energy Commission, June 1972.

U. Oklahoma, 1974a: "A Methodology and Documentation for Consistent Analysis of Energy Alternatives for Environmental Impact Statements, Vol. 1," University of Oklahoma, Science and Public Policy Program, Norman Oklahoma, October 31, 1974.

U. Oklahoma, 1974b: "A Methodology and Documentation for Consistent Analysis of Energy Alternatives for Environmental Impact Statements, Vol. 2," University of Oklahoma, Science and Public Policy Program, Norman, Oklahoma, October 31, 1974.

U. Oklahoma, 1974c: "A Methodology and Documentation for Consistent Analysis of Energy Alternatives for Environmental Impact Statements," Vol. 3, University of Oklahoma, Science and Public Policy Program, Norman, Oklahoma, October 31, 1974.

U. Okahoma, 1974d: "A Methodology and Documentation for Consistent Analysis of Energy Alternatives for Environmental Impact Statements," Vol. 4, University of Oklahoma, Science and Public Policy Program, Norman, Oklahoma, October 31, 1974.

USBM, 1968: U.S. Bureau of Mines, Department of the Interior, "A Dictionary of Mining, Mineral and Related Terms," 1968.

U. S. Congress, 1973: Science Policy Research Division, Congressional Research Service, Library of Congress, "Energy Facts," Prepared for the Subcommittee on Energy, 93rd Congress, First Session, November 1973.

USDA, 1974a: U. S. Department of Agriculture, Forest Service, Environmental Statement Badlands Planning Unit, "Management Prescription for the Badlands Planning Unit, Little Missouri National Grasslands Custer National Forest Environmental Statement," September 1974.

USDA, 1974b: U. S. Department of Agriculture, Forest Service, Environmental Statement Badlands Planning Unit, "Addendum to Management Prescription for the Badlands Planning Unit Little Missouri National Grasslands, Custer National Forest Environmental Statement," August 1974.

USDA, 1974c: U. S. Department of Agriculture, Forest Service, "Rolling Prairie Planning Unit Considerations for Future Management, Little Missouri National Grasslands Custer National Forest, Environmental Statement Draft," December 12, 1974.

USGS, 1974c: U.S. Geological Survey, "Rain—A Water Resource," Pamphlet No. 19740–550–107, 1974.

Van Voast, 1974: Van Voast, W. A., "Hydrologic Effects of Strip Coal Mining in Southeastern Montana—Emphasis: One Year of Mining Near Decker," State of Montana, Bureau of Mines and Geology Bulletin 93, 1974.

Visher, 1952: Visher, F. N., "Reconnaissance of the Geology and Ground-Water Resources of the Pass Creek Flats Area Carbon County, Wyoming," U.S. Geological Survey Circular 188, 1952.

Visher and Babcock, 1953: Visher, F. N. and H. M. Babcock, "Ground-Water Conditions in the Soil and Moisture Conservation Demonstation Area Near Torrington, Goshen County, Wyoming," U.S. Geological Survey Circular 238, Washington, D.C., 1953.

Weed Science Society, 1971: Weed Science Society of America, "Composite List of Weeds," Champaign, Illinois, July 1971.

Wicks and Synak, 1974: Wicks, P. H. and M. Synak. "Oregon Surveys Its Hazardous Wastes," Environmental Science and Technology, Vol. 8, No. 13, pp. 1080–1084, December 1974.

Woodward-Envicon, 1974a: Woodward-Envicon, Inc., "An Environmental Impact Analysis for a Shale Oil Complex at Parachute Creek, Colorado, Part I—Plant Complex and Service Corridor," Prepared for Colony Development Operation, 1974.

Woodward-Envicon, 1974b: Woodward-Envicon, Inc., "An Environmental Impact Analysis for a Shale Oil Complex at Parachute Creek, Colorado, Part II—Pipeline," Prepared for Colony Development Operation, 1974.

Woodward-Envicon, 1974c: Woodward-Envicon, Inc., "An Environmental Impact Analysis for a Shale Oil Complex at Parachute Creek, Colorado, Part III—Socio-Economic Analysis Offsite Development, and Part IV—Conclusion," Prepared for Colony Development Operation, 1974.

Wright, 1974: Wright, H. E., "Landscape Development, Forest Fires, and Wilderness Management," Science, Vol. 186 No. 4163, pp. 487–495, November 8, 1974.

W. States Water Council, 1974: Western States Water Council, "Western States Water Requirements for Energy Development to 1990," Salt Lake City, Utah, November 1974.

Wyoming, 1972a: Wyoming Water Planning Program, "Water and Related Land Resources of Northeastern Wyoming," Report No. 10, April 1972.

Wyoming, 1973a: State Engineers Office, Wyoming Water Planning Program, "The Wyoming Framework Water Plan," May 1973.

Wyoming, 1973b: Wyoming State Engineers Office, Water Planning Program, "The Wyoming Framework Water Plan," A Summary, May 1973.

Wyoming, 1974a: State Engineers Office, Wyoming Water Planning Program, "A Water Development Program for Wyoming," October 1974.

Wyoming, 1974b: Wyoming Conservation and Land Use Study Commission, "Statewide Land Use Planning Program for Wyoming, Vol. II, Appendices," October 1974.

Wyo. DEPAD, 1972a: State of Wyoming Department of Economic Planning and Development, "Engineering Report on the Development of Presently Unused Water Supplies of the Green River Basin in Wyoming, Part I—Report," Tipton and Kalmback, Inc., Engineers, Denver, Colorado, October 1972.

Wyo. DEPAD, 1972b: State of Wyoming Department of Economic Planning and Development, "Engineering Report on the Development of Presently Unused Water Supplies of the Green River Basin in Wyoming, Part II—Appendices," Tipton and Kalmback, Inc., Engineers, Denver, Colorado, October 1972.

Wyo. DEPAD, 1974: Wyoming Department of Economic Planning and Development, "Coal and Uranium Development of the Powder River Basin—An Impact Analysis," June 1974.

Yampa, 1973: "Yampa Project, A Cooperative Approach to Electric Energy Resource Development," Colorado-Ute Electric Association, Inc., Platte River Power Authority, Salt River Power Agricultural Improvement and Power District, Tri-State Generation and Transmission Association, Inc., 1973.

Mr. DINGELL. The subcommittee has got to recess. We have another vote on the floor. We will return as soon as we can.

[Brief recess.]

Mr. DINGELL. The subcommittee will come to order. Let me ask you this question. As I read the bill that we are considering, on page 3 and succeeding pages, the word "commercial" demonstration facilities has been stricken. As I read the testimony that was submitted by ERDA, and given by Dr. Seamans, at the hearing, I find in the last paragraph of page 24 the following:

> Mr. Chairman, this is the reason your proposed legislation is needed now, to enable the Federal Government to offer needed incentives to build and operate within the next 5 years a limited number of commercial or near-commercial scale plants to produce clean synthetic fuels, coal, oil shale, and other domestic resources.

Further on in Dr. Seamans' testimony, I read at page 29:

> And we have to move out now beyond our research and development and demonstration into a commercial type program to learn about the economic effects, the environmental effects, the socioeconomic effects, the resource requirements, water, transportation, water, labor, capital costs, and financing. We have to get into regulatory matters.

Now, these comments raise several questions in my mind. The first I would appreciate your addressing yourself to is the striking of the

word "commercial." What does that mean? Does that change the thrust of the bill or not?

Mr. FRI. I guess in part I would have to rely on the record made by House Science and Technology on that point. It does not change the purpose of the program because the purpose of the program right along, in our judgment, has been to gather information of the type enumerated in Dr. Seamans' statement.

Mr. DINGELL. Because of the limited time, let us stay with the question at hand, and that question is: Does that change the thrust of the bill, and, if so, how?

Mr. FRI. Well——

Mr. DINGELL. In other words, is this bill going to devote itself to commercial programs and to commercial plants or not?

Mr. FRI. I think it is intended to clarify the purpose of the bill so that it is not confused with an endeavor to subsidize an otherwise commercially OK technology, that there are some things to be learned first.

Mr. DINGELL. Now, tell me: What kind of technology or plant would be subsidized under the bill as it now stands that would not have been subsidized as the bill was originally introduced?

Mr. FRI. I don't believe there is any change, unless there has been further enumeration of the types of nonrenewable resources that would be covered under the bill.

Mr. DINGELL. The bill said—

To gather information about technological, economic, environmental, social costs, benefits, and impacts of such commercial demonstration facilities.

Now, the subsequent language in the bill has been changed. It says—

To gather information about technological, economic, environmental, and social costs, benefits, and impacts of such demonstration facilities.

What is a commercial facility for the purposes of the original bill and what is a demonstration facility for the purposes of the amended bill, so that we have it clear? What I am trying to find out——

Mr. FRI. My understanding is that the word "commercial" in the original bill, certainly as we read it, referred to the scale of the facility, a full-sized or commercial scale facility being built for the purpose of gathering this information, as Dr. Seamans' testimony indicated.

Mr. DINGELL. I don't mean to be facetious, but is it going to gather information or produce fuel?

Mr. FRI. Hopefully, it will do both. It can't really gather the information, I guess, unless we produce fuel, and, if the economics are such when these plants are finished that the fuel can be produced as a commercially viable venture, I would assume the asset would be run for that purpose after we have finished collecting the data.

Mr. DINGELL. Now, let me ask you this question. Can you tell us what the difference is between the two in the amendment? In other words, is it the same bill with different language or does the different language really denote a change?

Mr. FRI. Well, I don't mean to evade the question. I think you would have to read the record in House Science and Technology to know what they meant. As we read the bill—As I read the bill in its original version, "commercial" really referred to the scale of the facility that we were working with and the fact that there is going to be commer-

cialization of the technology in the private sector at some point in the future, and I don't think that intent, in my mind, has changed at all. We are going to build a full-scale facility, except in the case of shale, where the bill would direct us to build a full-scale module of a total facility.

Mr. DINGELL. Well, I hope I am not being unclear in these questions.

Mr. FRI. It is a word that has been troublesome admittedly from the very start, and probably we should have awakened to that fact when the original task force that talked through this program recommended and it was accepted that we undertake an information program, although way back when, when the whole idea was first conceived, the words "commercial" and "commercialization" were attached to it—that we weren't smart enough to get rid of the word when we decided we wanted an information program, and it has pestered us some ever since, and I think——

Mr. DINGELL. It caused some great problems up here, if you recall, because we felt that this was a big commercial program. I have had people from industry come in and say this is going to generate synthetic natural gas to supply markets in Michigan.

Now, is it going to supply commercial natural gas to markets in Michigan?

Mr. FRI. There is one high Btu gasification project which, if built and successfully run, is going to supply gas in Michigan.

Mr. DINGELL. On a commercial basis?

Mr. FRI. Yes.

Mr. DINGELL. Is this a commercial program or not?

Mr. FRI. The purpose of the government's involvement in this program is to get the kinds of information enumerated at some length in tab C of this fact book that I think the committee has, but, if you are going to build a commercial scale facility and it runs successfully, of course it is going to produce "commercial" quantities of product which are then going to be sold, and, if the economics are such 6 or 7 years from now when it starts to do that that it is commercially viable, so much the better, it seems to me.

Mr. DINGELL. I don't have any quarrel with that, but I just want to make sure that we are dealing fairly with ourselves. We are either going to have a commercial program or we are not. We are either changing the thing so that it is not going to deal with commercial programs or so that it is. I am not quite clear whether the record here reflects that distinction.

Mr. FRI. The physical facts is, in our judgment, that you have got to deal with a commercial scale facility in order to get the kind of information that needs to be gotten, as enumerated in this tab, nine different categories of it. That is a fact we have to deal with.

It is not a program to enter into a whole series of loan guarantees for any worthy projects that come along that would like to be put into commercial operation, but can't be, because of the economic uncertainties.

Its purpose is to build a limited number of these plants in order to get information. They will be commercial scale plants. Many—hopefully, most—hopefully, all of them—will——

Mr. OTTINGER. Will the gentleman yield on that point?

Mr. DINGELL. Let me just ask one question: Have you made this clear to industry? Because industry is rushing into my office and saying they have got to have this for commercial development. What I am trying to figure out is: Are they right or are you right? Is the original language of the bill right? Has the bill changed? Was it never commercial in the first place? Is it now not commercial where it was before? Now, where am I on this? I have got industry saying: "We have got to have this for commercial development," and I have got you saying it is not for commercial development.

Mr. FRI. This is the Humpty-Dumpty problem. We each get to define the word the way we like it, and "commercial" turned out to be something—that the House Science and Technology Committee simply dropped the thing.

I don't think—I hope by this time, after two rounds of this and a number of weeks of hearings—I hope there is no doubt in anybody's mind about what we at ERDA and the administration are trying to accomplish with this program. It is to get information on commercial scale facilities that will permit the future commercial development of an industry on a sound and safe basis. It is a transition step, and I suppose that is why——

Mr. OTTINGER. Would the gentleman yield there?

Mr. DINGELL. Yes.

Mr. OTTINGER. I don't believe that for 1 minute. Is the Energy Independence Authority intended for the same purposes, just to gather information?

Mr. FRI. No.

Mr. OTTINGER. Yet the testimony that we got, both from ERDA and from the Vice President, was that this was intended to be folded into the Energy Independence Authority.

Mr. FRI. Mr. Ottinger, I have answered that question now in this committee and at some length in the House Science and Technology Committee. Either you believe me or you don't, and I guess you don't because what I have tried to tell you is that the purpose of this program is what I have said the purpose of the program is, and that is to collect information.

Now, if the Congress passes the Energy Independence Authority, then the administration of the loan guarantee aspects of this from a purely management standpoint—it makes sense to be centralized in one agency instead of having a bunch of agencies, you know, running a bunch of different loan guarantee programs.

ERDA would continue to conduct the information—the research, if you will, part of this program, but you cannot put the words in my mouth that, if you buy this, your nose is under the tent for EIA, because I didn't say that. I don't believe it.

Mr. DINGELL. Let me here read a question from Mr. Goldwater in the Science and Technology Committee here. "Mr. Goldwater. The size and cost. Dr. McCormick. Tab G of the fact book in front of you has detailed breakdown among the plants and the cost of each plant, the amount of the guarantee needed and the budgetary authority and outlays which we expect over the next 5 or 6 years." Would you submit that same information, if you please, Doctor, for the record here, so we have it readily available?

Mr. FRI. It is tab G of the same factbook which the committee has.

Mr. DINGELL. So then Mr. Goldwater, at the top of page 43 says: "So a total of $11.1 billion is what we are talking about." Now, is that the total amount that you will be coming back to Congress for in connection with this project?

Mr. FRI. That is the total amount—that is the amount of total investment that we think would be generated in the building of 10 or 12 of the plants we are talking about. Yes.

Mr. DINGELL. Is that the total amount of the investment that you are talking about. What is the total amount of loan guarantee?

Mr. FRI. $4 billion.

Mr. DINGELL. $4 billion over what period of time, if you please?

Mr. FRI. I believe the law calls out that the whole thing terminates in the neighborhood of 1984.

Mr. DINGELL. Would you submit to us please a carefully done chart outlining the amount of loan guarantee, to whom, for what purpose, over what period of time?

Mr. FRI. There is an initial chart attached in my statement as attachment 2, I believe, but we will provide a more detailed chart.

Mr. DINGELL. I think that would be extremely helpful to us, and I would like to have it in the record at this particular point.

[The following material was received for the record:]

POSSIBLE $4,000,000,000 PROGRAM

Fuel category and plant type	Number of plants	Guarantee amount needed (million)	Percent by category
High Btu gas	2	1,600	40
Other fossil		1,200	30
Shale conversion (single module)	2	400	
Utility and industrial fuels (low, medium Btu gas, methanol, SRC)	4	800	
Biomass, renewables, conservation, etc.		800	20
Biomass (municipal, wood, agricultural, industrial waste)	6	300	
Renewables (direct waste utilization, solar, etc.	5–10	300	
Industrial conservation	5–10	200	
Impact assistance		300	7
Contingency		100	3
Total		4,000	

Mr. DINGELL. If we accept this program at this level, what actual or implied commitment have we made for later additions by other Congresses or administrations. Is it in excess of $11.1 billion in projects and $4 billion in amount of loan guarantees?

Mr. FRI. Not so far as we are concerned. The future Congresses—this is the program we have proposed to run with. The authorization for the loan guarantee aspects of it are in here carefully controlled. Each project has to be reviewed. If we engage in the use of price supports or construction grants, for which we have organic authority——

Mr. DINGELL. You have organic authority for price supports? Would you please give us for the record what you have organic authority for in terms of price supports, contract authority, and other financing mechanisms?

Mr. FRI. Generally contained in section 7 of the Nonnuclear Research and Development Act, but we will supply the specific citations.

[The following information was received for the record:]

ERDA's organic authority for price supports derives from Section 7(a)(4) of the Federal Nonuclear Energy Research and Development Act of 1974 (Public Law 93-577).

Mr. FRI. In any event, that statute requires us to come to the Congress for specific authorization, project by project. Future Congresses would presumably act on that authorization, but, so far as we are concerned, we are talking about, you know, this 10- or 12-plant program to gather information, total investment in the neighborhood of $11 to $12 billion, and that is what we are here for.

There is another debate going on on EIA, but that is—with or without EIA, we believe we need this program.

Mr. DINGELL. There are some who have dark suspicions that this is really the EIA in another guise, in smaller size. Mr. Ottinger has mentioned the camel's nose under the tent. You have indicated that not to be so. I don't suppose you have anything to add to that, but I hope that at some future time you good folks would stand on that answer, because there are those of us who have reason to think that it may not altogether be so.

Mr. FRI. Well, I recognize that that perception exists.

Mr. DINGELL. You should know——

Mr. FRI. In some extended testimony, I have tried to dispel that perception. I don't seem to be very believable. I can tell you——

Mr. DINGELL. I have got to say that we have observed that the size of this program tends to shrink. The big $100 billion program hit the press and then, subsequently, we saw science and technology come forward with a program rather larger than $2 billion. Then we see the $2 billion. Then all of a sudden the $2 billion has grown to $4 billion again. And this progression necessarily raises certain questions in the eyes of the beholder.

Mr. FRI. I would be delighted to go through that history now or for the record, but there is a history there and it is all consistent with what I have said, that you can have one without the other. Now, I support both, but I will allege that you can have one without the other and you certainly can.

[The following material was supplied for the record:]

HISTORY OF SYNTHETIC FUELS PROGRAM ESTIMATES

The Interagency Task Force on Synthetic Fuels estimated last year that to carry out a 350,000 barrels per day commercial demonstration program would require Federal incentives in the following amounts: $6 billion for loan guarantees, $4.5 million in price guarantees and $600 million in construction grants. During the summer of 1975 when the Task Force was completing its analyses, a $6 billion loan guarantee program for synthetic fuels was amended to the 1976 ERDA Authorization Bill in the Senate. The $6 billion figure corresponded to the estimate which the Task Force had made. Subsequently, the House-Senate Conferees agreed to retain the $6 billion program (Section 103), although numerous modifications were made in this program. On December 11, 1975 the $6 billion loan guarantee program was removed by the House from the Authorization Bill. Subsequently, the President decided that his 1977 budget request would contain funds for the synthetic fuels effort in the form of a Fiscal Year 1976 supplemental, in order that the program could be initiated in ERDA. The amount of loan guarantee authority contained in the President's supplemental

request was $2 billion; an amount sufficient to initiate the program in ERDA. Because the President included in his budget and legislative program the proposal for an Energy Independence Authority to be established in FY 1977, no separate funds were provided in the 1977 budget for the synthetic fuels program. Dr. Seamans testified on March 31, 1976 that additional funds beyond the $2 billion were contained in the EIA budget request and that if EIA were not enacted in 1976 the remainder of the $6 billion would be requested by ERDA for Fiscal Year 1977.

In its consideration of the synthetic fuels program this year, the House Science and Technology Committee provided for a $4 billion program; $2 billion in fiscal year 1977 and $2 billion in fiscal year 1978. The program authorized is similar to the original $6 billion program with the exception that it does not provide guarantees for full-scale oil shale plants and it would only provide for two high Btu gasification plants rather than the three originally proposed by the Administration. The House Science and Technology Committee did not provide any authorization for price guarantees or construction grants. ERDA has testified that for some projects price guarantees may be needed and since ERDA already has organic authority for price guarantees it would come back to the Congress to see specific authorization in the event such an incentive is needed.

In summary, the Administration has constantly maintained that in order to carry out the full 350,000 barrels per day information program that about $6 billion in loan guarantees would be required along with some price guarantee and grant authority. But since the proposed legislation limits oil shale development, the requirement for the additional loan guarantee authority and for price guarantee are largely obviated, although there could be some small requirement for price guarantees in the unregulated utility and industrial fuels area.

Mr. OTTINGER. Mr. Chairman, I ask unanimous consent to put in the record at this point an excerpt from a letter from Vice President Rockefeller to Dr. Robert Seamans that was submitted to the House Science and Technology Committee as the administration support, a letter dated April 13, 1976.

Mr. DINGELL. Without objection, the document will be inserted in the record.

[The excerpt referred to follows:]

I have been advised that some members of Congress have raised questions concerning the Administration's support for H.R. 12112, *a bill which among other things would provide for loan guarantees to advance commercialization of synthetic fuels.*

Although I am spending a good deal of my time on the Administration's *Energy Independence Authority proposal*, I just wanted to assure you that the Administration fully supports H.R. 12112 *as an important first step* in getting this country moving on a synthetic fuels program which can contribute significantly to our energy supplies in the future. *This authority, initially granted to ERDA, would hopefully be folded into the EIA should that broader program become law.* (Emphasis supplied).

Mr. OTTINGER. The authority initially granted would hopefully be folded into the EIA, should that program become law.

Mr. FRI. Mr. Chairman, may I comment on that? At one point in the debate on the subject, the question was asked: Does the administration really support this or what the devil is going on up there? So we said: "OK. Let us just get on the record that everybody understands and supports this program." The President had already made statements to that effect. The Vice President is associated with the notion of EIA. We suggested that, for the sake of completeness, the Vice President might want to comment on this program. He did. That is the purpose of that letter, to show that there is no equivocation in the support of this program in the administration, and I repeat that, if EIA does come about, the financial aspects of this program, though not the informational aspects, would logically be folded into EIA, but you don't have to buy both of them to buy——

Mr. DINGELL. That is the point to which I would like to now address myself. I am referring to a document entitled "Proposed Synthetic Fuels Commercial Demonstration Program Factbook," U.S. Energy Research and Development Administration, page 2. This is under tab G.

The paragraph reads as follows:

The President is requesting an initial $2 billion in loan guarantee authorizations, for fiscal year 1976, to initiate the program in ERDA. The remaining funding authorization for the loan guarantees and for price guarantees is contained in the Administration's funding request for the Energy Independence Authority for fiscal year 1977. In the event EIA is not enacted in 1976, ERDA would need an additional authorization of $4 billion in loan guarantees and would request price guarantee and grant authorization on a project-by-project basis. In that event, the following authorization levels will be needed to allow execution of Phase 1 of the Synthetic Fuels Commercial Demonstration program: Loan Guaranty, $6 billion; Price Guaranty, $4.5 billion; and Construction Grants, $.6 billion. Total Budgetary Authority: $11.1 billion.

Now, that is a rather larger amount than is involved in the bill, and it tends to indicate that the administration places some nexus between the Energy Independence Authority and the legislation which we have before us.

Now could you give us your comments please?

Mr. FRI. First, as to the $6 billion, this was put together prior to the passage—the reporting of the H.R. 12112 by House Science and Technology. One of the things they did in that is to say that all we really want you to do in the shale area is to build a first commercial module. Typically, there would be five or so such modules in a full-scale plant. That action reduces the potential requirements for loan guarantees by a sizable amount, and the information that is in the attachment to my testimony—and which we will elaborate on for the record—shows that, with that change in the legislation from its original form, that the $4 billion amount is sufficient.

The nexus between the two, between EIA and this program, is essentially this, that the President had to make a decision as to how to ask for the funding for this program. Now, he had the option of either saying: "Look, I am going to ask for $4 billion for this program and also $100 billion for EIA," or "I am going to make the assumption that I want EIA. We are going to work for it. We are going to get it passed, and, if it exists, it would pick up the 1977 loan guarantee amount for this program."

I think, quite naturally, the President presented his budget with the assumption that he was going to work for EIA and he was going to get it, and, therefore, the loan guarantee mechanics for this program for 1977 could be picked up there, but I view that as an essentially administrative and management convenience to get all of the loan guarantee mechanism together.

Mr. DINGELL. What you are saying then——

Mr. FRI. The purposes of the programs are different, however.

Mr. DINGELL. You know, I don't always have much trouble voting for a program if I am told what it is. But, when I hear folks come up and say: Well, if we get EIA, we are going to do it this way, and, if we get this other thing, we are going to do it another way," I get the feeling that in the administration's mind all of these are interrelated and really form part of one overall program.

Mr. FRI. May I just speak to that, because I think that is a very important point. The mechanism for executing either the purpose of gathering information, which is the purpose of the program that we are talking about here, or for the purpose of helping out nuclear powerplants or whatever other energy developments need acceleration which are already commercially viable—the mechanism—one of the mechanisms happens to be the same, the loan guarantee.

Now, the purpose of the two exercises are different, but the mechanism happens to be shared, just as grant mechanisms are shared by many agencies trying to accomplish different purposes.

Now, given the fact that the mechanism is shared, you know, makes it convenient to handle the budgetary aspects of it in this way, but it is a simple sharing, circumstantial sharing really, of a mechanism, and the fact that the mechanisms are shared, the same, don't mean that the programs are the same.

For example, this program contains a whole series of socioeconomic guarantees which are absent from EIA.

Mr. DINGELL. We seem to be getting far afield here. The point I want to clean up then is: If you actually have a preconceived idea that you are going to get from point A to point B in synfuels quickly, exactly what is point B worth? Is it $11.1 billion? $100 billion? $2 billion? $4 billion? Or $6 billion?

Mr. FRI. Point B is—I guess I would have to go back and refigure the totals, but it is no greater than $11.1 billion.

Mr. DINGELL. It is not $100 billion?

Mr. FRI. No. You don't need $100 billion to do this program.

Mr. DINGELL. You don't need $100 billion?

Mr. FRI. Not for this program. Not to get information.

Mr. DINGELL. Do we need $100 billion?

Mr. FRI. Well, that is a different subject, a subject for different hearings.

Mr. DINGELL. I gather that in either it is steps leading to commercialization of synthetic fuels.

Mr. FRI. My own view—well——

Mr. DINGELL. Maybe that is a different program.

Mr. FRI. What might happen conceivably is that we would go—if EIA—OK. We go through this program to learn what we need to know economically, environmentally, socioeconomically, financially, technically, to make a convincing case that the synthetic fuels technology could be developed at full-scale commercially.

Now, if EIA were sitting there and someone came in and said: "Hey, I am convinced, but I don't have enough money and there isn't enough money in the financial market for me to go ahead, but everything is OK," I presume he could apply to EIA. He sure wouldn't apply to this program because we would have already found out everything we need to know.

Mr. OTTINGER. Mr. Chairman, could I pursue this with one question?

Mr. DINGELL. The gentleman from New York.

Mr. OTTINGER. Is it not so that ERDA established an office to handle this program which it called the Office of Commercialization? ERDA sent me a letter—I think it was Dr. Seamans who said that they planned to take this office up to 210 people and have it parallel with people who are already doing the research and development program

in ERDA. Is not that the precursor of just setting that thing up as a part of EIA? Why else would you need 210 staff people to do what is being done now?

Mr. FRI. I don't understand why it ought to be a precursor to EIA.

Mr. OTTINGER. Why else would you need to set up an entirely new staff to administer this program, when you have already got people administering a——

Mr. FRI. We have got a staff office of around 25 or 30 people who are performing a set of functions dealing with how you go about commercializing technologies. This is a particular problem that the staff office is dealing with, but it is in no way an office of the size or complement necessary to administer a $4 billion loan guarantee program and a $300 or $400 million socioeconomic impact program.

Mr. OTTINGER. Then why did Dr. Seamans write me saying that this was going to be expanded into a 210-man office to administer this program?

Mr. FRI. Because it is something in that neighborhood that we think we need to administer this program. I mean I will be delighted to sit down and go over that question, but I don't think anybody even contemplated that EIA was going to be in ERDA, if that is what you are driving at.

Mr. OTTINGER. No. In this factbook, in tab E, at page 2——

Mr. FRI. You can continue to be suspicious about this whole thing, but I will tell you that very few subjects have been the subject of such exegesis down in the admisitration as to what the relationship between this thing and EIA happens to be, and the answer is that this is a program that is justified for its own purposes, on its own merits. EIA is a program that we happen to support. You can have one or the other or both or, for that matter, none, but there is no necessary relation between the two. Period. You can disbelieve that——

Mr. OTTINGER. Do we need these plants in order to be able to get information on environment? I understand—you need a 210-man office to administer that. It does stretch credibility a little bit.

Now, on page 2 here——

Mr. FRI. I would be delighted to sit down and go over this. Would you like us to submit how we arrved at that number?

Mr. OTTINGER. What the folks write about this program in the factbook—It says:

> The proposed synthetic fuels and commercial demonstration program would be operated primarily with loan and price guarantees and in general would result in the construction and operation of commercial plants with several modules of commercial scale equipment.

It seems to me that that gets at what this program is really about. It doesn't say anything about acquiring information. It says the guarantee approach is recommended because of the lower technical risks, although there is still a substantial financial risk associated with the first of a kind commercial scale plant, and apparently the risks are too great for the large energy companies to take off in this field. They are coming out and they want to be on welfare a little bit and see that the Federal Government finances them into an extension of their already overstrong arms in domination of this field as well, and ERDA is facilitating that.

Mr. FRI. I guess I am getting a little paranoid about this thing. You obviously read correctly, but it only has, you know—if only tells a part of the story. The reason for doing it is the result. The physical thing that will be out there are commercial-scale facilities. We all know that. The purpose of the program is to get the kind of information listed in tab C in nine categories, and, you know, that has just got to be pretty fundamental to my argument for this program.

Now, you know, what I sometimes think I am is a bad guy for trying to mount a program that is going to make an industry that I think we are going to have in the end anyway—to make that industry socially, regulatorily, financially, environmentally sound.

I am trying to create something other than the nuclear power industry, which has got its set of problems, because it came on line and nobody thought through these issues, and I guess I just think that it is high time that we do a program in this Government from front to back instead of from the middle both ways. And we have a chance to do it and I think we ought to do it, in the interest not of the big energy companies, but in the interest of the States who have to live with these things, the people who use that environment and all the rest.

Mr. DINGELL. The Chair recognizes counsel.

Mr. NORDHAUS. Mr. Fri, could you spell out for the committee your estimate of the production in barrels per day equivalent that would be produced by the facilities which would be financed with H.R. 12112?

Mr. FRI. Yes. It is in the neighborhood of 200,000 barrels a day. I thought it was attached to my statement. It is not, and I can provide the details.

[The following information was received for the record:]

ESTIMATES OF OIL EQUIVALENT PRODUCTION FROM DEMONSTRATION PLANTS CONSTRUCTED UNDER H.R. 12112

Type of plant	Number of plants	Barrel equivalent production per day
High Btu gasification	2	80,000
Oil shale modules	2	20,000
Utility and industrial fuels	4	40,000
Biomass plants	6	30,000
Renewables	5-10	30,000
Industrial conservation	5-10	20,000

Mr. NORDHAUS. Is this the entire information program that the administration recommended in their task force, Synfuels task force?

Mr. FRI. We were more in the neighborhood of 300 to 350, and the 200 or so reflects the downgrading of the size to initial modules in the oil shale program primarily, which cuts out 100,000 barrels a day in production.

Mr. NORDHAUS. I am quoting from Dr. Seamans' testimony before the Science Committee. He said on March 31:

> We remain firmly convinced that in order to obtain the objective of the full 350 barrels per day program, the $6 billion in loan guarantee authority will be required, along with $4.5 billion of price guarantees and $600 million in grants.

Now, have you scaled down your information program now to the extent that you will not have to come back to Congress for an addi-

tional $2 billion in loan guarantees, for the $4.5 billion in price guarantees, and the $600 million in construction grants?

Mr. FRI. Well, first of all, let me say that I think I promised earlier to submit a reestimate of that, which I will do. What the bill as reported out of House Science and Technology instructs us to do is to run a $4 billion program and build initial modules of shale, and it provides for a disposition procedure thereafter, and, if that is what the Congress wants us to do, we are prepared to do it.

Mr. NORDHAUS. The question, I guess, is: Will the administration, in your view, be coming back later, later this year, assuming it is in a position to do so next year, with a recommendation for further authorizations in order to expand the program to the full extent that you had originally recommended?

Mr. FRI. We would certainly not be back, if ever, but certainly not in a few months or 1 year. It would take time to build the initial modules. We will have to come back on the individual project authorizations and all that stuff, but in terms of the total envelope——

Mr. NORDHAUS. For instance, will you be back to ask for price guarantee authority?

Mr. FRI. Yes. Our statute already requires us, if we want to use that tool——

Mr. NORDHAUS. Will you want to use it?

Mr. FRI. Yes.

Mr. NORDHAUS. For the projects which are to be guaranteed?

Mr. FRI. If we do, we have to come back for project authorization to the Congress, which we are prepared to do. The envelope that you mentioned—well, I want to provide you a revised subsequent reporting type estimate. That envelope is what we plan to stick with.

Mr. NORDHAUS. I notice that you had projected only slightly more than $1 billion in loan guarantees for shale oil, which, if you eliminated that, it would only bring down—require the loan guarantee requirements for your information program—to $5 billion. The bill provides for only $4 billion.

Am I to assume for your testimony that you would not be coming back for the extra $1 billion that is not accounted for by the deletion of the shale oil authority?

Mr. FRI. Well, my own view is that we would, once we have authorization to proceed with the loan guarantees at the $4 billion level—that the smart thing to do is to shape a program around that figure and go do it. Then, if we discover—certainly not 6 months from now, perhaps 2, 3, 4 years from now—that it isn't what is required, fine, but I guess I cannot speculate that far in the future. We can start. We can do a good program with the envelope that we are talking about.

Mr. DINGELL. The question that Mr. Nordhaus asked about the 350,000 barrels per day, this figure has shrunk to 200,000. Are we to assume that this then remains the size package that is necessary for carrying out this program, or will it grow or shrink again at some time in the future?

Mr. FRI. Well, the shrinkage results from the scaling down of the shale program to modular size and from the elimination of one high Btu gas plant. We used to say two or three. Now limited to two. OK.

Now, the only thing that is really operational here is that the statute

as passed by House Science and Technology, reported by House Science and Technology, provides in the oil shale area that, if the initial module is successful—and "successful" is defined in financial, economic, environmental, and all kinds of other terms—it provides two things.

One, it provides that the addition of additional modules is eligible for guarantee authority under this statute, although it requires separate additional authorization. It also provides, in lieu of that, for a takeout by the private sector, and either one could happen.

The private sector, if the thing is successful, might take out the Government ownership at that point and go ahead and finish the thing itself. Some companies seem to indicate that that is what they would be inclined to do.

That is in the bill, and that is, I guess, the only way I can answer your question.

Mr. DINGELL. You spoke about a project that was succesful— that means if it is financially successful? If so, why would further assistance be necessary?

Mr. FRI. No. "Success" is defined—I can't find the specific citation, but "success" is defined not just as financially successful, but in a whole lot of other ways, whether it is environmentally sound and so forth.

Now, if it is in fact financially successful, as well as successful in other ways, my guess is the probability that a private company would decide to buy out the Government interest and go ahead and proceed on its own is at least as high as coming back and asking Uncle Sam for additional guarantees, if not higher.

The citation is on page 30 of the reported bill, beginning on line 12.

Mr. DINGELL. I guess it is at page 30. It says:

> No loan guarantees shall be provided in this section until after successful demonstration of a modular facility producing between 5,000 and 10,000 barrels per day, taking into account such considerations as water usage, environmental effects, waste disposal, labor conditions, health and safety, and the socioeconomic impacts on the local communities.

Mr. FRI. Right.

Mr. DINGELL. That is success?

Mr. FRI. Those are the considerations that must go into a determination of whether it is succesful, as I understand.

Mr. DINGELL. So, if they meet those criteria, they can come back and get more loan guarantees?

Mr. FRI. As this bill is drafted, they may either come back—they are eligible for more loan guarantees, although, as I understand it, that would require additional authorization. On the other hand, they may buy out the Government interest and then presumably finish it themselves. I guess I am not competent to predict the future.

Mr. DINGELL. I must confess I am not sure we are dealing with the English language here. Perhaps it is just not serving me well today. I am still not quite sure I understand what this tells me is a successful facility. It say it is successful if they take into account this whole shopping list of things.

What then is successful? If I have got to decide at the end of 10 years whether we are going to renew this thing or not, how am I supposed to judge its "success?"

Mr. FRI. Well, I guess in general the kind of questions that would have to be asked are: Is the water usage such that in this case there are adequate water rights in the Western States to support it with an adverse effect on recurring rights of others? Whether the environmental effects, notably the pollution levels, the emissions that result, can be controlled to an acceptable source performance standard. Whether the disposal of the waste is environmentally acceptable, probably determined through the use of an environmental impact statement. Whether the local people feel that they can handle through the grant mechanism or whatever the socioeconomic impact of building up a big construction force to expand the plant, and the like.

I guess that has got to be read in conjunction with page 34, line 4, section B, which several pages later picks up and says: "After successful demonstration of the modular facility is determined by the Administrator, it is eligible for financial assistance," but then it goes on to say how the whole thing can be gotten rid of if the private sector wants to buy it out.

Mr. DINGELL. Would you call this an objective definition or a subjective definition?

Mr. FRI. Well, I guess it is subjective in the same sense that NEPA is subjective. You know, you have got to inform—you delegate to the Administrator a determination of success, and he has to be informed on the basis of certain criteria, and, if he is fully informed, it is procedurally correct, he makes his judgment, and I guess that is subjective, except to the extent that EPA may have established a new source performance standard or something where you can actually measure.

Mr. DINGELL. If I were a banker, would I make a loan on my own on the basis of that kind of definition? If I were an engineer building a powerplant, would I build a powerplant on that definition?

Mr. FRI. Well, we are talking about something, you know—we are talking about a situation that will exist 5 or 6 years from now. When we build a module and run it, have seen what the consequences of doing so are, and the bankers as well as the Administrator have to make a subjective judgment at some point about whether they are going to invest in a project.

Mr. DINGELL. Are you telling me that this is going to be the basis for giving further loan guarantees in the future? This definition of success that we are discussing?

Mr. FRI. I am telling you that that is the way, as I read the law, that that is how—the bill. Excuse me. I am getting a little ahead of myself.

Mr. FRI. As I read the bill, that is how it is structured.

Mr. DINGELL. I don't mean to seem naive, but I don't ever recall seeing a bill that said:

> We are not going to make commercial loan guarantees. This is not the camel getting his nose under the tent. But we may make more loan guarantees at some future time on the basis of this kind of precise definition of success.

Mr. FRI. Well, maybe a little history here might be useful. There was a lot of concern expressed, both by the State of Colorado and its representatives and, to some degree, industry, that one simply ought not to go out and build a full-scale shale oil facility, that anybody

in their right mind would build the first module first, run it, see how it works, and that, if it is "successful," extend it to a full-sized plant, which would mean the addition of three or four or five essentially identical modules.

To accommodate that concern, the statute therefore provided that, at the outset—the bill therefore provides that, at the outset, you can't build more than a single module, and this shrinks the 10,000-ton-a-day range. Having done that, the bill has to then kind of cope with the question of what you do next, and this is how it coped.

Mr. DINGELL. Let me ask you this question. The bill requires modular construction of shale oil plants. Does it make the same requirement with regard to other things? Biomass, solar, coal gasification?

Mr. FRI. No; it doesn't.

Mr. DINGELL. Why?

Mr. FRI. Well, mainly because the economic size and nature of integration of the process of the high Btu plants suggests you ought to build the whole thing at once, and, when you get into the case of biomass and low Btu, medium Btu the gas plants, solar, and the like, they are inherently considerably smaller than a high Btu gas plant or a full-scale shale plant, so that the modular—the whole thing isn't very big, so you really don't have to worry about the modular approach.

I think the reason for the modular approach, as much as anything else, was to make sure we didn't foul up the local environment by stumbling into too big an arrangement at the outset.

Shale is perhaps more controversial, and the feeling was that we should go slower, and, if that is the feeling on the part of people who are affected, I am certainly willing to abide.

Mr. DINGELL. Are you going to tell me that coal gasification is not controversial?

Mr. FRI. Sure, it is controversial.

Mr. DINGELL. All right. Let me ask you this. If I were to build myself a coal gasification plant, would I build myself—one great big furnace to do the gasification, or would I build myself a series of them and pipe them all into one set of pipes feeding to the pipeline?

Mr. FRI. If you are asking the question: "Is there more than one reactor in a full-scale plant?" Yes.

Mr. DINGELL. That is what I am asking.

Mr. FRI. Yes; more than one reactor in a full-scale plant.

Mr. DINGELL. Why don't you then apply the rule of modular construction to this? It is economically feasible to so do, is it not? And it is also technologically feasible, is it not?

Mr. FRI. Well, I guess there are a couple of reasons. One is that, from a purely technological standpoint, there have been demonstration-size units of high Btu gas built, notably in Europe, but, more importantly, the high Btu gas plant is more integrated engineering job than a series of shale retorts, and, therefore, if the thing has a chance——

Mr. DINGELL. American Natural Gas——

Mr. FRI. [continuing]. Go ahead and do the whole thing at once.

Mr. DINGELL. American Natural Gas proposes two 125,000 cubic feet facilities as part of their production program. Will they get it for the whole thing or just for a part of it?

Mr. FRI. I guess that number doesn't ring a bell with me, Mr. Chairman. I think ANG is talking a 250 million cubic feet a day plant.

Mr. DINGELL. 125 million. I dropped three zeroes.

Mr. FRI. Then we are in the neighborhood of a full-scale plant.

Mr. DINGELL. They are going to do it in two modules though.

Mr. FRI. OK. Some aren't, I guess.

Mr. DINGELL. What I am trying to see is: If they can do it in two modules, why shouldn't the law go the modular route?

Mr. FRI. That could be considered, I suppose, but it seems to me that each project is settled on what is the optimum type plant, if the thing is in fact successful and gets over all these hurdles. That typically turns out to be a 250 million or thereabouts cubic feet a day plant, and that is not as easily separable as building a retort, you know, which isn't in any way physically connected to another retort which sits a few hundred yards away from it.

Mr. DINGELL. Why would two 125 million cubic foot modules not be susceptible to the same treatment as two retorting units in a shale oil plant?

Mr. FRI. Well, I don't know whether Bill can answer that question in more detail than I can. I guess to give you a real answer to that question, given the fact that I cannot—I am not going to sit here and try to penetrate that technology detail because I don't know it in detail. I would have to supply it for the record.

Mr. DINGELL. Thank you.

Mr. FRI. Bill might be able to add something.

Mr. DINGELL. Can you help us with it?

Mr. MCCORMICK. Yes, sir. Mr. Chairman, most of the proposals for high Btu gasification plants that have been made are for 250-million-cubic-feet-per-day plants. American Natural has indicated that they probably want to proceed on a half-scale plant, but I would point out this is more than one module. I believe it is three.

Mr. DINGELL. You are talking about six modules?

Mr. MCCORMICK. Six modules in a full-scale plant. The major difference between oil shale and gasification is as follows: In the case of oil shale, the largest plant that we have built in this country and operated is a pilot plant of approximately 1,000 barrels a day capacity. This is approximately one-tenth the scale of a modular plant and perhaps one-fiftieth the scale of a full-scale 50,000-barrels-per-day plant.

In the case of gasification, in Europe, we have tested the Lurgi technology at commercial scale, producing low and medium Btu gas, so there is no question of technical risk or no serious questions of technical risk about building full-scale gasification plants in this country.

There is some concern about going to the full scale in the shale production, however. I would point out though there is a difference of opinion among a number of shale producers about what the technical risk is in going from the 1,000 barrels per day up to the 10,000 or 50,000 barrels per day level, so, in general, we have had more experience already at larger scale in the gasification area than we have in the shale area.

Ideally, eventually we would like to build plants and have them operating at commercial scale in both shale and high Btu gas.

Mr. DINGELL. Are you talking about the Lurgi process then as the basis for your coal gasification?

Mr. MCCORMICK. In the case of the high Btu gasification, yes, sir; that would be the basis for the first plant or two.

Mr. DINGELL. And this has been commercially applied in Europe?

Mr. MCCORMICK. This has been applied at commercial scale in Europe, yes, using modules, and the last step of the gasification process, the so-called methanation step, has been tested commercially in Westfield, Scotland, so the technical risk in moving to high Btu plant is not considered large, and that is precisely why there are six or eight proposals by gas and pipeline companies that they want to proceed on this.

Mr. DINGELL. Are you telling me then that there is not much technological information that is needed in connection with the high Btu gasification program then?

Mr. MCCORMICK. What I am saying from a technical risk standpoint is that there is less technical risk.

Mr. DINGELL. When you say "technical risk," do you see the thing blowing up or the financing collapsing or the plants not being able to produce?

Mr. MCCORMICK. Technical risk of not producing more or less the kind of product at approximately the cost that you expect.

Mr. DINGELL. Now, quantify that for us, if you can, please.

Mr. MCCORMICK. Well, no one knows precisely what these plants will cost because they cannot project inflation precisely or labor strikes, so there is a certain amount of uncertainty in the construction cost, as is there with construction of any major project.

Mr. DINGELL. But those are normal hazards that you expect in the construction of anything from a pickle factory to a discotheque.

Mr. MCCORMICK. That is correct, and, since most of these gasification plants that we are talking about using Lurgi technology have been built at commercial scale in Europe, there is little uncertainty about how much it is going to cost to construct one of these. It is generally well known.

Mr. DINGELL. Are you telling us then that in the case of gasification you have a situation where the technology is known and the risks can be reasonably ascertained?

Mr. MCCORMICK. The technical risks in the case of high Btu gasification can be reasonably known.

Mr. DINGELL. And what are the peculiar social risks and perils that attach to this?

Mr. MCCORMICK. There are a whole laundry list of other uncertainties; for example, the whole question of regulatory uncertainties. We have never built and operated one of these full-scale plants in this country. Therefore, we have no experience with the regulatory and environmental climate, which is considerably different in this country.

Mr. DINGELL. What regulatory environmental climate do you refer to?

Mr. MCCORMICK. We have to meet air quality, water quality, and other standards which in general—I mean some States in the country are considerably stricter than they are in Europe. We have to put the plants through the regulatory systems. There are at least 16 major Federal laws that have to be met for each of these plants. We have listed those.

Mr. DINGELL. What are those please?

Mr. MCCORMICK. I don't have them in front of me, but we would be happy to provide the committee with them. They include such things

as NEPA, Occupational Health and Safety, Minerals Leasing Act. We can provide——

Mr. DINGELL. Would you please provide this for the record, and would you please inform us what unquantifiable information you have or need and what your apprehensions are with regard to regulatory environmental law? I understood NEPA was pretty well settled law. I understood that OSHA was pretty well settled. I understood that the air quality statutes are clearly in the hands of EPA, and you folks work with them, I guess, on a daily basis. Where is the problem on these?

[The following information was received for the record:]

SIXTEEN MAJOR FEDERAL LAWS THAT MUST BE COMPLIED WITH TO BUILD A PLANT

The significant legal/regulatory requirements that will have to be met in the process of building and operating a plant are set forth below: National Environmental Policy Act; Clean Air Act (as amended); Natural Gas Supply Act; Occupational Health & Safety Act; Antitrust statutes; Minerals Leasing Act; Mine Development Plan; Coal Mine Health & Safety Act; Interstate Commerce Act; U.S. Army Corps of Engineers; Department of Agriculture-Forest Service; Emergency Petroleum Allocation Act; Safe Drinking Water Act of 1974; Indian Lands and Resources; and Endangered Species Act.

In addition, any plants sponsored by ERDA will also be subject to the Federal Nonnuclear Energy Research and Development Act of 1974, The Energy Reorganization Act of 1974 and Federal Water Pollution Control Act amendments of 1972.

Mr. MCCORMICK. If I can take just a minute, Mr. Chairman, I can summarize some of the major kinds of information that we would get from this program that we don't feel can be obtained either from plants in foreign countries or from small-scale research plants.

Generally, these include the following categories: engineering, plant operations data, which includes continuous plant operation system reliability, occupational health and safety, the general category of environmental and socioeconomic information, which includes data on air quality, water quality, land disturbance, State and local economic impact.

We would get information on plant mining facility economic data, which includes capital investment cost, operating maintenance, economies of scale, and overall economics of the venture.

We would get, importantly, project financing information, including the investment uncertainty on the private sector financing experience which is necessary prior to any large-scale private investment in future plants.

We would get information on product distribution and marketing, including product substitutability. We would get information on the ability of these plants to meet Federal, State, and local environmental and other regulations.

We would get information on the water requirements that these plants would experience. We would get information on public acceptance. Lastly, manpower and equipment needs, as well as transportation.

So there are many, many categories of information that we don't feel we can get from plants in foreign countries or small-scale plants, and they all relate to the question of whether these plants will be viable in the future and whether investors in the future will be willing to make the necessary commitments for these plants.

Mr. DINGELL. The Chair is going to recognize Mr Hunt for some questions.

Mr. HUNT. Mr. Fri, I notice in a report dated November 1975, from the President's Energy Resource Council's Synfuels Interagency Task Force on Cost/Benefit Analysis, that there was an estimate that there would be negative benefits to a small-scale information program amounting to $1.6 billion for—I think it was 350,000 barrel equivalents per day.

Has there been an update to the 200,000 barrel level that you are now talking about as to what the negative benefits would be associated with the program that you are proposing? Basically I am trying to determine what it is going to cost us to get this information.

Mr. FRI. No, we haven't a direct answer to your question. In direct answer, we haven't rerun the models for the version of the program passed—reported out of House Science and Technology.

Mr. HUNT. Would it be inappropriate just to scale that down on a percentage basis, since there seems to be a reasonable linear relationship between your very large program to your medium sized program to your information program?

Mr. FRI. The linear relationship or the linear nature of that relationship is due to the fact that the mix is relatively the same at all the levels, the mix and type of plant, relatively the same for all the levels analyzed in that report.

The effect of H.R. 12112 as reported goes to the oil shale and high Btu gas, and that would probably louse up the linear relationship, and, if anything, the reduction negative benefit would be slightly more than linear. It would go down somewhat faster, I would guess. Is that right?

Mr. HUNT. On a purely linear basis, it would be roughly $910 million, if my arithmetic is correct.

Mr. FRI. I guess you are probably right.

Mr. MCCORMICK. Mr. Hunt, if I may add to that, that analysis was carried out assuming that we would have included within the mix a coal liquefaction plant. Subsequently, putting the final report together, we assumed that we would take out the higher-priced and less economic and not include a first generation coal liquefaction plant.

The other thing that I would like to add about that analysis is that it is, as you probably know from looking at it—. It is quite sensitive to a number of assumptions. These assumptions include such things as what the price of conventional oil and gas will be in the future, what the nature of the price of the OPEC cartel will price its imports, and a number of other factors.

Mr. HUNT. These are the questions that come to me relative to the analysis itself. What is it being compared to? As I understand it, these analyses were conducted under the presumption that there would be both deregulation of domestic oil as well as the deregulation of natural gas. So, in order to draw a proper comparison, you must have assumed some priceline for those two products.

Mr. MCCORMICK. Those estimates assume, for example, that there is a 50–50 chance that the OPEC cartel will remain intact and world oil will continue to rise, or a 50-percent chance that it will break and fall to some low level.

Depending upon what you believe about what the future pricing policies will be of the OPEC cartel, you can get a drastically different answer, and I think, to summarize it, it is very, very simple. If we are willing to bank on the OPEC cartel breaking and the world oil price falling, then the results of that analysis are striking, that this program would not be a good investment from a cost/benefit point of view.

If, on the other hand, the price of world oil continues to rise and OPEC remains together, the results of that analysis show a rather striking positive benefit for going ahead with the program.

It has been 1 year since that analysis was done. I think the events have led many people to believe that the OPEC cartel is going to be maintained.

Mr. HUNT. Well, there has been a shift as far as decisionmaking on this particular issue, on the probabilities of OPEC breaking or not breaking. Let us just forget the oil aspect for a moment and concentrate on the possibility of the deregulation of natural gas. Do you have a priceline there that was built into this model that you can recall?

Mr. MCCORMICK. Yes.

Mr. HUNT. Could you tell me how it rose and in what patterns?

Mr. MCCORMICK. I would be happy to go through the analysis with you. I don't have the details of that curve in front of me, but in general, as Mr. Fri pointed out earlier, if we were to assume that we would not have deregulation of gas in the near future, then the net benefits of this program and its contribution would be even more important than we assume from that analysis because we took the optimistic domestic supply case and the optimistic domestic supply case is a case wherein synfuels or synthetic fuels would contribute the least, if anything. If any measures were taken either to decrease the price of alternatives or hold down the price of alternatives, then the resulting supplies of those alternatives will be less, and the requirement for synthetic fuels will be correspondingly larger.

Mr. HUNT. Well, if we do go to that point and we are talking about the possibility of high Btu gas coming on line, say, in 5 or 6 years from the proposed plans—am I correct in the assumption that it has a 5- to 6-year gestation period?

Mr. MCCORMICK. We are talking of building two high Btu coal gasification plants. If we started tomorrow, the earliest they would be able to come on line would be 1980 or 1981, but this would only be a total production of perhaps 80,000 barrels or equivalent. It is hardly a dent in the total gas production in the country.

Mr. HUNT. Let me extend just a minute beyond this and see if I can track this question. What are the estimated costs at this point relative to this first generation, prime technology, in coal gasification, considering the experience that the British have had in their Westfield plant?

Mr. MCCORMICK. We have estimated—and there are some detailed estimates included in this fact book at one of the tabs—that the price of—you have to look at each individual category of synthetic fuels. The price of oil shale is in the range of $13 or $14 a barrel.

Mr. HUNT. I would really like to focus on gas.

Mr. MCCORMICK. The price of high Btu gas—we estimate a range of $3 to $3.25, using 1976 dollars.

Mr. HUNT. If indeed the Government went forward with a price support program, would we indeed put an envelope around that, so that there would be a strong financial incentive for the people who had both loan guarantees and price supports?

Mr. MCCORMICK. In the case of high Btu gas, we don't believe there will be any need for a price support for the following reason, that the Federal Power Commission ruling, for example, on the *Wesco* case is such that it was initially a $2.50 a million Btu, with an indication that they could come back and ask for additional rate in the event that unreasonable costs were incurred. The project sponsors of that particular project indicate to us that, with a Federal loan guarantee, that they would have sufficient financial capability to move ahead on that particular project. So, in the case of fuels which are regulated, such as high Btu gas, we only see the need for a mechanism to assist and share the risk in the front-end financing. We would not see the need for price supports, except in those areas perhaps where the fuels compete in unregulated markets.

Mr. HUNT. Are you familiar with the first application put forward, I believe, by Wesco for the production of synthetic natural gas?

Mr. MCCORMICK. Yes, I am.

Mr. HUNT. Do you remember what the price was that they applied for at that point?

Mr. MCCORMICK. The price they applied for at that time was $1.38.

Mr. HUNT. How long ago was that?

Mr. MCCORMICK. The time between those two applications, as I recall, was roughly 3 years.

Mr. HUNT. And now they are talking in terms of——

Mr. MCCORMICK. Yes. And I think the reason for that——

Mr. DINGELL [continuing]. An increase in price, as I read the figure.

Mr. MCCORMICK. I think there are two reasons for that. One is that, as you probably are aware, all of the major capital projects are escalating at roughly a rate of 20 percent compounded a year. This includes powerplants, nuclear, coal power, pipeline, et cetera, and we have seen that same type of escalation even in rather conventional projects such as pipelines. I think the Alaska pipeline has more than doubled since the original estimates, so this phenomenon of inflation and underestimation on large capital projects is not limited to synthetic fuels by any stretch.

Mr. HUNT. If I may turn now to oil, I believe there was an estimate made by a member of Tosco some time ago as to the price of shale oil that recent experience has shown to have been unrealistically low. I wonder if you might comment.

Mr. MCCORMICK. I think it is a common phenomenon when these projects get closer to the point where they are ready for construction, the designs get more detailed and people become more aware of the actual costs. The cost of all projects tends to be unrealistically low in the beginning when people are making estimates based on conceptual designs rather than detailed engineering designs, and I think, if you look at the history of the cost estimates of these projects as they progress from their very early conceptual stages to the stage where they have completed a detailed engineering design and they know each component that will have to go into the plant and estimate the labor charges and so forth, that the estimates become more realistic.

Again, this is the case that we have seen in the Alaska pipeline. It is the case we are seeing in conventional powerplants, and, as we get more familiar and the designs get more detailed, we get more precise in the estimating.

Mr. HUNT. These are phenomenal price increases that we have seen.

Mr. MCCORMICK. They are rather phenomenal for the Alaska pipeline. It has more than doubled since the original estimate.

Mr. HUNT. That is hardly the fivefold increase that one has seen from, say, the earliest figure put out on Tosco and apparently the current estimate.

Mr. MCCORMICK. I wuold suggest that the thing that is worthy of focus is comparing the best recent estimates that are based on detailed design with the price of alternatives with which these fuels will have to compete 10 or 15 years from today.

Mr. DINGELL. You were not, however, using a fair yardstick. You have indicated that in the case of gasification what we are engaged in is the application of the Lurgi technique. You have also indicated that your concern in this area is with the socioeconomic and environmental aspects, as opposed to the technological problems.

Now, the Alaska pipeline was in a situation where we had, as we were told, a fairly simple problem of laying a pipeline from Prudhoe Bay on down to Valdez. Now, the two situations are different, are they not?

Mr. MCCORMICK. Well, they certainly are, but I would——

Mr. DINGELL. In the one instance, you are talking about creating a new fuel out of other raw materials. In the other instance, you are building a pipeline.

Mr. MCCORMICK. But I think in both cases there is inexperience in moving in at the initial stages and unrealistic underestimation of the cost.

Mr. DINGELL. In the instance of the pipeline, they have had thievery; they have had careless welding; they have had to dig up I don't know how many lengths of pipe because they were sloppy in the welds, and they are going to have to do the same thing over again at a time very, very soon. They may be looking for waivers, but they are not going to get them.

So the situations are quite different. I don't think you should present them to us as being the same.

Mr. FRI. I think the point, as I understood, that Dr. McCormick was trying to make was that there are two forces at work here which in fact affect a number of energy projects. One is the escalation incident to construction, partly due to the cost of materials, partly due to the increase in interests rates, which have been relatively substantial. They tend to affect all capital-intensive projects roughly proportionately.

The other thing that goes on is the firming up of design, whether you are designing a pipeline or something else, a coal gasification plant. Firming up of design reveals things that you didn't know you were going to have to do, so you design that end and that increases the costs.

Really what we are seeing, which I think is the point being made, is the impact of those two forces which affect not just these kinds of plants, but many kinds of projects in the energy sector and elsewhere.

Mr. DINGELL. Are you going to tell me they are going to build these plants with the same finesse they are using to build the Trans-Alaska pipeline

Mr. FRI. Well, not being an expert on the Trans-Alaska pipeline, I don't think I had better answer that question.

Mr. DINGELL. If that is the way they are going to be built, there is going to be a real tussle before this bill goes through. There are hundreds of questionable welds up there.

Mr. FRI. I guess the purpose of the exercise is to build some initial plants and work your way through all these kinds of problems rather than march off to a commercial facility like the Alaska pipeline and get in the middle of the kind of situation——

Mr. DINGELL [continuing]. The problems we are beset with here. I am trying to see just how far you are prepared to carry the analogy or whether in fact it would be a valid analogy.

Mr. FRI. The only comparison I think we are making is that there are forces at work in both cases that are the same. How they will affect each case is a little bit difficult to tell as this point, but what we are trying to do is, instead of building a whole industry at once, like a whole pipeline, and running into all kinds of problems with the commercial facility and the investors getting all upset and saying: "Let us have waivers," and so forth—let us build the first few pieces and see how they work, so that we can proceed in a sound way when this industry really has to take off in the future.

Mr. DINGELL. Thank you very much. The Chair continues to recognize Mr. Hunt.

Mr. HUNT. The question, I guess, or the area I was leading up to is that it appears to me that, if we are faced with strong and continuing escalation of costs, by your analogy, through moving into unfamiliar territory, and perhaps a doubling, as has been seen on the Alaska pipeline—whether indeed the mechanism of loan guarantees is really that which serves the public's best interest from the standpoint of guaranteeing projects of this nature.

In line with that, I would like to know what alternatives were considered for alternative mechanisms of providing this stimulus and why they were rejected in favor of loan guarantees which seem to offer an unusual exposure to the public.

Mr. FRI. The task force considered a very large number of options, all of which I cannot remember. Basically—I will let Bill comment on this in a moment. They were basically rejected either because they were indiscriminant and would encourage a lot of things to happen outside the immediate purpose of the program or they were less cost-effective, more costly.

Mr. HUNT. What was the figure of merit, if I may ask?

Mr. FRI. Let me ask—Bill did the study. I think perhaps he is in the best position to comment on what alternatives were considered and how they were rejected.

Mr. MCCORMICK. The major alternatives, Mr. Hunt, we considered were of several varieties. The front-end kinds of incentives, which included loan guarantees, loans, and direct grants; the price kinds of incentives, which included price guarantees and purchase contracts; and then a number of tax incentives, which included investment tax

credit, accelerated depreciation, and construction expenses. We considered these——

Mr. HUNT. Mr. McCormick, may I break in at this point. One final point. All of the mechanisms that you have suggested seem to have focused directly upon having private industry do it on an ownership basis, as opposed to the contract mechanism.

Mr. MCCORMICK. Excuse me. We also considered the option of government-owned, contractor-operated, or completely Government financed. We compared these with respect to a number of criteria, and this analysis is described in detail in volume 3 of the Interagency Task Force Report.

Some of the major criteria that we considered were the expected cost of the Government and the degree to which the incentives would promote competition and competitiveness, the extent to which the incentives involved a great deal of Government oversight or government administration, and a number of other incentives, the extent to which they simulated the real world.

If you like, we can go into greater discussion after the hearing on that, but basically we have about 9 or 10 major criteria for each of the technology areas, shale, oil, high Btu gasification, electric utility, industrial fuels, and biomass.

We considered each of the nine criteria and each of the major incentive types, including Government ownership, for each of the technologies, and we made a selection.

In general, the result was that the most efficient, the least expensive, mechanism in the case of regulated industries was the loan guarantee, which would provide some assistance in gaining capital for those industries such as pipeline gas companies wishing to build coal gasification plants.

Now, we also looked at the unregulated sectors. In the case of oil shale, we felt that perhaps some combination of loan guarantees and price guarantees might be appropriate, but, as Mr. Fri mentioned, the House Science and Technology Committee has limited the initial phases of the shale to modular development, in which case the price guarantees are no longer appropriate mechanisms for that particular technology type.

But there is a rather detailed analysis which is described in volume 3 of the task force report which touches on each of these major technoligy types and all the major criteria that we used.

Mr. HUNT. Did Dr. Cosminsky do any analysis for you or not?

Mr. MCCORMICK. I don't recall that he did. I don't believe so.

Mr. HUNT. Thank you very much.

Mr. OTTINGER [presiding]. Mr. Fri, I understand that a study has recently been completed by Dr. Rosenfeld and others at ERDA's Lawrence Berkeley Laboratory that indicates that there are huge advantages to proceeding with conservation as opposed to either nuclear or synthetic fuels, high cost options. I understand that this is still in draft form, but I wonder if we could have that for our consideration by putting it in the record in this proceeding.

Mr. FRI. I am sorry?

Mr. OTTINGER. We would like to have the draft, if we could, from Lawrence Berkeley study.

Mr. FRI. I would be happy to check and see if we can provide that. [The following material was received for the record:]

CONSERVATION AND PEAK POWER—COST AND DEMAND[1]

(By David B. Goldstein and Arthur H. Rosenfeld, Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, Calif.)

1. INTRODUCTION

In this paper, we discuss some of the historic areas of growth in electricity demand, compare their benefits with the cost of new power plants and find that few of them can be economically justified. We find potential savings that can result from an aggressive State conservation program so that electricity demand can be satisfied for the next 10 years with no new powerplants. Most of the new capacity which will be required over a 20 year horizon can be provided by hydro and geothermal units already planned.

1.1 Present Supply and Demand

Currently there is considerable excess generating capacity in California. As shown in table 1, we have a reserve margin of 36 percent which is far greater than th 20 percent requirement recommended by the PUC. California's need for installed capacity in 1974 was about 33,000 megawatts (MW). As of May 1975 there was a total of 38,000 MW, of which 500 MW is nuclear.

TABLE I.—DEMAND AND SUPPLY—ELECTRIC PEAK POWER TRANSMISSION LOSSES EXCLUDED

Line		Actual, 1974 (megawatts)	Projected, 1984 (megawatts)	1974—84 annual growth (percent)
1	Peak demand (sum of individualutility peaks)	29, 356		
2	Peak coincident demand (96 percent of line 1)	28, 000	[2] 31, 500	1.2
3	Required installed capacity[4] (1.2 times line 2)	33, 600	[3] 37, 800	1.2
4	Hydro and geothermal capacity	10, 500	[1 2] 14, 600	3.3
5	Total nonnuclear capacity (includes line 4)	[1] 37, 500	[1] 52, 000	3.0
6	Nuclear capacity	[1] 500	[1] 9, 000	33.5
7	Total installed capacity	[1] 38, 000	[1] 61, 000	4.8
8	Total capacity available at plant (line 7/1.2)	31, 667	50, 833	4.8
9	Line 8/96 percent for capacity[5]	32, 986	52, 951	4.8

[1] Source: PUC, Report on Ten-Year Forecasts of Electric Utilities' Loads and Resources, General Order 131, sec. 2, May 1975, table I.
[2] See Goldstein-Rosenfeld, LBL-3274 (1975).
[3] Most of the proposed hydro plants are pumped storage.
[4] Corresponds to 20 percent reserve margin recommended by PUC.
[5] This corrects "available capacity" to make it comparable with PUC's demand notation of line 1.

We discuss conservation measures, especially those with capital costs that are lower than the capital savings that they make possible for utility companies, which would reduce the growth of California peak power demand to 1.2 percent. This could be met by planned hydro and geothermal electric capacity. Total energy plants and cogeneration are considered as alternatives to central power plants. We conclude that conservation measures and the production of more efficient buildings and equipment will generate more jobs than will be lost in reduced power plant construction.

2. PROJECTIONS

The reason, then, that the utilities are planning construction of new units is to satisfy projected increases in demand for electricity. Their projections are based on historical growth patterns, which were established during periods of rapid population growth and declining electricity prices. This historical records also includes the replacement of efficient uses of natural gas for heating hot water, cooking, and home heating, by electricity, which is more expensive and less efficient (see section 3.2). Thus extrapolation of historic patterns will give projections that involve high growth rates, but which are inappropriate to periods of rising prices and energy awareness.

[1] Work done under the auspices of the U.S. Energy Research and Development Administration.

2.1 Difficulties with Projections When Energy-Awareness is Changing

Not only are most utility projected needs (and those of the California Public Utilities Commission) based on oversimplified extrapolations, but they generally fail to list the end uses the growth in electric energy will serve. The reason for this may be such that an enumeration would clearly show that the projected growth in electricity use comes about either by the expansion of uneconomic uses of electricity, uses for which there are cheaper and better substitutes, or by the continued erosion of efficiency.

An example: Automobile fuel economy. To illustrate the decreasing efficiency of energy-using apparatus, we show the average miles per gallon of U.S. cars in Fig. 1. Although cars do not use electricity, this figure is typical of the changes in efficiency of many electric appliances. It shows that fuel economy declined steadily from 1967 to 1974, continuing a 30-year trend. Any statistical projection of gasoline use would incorporate this continuing loss of efficiency into its estimates of future gasoline needs.

One can actually choose a range of costs for peak power from about 50 cents a watt for inefficient fossil peaking-plants through $1 a watt for modern base-load fossil-fuel to about $2 a watt for nuclear. Which figure is relevant depends on one's opinions about which plants will be built, and on whether the end use in question is basically peak-or base-load. We have chosen $2 a watt because it allows us to compare first costs of appliances directly with first costs of new supply. If the lower-first-cost power plants are built, then more attention must be paid to operating costs.

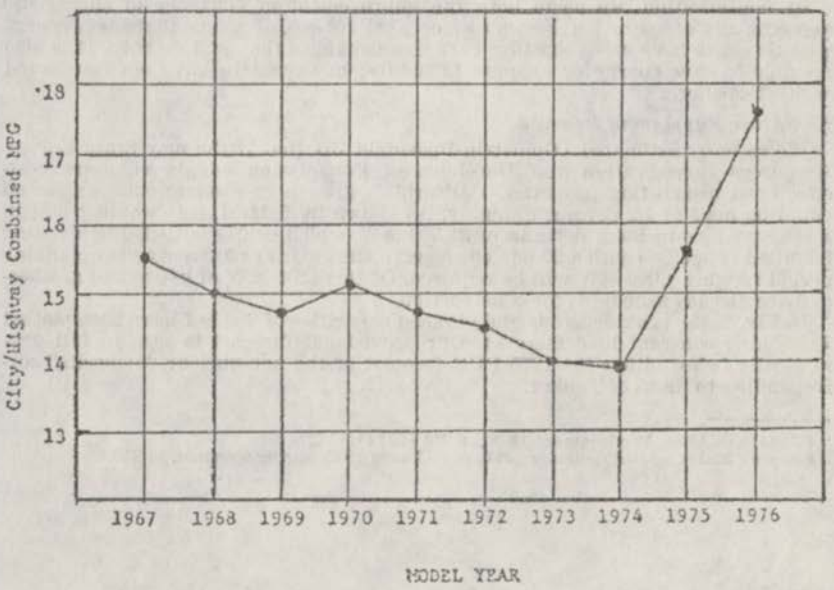

FIGURE 1—Sales-weighted fuel economy trends—1967 to 1976. (From T. C. Austin, R. B. Michael, and G. R. Service. "Passenger Car Fuel Economy Trends Through 1976," S.A.E. Automobile Engineering Meeting, Detroit, Michigan (October 13–17, 1975), S.A.E. Publication 750957)

However, in response to "energy awareness," i.e. higher prices and fear of shortages promoting technological innovation, the average mileage per gallon of U.S. cars rose dramatically in 1975 and 1976, with present cars getting 27 percent better fuel economy than 1974 cars. We doubt that any economic forecasting method could have predicted this dramatic reduction in the energy demand of cars, nor would it have forecast that in 1975 consumption of gasoline would be less than in 1973. Remarkably, the 27 percent gain (from 13.9 to 17.6 mpg) is not due to sales of smaller cars. The weight distribution of new cars sold in the U.S. has hardly changed from 1974 to 1976 and (surprisingly to Californians) the projected average weight of the 1976 U.S. fleet is higher than it was in 1974 (or any earlier year).

The efficiency of electric motors could also suddenly rise. Table II shows the declining efficiency of electric motors since 1940. These motors are used to power refrigerators, air conditioners, ventilation fans, etc., in homes and commercial buildings. This decline can be reversed by state efficiency standards; and is already being reversed by some manufacturers' new equipment. Projections of electricity demand based on historical experience would extend these historic losses in efficiency into the future and would be unable to account for increases in energy-efficiency. Such increases are clearly feasible; they only entail improving new equipment to the levels of 1940 technology.

End-use projections. A more accurate method of prediction is to look at each end-use of electricity, evaluate the possibilities of growth in consumption and of "conservation" in each use, and then to project future demand for electricity as the sum of demands for each end use. Growth in electricity use does not occur as an inevitable result of economic growth, but because the demand for end uses grows.

TABLE II.—*Efficiency of quarter horsepower electric motors* [1]

	Efficiency Percent
1940 Wagner electric heavy duty	71
1975 Wagner electric heavy duty	58
1975 Wagner electric standard	54
1975 Wagner electric economy	49
1976 Sears catalog (average of ¼ and ⅓ hp motors) [2]	51
1976 Sears fans and blowers [2]	30

By conservation, we mean both the improvement of efficiency of energy use and economy of operation. For most electrical devices, a change that saves energy will also save money, we consider only those changes that will do both. It is also possible to save energy by changes in habits; however, we have not considered such effects here.

2.2 Future Supply and Demand

We recently estimated (Goldstein-Rosenfeld 75) that if the new State Energy Resources Conservation and Development Commission adopts vigorous, cost-effective conservation measures, California's growth in electric energy demand could be held to 1.2 percent annually. As shown in Table I, this would result in a 1984 peak co-incident demand of 31,500 MW, which can be satisfied by existing installed capacity (with a 20 percent reserve margin). For a twenty year planning period roughly 4,000 MW will be required. Of this 3100 MW of hydro and geothermal are already scheduled for construction.

In Fig. 2, the peak demands and planned capacities of Table I have been plotted (assuming constant load factors). Our provisional forecast is seen to fall dramatically below either the 1975 PUC forecast or the non-nuclear "umbrella" corresponding to line 5 of Table I.

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[1] Jonathan Allen, Environment 16 No. 8, 36 (1974).
[2] Sears Catalog, spring/summer 1976, p. 895, also 1975, spring/summer, p. 859.

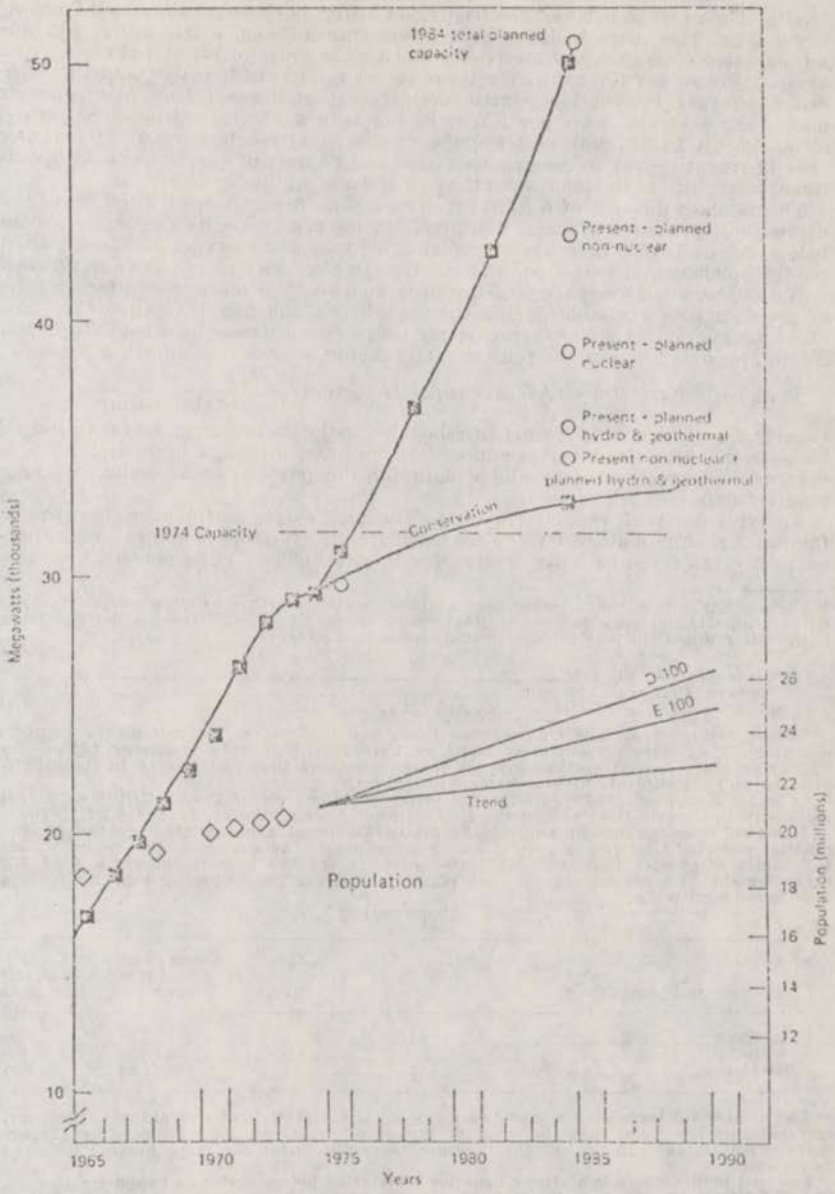

FIGURE 2.—Projections of California electricity consumption with and without explicit conservation assumptions

8. CONSERVATION

3.1 Costs of New Electric Power

Although there is some question about whether new nuclear plants have lower or higher total cost than new fossil-fired plants, there is no question that new plants will produce electricity that is much more expensive than present elec-

tricity. The average price of electricity to California customers is about 3 cents [1] per KWhr; this price includes generation, transmission, distribution, and administrative costs. Nuclear electricity has a wide range of estimated costs, from about 2½ cents per KWhr to over 4½ cents per KWhr at the power plant. (Southern California Edison has stated that its expected costs from new nuclear plants are 4 to 4½ cents per KWhr.) [2] For both nuclear and coal-fired plants, it is difficult to estimate cost because of the rapid escalation (30 percent per year in recent years) in construction costs and because of questions about operational reliability of the plants and the cost and availability of fuel.

To calculate the cost of a kilowatt of new peak demand, we will estimate the capital cost per rated kilowatt and divide by the peak capacity factor, as defined below, for each type of generating plant. We look at two types of based loaded plants: nuclear and coal-fired, and one type of peak-only plant: the gas turbine.

We define a peak capacity factor to measure how often a generator or type of generation is available during the peak hours. Roughly this can be thought of as the average capacity factor during peak hours corrected for load following. As an approximation of the peak capacity factor, we use the following formula:

$$\text{Peak capacity factor} = (\text{Average capacity factor}) \frac{1}{1\text{-scheduled maintenance}}$$

Clearly the time a unit spends in scheduled maintenance must be taken out of its assessed peak load performance. Our formula, although approximate, is a reasonable correction of available data for the purpose of assessing capacity requirements.

Applying our peak capacity factor to Komanoff's data on the average capacity factors for large mature PWR's we calculate an availability at peak of 76 percent. The projected capacity factors for this technology is 64 percent.[3] Assum-

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[1] 3¢ per KWhr is a rough estimate of average electricity price to California users, based on the following average prices per KWhr sold by the major utilities (as derived from California Public Utilities Commission staff economic studies):

	Cents
Pacific Gas & Electric	2.6
Southern California Edison	3.3
San Diego Gas & Electric	4.0

[2] These estimates exclude transmission losses and the cost of the rest of the utility's operation. They were presented by Southern California Edison in testimony before the California State Assembly Committee on Resources, Land Use, and Energy in their 1975 hearings on the California Nuclear Safeguards Initiative.

[3] Charles Komanoff (1976). Testimony before the Connecticut Public Utilities Control Authority in Generic Hearings on the Economics of Nuclear Power, February 27, 1976.

Komanoff uses statistical analysis to derive historical average capacity factors for nuclear and coal-fired power plants. For nuclear plants, he examined the record of all U.S. units of greater than 100 MW rated capacity for the operational years 1961–75, excluding the first partial year of each plant's operation. The following capacity factors were found for PWR's:

[In percent]

Size range (megawatts)	Factor for 1st 2 yr of operation	Factor for later years
400 to 599	62	73
600 to 799	59	69
800 plus	53	(30)

The number for large plants over two years old is not statistically significant. However, extrapolation the trend that the capacity factors of "mature" units improve by 11 percentage points, one can project the "mature" capacity factor for large nuclear units as 64 percent.

For coal plants, there is a strong negative correlation between size and capacity factors. For 575 MW units, the capacity factor is 67 percent for the first two years of operation, 72 percent thereafter; for 1100 MW plants, the figure is 57 percent for mature units. Komanoff estimates that sulfur-controlled coal plants have capacity factors about 4 percent lower.

In more recent work, Komanoff has derived the following average capacity factors for BWR's:

[In percent]

Size range (megawatts)	Factor for 1st 2 yr	Factor for later years
400 to 599	60	67
600 to 799	54	59
800 plus	56	(43)

ing that scheduled maintenance is eight weeks per year for refueling then we get 64 percent (52/44)=76 percent. This estimate may be somewhat optimistic in that it assumes no degradation of capacity factor with age of plant, despite some evidence to the contrary (Comey 75). On the other hand, it also assumes no improvements in future operational reliability.

Turning to the cost of supplying nuclear power at peak load, we calculate that a peak kilowatt costs about $1500. Correcting for 10 percent summer peak transmission losses, and adding transmission line costs, the cost of a peak kilowatt is $1750 or more, or $1.75 a watt.

New coal plants are comparably expensive. A new coal plant of 1000 MW capacity would cost about $850–$900 a kilowatt (Reichle, 75), (Komanoff, 76)[5a] including sulfur control devices. The availability of the plant for peak power is about 67 percent,[4] so the cost for a kilowatt of peak demand is about $1300. Correcting for transmission losses and costs, we arrive at an estimated $1500 per kw of demand.[5]

It should be noted that these costs do not include the investment the utility must make in distribution facilities, which can be substantial for the residential sector. On the other hand, they invoke a stream of future dollars to be spent during the period of construction and so would be somewhat smaller if expressed in current dollars. In sum, it seems reasonable to assert that the cost of new base-load facilities is considerably in excess of $1 a watt.

At these prices the cost of saving a watt by more efficient design of energy using devices is much lower than the cost of supplying that watt.

There are as many ways to save electricity as there are to use it. In many cases, present efficiencies are so low that reductions of energy demand by 50 percent and more are possible without raising costs to the consumer.

3.2 Strategies

Saving peak power is even easier than saving energy, since there are two methods of accomplishment: To reduce power demand at all times (e.g., by raising efficiency); To shift demand away from the utilities' peak period.

ELECTRICAL ENERGY CONSUMPTION IN CALIFORNIA

Objectives

(1) "Stock-use" model forecasts of electricity sales.
(2) Conservation strategy cost/benefit analysis.

Methodology

(1) With assistance of ERCDC, obtain data from utility companies.
(2) Analyze and check utility data using census data, sales data, manufacturers data, and engineering calculations.

Results

(1) A rough but reasonably complete picture of the residential sector.
(2) Data inadequate for an understanding for the commercial and industrial sectors.

[5a] Komanoff's testimony also covers the projected capital costs of new facilities. His estimated cost per kw for a New England nuclear power plant coming on-line in 1984 is $1,017, not including fuel costs; this is the cost figure presented by Northeast Utilities. The cost of a coal plant is about 84% as much or $850/kw including SO_2 scrubbers, for 1984 completion without sulfur removal, the cost would be about 68% of nuclear costs or about $700.

[4] For scrubber-equipped coal plants of 1000 MW size, Komanoff's statistics predict a 56% capacity factor. To be conservative, we inflate this by the same factor we used for nuclear (52/44) to account for scheduled maintenance off-peak. This results in a peak availability of 67%.

[5] If we consider smaller coal plants (575 MW) as Komanoff does, the capacity facto. for mature plants is projected to be 68%, so we estimate a peak availability of 80%. But capital costs go up to 11% to $950–$1,000 or about $1,200 per kw of demand. The cost corrected for transmission is thus on the order of $1,400, slightly cheaper than the larger plant.

DATA PROJECTS AT LBL

National Geothermal Information Resource (GRID).
Survey of Instrumentation for Environmental Monitoring.
Socio-Economic and Environmental Data and Information System (SEEDIS).
Energy Research and Development Index for California (ERDI/CAL).
The Particle Data Group.
The Table of Isotopes.
Electrical Energy Consumption in California.

AGENDA FOR FUTURE WORK

Organize data using the Berkeley Data Management System (BDMS).
Extend data base to include other fuel uses.
Extend data base to region IX.
Working with State regulatory agencies, get utility companies to supply additional data.
Gather additional primary data on consumption using the services of subcontractors.

For example, if we improve the motor of a refrigerator and put thicker insulation in the walls, we can decrease its power consumption by 60 percent. If we add a timer, we can have it work harder off-peak at night and freeze an extra cubic foot of ice; then during peak times, it can shut off entirely and coast on the stored ice.

Table III lists some ways to save peak power in residential and commercial buildings. The first column lists the present peak power demand of an appliance and the reduction that is possible with current technology or policy changes. The second column lists the potential unit savings in utility investment requirements assuming that peak-only devices are served by gas turbine electric plants while constant-power or intermediate load devices draw power from large base load plants. These savings are greater than $1 a watt for base demands and about 50 cents a watt for peak demands.[6] The third column gives the number of units affected annually, as determined by average annual sales.

The savings in statewide available peak power requirements in 1985 are estimated by multiplying ten years of sales at current levels by the unit savings and are given in column 4. For comparison, the last column estimates the existing statewide peak demand caused by the appliance.

This table is presented only to illustrate the magnitude of the energy and power (and money) savings possible with conservation measures which are legally and technically feasible and which do not compromise people's lifestyle. It is not the basis for the projection presented in Table I and Figure 2; this was derived from adding the projected demands for residential and commercial end uses assuming that new devices and buildings satisfy standards, but that old devices are neither retrofitted nor retired early.

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[6] This represents an oversimplification of the complex problem of satisfying a varying demand for electricity with the least costly combinations of new and existing powerplants, a problem which is made even more difficult by the presence of large amounts of hydropower in California. The actual cost of a new kilowatt of peak demand depends on the details of the operating costs of all the utility's existing powerplants and how the utility's operating engineers take each plant into and out of service, as well as the utility's construction plans.

However, one can assert that the cheapest way of providing for a kilowatt of new year-round demand (e.g. a water heater) is with a base load powerplant, at an investment cost of over $1 a watt. A kilowatt of new peak-only demand can be satisfied in a number of ways.

However, a more direct way of satisfying a kilowatt of peak demand is with a kilowatt of peak supply, for example, with a gas turbine. New gas turbines are estimated by the New York Public Service Commission to cost $200 per kilowatt. However, gas turbines are presently not very reliable. The average gas turbine in use in the United States was producing 32.68 percent less energy than desired due to forced outages; another 5.34 percent of its output was lost due to scheduled outages. (Edison Electric Institute. Report on Equipment Availability for the 10-Year Period 1965–1974. A Report of the Equipment Availability Task Force of the Prime Movers Committee. EEI Publication 75–50, November, 1975.) Thus, gas turbines had an equivalent availability of 61.98 percent; the cost of supplying a kilowatt of peak demand with gas turbines is the $200/.6198 or $323. If we assume transmission line cost of $70 and compensate for 10 percent peak transmission losses, the minimum cost of supplying a kilowatt of peak demand is $445, about 50 cents a watt. This refers to investment only; it is well known that operating costs of such units are much higher than for any other technology.

In table III, we consider only the investment costs so the approximate capital savings for peak demand conservation are taken to be 50 cents a watt.

TABLE III.—SOME EXAMPLE POTENTIALS OF PEAK POWER SAVINGS

Conservation measures	Unit peak demand: Present to possible (watts)	Utility capital savings at $1 watt [1]	Annual California unit sales [2] 1972–74	California peak savings after 10 yrs megawatts		1975 California peak demand [3]
I. Residential:						
Water heater: Use natural gas	500→0	$500	100,000	500	925	300
Range: Switch half to gas	500→0	250	½×170,000	425		1,600
Refrigerators (options):						
1. Choose best available	188→115	73	540,000	400		1,100
2. Redesign (LBL)	188→75	113	540,000	600	600	
3. Thermal storage	188→0	188	540,000	1,000		
Central air-conditioners:						
Optimize house and a.c. efficiency	4,000→1,100	1,450	[4] 60,000	1,750		
Effect of 1975 insulation standards	(4,000→2,000)	(1,000)	60,000	(1,200)	2,200	4,500
Room air-conditioners: EER 7→10	1,500→1,050	350	100,000	450		
Total of residential examples					3,725	[5] 7,500
II. Commercial:						
Electric motors				2,000		7,000
Lighting (daylight 1/5 of area)				1,000		4,000
Fresh air (15→7.5 ft³/min/person×4,000,000 people)				150		350
Total of commercial examples				3,150		11,350

[1] $1/watt is a weighted average of about 50 cents for peaking plants, $.50 to $1 for fossil plants, or $2 for nuclear plants adjusted for availability.

[2] Based on estimated 3-year average sales per household for the Pacific region in Merchandising Week 1975 Statistical and Marketing Report, p. 53.

[3] Based on RAND energy use data and rough estimate of number of hours of annual operation.

[4] Based on 40 percent of an estimated 150,000 new housing units constructed annually in California with central air-conditioning.

[5] Total residential peak demand is about 10,000 MW, so our list is about ¾ complete.

RESIDENTIAL

In this section we consider those conservation strategies to be potential savings which meet our definition of cost effectiveness. Any conservation measure has a marginal demand reduction associated with it, that is, the amount of energy saved by that measure compared to the average consumption for that use. When the capital cost of a conservation measure is less than the capital cost necessary to generate electricity at the level of the marginal demand reduction, we say there is a potential savings. In short, it is cheaper to save the power than to build plants to supply the load.

In our calculation of the marginal demand reductions for specific measures, we look at the load curve of the use in question to determine the degree that each end-use contributes to capacity requirements. Since increases in capacity requirements for residential uses are based on new demands on top of the existing base, we calculate marginal demand reductions in terms of new devices only. The residential demand for electricity can only grow if more devices are sold. So marginal increases in efficiency for new devices imply marginal savings of capacity, factoring in the load curve.

Consider first the home water heater. A gas water heater supplying 50 gallons a day of 140° F water, requires 270 therms of gas per year, at a cost to the consumer of $40. A similar sized electric water heater consumes 4400 KWhr annually, which costs the consumer $105 at PG&E's lowest residential block rate, 2.4¢/KWhr. Rates in southern California are higher.

This price differential is not solely a result of the low regulated price of natural gas; it reflects the inherent inefficiency of using electricity for heat. A power plant supplying a typical electric water heater must burn between 450 and 500 therms of gas (or the equivalent amount of other fuel); almost twice as much as would be required if the fuel was burned directly in the water heater.

A water heater draws power all year long, averaging 500 watts, even during peak times. Hence, a new electric water heater commits the utility to invest in 500 watts of new power availability, at $1 per watt, or $500. This huge invest-

ment to supply a single home water heater is not paid directly by the purchaser of the heater; it is rather, distributed among all the utility customers in the form of higher rates, even for poor people who mostly heat their hot water with gas.

At present, roughly 100,000 electric water heaters are sold in California each year. If the state acted to prevent their installation (where alternate fuel is available), we could save about 50 MW of new electricity demand each year. After ten years, the state would require 500 MW less electricity than it would if present trends were allowed to continue (Table III, column 4).

Similarly for electric ranges and ovens, listed on line two of Table III. An electric range uses about 1000 KWhr annually; estimating conservatively that this is distributed over 2000 hours, which include the peak period (noon to 6 p.m. in summer), the range, like the electric water heater, averages 500 watts[7] and forces the utilities to invest $250. As shown in Table III, a State policy to switch half of new electric range sales to gas would prevent the need for about 425 NW of capacity by 1985.

The use of electricity for space heating is also uneconomic. At present the heating season is off-peak for most California utilities, so that no new electrical plants of any variety are required for electric heating. However, if enough electric heat were installed to shift the peak to winter, then its continued installation would be prohibitively expensive. A home heat pump uses about 7 KW; the capital cost of 7 KW of new power is $7,000, clearly an excessive expenditure for heating one house. Needless to say, electric resistance heating is even worse.

Actually, any use of electric space heat for houses is uneconomic for the consumer, even at present rates. Gas heat costs $2.50 per million Btu's (MBtu) delivered as useful heat in the PG&E area, while the same amount of electric resistance heat costs $7.00.[8]

If electricity is used to supply these end uses, rates will increase dramatically, but if State policy directed toward conservation is instituted, then electricity needs and costs will not rise as rapidly; thus a slowdown on new power plant construction would have positive economic effects. Such a program would even have indirect beneficial consequences for the economy since investment in conservation produces more jobs than investment in electricity generation (see Section 4.2 and Table V).

In addition to the savings in heating appliances, there are large savings possible in increasing the efficiency of appliances that continue to use electricity. Refrigerators use about 8 percent of California's electrical energy and their energy consumption has been growing rapidly in recent years. Currently one finds a range of about 2 to 1 in the energy consumption of most classes of regrigerators of equal size and with identical features. Simply choosing the right model within each size-and-feature class can save the state about 40 MW of new capacity needs each year. In addition, considerable improvement is possible over even the most efficient refrigerators presently being sold. As shown in Table III, an energy saving refrigerator would use only about 40 percent as much energy as an average one; this could result in an additional savings of about 20 MW of new capacity each year. In all, the improvement of refrigerators, after ten years, can eliminate the need for about 100 MW of generating capacity at average capacity factor.

Present air conditioners also exhibit an almost 2 to 1 range in energy consumption for a given size, while evaporative coolers use less than one-fourth as much electricity for the same output, and are satisfactory in many parts of the state. Table III shows that the new insulation standards for homes will automatically save 1200 MW of air conditioning power after ten years; efficiency improvements can increase this savings to 2350 MW.

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[7] PG&E load study of electric ranges shows a coincident peak demand of 1,000 watts at 5:30 p.m. and over 500 watts at 5:00 and 6:00 p.m. There is reason to believe that due to studying a non-random sampling of users, PG&E underestimated range usage.

[8] If we instead compare the costs of new gas supplies vs. new electricity, analogous results are obtained. Now gas supplies will cost in the range of 30–40 cents per therm at the State boundary. (PG&E's LNG imported from Indonesia is projected to cost 29 cents per therm in 1981.) This is equivalent to about $6.00 per MBtu of useful heat delivered. New electricity from coal or nuclear plants will cost from 3½ to 5 units per kilowatt-hour at the power plant; adding the effect of transmission losses and distribution costs boasts the residential price to over $12.00 per MBtu delivered, still twice as costly as gas heat. (Gas prices are calculated assuming a 60 percent conversion efficiency: cost per MBtu delivered = cost per $\frac{\text{MBtu}}{.60}$.)

While more efficient air conditioners and better insulation will cause increased first costs to the purchaser, these extra costs are much smaller than those the utility must otherwise pay to supply the extra power for less efficient devices. For example, choosing a 12,000 Btu-per-hour room air conditioner with an EER of 10 instead of 6.5 will cost the consumer a little extra, but nowhere near the $300 that the utility would have to spend to provide the additional capacity to run the inefficient model. Similarly, using home insulation up to the 1975 standard can be costly, but will not require the additional $1,000 that the utility would have to spend to power air conditioning if the insulation were not installed.

After 10 years, Residential Conservation Measures listed in Table III add up to a decrease of 50 percent of present residential demand. During ten years the growth in number of households will be about 30 percent so a net decrease in residential peak demand might well occur.

Commercial buildings—most operators of large buildings have found that they can cut energy and peak power consumption by about 35 percent with better management and with only those investments whose payback time is less than three years. Thus lighting levels, which have been demanding as much as 5 watts per square foot of new buildings are being cut back to 2 watts per square foot, with little or no discomfort. This measure is so well accepted that it is not even mentioned as a "conservation measure" in Table III; we do, however, list the following:

Air Conditioning—according to Fred Dubin (Dubin 76) the EER (electric efficiency ratio) of air conditioners in both new and existing buildings can be raised nearly 70 percent, decreasing the power demand by 40 percent. Many windows can be better shaded from the summer sun, and some new buildings can have chilled water storage, and thus use no peak air conditioning power at all.

Daylighting—simply switching off lamps within 10 feet of a window in commercial buildings in California will save about 1000 MW. Our group has been experimenting with better sorts of windows, venetian blinds, ceilings, and switches to achieve such daylighting effectively.

Since it is not cloudy in California on summer afternoons when we have our peak power demand, it seems cost-effective to switch off 2 watts per square foot in 500 million square feet (1/5) of our nonresidential space. As mentioned, the peak power savings is 1000 MW.[9] The necessary taller windows and reflective venetian blinds cost very little, and the photocell switches pay for themselves in a year or so out of energy savings.

Fresh air—the new state and national codes for nonresidential buildings recommend 7.5 cubic feet per minute of fresh air per person, but current practice is to supply roughly twice that much. This wastes energy in the winter and requires peak power for air conditioning this excess air in the summer. Table III shows that merely by encouraging building managers to conform to the new standards we can save 150 MW at no capital expense whatsoever.

This concludes our list of explicit conservation measures in nonresidential building—they add up to about 30 percent of present peak commercial demand, over and above the 35 percent (for better management) that we quoted earlier. Peak power demands per square foot could then be reduced to 0.7 x 0.65 or about 50 percent of their current value, yet commercial floor space in 1984 will have risen by only about 35 percent. So it appears that we need expect little increase in peak power demand from the commercial sector.

Finally, note that even though Table III is incomplete, it is long enough to add to a savings of 6000 MW, which is the total contribution to peak power of all 9000 MW of nuclear plants scheduled for the next ten years.

Industry—we have no "industry" entry in Table III, even though it accounts for about one-third of California's peak power demand. We assume that industry is technically sophisticated enough to respond rationally to rising power and energy costs and particularly to anticipated peak power pricing. For industry we feel that the usual concept of elasticity between demand and price is fairly well understood and needs no special attention from us. We foresee that this elasticity will hold peak demand nearly constant for the next few years.

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[9] A. H. Rosefeld and S. Selkowitz, Chapter 5 of LBL 4411 (1976), and Chapter —. The estimate assumes that California is cloudless on summer afternoons, and hence, that the lights can reliably be off during time if peak demand. This may not be quite true. However, it is conservative because it considers only retrofit and ignores the fact that in ten years we can expect a 30 percent increase in commercial space, 35 percent of which can probably be daylight. This would save another 30% x 35% x 2.5 B x 2W = 500 MW.

3.3 Total Energy Systems, Co-Generation of Electricity

On a life cycle basis, it is now becoming cheaper for the owner of a large building to install his own total energy system than it is to purchase commercial power. The total energy system can be powered by diesel engines and perhaps by the combustion of solid waste and even some solar energy. Most of the "waste" heat from the diesel is recoverable. We shall now discuss why we estimate that up to 30 percent of the power demand of new commercial buildings will never be felt by the utiilties.

We present in Table IV partial results of a study of total energy vs purchased power for a one million square foot hospital designed for Travis Air Force Base. Life-cycle costs were calculated assuming a 9 percent interest rate and an inflation rate of 7.5 percent for fuel, supplies, and labor. Twenty-one configurations were studied, and diesel-electric came out best. Table IV compares 25-year life-cycle costs only for utility power vs diesel-electric, which turns out more favorable by 15 percent in dollars and 43 percent in energy.

TABLE IV

	Power	
	Purchased	Diesel electric
1st cost (million dollars)	5.7	7.8
Life cycle costs (million dollars)	34.1	29.6
Life cycle fuel (10^{12} Btu)	13.7	7.8
Life cycle fuel (percent)	100	57

Note: Relative cost of purchased electricity versus a diesel-powered total energy plant for the 1,000,000 ft New Generation Military Hospital planned for Travis Air Force Base, Calif. The maximum demands are electricity, 7.5 MW; coolin g 3,800 tons; heating, 80 MBtu/hr.

Source: Consultants Computation Bureau, San Francisco, Calif.

The rate of installation of total energy plants in the U.S. is still tiny—about 100 MW each year, in the form of about 50 plants, averaging 2 MW each, in buildings of 100,000 ft.^{2} or larger. But it seems likely that total energy plants will "take off", and even "take over" if an electricity shortage threatened. Our colleague, Fred Dubin, has been studying peak-power saving on Long Island. His estimate is that 10 percent of the total Long Island peak-power demand (30 percent of commercial demand) comes from users large enough to benefit from total energy. Accordingly it seems reasonable to assume that about 30 percent of new commercial power demand in California too could switch away from utility purchased power.

Co-generation—a total energy system becomes even more economical if the local utility will collaborate, i.e., buy as well as sell power at reasonable rates. A challenge for the state is to formulate incentives or rules for cooperation (rather than the present hostility) between utilities and total energy plants for industry as well as buildings. One possibility is simply to permit the utility to enter the total energy business.

4. ENERGY USE, ECONOMIC GROWTH, AND JOBS

4.1 Economic Growth

Despite the fact that saving energy and peak power also saves money, both for the consumer and for the state as a whole, a belief still prevails that a growing

economy requires increasing use of energy, and that cutbacks in energy use will lead to economic stagnation.

To support such an argument, one would have to demonstrate that the use of greater amounts of energy is associated with higher levels of economic activity. Figure 3 shows a plot of national income per capita vs energy use per capita for several developed countries. If energy use were flexibly linked to income, we could expect to see all the points lying along a straight line. What actually occurs is a great deal of scatter: Some countries can achieve the same level of income as others with much less energy use. The figure shows that the U.S. uses about twice as much energy per capita as the three most developed European economies without achieving substantially higher per capita income.

There is even less of a fixed link between electricity usage and income. Figure 4 shows a plot of national income per capita vs electrical energy used per capita. Some countries use more electricity than the U.S. while having lower national income; other countries achieve almost as high income as the U.S. with lower electricity use. It should be noted that of all the countries using over 5 MWhrs of electricity per person, only the United States has less than 60 percent of its electrical capacity in hydroelectric facilities.

4.2 Jobs

Another belief is that even if we do not need more energy for a growing economy, we need it to solve our unemployment problems. However, as we have shown, more energy requires more investment in energy production, but money spent on power plants produces fewer jobs than the same money spent elsewhere. According to Edison Electric Institute figures, $1 million invested in electric utilities produced 5.78 jobs, while the same $1 million invested in an average factory produced 45.5 jobs.[10]

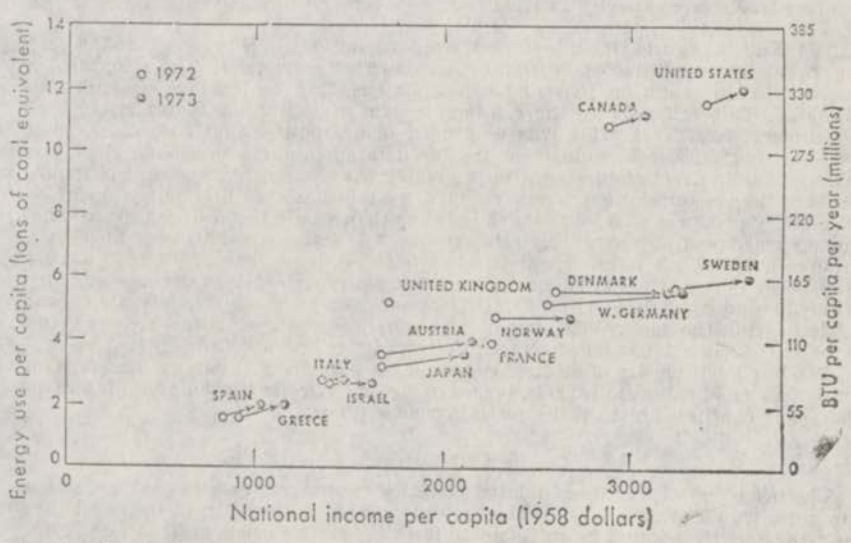

FIG. 3.—Comparison of national income per capita with total energy use per capita, 1972 and 1973, for selected countries.

[10] Lee Schipper, Explaining Energy, LBL–4458 and University of California, ERG076–04; p. 19 lists capital investment per employee for several industries in 1971, using 1973 Edison Electric Institute data.

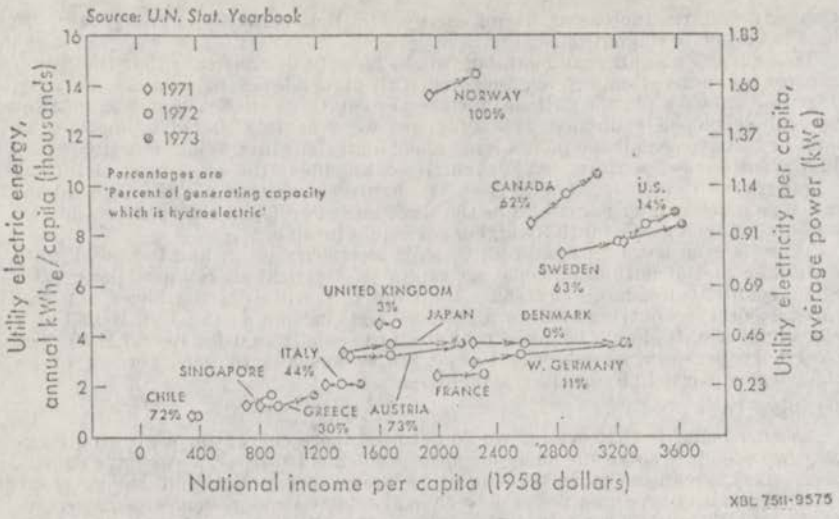

FIGURE 4.—Comparison of national income per capita with public utility electricity consumption per capita, 1971–73, for selected countries. The percentage of hydroelectric capacity in each country's total generating capacity is noted.

The Edison figures include direct employment only; they don't count jobs produced by supplies of power-plant construction companies. The results of a more detailed study on jobs and consumer spending choices are presented in Table V. This table shows the consequences of spending one dollar on various consumer items. This table was developed using input-output economics, so it includes not only the employment produced in supplying a consumer item, but also all the indirect employment in producing the equipment necessary to manufacture the consumer item. From Table V, we see that a million dollars spent on electricity produces 43.6 jobs, which is fewer than would be produced if the same money was spent on almost any other option. (Average expenditure of $1 million produces 80 jobs. A dollar spent on electricity produces fewer jobs than almost any other option. One particularly interesting comparison is between electricity (line 1) and appliances (line 4). This comparison suggests that a dollar spent in improving the energy-efficiency of an appliance produces about twice as many jobs as the same dollar spent on extra electricity to operate an inefficient one.

The low job intensity of electricity purchases suggests that energy conservation measures (and this resultant decreases in electricity consumption) produce more jobs than continued historical growth in consumption.

5. CONCLUSIONS

The net effect of a state-mandated electricity conservation and peak reduction program would thus be to slow the growth rate of consumption to the point that existing facilities would be sufficient to meet the state's needs until at least 1985. This scenario of state-sponsored conservation could result in cost savings to consumers, no sacrifice in well-being, greater employment and lower electric rates than a scenario of rapid construction of new power plants.

6. ACKNOWLEDGMENT

We are indebted to Dr. Robert D. Clear for sharing with us his data and ideas, particularly on appliances.

TABLE V.—ENERGY AND LABOR INTENSITIES OF THE LARGEST (DOLLARWISE) PERSONAL CONSUMPTION ACTIVITIES FOR 1971

	Energy intensity (Btu/dollars)	Labor intensity (jobs/$1,000,000)
Personal consumption expenditure section description:		
Electricity	502,473	43.63
Gasoline and oil	480,672	72.96
Cleaning preparations	78,120	73.32
Kitchen and household appliances	58,724	95.51
New and used cars	55,603	77.54
Other durable house furniture	45,593	89.48
Food purchases	41,100	85.28
Furniture	36,664	91.76
Women and children's clothing	33,065	100.08
Meals and beverages	32,398	87.56
Men and boys' clothing	31,442	98.45
Religious and welfare activity	27,791	86.36
Privately controlled hospitals	26,121	171.89
Automobile repair and maintenance	23,544	48.39
Financial interests except insurance companies	21,520	78.45
Tobacco products	19,818	58.54
Telephone and telegraph	19,043	54.93
Tenant occupancy nonfarm dwelling	18,324	35.02
Physicians	10,271	32.58
Owner occupancy nonfarm dwelling	8,250	16.76
Average, including energy purchases	70,000	80.00
Average, nonenergy purchases only	[1] 52,000	

[1] 1967 figure. The corresponding 1967 figure for average including energy was 80,000 Btu/dollars. Source (1967 figures), R. Herendeen, private communications.

Source: Hannon and Puleo, Center for Advanced Computation, University of Illinois, 1974.

REFERENCES

David D. Comey (1974, 1975). "On Cooking Curves" and "Points vs Trends" in The Bulletin of the Atomic Scientists, Vol. XXXI, No. 8 (October 1975) pp. 38–45; and "Will Idle Capacity Kill Nuclear Power", Ibid. Vol. XXX, No. 9 (November 1974) pp. 23–23. The cumulative weighted average capacity factor for U.S. nuclear power plants larger than 400 MW is 54.7 percent.

D. B. Goldstein and A. H. Rosenfeld (1975). "Projecting an Energy Efficient California", Lawrence Berkeley Laboratory Report No. LBL–3274.

Leonard Reichle (1975). "The Economics of Nuclear Power", presented by Ebasco Services Inc. to the New York Society of Security Analysts, August 27, 1975. The capital cost for construction alone is $1005 per kilowatt, while the capital cost for the initial core fuel is $123, for a total investment of $1123 per kilowatt. The New York Times (October 5, 1975) quotes Mr. Reichle that the cost of building a nuclear reactor is $1135 per kilowatt.

Mr. OTTINGER. Now, are you familiar with that study?

Mr. FRI. I have heard of it.

Mr. OTTINGER. You have not seen it?

Mr. FRI. I haven't actually seen the draft. No.

Mr. OTTINGER. Now I wondered how this financing was actually going to work. The bill provides for an overall 75 percent financing with 90 percent during construction and start-up costs. The borrower can also get an investment credit on your other law. How is ERDA going to maintain a 75 percent limit by the end of the start-up costs and insure that the borrower has a meaningful equity in the project? Why not just limit the thing to 75 percent from the outset?

Mr. FRI. I guess I am not 100 percent sure. I understand we can provide up to 75 percent or up to, during construction, 90 percent.

Mr. OTTINGER. But the overall has to be 75 percent when you are finished. I wonder how you are going to accomplish that.

Mr. FRI. I am hesitating because I guess I don't know the exact mechanism. It would depend heavily on the kind of financial arrangement in each case. It would have to be negotiated out in each project, but Bill can probably talk more about that than I.

Mr. MCCORMICK. Mr. Ottinger, as Mr. Fri mentioned, there are a number of ways to do it, but one perhaps would be to have one loan which is perhaps 75 percent of the total project cost, which would be guaranteed over its lifetime by the Government, and then another note, if you will, which represents up to an additional 15 percent, which would only receive a Government guarantee during the construction period of the project.

I would like to emphasize that these are statutory limits or maximums in the legislation, and it doesn't necessarily mean that ERDA would provide guarantees up to those statutory limits.

Mr. OTTINGER. I wonder if you provided for start-up costs, 90 percent, how you are going to get the overall down to 75 percent, which is the statutory limit.

Mr. MCCORMICK. The start-up period is normally a period that could run anywhere from 6 months to 1 year, during which the plant is in some phase of shakedown before it reaches its full capacity production level, and this start-up period would have to be defined, of course, in the negotiations, in the contract, in the agreement between the Government and a project sponsor.

So, if, for example, it were a period that were defined perhaps on the order of a year of when the plant reached some specific level of production, then the costs associated with that initial operation to be included in the guarantee up to 90 percent of the costs.

ERDA would have to publish administrative regulations which would spell out these procedures in detail, and that would have to be done prior to issuing any formal solicitation. We have not thought through, frankly, all the details of how it would work. We have some general ideas, but in any event we have to work it out in such a way that it would come within the statutory limitations specified in the bill.

Mr. OTTINGER. I wonder if you could supply that mechanism, because in thinking it out, we did not really cover it out in the Science Committee. It seems to me very hard to visualize a 90-percent guarantee and is the company going to buy the Government out or pay the banks back?

Mr. FRI. Similar kinds of things happen all the time. Construction financing and so-called permanent financing are very often different things in a large construction project.

Mr. OTTINGER. The definition of this law is peculiar. You do not just separate those two phases, one at 90 percent and one at 75 percent. The overall cost has to be brought down to 75 percent.

Mr. FRI. There has to be a period in which the startup period of the time for which the startup period is defined, and I presume the Administrator would have to know in advance what the takeout financing mechanism was for the other 15 percent, whether that is equity or something on an unguaranteed loan is more or less up to the private sector adventurer.

There are issues that we really cannot be very precise on until we have gone through a formal and open solicitation and negotiation, which we are hardly in a position to do until we have something to solicit about.

Mr. OTTINGER. I am concerned that the Government be protected. If we start out at 90 percent you will, in fact, be able to get down to an overall Government participation of 75 percent, the Government would not be struck with 90 percent. The law seems to be inconsistent. The bill, as it is written, seems to be inconsistent. The Government could, in fact, be struck with 90 percent. That is what I am concerned about.

I understand Mr. Hill has to leave. Mr. Hunt has two very short questions, and we will let you go.

Mr. HUNT. Let us assume we have a coal gasification plant in construction and it is on line. Would it qualify as an investment tax credit for the full amount, and how much would that be? It is my understanding it will be about 10 percent, which could minimize the exposure.

Mr. MCCORMICK. We can provide some detailed information for the record on this, Mr. Hunt. We have done rough calculations which indicate that for a $1 billion plant it would qualify to the extent of approximately $65 million in investment tax credit.

[The following information was received for the record:]

ERDA's analysis with respect to the amount of the investment tax credit for a goal gasification plant assumes that the present 10 percent investment tax credit (provided in Section 38 of the Internal Revenue Code of 1954) will remain available through the construction life of the coal gasification plants.

Under present IRS Code provisions this credit could become available as qualifying property was completed. For a $1 billion plant we estimate that approximately $65 million of Investment Tax Credits (ITC) would be available. Full utilization, however, will require an aggregate tax liability of $130 million in the period(s) when the ITC is earned and in available carry back and forward periods (generally 3 years back and 7 years forward).

Mr. HUNT. Fine. Would there be a depletion allowance associated with the extraction of coal? We are talking about coal gasification.

Mr. MCCORMICK. I don't know the answer.

Mr. FRI. It depends on who owns the coal. We will probably have to supply that one.

Mr. MCCORMICK. I am informed it is 10 percent.

Mr. HUNT. My concern is, it might put the proponents of such a scheme in literally a no-risk position.

Mr. MCCORMICK. No, sir, I do not think so with investment tax credit and with depreciation.

Mr. HUNT. Under accelerated depreciation schedule?

Mr. MCCORMICK. Yes. Even using double declining balance, it is less than $40 million in the first year. So the net cash required, net equity in the first year is still going to be, assuming we made a guarantee up to 75 percent, which would be the statutory maximum, you still have a required equity on the order of $150 million at the minmum; not a significant amount.

Mr. FRI. I think it is important that the "up to" is in there because the purpose of the other thing is negotiate an arrangement that provides a leased financial exposure to the Government. I think we would

be motivated not to just say, 75 percent everybody, but we look at the financial structure and cash flows of an individual project and try to understand what the equity holders' position is going to be, what the nonguaranteed borrowers' position is going to be and try to use this program to absorb risk beyond that which are acceptable under more normal circumstances, but not simply to go 75 percent.

It is a complicated kind of analysis, but the objective of the exercise is pretty clear not to just give away 75 percent, make sure there is an equitable participation on the basis of the specific project.

Mr. McCormick. I might also add, if I may, Mr. Hunt, the bill, as drafted, requires that the awards be made on a competitive basis, and presumably, that one of the factors of competition would be the equity share that the potential project sponsor would have.

So as Mr. Fri indicated, that would certainly be a consideration in the final project selection. That is what the stake of the potential project sponsor is of the project.

Mr. Hunt. It does not preclude the proponents of building facilities with his own contracting company, does it?

Mr. McCormick. No. The coal mine, for example, could be built in another.

Mr. Hunt. From a subsidiary?

Mr. McCormick. Sure.

Mr. Hunt. Fine.

Mr. McCormick. And could be contracted for.

Mr. Fri. In this table or book that I think by now I promised to give to you at least once, the contractors, as well as the sponsors, are all listed.

Mr. Ottinger. The time of the chairman has expired.

I thank you, Mr. Fri, for your patience. I appreciate your coming before us. You are excused.

Our next witness is Mr. John A. Hill, Deputy Administrator of the Federal Energy Administration.

We are glad to have you with us. We appreciate you being with us. If you would—I am sure, in view of the hour, you probably will be delighted—I hope you put your full statement in the record and proceed on that basis as you will. But you are simply welcome to summarize the statement.

STATEMENT OF JOHN A. HILL, DEPUTY ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATION

Mr. Hill. Mr. Chairman, I certainly appreciate the opportunity just to put the statement in the record and briefly summarize that and then answer any questions you may have of the FEA at this point.

The bill before this committee, in FEA's mind, is a legitimate and valid approach to this area of synthetic fuels, of the energy sources such as solar and biomass conversion and conservation. It is important in the sense that what we are dealing with long leadtimes and with a great deal of uncertainty during that period. Uncertainties regarding the economics of these systems, regulation of these systems, the environmental impacts of these systems, and uncertainty as to the shape of the energy world 10 years from now, 20 years from now, particularly in terms of whether or not there may be a cartel holding oil

prices very high or whether the cartel may have collapsed and we are back looking at fairly inexpensive oil, at least cheaper than the alternatives that would be assisted by this program.

It is our feeling that we should not let those uncertainties restrict the development of these activities to run these various tests, the economic tests, the environmental tests, the regulatory tests, so forth.

We are actually talking about something the country will need under any scenario that we can visualize by the year 2000.

It is better, in our judgment at FEA, to start this process now and not get to 1990 or 1995, as we frequently do in this town, and have to have a crash effort to try to solve some problems that could have been done on an extremely scientific and analytical basis on a better schedule.

So we do support the bill before this committee. We think it is important. We think it is time to get started on this effort if we are going to have the set of alternatives represented by this bill toward the end of this century when we believe we are going to need them.

[Mr. Hill's prepared statement follows:]

STATEMENT OF JOHN A. HILL, DEPUTY ADMINISTRATOR, ENERGY RESOURCE DEVELOPMENT, FEDERAL ENERGY ADMINISTRATION

INTRODUCTION

Mr. Chairman and Members of the Committee, I am pleased to testify today in favor of H.R. 12112 which would amend the Federal Nonnuclear Energy Research and Development Act of 1974.

H.R. 12112 would provide Federal assistance for a demonstration program to produce synthetic fuels from coal, oil shale, and to convert renewable energy resources to desirable energy forms.

I cannot emphasize too strongly, Mr. Chairman, that there is an urgent national need to increase the production of energy supplies from our abundant domestic resources. H.R. 12112, as reported out by your colleagues in the House Science and Technology Committee, represents an important milestone toward meeting that need.

Our Nation has been blessed with an abundance of energy resources. Our emergence as a world power reflects that fact. We still have an abundance of energy resources, but the domestic resources we rely on most—oil and gas—are dwindling rapidly. Meanwhile, the use of our more plentiful resources is limited by the lack of adequately proven technology, unfavorable economics, and concern over environmental consequences. The result has been a growing dependence on imported energy, the availability and price of which is controlled by a few countries.

Let us explore the energy picture a little further:

Oil production in this country is more than a million barrels a day less than at the start of the embargo.

The natural gas problem continues to worsen. Proved reserves in the lower 48 states have declined steadily. Production is also declining at the rate of 6 to 7 percent a year.

Of our fossil fuels, only coal production increased last year. And it was only six percent higher than the year before.

Finally, more than one-half of all new coal and nuclear power plants scheduled for operation between now and 1985 have been deferred or delayed in the last 18 months.

As you can see Mr. Chairman, the short-term energy situation is not bright. Moreover, our long-term energy situation will be worse unless we take positive actions to increase supply and reduce demand. If we do nothing, oil imports will reach dangerously high levels between now and 1985.

H.R. 12112 is an important piece of legislation. Its enactment will be a key step to accelerating the development of alternative domestic energy supplies. These supplies will be vitally needed as our traditional energy supplies—

notably oil and gas—continue to decline. Thus, H.R. 12112 may be viewed as a long-term energy insurance policy—a policy we cannot afford to be without.

The long-term nature of alternative fuels technology must be emphasized to underscore the need to get started now. Consider, for example, that the first nuclear powerplant was built in the mid-fifties. Yet it wasn't until 1970 that we obtained as much energy from nuclear power as we obtain from firewood.

The lead-time problem will also apply to synthetic fuels, solar energy and geothermal energy. To overcome this problem, we will have to provide Federal assistance during the next decade to bring these new technologies to commercial use. H.R. 12112 authorizes a demonstration program; thus, the quantity of synthetic and other fuels produced will not be large. However, enactment of this legislation will help remove the barriers and lay the groundwork for the accelerated development of one or more major energy industries in this country before the turn of the century.

Synthetic fuels will not be inexpensive. Between now and 1985, we estimate they will be more costly than both domestically-produced and imported petroleum. But if we don't invest the financial resources now, in the years beyond 1985 when our oil and natural gas reserves are further depleted, we won't have a chance to replace them in a timely manner.

Thus, Federal participation in a synthetic fuels program should be viewed as a deposit in an energy savings account that will be returned to the Nation with substantial interest. The same thing may be said for efforts that are underway to develop other new energy technologies.

I would like to comment on a few provisions of H.R. 12112 which are exceptionally noteworthy.

First, it is widely recognized that commercial size synthetic fuel plants and related facilities have the potential to create significant environmental damage if not designed and operated properly. One of the stated objectives of this legislation is to gather information about the environmental consequences of such facilities. This objective will ensure that reliable environmental data is obtained, with the plants using advanced control techniques, to provide a sound basis upon which to regulate air quality, water quality, and land disturbance of a future synthetic fuels industry.

Secondly, synthetic fuel plants can have significant impacts on state and local communities. Some of the effects would be beneficial, such as new job opportunities. In some areas, a synfuel plant would result in rapid population growth. With lack of planning, rapid growth is accompanied by such adverse impacts as disruption of local labor markets, severe housing shortages and lack of essential commmunity services. The proposed legislation requires the Federal Government to inform appropriate state and local officials as soon as the location of a proposed facility is determined and provides for planning assistance.

But more importantly, H.R. 12112 would establish a panel to advise the ERDA Administrator on the impacts of the program on communities, states, and Indian tribes, and on environmental and health and safety effects of synfuel plants. One of the panel members shall be designated by the National Governors Conference. Other members will come from Indian tribes, environmental organizations and the general public. This panel will help ensure that the Federal Government is responsive to the needs and concerns of state and local governments.

Finally, Mr. Chairman, I would like to point out that this Nation still faces an energy crisis. The most serious causes of this crisis are the uncertainty as to future supplies and prices, uncertainty as to Federal regulatory policies, and uncertainty as to future markets.

I'm firmly convinced that passage of H.R. 12112 in essentially its present form would remove a substantial part of this uncertainty and help resolve our future energy supply-demand imbalance. The benefits would be two-fold: first, between now and 1985, we would gain valuable data and experience in producing synthetic and other fuels on a commercial scale. Second, passage of this legislation would demonstrate that we, as a Nation, have the resolve to undertake a difficult task. This alone would help remove some of the uncertainty associated with our energy policy.

I urgently request that your Committee and the Congress act expeditiously and favorably on this important piece of legislation.

Thank you. I will be glad to answer questions you may have.

Mr. OTTINGER. Why should we have commercial size demonstration of obsolete first generation technology when we are spending $416 million, I think quite successfully, to develop new technology?

Mr. HILL. I guess I am not familiar with the obsolete technology that is being tested.

Mr. OTTINGER. The ERDA research and development program has an extensive program, synthetic fuels, including five pilot plants in the coal gasification area to demonstrate different kinds of technology in the shale oil field. They had demonstrations on above-ground oil shale on a pilot plant approach.

Why can't you get the answers that you need on that basis? And, No. 1, rather than financing the commercial production of these fuels at this point with the existing technology, why should we proceed when that research and development is proceeding satisfactorily with a commercial program at all using the old technology?

Mr. HILL. Well, in one sense, Mr. Chairman, it is our judgment that this technology is ready for commercial application. I think we have to be very careful about continuing to do research and development and build pilot scale plants. There are always people who would like to just keep that kind of focus on programs forever.

It is our view that we know enough about these programs at the pilot scale and in the engineering sense that it is time to answer some of the questions which cannot be answered in the pilot stage. The impacts on the environment of a commercial scale facility, the economics of a commercial scale facility, the socioeconomic aspect and the time to test out, as well, new governmental arrangements to deal with facilities of this size since they are going to be part of our energy future. Those things we do not think you can adequately test on a small pilot scale research and development basis. There is some danger in continuing to do some of these things at the pilot scale. It is time to go commercial.

Mr. OTTINGER. There is something of an entirely different order. The entire purpose of ERDA's research and development program has been to prepare for commercialization, do research and development and help to speed that along to the point at which technology that has been developed can be turned over to the private sector. They will exploit it.

And this program, for the first time—this is the thing that is particular bothersome about it—it says that we are going to depart from that and the Federal Government is going to get into a major financing program for the commercial production of the fuels.

Mr. HILL. I think what is involved here, in my mind, is consistent, in fact, with the ERDA approach of doing the research and development and developing a series of options and, in a sense, turning them over to the private sector.

In this particular set of cases, however, it is clear that the uncertainties that I have referred to already are such that the private sector will not pick it up in terms of a full-scale commercial operation because of all of the knowledge that is still lacking, the economic knowledge, the environmental impact knowledge, the regulatory knowledge, whether or not the new arrangements with State and local governments can be made to work.

When you are talking about investing one-half or $1 billion against that kind of uncertainty, plus the behavior of the members of the OPEC cartel, it is really a question, while it may be ready to be done by the private sector given all these remaining questions, will it be done?

It is our judgment that it will not without some type of Federal assistance, even though we believe that in the out years that these matters will prove out and that it will be commercially viable and will not need Government assistance.

We are trying to break down some of the initial hurdles and look at some of these problems that are leading to these hurdles and try to put them to rest once and for all.

Mr. OTTINGER. How do you see the relationship of this program to the energy authority proposals?

Mr. HILL. I think the relationship is distinct at the current time. Separate and distinct, although it could be made a part of a larger EIA in the future if an EIA were to be passed.

By and large, I see this program as trying to run full-scale commercial size facilities in a commercial setting; whereas, EIA function is not so much that but to insure that certain technologies which are proven and have been fully tested out and that have advantages, cost/benefit advantages, that have financing difficulties, still find their way into the marketplace. I think this program will examine a lot of technologies that eventually might be funded by an EIA if it were approved.

On the other hand, the fact that this program proves them out could create a situation downstream where an EIA was not even necessary once all these basic questions were answered. I do not see it as a step trial. I do not see it as a precursor. I see them as separate and distinct programs with different objectives. At some point in the future, the funding of this program could be handled through the long facility and capabilities of EIA.

Mr. OTTINGER. What makes synthetic fuels so particularly attractive where they are being singled out for this special kind of treatment as opposed to other energy options that we have?

Mr. HILL. I think they are attractive in the sense that they are potentially fuel sources of significant size in terms of their ability to make a contribution to the Nation's energy problems.

Mr. OTTINGER. The indications we have is that they are very energy inefficient. It takes a great deal of energy to turn the coal into gas. We probably would be better off burning the coal directly, from the point of view of energy.

Mr. HILL. We are having some difficulties, as you know, burning coal directly, from the point of view of energy, for a variety of reasons. If the coal were gasified, it would be easier to ship with less of the problems associated with the shipping, and it would be easier to burn in an environmental sense if it could be gasified in ways that were more environmentally acceptable than the direct burning of coal.

We think we need to know more about these kinds of questions to see if it does offer those advantages; but at the current time, we are having extreme amounts of difficulty using coal in this country. I do not see that abating any time in the near future.

Mr. OTTINGER. Counsel, I understand, has one question.

Mr. HENKE. Mr. Hill, given the fact that both EPCA and EPAA are silent toward the treatment of synthetic fuels in terms of price regulation and allocation as well, would it or would it not be appropriate, in your opinion, for synthetic fuels produced by the type of projects developed under the proposals we have in front of us in this legislation, would it be proper for those to be exempted from the provisions of both EPAA and EPCA?

Mr. HILL. You are correct. Both of those acts are silent on fuel produced from synthetic and through synthetic techniques. Our counsel has taken the position since those acts are silent and synthetic fuels are, in fact, not covered by the Energy Policy and Conservation Act or its predecessor the Emergency Petroleum Allocation Act, that is basically a decision based on the silence, and we have prepared a formal ruling which we will be going out in a few days to so indicate this is our conclusion. But given the fact this is a ruling based on lack of specific information, I think it is our view that at some point Congress ought to specifically state in legislation that synthetic fuels are not covered by the Energy Policy and Conservation Act just to insure this is a legal ruling and correct interpretation.

Mr. OTTINGER. It is the intention of the Administration, at any rate, on top of all the other help they are giving synthetic fuels, to allow it to be so free of regulation.

Mr. HILL. In the near term, first of all, we think there is significantly likelihood that the EPCA regulations will not extend past 36 months. We are talking here about systems that will come into being via demonstration and with Government assistance after that time, but it is our view that ERDA, as an administrative agency, will be in a position to basically determine the economics of all those Government-assisted programs, and you do not need another Federal agency in there doing a different kind of regulation when we think the management of the program for ERDA will accomplish that same end.

If you have to bring all these systems under our 5,000 pages of regulations, that in and of itself could prevent these things from going just to what it takes to sort through those regulations in terms of one of these projects. We think the ERDA involvement in management will be such that tht FEA regulatory program is unnecessary and duplicative.

Mr. OTTINGER. Thank you very much, Mr. Hill.

Mr. HILL. Thank you.

Mr. OTTINGER. We would like the next three witnesses to appear as a panel and have them make their statements and question them together as Mr. Monte Canfield, Jr., U.S. General Accounting Office, Director, Energy and Minerals Division; Dr. Edward G. Cazalet, Stanford Research Institute in Menlo Park, Calif., and Dr. Charles A. Berg, Buckfield, Maine.

We certainly are appreciative of your being here. If you are bearing with us, as long as you have, we are sorry to delay you this morning.

I understand Mr. Berg has to catch a plane. So, Mr. Berg, why don't you kick things off.

STATEMENTS OF A PANEL CONSISTING OF CHARLES A. BERG, Sc. D., BUCKFIELD, MAINE; MONTE CANFIELD, JR., DIRECTOR, DIVISION OF ENERGY AND MINERALS, U.S. GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY RALPH CARLONE, ASSISTANT DIRECTOR, AUDIT, ERDA, AND WILLIAM McGEE, AUDIT MANAGER, ERDA; AND EDWARD G. CAZALET, PH. D., MANAGER, DECISION ANALYSIS—ENERGY, STANFORD RESEARCH INSTITUTE, MENLO PARK, CALIF.

Mr. BERG. Thank you, Mr. Ottinger. I am happy to be here this afternoon. I believe you have my name and address for the record, so I will skip that.

If I may, I will testify from notes. I was called rather late to testify and am unable to submit a prepared statement.

In general, I believe that the bill merits the support of all of us who are interested in the development of conservation as a going sector of American industry and I hope to see it pass. I believe that it will provide an important instrument to accelerate the development and the application of technology, of business practices and of all those things that come together to make up a going sector of U.S. industry and, in particular, I would hope that this bill might aid the development of a conservation industry in itself.

The particular question which I understand is of concern to you and your colleagues on the committee, and one which is certainly to me, is the question of the economics of conservation, the effectiveness with which expenditures might be made on conservation and that as compared with the effectiveness of expenditures of increasing energy supply.

I would like to say that although in the discussion of this bill and the language that appears in the print, there is a predominant concentration on synthetic fuels, this is the first piece of legislation I have seen which, to me, appears to offer the hope of bringing conservation to a commercial reality. I believe that there could be improvements further to emphasize conservation, but the hope is there and I am pleased to see the evidence to support my hopes.

Conservation is associated, in my mind, with certain aspects of the use of alternative energy sources and biomass and other such related practices and technology. So, in my comments on this bill as the bill may pertain to the development of conservation industry, that association will be reflected.

I feel that right now there is probably a developing wave of engineering services for conservation of fuel and power and industrial use. New products, inventions, developments, all of which are related to improving the efficiency of the use of fuel and electric power throughout the economy are in the offing. Many of these are particularly focused on the use of fuel and power in industry.

All of these will eventually come to a sort of a sticking point that is characteristic of all product development, a sticking point that is, in fact, emphasized in the description and development of synthetic fuel plants but has not been touched upon with regard to conservation in the discussion thus far. That is the point at which the laboratory tests are complete, the designs are fairly certain, things have been reduced

to practice. But you have to go through the process of commercializing the device, not only building it so it works and so it pays, but building it so it can be marketed and figuring out a marketing system that will take it through to being a commercial product rather than merely a device that works and works well.

At that point, there are tremendous risks for anyone who might lend money to the establishment of a venture with that as a goal, or who might invest money. I feel that the development of products, services, and practices for conservation will come. I feel, in addition, that if the loan guarantee program described in this bill is administered appropriately, the bill can be very powerful in accelerating the development of these products. Moreover, the bill will have great power in accelerating and, in fact, buying development of conservation products and businesses.

I have a short list of examples of products and some services that I know are now at this sticking point in product development. I just wanted to mention them to you to provide you with some concrete examples.

There is, for example, a device under development by a joint effort of two small companies that happen to be based in Maine, to build an externally fired gas turbine for electric power generation. This gas turbine would be able to use wood waste. With some modification, it might be able to use peat, coal, other sorts of fuels to generate electricity in small-scale plants at rather low capital costs and with respectably high efficiencies, typical of the efficiencies that you get in central power generation.

I would indulge myself if I were to go into the technical and economic details in the plants, because I took part in the design; we engineers have a way of falling in love with our products. So I will try to restrain myself from going into those details.

I will point out that the sort of money that is required to produce a sufficiently conclusive demonstration of the product that it could be commercialized, would be on the order of a few million dollars, say, $2 million to $5 million for demonstration plants. I will also point out, even though I have had a role in the development of the product, I will have to confess that a potential customer would be making a mistake to buy it without a conclusive demonstration. The risk of a power outage in the sorts of industrial applications for which it is designed would be too great to accept. A conclusive demonstration is absolutely necessary to commercialize this product and any number of the others, a few of which I will also list.

Another product I might mention is a new form of slot forging furnace. This is one in which I can praise a little bit more because I did not have anything to do with its design.

The slot forging furnace would be to replace the present units used in the forging industry. There are approximately 50,000 forging furnaces running in the forging industry. Each one consumes roughly a barrel of oil per hour. They operate from 8 to 16 hours a day, and you can do the calculation very easily and see how many barrels of oil that is under present practices. The designers of this furnace happen to be Hague International, Inc., of South Portland, Maine. They are confident that they can reduce the oil consumption in the furnace by 70 percent. That is, reduce it to 30 percent of its present level.

This furnace will also have to be demonstrated conclusively before it could be commercialized, because the risk of coming up with any surprises or discoveries in a production installation would just be too great for a producer to accept on his own.

There are, in addition, highly novel infrared recuperators to recapture some of the most ubiquitous and expensive heat losses that occur in industry, that is, radiation from high temperature materials. These are coming on now. The requirements to demonstrate the recuperators might be on the order of, say, half a million dollars. The requirements to carry the furnaces that I just mentioned through to a point where they either become commercial and go on their own or else you know you have done something wrong is on the order of a half million dollars.

What I am getting at is there are numbers and numbers of products that bright people have come up with that are capable of saving great quantities of fuel. They all need demonstration and none of them happens to cost very much to demonstrate. The potential of saving fuel through using them is quite great. They will eventually be commercialized. I want to emphasize that. They eventually will come to the market on their own.

It is not absolutely necessary to subsidize their commercialization, but you can gain many years through the loan guarantee program.

There are some special points in the language of the bill which I wanted to call to your attention because I believe they may bear upon the way in which the bill could influence the commercialization of conservation technology.

On page 30, line 8, the list of the energy forms terminates with chemicals. I wish that electrical energy, as an output from one of the projects, had been included. It has not been included explicitly as far as I can tell from reading the bill, and it is a very important aspect of developing technology for conservation. Not only is it an important aspect of developing the technology that would permit you to use wood chips economically to replace peaking power stations as with the gas turbine I mentioned a moment ago, but it is very important in developing those possibilities where the high temperature reject heat from furnace plants; for example, might be used to generate on-site electric power.

So electricity is an important thing, and I hope it will be possible in some way to work it in explicitly.

On page 31 from line 20 to 25, I believe that the field of conservation should have been treated separately. I am concerned about the rather detailed explanation that follows, on mechanisms for financing the synthetic fuel plants.

As I understand the mechanisms suggested here for financing the synthetic fuel plant, the loan would be given to the company that builds and operates the plants and produces the product. In very many instances, in fact in almost all instances where conservation technology would be applied, the technology, the machine, the services, whatever it will be, is a substitute for fuel use on-site. So there will be a customer for a product, and in trying to finance such a product, there is going to be a question about who owns it. Should the company that produced a recuperator own it and put it in; do they get the loan? Or is the company that installs the recuperator and uses it get the loan? The bill is not clear on such possibilities.

I have a feeling, based on experience, that if something like that is not clarified, it could fall through the slats.

There is one other point I wanted to bring up. On page 42, the language in lines 1 through 8 suggest that background patents might be encumbered in a demonstration project. If that were the case, it would make it rather difficult for designers of plants or equipment to deal with others whose equipment might be first applied under separate patents in the demonstration project. If that is the intention, well enough. But I would hope that that is not the intention.

I wish it would be possible to come up with a clear statement on background patents. My feeling also is that it would be desirable and it would serve further to accelerate the development of conservation technology, in particular, if the entire issue of patents could be stated with some more forceful and clear language to indicate that the objective of the program is not to place patents in the public domain.

I get the feeling that the program does not intend to place the patents in the public domain, but it is not clear from the language on page 41 that that could not happen. And if that happens, I feel there will be a retardation in development of the products.

Thank you, Mr. Chairman. That completes my notes.

Mr. OTTINGER. What is your time schedule? I have a couple of questions.

Mr. BERG. My plane leaves at 6:15. I will be happy to stay for as long as I possibly can.

Mr. OTTINGER. Let me ask you a couple of questions, and if the other witnesses will bear with us a bit longer.

The kind of programs that you described seem to me to be quite appropriate for loan guarantees; the traditional kind of effort that the Government has applied to encouraging relatively small operations and bringing them out to the point of commercial availability.

We put in, with my full support, a loan guarantee provision in the electric carbon. We are trying to take experimental technology and get it out.

Are you aware of the fact there is a Kennedy-Hollings bill, Energy Conservation Act of 1976, S. 2932, that provides specifically for this kind of work in the conservation effort, in the conservation field?

Mr. BERG. Sir, I am aware there is a bill. I did read it at one time. It was my understanding the loan guarantees in there were for purchases of proven items primarily and less so for support of commercialization of products. Perhaps my memory fails me, but that is my recollection of it.

Mr. OTTINGER. I think that is probably the way the bill was presented. That is the thrust of it. My recollection is there is no limitation. It seems to me quite different.

What you are talking about, which is a new invention that somebody has developed and has gotten to the point of commercial demonstration, in giving him assist to get it on the market, ERDA is talking about in this legislation, you support, which is the guarantee of the financing of a $1 billion plant, what they estimate the cost of the high Btu plant for commercial operation. And from the sound of things, we are talking about apples and oranges here.

I am perfectly willing to go with the kind of program that you are talking about, but I do not think that is the nature of this legislation.

And would it be your recommendation that we restrict this legislation to that kind of an effort, which I would very much favor?

Mr. BERG. I do not feel I am in a position to make a recommendation on restricting the legislation to that, because I am unaware of what the effects would be on the synthetic fuel industry.

However, if I may say, I realize the bill in the way it is constructed places its predominant emphasis on synthetic fuels and that conservation is a subsidiary interest, I am fully prepared to live with that because the bill is the first live looking piece of legislation that has given the development and commercialization of conservation industries some attention. I am willing to take that as a starting point.

Mr. OTTINGER. That is where your support lies of financing conservation rather than with financing the commercial production.

Mr. BERG. Yes, sir. However, I am not opposed to the synthetic fuels part. I do not feel I know the synthetic fuel industry enough to advocate it more strongly and certainly not well enough to say anything adverse toward it.

Mr. OTTINGER. ERDA made it quite clear in its testimony before the Science and Technology Committee its prime interest is in the synthetic development, coal gasification, and oil shale. They have enough projects backed up to take the whole amount of money in that, but in order to try to gather more support, they did not limit the coal gasification to 50 percent and the other synthetic fuel development 30 percent, leaving 20 percent for what I consider ought to be their No. 1 priority, which is renewable resources and conservation.

If they were to turn it around—actually, we tried. I offered an amendment—I think I offered it—to have 50 percent of this devoted to conservation renewable energy, and ERDA testified against and it was defeated in the committee.

ERDA is going to the public saying they consider conservation to be on a par of priority with development of resources. This is really the problem. One of the problems we have on this program.

I share your enthusiasm with going ahead and bringing into commercial conservation technologies. I hope we are going to be able to achieve that.

Do either of the other panelists want to comment on Mr. Berg's statement? Would you prefer to proceed on your own? Do either of the other panelists have time problems?

Mr. CAZALET. No.

Mr. OTTINGER. We will take Mr. Canfield next.

Thank you very much for being with us, Dr. Berg.

STATEMENT OF MONTE CANFIELD, JR.

Mr. CANFIELD. Mr. Chairman, in view of the hour, if you would please introduce my full statement into the record, I will summarize it briefly.

Mr. OTTINGER. We will be glad to do that.

Mr. CANFIELD. I have with me Mr. Ralph Carlone on my right, who is our Assistant Director in charge of our ERDA audit site: and behind him Mr. William McGee, our audit manager at ERDA who is responsible for an ongoing study of this very problem that I will talk to in a moment.

Basically, what my statement says is that we need to take a fairly large perspective on the problem of looking at synthetic fuels, recognizing that there are no simple choices and recognizing that there be many options which are at least as important in a national energy strategy as the development of synthetic fuels.

I point out in the statement that while often overlooked, conservation is truly one of our least costly supply options. To this extent, I certainly would agree with Mr. Berg, although I do not share his optimism that this bill can produce that goal.

We talk in the statement about the fact that sufficient capital probably will not be forthcoming in this decade, at least, in order to support the entire range of developing energy technologies and that, in fact, if you really want to move ahead on synthetic fuels, some form of government financing will probably be necessary to stimulate new energy technologies.

But I concentrate in my statement on the need to develop criteria by which to judge those synthetic fuels among themselves and between those kinds of options and conservations and other kinds of options.

When criteria are available—and I think such criteria could be written into legislation—deciding which are the most desirable methods of encouraging developments, including full government ownership, tax policy, import controls, et cetera, will be easier. It all depends on the technologies you are looking at and on the energy strategy goals that the Nation is trying to pursue at a given time.

I then move to a statement which describes what I think has been a fundamental flaw in the dialog on this subject as it has emerged. We have too quickly concentrated on specifically financing a given kind of technology rather than just looking at the technology across the board. In essence, when you look at energy development legislation, leaving conservation aside for a moment, what you find is that there are a whole host of bills on the Hill designed to cover three basic parts of development, and it is only by looking at the entirety of those three parts that you can get a full assessment of the total cost of development.

First, you have a whole slug of bills dealing with what I call "front end" assistance, which is subsidies to States and localities who are going to be impacted by this kind of activity. You saw it on the Outer Continental Shelf; you see it in a host of bills to subsidize the development around oil shale areas and particularly around coal areas in the Great Plains.

So you have a whole coterie of bills around this question of front-end assistance.

Second, you have a series of bills associated with problems of financing the actual technology itself, financing the model of the technology and financing the activities around that.

The bill that you are considering today, H.R. 12112, is an example of a loan guarantee program which would finance particular technologies.

The third area is that even once you have developed these technologies, there is the very real possibility that they will produce a product which cannot sell. That it would likely oftentimes cost too much and would not be competitive in the marketplace. So you

have a third kind of subsidy, which is coming back to the Congress and asking for additional authorization to subsidize in the form of price supports, product purchase agreements, tax incentives or low interest loans.

The point is that you must consider all three of these things in order to adequately understand what you are buying when you buy an energy development package.

I then, in the center section of the statement, go into some detail, which I will not do here, about the energy independence authority. There has been some question raised as to the relationship between EIA and this legislation. Our point in going into the energy independence authority was to show that there is not really very much balance in the program presented by the administration. The energy independence authority is their grandest and most comprehensive program. It is not balanced well between conservation and supply options, nor is the synthetic fuels bill balanced well between conservation and supply options.

So the point was to say that there is a nexus, to use the chairman's term, between these two things. And while you can consider them separately, it is well to look at the total packages that the administration is putting forward. These are basically supply dominated packages.

Essentially, we argue then that in any of these things, we must develop a balance in the legislation in order to allow conservation activities to compete with supply activities. We should not give conservation a preference. But we should use criteria that are used right now within the administration, developed by the FEA, for example, to give you a feeling of how much bang you get for the buck.

Essentially, FEA has developed some rather simple formulas for computing the cents per gallon or the dollar per barrel value of conservation and supply oriented options.

What I am saying in essence in this part of the statement is: Simply allow the conservation options to compete against the dollar per barrel equivalent of these large high-technology centralized solutions that you get through the more expensive propositions on the supply side.

If they compete, fine, finance them. If they don't compete, then they lose and you finance the other. But to not have this sense of balance written in the legislation, I think, would be a mistake.

We do point out that there is a crucial question underlying all these debates which is not talked about very much and that is, "How is the Government going to go about dealing with the question of supporting an artificially high price of crude oil?" There are various implications of any kind to a subsidy program as to whether or not, at some point once you are into it, you can afford to walk away from it.

Now you can say, you can take a $4 billion, $6 billion, $11 billion program, dump that much money into it, and allow it to fail. But we do not do it in many other walks of life in our economy. The question has to be raised in the energy sector whether we would be willing to do it here.

The only things that allow these kinds of things—synthetics—to be competitive at all is through the guaranteed assumptions of prices at

least equivalent to, and probably above, world artificially high-price oil prices. So in essence, we argue that that ought to be considered in any analysis.

Specifically, we produced a report back in March which laid the groundwork for understanding the nature of the current proposal. That was essentially reportorial. It did not have much analysis in it. We only had about 6 weeks to produce it. We dumped it on the Congress as a fact sheet, essentially. It says: Here is what ERDA says its program is; here is what we have been able to confirm that ERDA says it is. That study led to more questions than answers.

Out of that study, I determined that we should go back and take another shot at this thing, and we are doing that right now. It is somewhat out of sync with your problems, and I appreciate that. But the only part of my statement I would like to read are the two pages which say what we are studying now so you will have a clear idea of what it is that by the 15th of July we hope to produce, and you can make a judgment whether that would be of use to the Congress in this kind of decision.

Mr. OTTINGER. What are those two pages?

Mr. CANFIELD. Pages 8 and 9.

GAO has undertaken a review which focuses on technologies that have demonstrated technical feasibility but which do seem to have impediments to full commercialization. These impediments are caused by a variety of nontechnical reasons such as financial, environmental, and regulatory. The technologies considered are synthetic fuels, solar and geothermal energy, enhanced oil and natural gas recovery and certain conservation measures. Within this framework we will first address future supply/demand balances to the year 2000 and consider the probable roles of each of these technologies.

We will attempt to determine the current status of each of the technologies and the current impediments to commercialization as well as the pros and cons of various Government options to stimulate financing activity. The options will cover such mechanisms as direct loans, loan guarantees, price guarantees, tax incentives, and Government ownership.

We will then attempt to evaluate what priorities the Government should attach to the various technological options for the purpose of allocating funds or guarantees. In this section we will consider various social and economic goals such as obtaining the most energy at least cost, the maintenance of a competitive environment, economies of scale, tradeoffs between first- and second-generation technologies and the implications of on-budget and off-budget financing. As a conclusion, we will attempt to specify what legislative or policy approaches would, in our judgment, allow the most consistent and systematic consideration of Government role in financing energy commercialization efforts. We will also identify key tradeoffs in this area between the supply and conservation options considered in our report.

As you can see, Mr. Chairman, there are matters requiring closer examination regarding the scope and magnitude of Federal financial support for synthetic fuel and other forms of energy development. We hope that our further study will provide some useful insights on these matters. We plan to complete our study in midsummer which is

around the same general timeframe that ERDA plans to complete its follow-up studies on synthetic fuels.

We are suggesting that information which should be available from ERDA and GAO early this summer, in our case, around the middle of July, should be helpful to the Congress as it proceeds toward a final conclusion on this legislation.

That is a quick summary of my prepared remarks, and we have a copy of the report for the record if you would care to have it. We are prepared to answer questions. But this is, in essence, where we stand on this issue at this time. We are about halfway through this study.

Thank you, Mr. Chairman.

[Mr. Canfield's prepared statement follows:]

STATEMENT OF MONTE CANFIELD, JR., DIRECTOR OF ENERGY AND MINERALS, UNITED STATES GENERAL ACCOUNTING OFFICE

Mr. Chairman and Members of the Committee, we welcome the opportunity to be here today to consider with you the difficult problems of developing and commercializing energy technology. I would like to lay out a perspective and then focus my comments on two things:

An overview of the scope of various legislative proposals now before the Congress that would provide various combinations of Federal financial support for developing and commercializing energy technologies;

A brief description of recent and ongoing GAO work bearing on the question of Federal financial assistance for developing and commercializing energy technologies.

PERSPECTIVE ON ENERGY DEVELOPMENT

A large number of issues and choices face Congress in dealing with energy development. Energy development is a slow process. Legislative action will occur years in advance of actual impacts. While we recognize that legislative decisions will be required without full information, it is important that the Congress and the Nation focus on some critical issues and trade-offs that can enhance the quality of the decisions to be made.

First, there are no simple choices. Each technology has to be weighed against the benefits and costs of competing options. Those options are not only on the domestic production side. For example, while often overlooked, conservation is truely one of our least costly supply options. Consideration of financing conservation improvements as alternatives to, and complements to, large capital-intensive supply technologies is esential to rational decisionmaking.

Second, although no consensus exists among financial experts, sufficient capital will probably not be forthcoming to support the entire range of developing energy technologies. We can't do everything—we must choose. Further, since it is unlikely that private industry will be able to capture the benefits of many of the more expensive and risky research and development options, some form of Government financing will probably be necessary to stimulate new energy technologies. Developing the criteria to choose among competing technologies and choosing the funding levels for each will be difficult, but equally essential.

For each option we should pursue the question: When could the technology be commercialized? Also the energetics, or thermodynamic efficiencies, should be carefully weighed. Such a weighing of the net energy output for each technology, will enable us to make energy efficiency comparisons among competing technologies. Adverse environmental effects and social costs of development must be considered as part of the total cost of any energy development project. Also, external influences, such as dependence on foreign oil, must be considered in choosing among future options and short term security.

Even once a decision is made to pursue a given option, we are not home free. Deciding among the most desirable methods for encouraging development, including various forms of Government ownership, tax policy, import controls, loan guarantees, price supports, etc., all depend upon the technology and the energy strategy and goals.

ENERGY DEVELOPMENT LEGISLATION

With this perspective in mind, it is useful to recognize that there are three main types of legislative proposals to financially assist the development of new energy technologies. Only by looking at all three areas comprehensively can a true picture of the total costs of energy development emerge.

First, what is termed "front-end" assistance is proposed. This amounts to subsidies to states and local governments in regions which are largely rural and unindustrialized to help them plan for development and to provide the public facilities necessary as a result of the development. Assistance could be in the form of loans, loan guarantees, and planning grants.

Second, since private investors are reluctant to build and operate new risky commercial or near-commercial facilities, incentives in the form of loan guarantees, interest subsidies and tax write-offs are proposed.

Finally, even after commercial-sized plants are subsidized and operating, there is a potential that synthetic fuels will be too high priced to compete with alternatives such as domestic oil and coal or oil imports. Therefore, subsidies to producers in the form of price supports or to users in the form of tax incentives or low interest loans have been proposed to enable higher cost technologies to compete in the market place.

For example, legislative proposals have been submitted which would guarantee purchase of products. One would set up a board to purchase synthetic fuels and solar energy, and auction them off to the highest bidder. Some of these proposals cover more than one of the three financing categories discussed; but none is truly comprehensive. The point is that no one piece of proposed legislation covers in any comprehensive way the entire range of financial support being considered.

ENERGY INDEPENDENCE AUTHORITY

The Administration's most comprehensive energy development proposal would establish an Energy Independence Authority (EIA). The bill, S. 2532, would encourage the development and commercial operation of domestic energy sources and to a lesser extent, encourage energy conservation. A total of $100 billion would be available to the EIA. The proposal would authorize direct investment in energy technologies, loans, loan guarantees, and price guarantees.

Our central concern lies in the proposal's lack of balance. The bill exhibits a clear perference for initiatives of the supply-increasing variety. According to one provision of the bill the conservation projects eligible for funding appear to be those not in widespread use. This would appear to preclude, for example, assistance to a utility-administered residential insulation project, since home insulation is already in "widespread domestic commercial use." No equivalent condition is attached to supply increasing projects.

The bill would hamper conservation efforts rather than simply fail to promote them. This is true because the bill would result primarily in the allocation, not creation of capital. The EIA's loan funds would, in large part, be raised in the private capital market. Its guarantees would make projects it assists financially more attractive to private capital than conservation projects not backed by Federal guarantees. Thus, both its loans and its guarantees will siphon private capital away from conservation projects which might have been able to obtain private financing in the absence of EIA operations.

The choice of projects to receive financial assistance, and the form of assistance, ought to be based upon reasonable forecasts of the degree to which each project will advance the goal of independence per dollar of assistance accorded it. We believe that many initiatives in the direction of conservation hold the promise of moving the country farther down the road toward energy independence per dollar spent than do most supply increasing options.

In addition, the bill is underlaid by some assumptions regarding national policy which are by no means settled. Its predilection toward nuclear power generation is the most obvious example. Another is seen in its willingness to give the Government a large quasi-commercial interest in energy supplies which would be in competition with imported crude oil. Since the bill does nothing to limit imports directly, the underlying assumption appears to be that world crude prices will stay high enough to insure the profitability of the EIA's investments in alternative domestic supplies. Thus, the Government would have a

financial interest in keeping world crude prices artifically high. We believe that legislation regarding financial support for synthetic fuels and other energy development should be coordinated in a systematic fremework which includes all the likely costs associated with development and detail on the mix, number, and size of plants, and types of financial support needed for each. Specifically, adequate financing for synthetic fuels commercialization requires further information, analysis, and evaluation of many factors, particularly the arrangements for subsidies or price supports which may be necessary to make synthetic fuels competitive. Subsidies or price supports in turn raise the question of Government energy pricing policy. For example, oil and gas prices are being held down by regulations while it appears that it would be necessary to subsidize higher cost synthetic fuels. While legislation on energy development need not be comprehensive, it should seem obvious that a balanced and consistent energy strategy can provide a useful framework within which individual proposals can be evaluated.

SYNTHETIC FUELS REPORT

Our March 1976 report discussed an Administration proposal to authorize ERDA to provide up to $6 billion in loan guarantees for, among other things, commercial demonstration facilities for the production of synthetic fuels. To encourage industry to participate in synthetic fuels commercial demonstration programs the Administration recommended Government incentives consisting of loan guarantees, price supports, and construction grants.

Because of time constraints we did not evaluate the pros and cons of the various forms of Federal assistance considered by the Administration in arriving at its recommendation in that report. We did note, however, that important policy and judgmental questions were involved in arriving at the recommendations. A different emphasis on certain considerations such as impact on the budget, degree to which an alternative preserves and enhances competition, ability to achieve program goals, and extent of Federal involvement in management of operations—could conceivably lead to a different choice of alternative forms of assistance.

We stated our view that the Congress should consider awaiting further studies which ERDA expects to complete in July 1976 before approving any legislation. The studies should provide better information on the scope and magnitude of Federal assistance needed to carry out the programs, including better information on the type and number of plants needed.

ON-GOING GAO WORK

GAO has undertaken a review which focuses on technologies that have demonstrated technical feasibility but which do seem to have impediments to full commercialization. These impediments are caused by a variety of non-technical reasons such as financial, environmental, and regulatory. The technologies considered are synthetic fuels, solar and geothermal energy, enhanced oil and natural gas recovery and certain conservation measures. Within this framework we will first address future supply/demand balances to the year 2000 and consider the probable roles of each of these technologies. We will attempt to determine the current status of each of the technologies and the current impediments to commercialization as well as the pros and cons of various Government options to stimulate financing activity. The options will cover such mechanisms as direct loans, loan guarantees, price guarantees, tax incentives and Government ownership.

We will then attempt to evaluate what priorities the Government should attach to the various technological options for the purpose of allocating funds or guarantees. In this section we will consider various social and economic goals such as obtaining the most energy at least cost, the maintenance of a competitive environment, economies of scale, tradeoffs between first and second generation technologies and the implications of on-budget and off-budget financing. As a conclusion, we will attempt to specify what legislative or policy approaches would, in our judgment, allow the most consistent and systematic consideration of Government role in financing energy commercialization efforts. We will also identify key tradeoffs in this area between the supply and conservation options considered in our report.

As you can see, Mr. Chairman, there are matters requiring closer examination regarding the scope and magnitude of Federal financial support for synthetic fuel and other forms of energy development. We hope that our further study will provide some useful insights on these matters. We plan to complete our study in

mid-summer which is around the same general timeframe that ERDA plans to complete its follow-up studies on synthetic fuels.

I want to emphasize that our study not only addresses the fundamental question of whether early commercialization of synthetic fuel technology should be pursued as aggressively as the Administration proposed but also the broader question of how this country can best provide for its future energy needs.

In summary, we are suggesting that information which should be available from ERDA and GAO this summer should be helpful to the Congress as it proceeds toward final legislative action on H.R. 12112 or any of the other bills currently in Congress dealing with the Federal financial support for construction costs, price supports, and intial costs to State and local governments.

Mr. Chairman, this concludes my prepared statement. We will be glad to respond to questions.

Mr. DINGELL. The committee thanks you for your testimony. You have always been most helpful to us and we appreciate your being here.

Mr. OTTINGER. I have some questions of Mr. Canfield.

If you want me to hold——

Mr. DINGELL. I think it would be in the best interest.

We have Dr. Cazalet who has a statement.

Mr. DINGELL. Dr. Cazalet.

STATEMENT OF EDWARD G. CAZALET, PH. D.

Mr. CAZALET. Thank you, Mr Chairman. I ask that my complete study and prepared testimony be put in the record, including the figures.

Mr. DINGELL. Your full testimony will be put in the record and we are glad to recognize you for such summaries as you wish.

Mr. CAZALET. My statement is based on my consulting work for the Synthetic Fuels Interagency Task Force and for other Government Agencies and private energy companies.

In my work for the task force, I directed a team of SRI analysts who worked closely with Government experts and analysts in performing and analyzing of synthetic fuels commercialization policy.

In making this statement, however, I do not represent the task force or SRI or any of the other organizations for which I have consulted in this field. All the information that I will quote here today is publicly available and much of it is in the volumes produced by the task force on the analysis itself.

The most important factor, I think, affecting the decisions on commercializing synthetic fuels is the size of future markets for synthetic fuels. Attached to my prepared statement are some figures at the back that I will be referring to.

Figures 1 and 2 show the total quantity of synthetic fuels that will be produced and demanded under a range of assumptions concerning synthetic fuels cost and imported oil prices.

The vertical scale on both those figures expressed in quadrillions of Btu's per year on the left and, in more familiar terms, of millions of barrels per day of oil equivalent on the right.

Just for comparison, the total U.S. oil and gas consumption in 1975 was about 26 million barrels per day. As you can see, the horizontal scale spans the next 50 years, a very long period of time.

The nominal or middle case shows present production at about 10 million barrels per day in the year 2000. This is the figure that Dr. Fri was quoting earlier.

Of course, many assumptions underlie the nominal case. For example, the nominal case assumes the imported oil price will increase continuously to about $18 per barrel in the year 2000. This is a 1975 dollar figure. So, the actual price will be $18 per barrel plus inflation.

The low import price case shown in figure 1 assumes import prices drop to about $8 per barrel and then rise to current levels by the year 2000, again, expressed in current terms, 1975 dollars.

The assumption of low import prices reduces the projected synthetic fuel production considerably to about 2 million barrels per day in 1995.

The assumption of high import prices, $3 per barrel higher than for the nominal case, increases synthetic fuels production only slightly.

Clearly, you can see the market potential is highly dependent on imported oil prices. You get a similar effect of the market for synthetic fuels by looking at changes in the price you will have to pay for synthetic fuels.

The nominal case projections assume synthetics on the average would cost $15 per barrel at the plant. If the cost of synthetic fuels is at the high end of range of uncertainty, about $22 per barrel, the production of synthetic fuels is reduced considerably.

On the other hand, if the cost is only $12 per barrel, there is a slight increase in the production over the nominal case.

So, figures 1 and 2 illustrate the great uncertainty we face in the size of the future synthetic fuels market. Of course, joint variations in the synthetic fuels and imported fuel costs wold produce even wider variations in synthetic fuels production.

Figures 3 and 4 show the effects of changes and other important assumptions, namely, the availability of oil and gas, natural forms of oil and gas in the United States and the growth in total end use demand for energy.

As you can see, uncertainty about those variables is less important in terms of a market for synthetic fuels and imported fuels.

I might also note there are a number of other variables which you might think would be very important in affecting your decision on synthetic fuels. For example, a national nuclear moratorium would not significantly affect synthetic fuels production because the best alternative to nuclear power production is coal. Synthetic fuels would be considerably more expensive than either coal or nuclear.

The uncertainty in this market potential is illustrated by these figures, and as many others have concluded from their analyses, this uncertainty is a major reason why commercial synthetic fuels projects have not proceeded.

Presently, this uncertainty is reflected in terms of the inability of private companies to raise financing for proceeding with their programs. Thus, many companies have concluded the only way a synthetic fuels industry can develop at this time is with Government loan guarantees or other incentives.

As many others have pointed out, a decision on Government guarantees must take account of a broad range of international, environmental and economic issues in addition to the market economics faced by private industry.

Synthetic fuels are a substitute for imported fuels. Dependence on

foreign supply for these imported fuels involves such concerns as international relations, balance of payments and exposure to future embargoes.

In other words, dependence on synthetic fuels involves environmental consequences and large capital investments.

Also, early development of a synthetic fuels industry would reduce uncertainty about synthetic fuels technology and contribute to lower costs for later synthetic fuels plants through development of infrastructure and learning about the technology.

Many of these important issues are not fully accounted for in corporate decisionmaking and, therefore, must be accounted for in the Government's decision.

The Synthetic Fuels Task Force, with the assistance of SRI, performed a comprehensive analysis of four levels of synthetic fuels commercialization programs. These have been referred to by earlier witnesses.

The levels involve no program, an information level program of 350,000 barrels per day by 1985, a medium level program of a million barrels per day, and a maximum program of 1.7 million barrels per day.

It is a little tough for me to judge where the present proposed program fits relative to these alternatives. The 350,000 barrels per day program originally required approximately $6 billion in loan guarantees and about $41½ million in price supports.

So, the proposed program appears to be somewhat smaller than the 350,000 barrels per day program. The analysis also assumed that coal liquids and full-scale shale plants would be included in the programs.

The analysis considered several thousand possible outcomes under varying conditions of imported oil prices, synthetic fuel costs, domestic energy supply and demand and future corporate synthetic fuels adjustment.

Judgments by the task force on those crucial factors were made explicit in the analysis. The overall measures of net benefit produced by the analysis reflect all significant categories of cost and benefit with the exception of specific international relations categories that I will describe shortly.

As shown in figure 5, the expected costs of all commercialization program levels exceed the benefits. Relative to no Government program, the expected discounted net benefits, in 1975 dollars, are minus $1.6 billion for the information level, minus $5.4 billion for the medium, and minus $11 billion for the maximum program.

It is important to note there is considerable uncertainty in the ultimate net benefit. The uncertainty is explicitly accounted for in the analysis by weighting the net benefit of each outcome by the probability that it will occur.

The analysis showed, for the information program as an example, that there was a 10 percent chance that the net benefit of this information program would exceed 7 billion. In other words, the Nation would be better off by $7 billion.

On the other hand, the same analysis showed there is a 10 percent chance the net loss would exceed $9 billion. The net loss is what you spend less what you get back.

When the benefit levels are properly weighted by the corresponding probabilities, as judged by the task force, the resulting expected net benefit is negative.

The most important single factor affecting the net benefit of a synthetic fuels commercialization program is strength of the oil producers' cartel. A strong oil producers' cartel in 1985 was judged to increase prices of imported oil by $4 to $9 per barrel over the prices that would occur with a weak cartel.

The probability of a strong cartel existing in 1985 was assessed at 50 percent by the task force. Figure 6 shows how the net benefit of the synthetic fuels program levels are affected by the probability assigned to a strong cartel in 1985.

The vertical scale measures net benefit, the horizontal scale is the probability assigned to a strong cartel in 1985. If a weak cartel occurs then all program levels have highly negative benefits.

On the other hand, if a strong cartel occurs, all levels have positive net benefits. Assuming all other factors are held constant, the break-even probability required to justify a synthetic fuels program is 80 percent.

If you believe that the likelihood of a strong cartel in the mid-1985's exceeds 80 percent, then this analysis indicates you should support the program. On the other hand, if you feel a strong cartel is much less likely in 1985, holding all other factors constant, would indicate you should not support the synthetic fuels program.

Wide differences of opinion on the probability of a continuing strong cartel exist. Some argue that the free market always prevails and, therefore, they advocate assigning a very low probability of a strong cartel existing.

Others assign a high probability of a strong cartel on the basis that unless we believe the cartel will remain strong, we will not take the necessary actions to help weaken the cartel. Neither extreme, of course, is correct.

Clearly, the assessment of the strength of the cartel is a difficult judgment, but it is one that must be made on the basis of the best available information in order to formulate a wise policy on synthetic fuels.

Three categories of overall benefit were defined in the analysis: economic benefit, dependence costs and environmental and socioeconomic costs.

Economic benefit is the difference between what the country would pay for fuels without a synthetic fuels program and what it would pay with a synthetic fuels program. The net economic benefit of the information level program as excluding the other categories of benefit was a negative $1.7 billion loss. This was because the expected synthetic fuels costs are higher than the expected imported fuels cost.

The central question is, do the noneconomic benefits outweigh the economic costs of the program? Dependence costs, one of the other categories, include future embargo losses, balance of payments cost and international relations costs.

The analysis credited a synthetic fuels program with any reductions in dependence costs that would result from substituting synthetic fuels for imported fuels. Assuming the probability of another embargo to be 10 percent a year, the information level synthetic fuels program is credited with a $400 million reduction in expected embargo loss.

This reduction may appear small, but the amount of synthetic fuels produced by the program is also small relative to total imports and large reductions in import. As a result, synthetic fuels could only occur under conditions where synthetic fuels are much cheaper than imports, and this event does not have a probability of 100 percent.

With respect to concern about the future, it is worth noting that a strategic storage program is a much more effective alternative for reducing embargo losses. On the same basis as the synthetic fuels analysis, a storage program of 600 million barrels has an expected positive benefit of $9 billion as compared to the $1.6 billion net loss of an informational level program.

The effect of a synthetic fuels program on U.S. balance of payments was judged as insignificant. Possible reductions in imports over the long life of a synthetic fuels plant would be balanced by reductions in U.S. exports of other goods, directly or indirectly to the nations from which we would buy the imported oil.

Thus, there would be no significant net impact on U.S. employment, tax revenues, or gross national product. In other words, the balance of payment effects on this synthetic fuels decision can be safely ignored.

International relations costs or benefits could include demonstrations to other nations of U.S. resolve to be a world leader in energy or perhaps the economic benefits to other nations of a U.S. program. But, the crucial international relations issue is whether U.S. foreign policy interests would be improved or degraded by reduced imports of fuel from other nations.

The task force analysis was unable to draw any official conclusions of this benefit category and the $1.6 billion net negative benefit for the information level program does not assign any costs or benefits to the international relations effect.

The implication is that those who assign a high positive benefit to the international relations effect, greater than the $1.6 billion, should support a synthetic fuels commercialization program.

Another way to illustrate the importance of the international relations issue is to consider the effect of import quota on the value of a synthetic fuels program. If the Government should adopt a quota at about the current level of imports of 6 million barrels per day, the information level program would have a strongly positive net benefit of about $5 billion.

On the same basis, however, the cost to the Nation of the import restrictions of this quota would be a minimum of $44 billion, so that a synthetic fuels program would make up for only a small portion of losses that would be imposed by a quota to reduce our dependence on foreign supplies.

The greatest single contribution to benefits of a synthetic fuels program is the effect of a program in providing information to reduce future synthetic fuels costs.

This information would include information on environmental, on regulatory and other matters that might increase the cost of building a plant or delay its construction.

One of the major reasons for uncertainty at this time in the cost of synthetic fuels results from uncertainty about interruptions of construction due to legal actions over environmental standards. Thus,

there can be uncertainty in the plant costs even when the technology is moderately well known.

The information program is judged to reduce 1995 synthetic fuels costs by $1.50 per barrel. Without the inclusion of this effect in the analysis, information level program represents not a $1.6 billion loss, but a $3.2 billion net negative benefit.

The program, however, would not resolve uncertainty in the cost of imported fuels. Thus, private corporations may still face considerable market uncertainty, say, in 1985, even after the major uncertainties are resolved.

An attractive feature of the program is that it would pay off if the Nation should face the very bad outcome of high import prices imposed on it by a strong cartel. On the other hand, if import prices are very low, the program would be regarded as having been very costly.

If the Nation were sufficiently risk-adverse, then only the unfortunate case of high import prices—well above the cost of the synthetic fuels, $18, $20 a barrel in today's dollars—would be relevant to the analysis.

In this case, the synthetic fuels program would have reduced the total cost of energy to the Nation. The program would be regarded as highly beneficial to the Nation. The analysis, however, explicitly considered the various levels of national risk adversion that might be appropriate and it was found that unacceptably high level of risk aversion would be required to justify the program.

Finally, I must emphasize that all available long-range projections of future energy supply and demand tell us that synthetic fuels of some sort will ultimately be needed in the energy market. Only the timing of this event is uncertain.

Moreover, the task force analysis says nothing about the benefits of continued research and development on synthetic fuels. This is a separate matter and presumably continued research and development including the construction of modules of potentially commercial plants is beneficial.

Government decisions on the commercialization of synthetic fuels involve the commitment of large amounts of natural resources. Regardless of whether the Government incentives take the form of loan guarantees, price supports, capital grants, tax relief or regulatory changes, it is the consumer who pays the bill.

Since Government decisions are not subject to the normal economic checks and balances of the market places, it is essential that decisions on synthetic fuels commercialization be based on the best available analysis and expert judgment and not on the emotions of the moment.

That concludes my testimony. I will be happy to answer any questions.

[Mr. Cazalet's prepared statement follows:]

STATEMENT OF DR. EDWARD G. CAZALET, MANAGER, DECISION ANALYSIS-ENERGY, STANFORD RESEARCH INSTITUTE, MENLO PARK, CALIF.

Mr. Chairman and members of the committee: I am pleased to be here today to discuss the synthetic fuels bill (HR 12112). My statement is based on my consulting work for the Synthetic Fuels Interagency Task Force and for other government agencies and private energy companies. In my work for the Synthetic Fuels Task Force I directed a team of SRI analysts who worked closely

with government experts and analysts to conduct an overall cost/benefit analysis of synthetic fuels commercialization policy. In making this statement I do not represent the Synthetic Fuels Task Force, SRI, or any of the other organizations for which I have consulted. All of the information I will quote today is publically available and much of it is documented in Volume II of the report by the Synthetic Fuels Task Force.[1]

I think most of us agree that decisions concerning government incentives for synthetic fuels commercialization are very complicated. Necessarily, many of the factors affecting the desirability of government support for synthetic fuels are uncertain or involve difficult value judgments. For example, the future costs of imported oil and synthetic fuels are highly uncertain and have a major impact on the ultimate market for synthetic fuels. Also, value judgments on the indirect international relations effects of depending on imported fuels are clearly central to the decision on the synthetic fuels bill. In my statement I will focus on these and other important factors affecting this decision.

The most important economic factor affecting decisions on commercializing synthetic fuels is the size of the future market for synthetic fuels. Figures 1 and 2 show the total quantity of synthetic fuels that would be produced under a range of assumptions concerning synthetic fuels costs and imported oil prices. The vertical scale on the figures is expressed in quadrillions of Btu's per year on the left and millions of barrels per day of oil equivalent on the right. (For comparison, the total U.S. oil and gas consumption in 1975 was about 26 million barrels per day.) The horizontal scale spans the next fifty years.

The nominal or middle case shown in both figures projects synthetic fuels production at about 10 million barrels per day in the year 2000. Many assumptions underlie the nominal case. For example, the nominal case assumes the imported oil price will increase continuously to about $18 per barrel in 1975 dollars by the year 2000. The low import price case in Figure 1 assumes import prices drop to about $8 per barrel and then rise to current levels by the year 2000. The assumption of low import prices reduces the projected synthetic fuel production considerably. The assumption of high import prices, $3 per barrel higher than for the nominal case, increases synthetic fuels production only slightly. Clearly, the market potential for synthetic fuels is highly dependent on imported oil prices.

The cost of synthetic fuels is also an important determinate of the size of the synthetic fuels. The average cost of synthetic fuels in the nominal case is about $15 per barrel at the plant. If the cost of synthetic fuels is high, $22 per barrel, the production of synthetic fuels is reduced considerably. If the cost of synthetic fuels is only $12 per barrel there is a slight increase in production over the nominal case.

Figures 1 and 2 illustrate the great uncertainty in the size of the future synthetic fuels market. Joint variations in synthetic and imported fuel costs would produce even wider variations in synthetic fuels production.

Other variables affect synthetic fuels production but not to the same degree as imported oil prices and synthetic fuels cost. Figures 3 and 4 show the effect of changes in assumptions regarding domestic oil and gas availability and end-use total energy demand. Uncertainty about these variables is less important than uncertainty about synthetic and imported fuel prices.

Some variables while important for other reasons, have no effect on synthetic fuels production. For example, a national nuclear moratorium would not significantly affect synthetic fuels production because the best alternative to nuclear for electric power production is coal.

The uncertainty in the market potential as illustrated by these figures is a major reason why commercial synthetic fuels projects have not proceeded. Presently this uncertainty is reflected in terms of the inability of private companies to raise capital for synthetic fuels projects. Thus many companies have concluded that the only way a synthetic fuels industry can develop at this time is with government loan guarantees and other incentives.

A decision on government guarantees and incentives for synthetic fuels must take account of a broad range of international, environmental and economic issues in addition to the market economics faced by private industry. Synthetic fuels are a substitute for imported fuels. Dependence on imported fuels involves

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[1] "Recommendations for a Synthetic Fuels Commercialization Program: Volume II—Cost/Benefit Analysis" report submitted by the Synthetic Fuels Interagency Task Force to the President's Energy Resources Council, November 1975, for sale by the U.S. Government Printing Office, Washington, D.C., 20402, price $4.20, stock number 041-001-00111-3.

such concerns as international relations, balance of payments and exposure to future embargoes. On the other hand, dependence on synthetic fuels involves environmental consequences and large capital investments. Also, early development of a synthetic fuels industry would reduce uncertainty about synthetic fuels technology, and contribute to lower costs for later synthetic fuels plants through development of infrastructure and technological learning. Many of these important issues are not fully accounted for in corporate decision making and therefore must be accounted for in the government's decision.

The Synthetic Fuels Task Force with the assistance of SRI, performed a comprehensive analysis of four levels of synthetic fuels commercialization programs: no program; an information program of 350,000 barrels per day by 1985; a medium program of 1,000,000 barrels per day; and a maximum program of 1,700,000 barrels per day. The analysis considered several thousand possible outcomes under varying conditions of imported oil prices, synthetic fuel costs, domestic energy supply and demand and future corporate synthetic fuels investment. Judgments by the task force on crucial factors were made explicit in the analysis. The overall measures of net benefit produced by the analysis of specific international relations categories that I will describe shortly.

As shown in Figure 5, the expected costs of all commercialization program levels exceed the benefits. Relative to no government program, the expected discounted net benefits (in 1975 dollars) are: 1.6 billion for the information program; 5.4 billion for the medium program; and 11.0 billion for the maximum program.

It is important to note that there is considerable uncertainty in the ultimate net benefit. This uncertainty is explicitly accounted for in the analysis by weighting the net benefit of each possible outcome by the probability that it will occur. The analysis showed, for the information program, that there was a 10 per cent chance that the net benefit of this information program would exceed 7 billion dollars and correspondingly, a 10 per cent chance that the net loss would exceed 9 billion dollars. When the benefit levels are properly weighted by their corresponding probability the resulting expected net benefit is negative.

The key factor affecting the net benefit of a synthetic fuels commercialization program is the strength of the oil producers' cartel. A strong oil producers' cartel in 1985 was judged to increase prices of imported oil by 4 to 9 dollars per barrel over that of a weak cartel. The probability of a strong cartel existing in 1985 was assessed at 50 per cent by the task force. Figure 6 shows how the net benefit of the synthetic fuels program levels are affected by the probability assigned to a strong cartel in 1985. The vertical scale measures net benefit; the horizontal scale is the probability assigned to a strong cartel in 1985. If a weak cartel occurs all program levels have highly negative net benefits; if a strong cartel occurs all program levels have positive net benefits. Assuming all other factors are held constant, the breakeven probability required to justify a synthetic fuels program is 80 per cent.

Wide differences of opinion on the probability of a continuing strong cartel exist. Some argue that the free market always prevails and therefore they advocate assigning a very low probability of a strong cartel existing. Others assign a high probability of a strong cartel on the basis that unless we believe the cartel will remain strong we will not take the necessary actions to help weaken the cartel. Neither extreme is correct. Clearly the assessment of the strength of the cartel is a difficult judgment but it is one that must be made on the basis of the best available information in order to formulate a wise policy on synthetic fuels.

Three categories of overall benefit were defined by the analysis: economic benefit, dependence costs and environmental and socioeconomic costs. Economic benefit is the difference between what the country would pay for fuels without a synthetic fuels program and what it would pay with a synthetic fuels program. For example, the net economic benefit of the information level program is negative, a 1.7 billion dollar net loss because the expected synthetic fuels costs are higher than the expected imported fuels costs.

Dependence costs include future embargo losses, balance of payments costs and international relations costs. The analysis credited a synthetic fuels program with any reductions in dependence costs that would result from substituting synthetic fuels for imported fuels. Assuming the probability of another embargo to be 10 per cent per year, the information level synthetic fuels program is credited with 400 million dollar reduction in expected embargo loss. This reduction may appear small but the amount of synthetic fuels produced by the program is also small relative to total imports and large reductions in imports as a result of syn-

thetic fuels only occur under conditions where synthetic fuels are much cheaper than imports.

With respect to concern about future embargoes, it is worth noting that a strategic program is a much more effective alternative for reducing embargo losses. On the same basis as the synthetic fuels analysis, a storage program of 600 million barrels has an expected positive net benefit of 9 billion dollars.

The effect of a synthetic fuels program on U.S. balance of payments was judged by the task force as insignificant. Possible reductions in imports over the long life of a synthetic fuels plant would be balanced by reductions in U.S. exports of other goods. Thus, there would be no significant net impact on U.S. employment, tax revenues, or gross national product. In other words, the balance of payment effects on this synthetic fuels decision can be safely ignored.

International relations costs or benefits could include demonstration to other nations of U.S. resolve to be a world leader in energy or perhaps the economic benefits to other nations of a U.S. program. But the crucial international relations issue is whether U.S. foreign policy interests would be improved or degraded by reduced imports of fuel from other nations. The task force analysis was unable to draw any firm conclusions on this benefit category and the 1.6 billion dollar net negative benefit for the information level program does not assign any costs or benefits to the international relations effect. The implication is that those who assign a high positive benefit to the international relations effect (greater than the 1.6 billion dollar loss) should support a synthetic fuels commercialization program.

Another way to illustrate the importance of the international relations issue is to consider the effect of an import quota on the value of a synthetic fuels program. If the government should adopt a quota at about the current level of six million barrels per day of imports, the information level program would have strongly positive net benefits of about 5 billion dollars. On the same basis, however, the cost to the nation of the import restrictions would be 44 billion dollars.

The final category of benefits includes environmental and socio-economic costs. The costs of complying with present and future environmental standards and providing for a portion of the community infrastructure are included in the costs of synthetic fuels. The high level of uncertainty about environmental and socio-economic costs is one reason for the uncertainty in the cost of synthetic fuels.

The economic costs of synthetic fuels do not include the social costs of synthetic fuels associated with residual air emissions, water quality and depletion, land disturbance, health and safety, and social disruption impacts. The cost/benefit analysis utilized rough judgments on the equivalent dollar costs of these impacts. The total discounted external environmental cost of the information level program was about 400 million dollars. Coincidentally, this cost approximately balances the embargo costs associated with imported fuels.

The greatest single contribution to benefit of a synthetic fuels program is the effect of the program in providing information to reduce future synthetic fuels costs. This information would include environmental and institutional information. The information program was judged to reduce 1995 synthetic fuels costs by $1.50 per barrel. Without the inclusion of this effect in the analysis, the information level program would represent not a 1.6 billion dollar loss, but a 3.2 billion dollar loss.

The analysis also assumed that the program would reduce the range of uncertainty in synthetic fuels costs. The program, however, would not resolve uncertainty in the cost of imported fuels. Thus, private corporations may still face considerable market uncertainty, even after the major technological uncertainties are resolved.

An attractive feature of a synthetic fuels program is that it would pay off if the nation should face the bad outcome of high imported oil prices. On the other hand, if imported oil prices are very low, the program will be regarded as having been very costly. If the nation were sufficiently risk averse, then only the unfortunate case of high import prices would be relevant to the analysis; in this case, synthetic fuels could reduce the total cost of energy and the program would be regarded as highly beneficial. The analysis, however, explicitly considered various levels of national risk aversion, and it was found that an unacceptably high level of risk aversion would be required to justify the expected net cost of a program.

Finally, I must emphasize that all projections of future energy supply and demand tell us that synthetic fuels will ultimately take their place in the market: only the timing of this event is uncertain. Moreover, the task force analysis says nothing about the benefits of continued research and development on synthetic

fuels, presumably continued research and development, including the construction of modules of potentially commercial plants, is beneficial.

Government decisions on the commercialization of synthetic fuels involve the commitment of large amounts of national resources. Regardless of whether the government incentives take the form of loan guarantees, price supports, capital grants, tax relief, or regulatory changes, it is the consumer who pays the bill. Since government decisions are not subject to the normal economic checks and balances of the market place, it is essential that decisions on synthetic fuels commercialization be based on the best available analysis and expert judgment and not on the emotions of the moment.

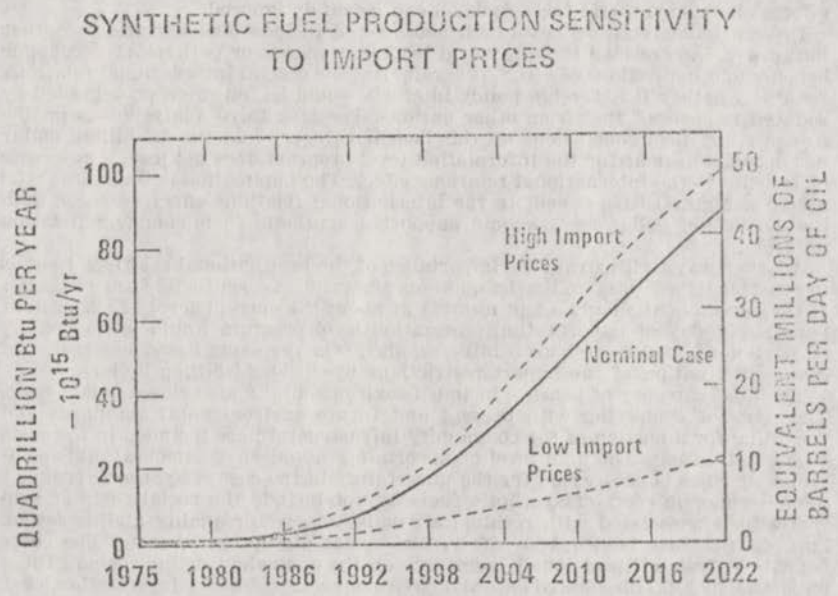

FIGURE 1

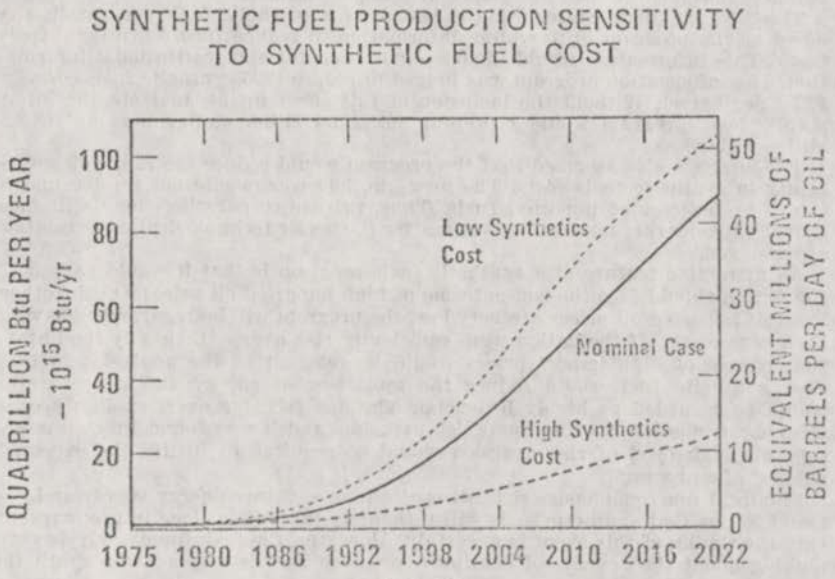

FIGURE 2

SENSITIVITY OF SYNTHETIC FUEL PRODUCTION TO U.S. GAS AND OIL RESOURCE POSITION

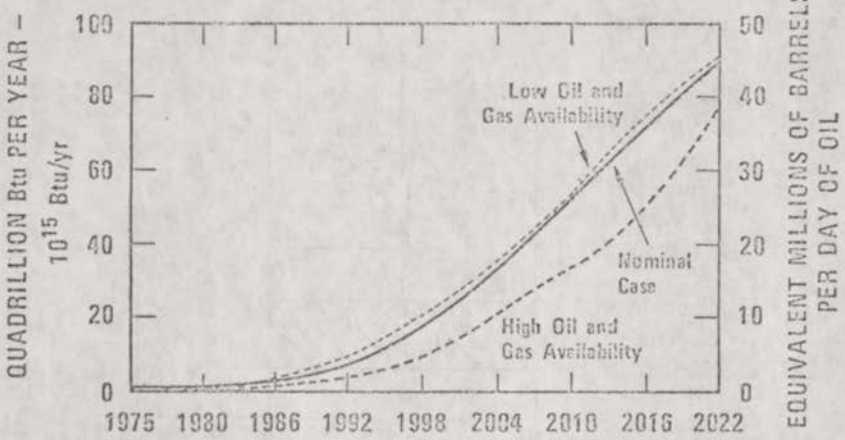

FIGURE 3

SYNTHETIC FUEL PRODUCTION SENSITIVITY TO TOTAL DEMAND

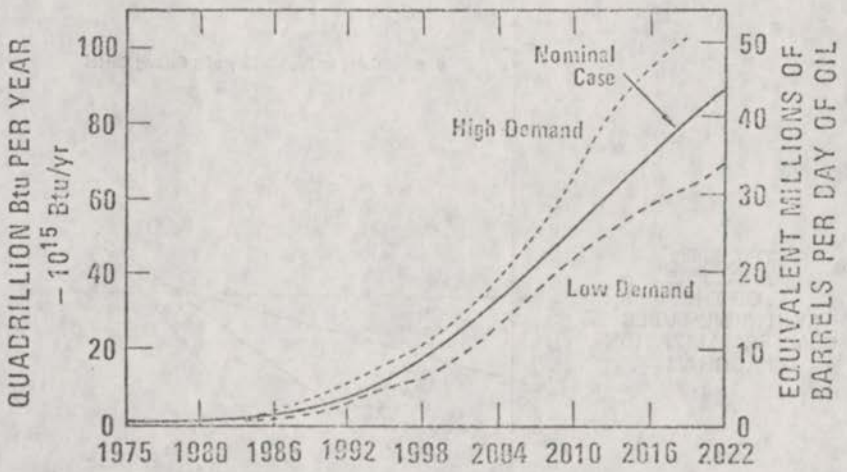

FIGURE 4

DECISION ANALYSIS OF THE SYNTHETIC FUELS COMMERCIALIZATION PROGRAM

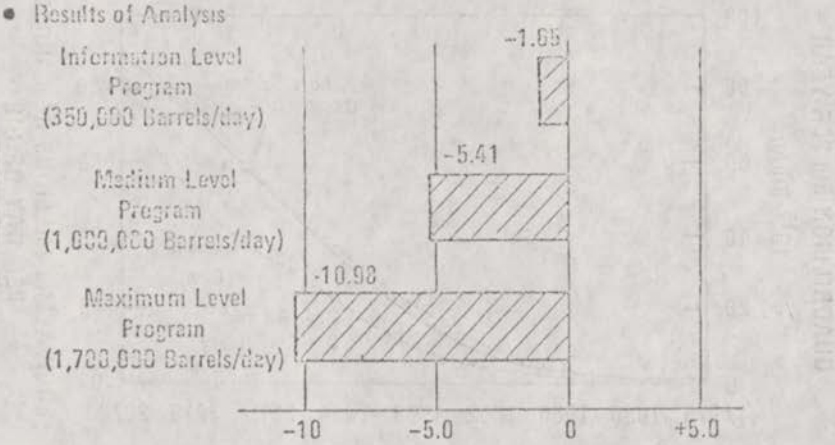

FIGURE 5

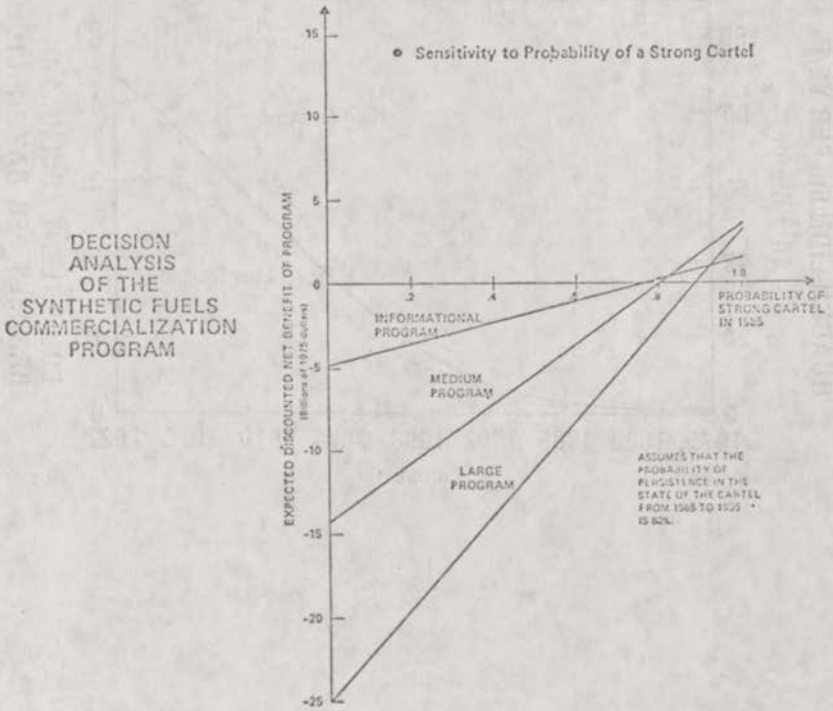

FIGURE 6

Mr. DINGELL. Mr. Cazalet, we thank you.

The Chair recognizes the gentleman from New York, Mr. Ottinger.

Mr. OTTINGER. Thank you, Mr. Chairman. I thank you both for your very informative statements.

Mr. Canfield, I have a couple of questions directed to you. I am encouraged by the study you are doing. I think it is important that it be done.

I wonder why in your study you restricted yourself to the specific energy options included and why you did not include a comparison of the direct burning of coal as I think the No. 1 question, with the necessary equipment necessary to clean up the air if coal is just and No. 2 is kind of a fascinating option that is on the horizon that has not been pursued much by ERDA; that is, hydrogen separation, separation of hydrogen from water, using hydrogen as the basic fuel of our economy and whether you might not consider expanding your study to include those two options.

Mr. CANFIELD. We have a major study going on now, some 3,500 staff days, as a matter of fact. It is the largest study that has been undertaken by my office on the future of coal and all its aspects, including direct burning as well as its use to make synthetics. And the information gathered in that study will provide input here. However, we wanted in this study, particularly, to look at some of the technologies which were on the shelf and were not occurring in this country, at least, in this point in time.

I would not have any objection to looking at the hydrogen option. I have a feeling that when we look at it we may find that it is not as close down the road as some of the others. I think that is probably why the staff excluded it. I do not have any problem going back and taking a second look at that.

Mr. OTTINGER. When is your coal study due for completion?

Mr. CANFIELD. It is a big one. It will not be completed until January of next year. We were hoping that it would be useful to the Congress when it considers a whole variety of coal issues coming up after the election is over, and that is what we are timing it for. It is the third in a series of supply option studies we are undertaking.

Mr. OTTINGER. I am very encouraged to hear that, but won't the results of that study have direct impact on what kind of legislation we should or should not pass with respect to encouraging synthetic fuels, both gasification of coal and the development of oil from oil shale?

Mr. CANFIELD. I think it could if you would wait long enough. But since it is not coming around for a while, it is going to be tough to have an impact on your decisions. We do have a timing problem. I think all other things being equal, I would like to take this hard look at the coal issue. It is the only thing in the so-called second phase of Project Independence, the National Energy Outlook, that did not change much. It says that we are still going to double coal production in the next 10 years, and I am highly skeptical of that. And we want to take a very hard look at whether that is possible and literally ask the question, "Can you get there from here?" That is what this study does.

There is no way we will be able to complete it or significant parts of it in time to help you very much on this year's decision, this year's problems. That is one of the reasons why we did this more intense, quick look at some alternatives to synthetics. For example, the tradeoffs between synthetic and secondary and tertiary oil recovery. The economics of secondary-tertiary recovery looks pretty good relative to synthetics. We thought we at least should look at that. We will go back and look at hydrogen. However, there is no way on God's earth we can get it done this year.

Mr. OTTINGER. Does this study also look at the potential of Outer Continental Shelf oil?

Mr. CANFIELD. Not as an alternative to synthetics. We know what the costs of that is, and we can anticipate what its future cost will be. We will consider these kinds of options against the synthetics. But we won't do any additional analysis of it. We are going to take the information that is available.

Mr. OTTINGER. It just impresses me if we are really going to make a sound decision in this area, it would be very valuable to have that study available to us.

Sam Hughes, when he testified before the Science Committee, said that he was very much concerned about the type of loan guarantees that are being suggested in this legislation, and he concluded:

> I think my feeling we would like to consider further, my feeling would be that the total loan guarntee should be in the budget because of the fact that it is, in effect, a contract authority to take out the particular financial institution if the project goes sour.

This is language leading up to that, basically he says this is a different form of loan guarantee than you get in your traditional veterans loan or housing insurance loan.

And I wonder whether GAO has thought about this future further and come to any more firm conclusion.

Mr. CANFIELD. It is one of the sections of our analysis, and we have not come to any additional conclusions, but we have a separate special section dealing with implication of on-budget off-budget alternatives directly in response as to what he said at that hearing. So that will be part of the report which we will release in mid-July.

Mr. OTTINGER. In mid-July?

Mr. CANFIELD. Yes, sir. Our target date—which I think is optimistic, but we are still going to hold it—is July 15.

Mr. OTTINGER. It would be your recommendation that Congress not act until you have had a chance to supply us—that is, a policy decision.

Mr. DINGELL. Mr. Canfield will not differ strongly if you were to make that statement.

Mr. OTTINGER. I will make the statement as my own rather than putting you on the spot.

Thank you, Mr. Chairman.

Mr. DINGELL. The Chair recognizes Mr. Schroeder.

Mr. SCHROEDER. Thank you.

First, Dr. Cazalet, looking at your charts, is it correct to infer that in general the smaller the program the less negative its net benefit to the overall economy?

Mr. CAZALET. Yes.

Mr. SCHROEDER. With perhaps the greatest degree of sensitivity with respect to all parameters being the price of foreign oil?

Mr. CAZALET. Yes. It is also determined by the state of the cartel.

Mr. SCHROEDER. Right.

Does this suggest a directive toward trying to minimize the scale and perhaps the purpose of a program toward small module-type programs, again, oriented primarily toward an informational purpose as opposed to a commercially viable purpose at this point?

Mr. CAZALET. I do not think you can draw such conclusions from the analysis simply by interpolating the result of various levels of cases. A reduced scale program will not necessarily be beneficial to the Nation.

As to whether a modules program is desirable, I understand you are implying modules for all plants rather than shale only as presently planned. Is that right?

Mr. SCHROEDER. Yes.

Mr. CAZALET. I think a module program is an option that should be considered, and it was not considered in this analysis.

Mr. SCHROEDER. I have heard it discussed, I think, in the context of the study you prepared for the interagency task force that one ought to be aware of the "double-edge sword" nature of a synthetic fuels program. Should we discover that the oil equivalent price for synthetics is in the $20 to $25 range, this might be a signal to oil producing countries that their prices are too low and that they have plenty of head room for their prices to rise before they have to worry about losing production to synthetic oil or synthetic fuels.

Could you comment on whether that possible penalty was incorporated in the analysis and how so?

Mr. CAZALET. The penalty or that relationship was incorporated in the analysis in two ways. First, if you assume the strong relationship between the price of foreign oil and synthetic fuels cost, then a reduction of synthetic fuels cost would bring down the price of foreign oil. On the other hand, if synthetic fuels costs turned out to be high the price of foreign oil would go up.

However, when the experts who were involved in the task force looked at this effect more closely, they judged that that link was rather weak, at least over the next 25 years. So there was not a very strong relationship either up or down between the price of foreign oil and cost of U.S. synthetics. But that effect was included in the analysis, and since it can help the program or it can hurt it, the effect on the program about balances out.

Mr. SCHROEDER. A question for both of you, if you care to comment.

Turning to the relationship that synthetic fuels commercialization, particularly with respect to high Btu coal gasification, might have in the context of what may well be a changing natural gas market should the natural gas regulatory environment change, the concern I have is that one of the primary forces that makes synthetic gas attractive at this point is the capability that the pipelines have for rolling in this very high-priced gas with large volumes of very low-priced regulated natural gas.

Should we be concerned about the possibility that deregulation might have a negative influence on the commercial potential for high

Btu gas in the near and medium term under deregulation of natural gas? Would any of you care to speculate on just how serious that problem might be, how long deregulation might pose a disincentive to synthetic commercialization and at what point that might turn around to become an advantage with respect to incentives for commercialization.

Mr. CANFIELD. Our study showed that there would be at least a $1 to $1.25 gap between the synthetics at the most optimistic and deregulated natural gas, as I understand it, the gap will be running around $2 or a little over.

What I would be concerned with, though, is that we not leap to the assumption that you ought to be allowed to roll in the prices of natural and synthetic gas. Nobody talked about that this afternoon. I sat here for several hours. That would be a mistake to assume roll-in—unless you have a further subsidy. That is, another subsidy that is off-budget that you never talk about. I don't think you ought to make a leap of faith that we are going to allow people to roll in the price of synthetics. I do not understand why synthetics should not stand on their own two feet like everything else should, but doesn't, in prices.

Frankly, I think I would challenge making the assumption just offhand. Ultimately, the customer gets it in the end if you allow them to roll in this high price stuff.

Mr. SCHROEDER. So you are suggesting, if I interpret you properly, to follow what I understand are FPC recommendations to incrementally price synthetic production much as they are proposing for LNG?

Mr. CANFIELD. We have consistently over the years been in favor of things carrying their own weight. We talk about it in the utilities, we talk about peak load pricing, letting the peak load users carry their own weight. It is precisely in this entire range of subsidies that I think is misleading to consider just H.R. 12112 by itself. One just can't argue that if you finance, whatever billion it is, if you finance that, then you are home free. You have a lot of lunch on both sides you have to pay for. Part of it is the price of this stuff—synthetics.

It is going to cost at least $3, $3.25, $3.50 per million cubic feet. If you decontrol natural gas prices, our study indicated that the top of that price by 1985 was not going to go more than $2.85 per million cubic feet. So you are still going to have a big spread between synthetics and decontrolled price of natural gas.

You also recall our study said there were constraints and impediments to additional natural gas production which had nothing to do with price. The total amount of incremental production was only about, as I recall, 1.5 trillion cubic feet a year, which is not a great deal. The incremental cost of that was about $10 per million cubic feet. If you roll it in, you have to start worrying about those kinds of problems.

Mr. SCHROEDER. Thank you very much.

Mr. Cazalet?

Mr. CAZALET. I think his statement is essentially correct. If synthetic gas were forced to stand the test of competing in the market on an incremental basis at $3.25 per million Btu, plus nominally another 40 cents per million Btu to deliver it, its total cost is $3.55. Multiply that figure by 6 to get the equivalent cost per barrel of fuel oil you are up over $20 a barrel.

Most projections suggest we can get imported oil for less than that and there is considerable domestic oil for less.

So if synthetic gas has to stand the test of competing with oil under industrial boilers or for direct heat applications and other markets, and if there are no large environmental penalties put on the low sulfur fuel oil as opposed to the natural gas, then it would seem like synthetic gas standing on its own would have a tough time competing against oil in some of these markets. That is precisely why there is a strong relationship between the price of imports and the desirability of a synthetic fuels program.

Mr. SCHROEDER. Thank you.

Mr. OTTINGER [presiding]. I understand minority counsel, Bruce Henke, has a couple of questions.

Mr. HENKE. I would like to refer to figure 2 in your attachment. I would just like to understand why synthetic fuel production is more sensitive, apparently, to higher cost of synthetic fuel than lower cost. I wonder if you could explain that?

Mr. CAZALET. Yes; there are two factors. One is, even if synthetic fuels were very attractive, there exists inertia in the market in terms of developing the infrastructure such as providing the skilled manpower in order to build these plants. Even if synthetic fuels were low cost, you could only expand at a limited rate. The model that was used to compute these projections, shown in figure 2, took this into account.

There is perhaps a second reason. In the case of import price sensitivity analysis, the nominal import price assumptions are closer to the high case than to the low case. So it is a matter of bias in the nominal assumptions.

Mr. HENKE. Doesn't that somewhat argue, though, for expedited production and entry into the synthetic fuels area so we can bring them on line as soon as possible to create greater economies of scale, and that sort of thing, to lower the cost?

Mr. CAZALET. Yes; it most certainly does, and that is a major benefit to the program. I cannot remember the exact figures, but essentially the analysis roughly assumes that without a program the maximum production of synthetic fuels in 1995 might be only a couple of million barrels a day.

If you have an information program it might, for example, double that production level. This effect was taken into account in the overall cost-benefit analysis, so the benefits have been credited with this effect. It is a rather important factor, I would agree.

Mr. HENKE. Thank you, you just answered my second question.

Mr. OTTINGER. Are there any further questions?

If not, we thank both of our witnesses for your great help, and we will call the meeting adjourned.

[Whereupon, at 6:15 p.m., the subcommittee adjourned, subject to call of the Chair.]

SYNTHETIC FUEL LOAN GUARANTEES

WEDNESDAY, MAY 26, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D.C.

The subcommittee met at 2 p.m., pursuant to notice, in room 2123, Rayburn House Office Building, Hon. Richard L. Ottinger, presiding, Hon. John D. DINGELL, chairman.

Mr. OTTINGER. The subcommittee will come to order.

This afternoon we are continuing with our hearings on H.R. 12112, a bill to provide loan guarantees for the production of synthetic fuels.

Our first panel consists of Dr. Barry Bosworth, research associate at the Brookings Institute; Mr. Laird Willott, senior vice president, Dillon, Read & Co.; Dr. Charles J. Cicchetti, director of the Office of Emergency Energy Assistance in the State of Wisconsin.

Gentlemen, we are pleased to have you with us. If you would like to put your statements in the record, you may proceed as you wish.

We will start with Dr. Bosworth.

STATEMENTS OF A PANEL CONSISTING OF BARRY BOSWORTH, Ph. D., RESEARCH ASSOCIATE, BROOKINGS INSTITUTION; D. LAIRD WILLOTT, SENIOR VICE PRESIDENT, DILLON, READ & CO., INC., ACCOMPANIED BY MICHAEL R. McCLURG, VICE PRESIDENT; AND CHARLES J. CICCHETTI, Ph. D., DIRECTOR, OFFICE OF EMERGENCY ENERGY ASSISTANCE, STATE OF WISCONSIN

Mr. BOSWORTH. Thank you ,Mr. Chairman.

I wish to thank the subcommittee for the invitation to comment on the loan guarantee programs. Before I begin, I would like to make it absolutely clear that in my testimony, I will be only considering the issue of alternative incentives for these programs, and not the question of whether or not the incentives themselves, or the programs themserves are particularly desirable.

With regard to the proposed loan guarantee program, and other incentives that are likely to follow it, there are really several questions that bother me.

First, I think that the subcommittee should clearly understand that any decision to provide special incentives in the energy area has to be in terms of the tradeoffs against other resources in the economy. If more resources are moved into the energy area, less is available in other areas of private investment, consumption, and Government expenditures.

What is particularly important for the incentives is the way in which this is done, because if it is done through preferred access in the capital markets, as it is proposed with the loan guarantee program, the off setting reductions would come out of other investments, particularly the housing industry and higher risk loans to small business.

In contrast, direct budgetary financing would concentrate the offsets in other Government expenditures and current consumption.

The fact that these programs might create jobs is irrelevant to this particular decision, since such a statement is true of any economic expenditure and is not a basis for favoring one over another.

The second problem that I can foresee with the loan guarantee program is that because the problem is substitution, it does not necessarily increase the total amount of investment that occurs in the subsidized area.

It is very hard to exclude projects that would have been undertaken in the absence of the guarantee, and the guarantee may be exhausted by these projects.

I would emphasize that such substitution effects have caused serious problems for the students loan guarantee program, and some part of the home mortgage market. Thus, they are not frivolous concerns.

In addition, because the administrator of such a program fears recriminations in the event of default, the actual risk criteria used for the approval of loan guarantees may, in fact, be no easier than that of the private market would apply.

Thus, the loan guarantee program will automatically take over the whole market, and its maximum size must exceed the amount of investment that would have occurred in its absence if any incremental increase in effort is to result.

Third, the loan guarantee program encourages the termination of a project at a far earlier date than without a guarantee. To illustrate this by example, we might assume that an operating plant, with operating costs of $10 per barrel of oil equivalent, and that fixed capital costs at $10 per barrel require $20 a barrel to make a profit.

Without a guarantee, putting up its own capital, a firm will continue to operate the plant as long as the price for the product exceeds the operating costs by $10 a barrel. But with the guarantee, the firm will immediately have an incentive to terminate and default the loan at any price below full cost recovery.

Alternatively, for example, either price guarantees or governmental participation in the program directly, will avoid this problem of premature shutdown.

Fourth, in combination with current tax laws, the loan guarantee program can seriously distort incentives and become a tax haven rather than a viable economic operation.

As an example of this, we might consider a 90-percent loan guarantee together with the present legal requirement for a 10-percent investment tax credit. That particular combination results in a situation in which there is zero owner equity in the plant once it is constructed, and prior to it ever being operated.

Yet, if at any time the owner's equity should become negative, the rational investor will default.

In future years, rapid tax depreciation and depletion lower the critical level at which the loan guarantee program could initiate a default on the project.

Since most of the benefits in terms of knowledge are likely to accrue in the construction phase, and the first few years of operation, there is a very strong likelihood that the default might actually occur.

Such a problem of loan defaults was serious, for example, for some parts of the Federal housing program in some of our major cities. There is absolutely no reason to think that businessmen are any less rational than homeowners.

Thus, it will be very important to insure that any combination of loan guarantees, tax measures, and construction loans maintains a substantial amount of owner equity in all years of the project.

In addition to these considerations, I believe that the first realistic view of many of these projects is not that they are simply a high risk or that the risk is high, but rather than there is very expectation that the first few of them will be unprofitable.

For a few industries they are attractive as a guaranteed source of supply, particularly regulated utilities where cost is not of primary concern.

But, for others, the problem is most similar to that of infant industries where those who follow will benefit from the learning aspects of the first. In such a case, an effective stimulus of these new technologies, if desired, will require a direct Government contribution to costs rather than just a loan guarantee.

I think that we can illustrate some of the problems of risk by considering three alternative cases, what we mean when we talk about a risky project.

The first case would be a project which is profitable at mean expected future prices of energy, but there are risks that prices may, in fact, fall in the future.

In this case, the loan guarantee simply encourages a premature shutdown at any price below total unit costs instead of continuing to operate at prices above variable costs. The investors are protected against loss, but the project is not continued.

The second case would be a project which is unprofitable at the expected price. Normally, in this case, it would not be undertaken in the absence of a loan guarantee, but with the loan guarantee, and with an intention to default because the returns are positive in the first few years, and because of tax advantages or knowledge benefits such an investment might be undertaken.

The third case is where the risks accrue, not from uncertainty about the future prices, but rather uncertainty about future costs.

Again, a loan guarantee program simply results in default and premature shutdown. It offers no protection whatsoever to the unforeseen circumstances that costs may be higher than expected.

Thus, as far as I can determine with these two considerations of uncertainty about future prices, or uncertainty about future costs, the loan guarantee does nothing except protect the investor. It does not insure that the project will be carried through to completion.

In practice, any project is likely to be a mixture of these cases, but in no case is a loan program an appropriate response to risky projects of this type. Instead loan guarantees were originally designed for situations such as home mortgages where the cost of gathering information about many small borrowers is very high, and where the pooling of many loans reduces risks, and allow for the use of average

default experience as a means of charging an insurance fee. This is not the case for a few large projects where the private market knows as much or more than the Government.

In addition, the fact that there are large projects does not itself create a need for a guarantee since U.S. capital markets have frequently been able to meet such needs in other areas with participatory financing.

In summary, I am most concerned that loan guarantee programs will significantly reduce incentives to develop viable production processes because of premature decisions to quit, limited owner equity, and their potential use as tax havens.

In addition, I think it is undesirable to place further burdens upon the capital markets as the means of directing resources to the energy field.

Price guarantees seem to be the most direct response to the issue of future price uncertainty, but they should include a buy-out feature based on the value of the remaining capital. Otherwise, the Government might be committed to subsidizing high cost energy, if alternative sources result in much lower than expected future prices. Such a price guarantee must be equal to or less costly than a loan guarantee over the life of the project.

The problem of cost uncertainty can only be met by a sharing of capital and operating cost through a joint venture as was done for the nuclear programs.

Loan guarantees, construction grants, and other subsidies to capital costs can also seriously distort the evaluation of the most economic technique when choosing between those which are capital-intensive—the subsidized—versus operating cost-intensive—the unsubsidized.

Finally, I wish to emphasize that my remarks are directed only at alternative means of subsidy, and not the desirability of the overall venture.

[Mr. Bosworth's prepared statement follows:]

STATEMENT OF BARRY BOSWORTH, RESEARCH ASSOCIATE, BROOKINGS INSTITUTION [1]

I wish to thank the Subcommittee for the invitation to comment on the use of loan guarantee programs to promote growth in energy supplies. While I am aware of most of the issues, I wish to make clear that I am not particularly knowledgeable in the energy area and I wish to limit my remarks to the economic effects of loan guarantee programs. Thus, I will only consider the issue of loan guarantees versus other incentive programs without addressing the first issue of whether or not the proposed plants should be built. In this regard our previous experience with loan guarantees may be of value to the Subcommittee. This specific issue is closely related to my own research interest in financial market structure.

First, the decision to provide special incentives in the energy area must be seen as reflecting a tradeoff with other claims on the Nation's resources. If more resources are moved into the energy area, less will be available in other areas of private investment, consumption, and government expenditures.

If this is done through preferred access in the capital markets, the offsetting reductons would come from other investment—primarily housing and higher risk loans to small business.

In contrast, direct budgetary financing would concentrate the offsets in other government expenditures and current consumption.

[1] The views expressed are my own and are not necessarily those of the officers, trustees, or other staff members of the Brookings Institution.

The fact that these programs might create jobs is irrelevant to this particular decision, since such a statement is true of any economic expenditure and is not a basis for favoring one over another.

At the same time, it is unrealistic to believe that such a program will have a serious disruptive influence on capital markets.

Second, the simple existence of a loan guarantee program does not necessarily increase the total amount of investment in the subsidized area.

It is very hard to exclude projects that would have been undertaken in the absence of a guarantee, and the guarantee may be exhausted by these projects.

Such substitution effects have caused serious problems for student loan guarantees and some parts of the home mortgage market.

Because the administrator of such a program fears recrimination in the event of default the actual risk criteria may be no easier than that of the private market.

Thus, a loan guarantee program will automatically take over the whole market, and its maximum size must exceed the amount of investment that would have occurred in its absence if any incremental increase in effort is to result.

Third, a loan guarantee encourages the termination of a project at an earlier date than without a guarantee.

For example, assume operating costs are $10/barrel of oil equivalent and that fixed capital costs at $10/barrel require a price of $20/barrel. Without a guarantee, the plant will make a profit at $20/barrel; but, more important, it will continue to operate at any price above $10/barrel (operating costs) until the fixed capital plant is exhausted as a means of minimizing the loss.

However, with a guarantee the firm will default at any price below $20/barrel and leave the government with the problem of operating the plant.

Alternatively, either price guarantees or government financial participation avoid this problem of premature shutdown.

Fourth, in combination with current tax laws, a loan guarantee program can seriously distort incentives and become a tax haven rather than a viable economic operation.

For example, a 90 percent loan guarantee together with a 10 percent investment tax credit results in zero owner equity after the plant is constructed.

If at any time the owners' equity becomes negative, the rational investor will default.

In future years rapid tax depreciation and depletion lowers the critical level of the loan guarantee even further.

Since many of the knowledge benefits are likely to accrue in the construction phase and first few years of operation, there is a strong likelihood of default before the loan is repaid.

Such a problem of loan defaults was serious for some parts of the federal housing program, and there is no reason to think that businessmen are less rational than homeowners.

Thus, it will be very important to insure that any combination of loan guarantees, tax measures, and construction loans maintains a substantial amount of owner equity in all years of the project.

Such projects are likely to be most attractive to public utilities.

Rate of return regulation allows the cost to be folded into the rate base.

The opportunity to have a guaranteed source of supply is likely to be of more concern than costs, since the risks of being cut off from natural gas supplies in the future are reduced.

However, a program to reduce the risk position of the public utilities is not consistent with efforts to explore uncertain costs of new energy sources.

Therefore, regulated public utilities should probably be excluded from such a program.

I believe that the most realistic view of these projects is not that they are simply of high risk, but rather there is every expectation that the first few will be unprofitable.

For a few industries they are attractive as a guaranteed source of supply—particularly regulated utilities where cost is not of primary concern.

But, for others, the problem is most similar to that of infant industries where those who follow will benefit from the learning aspects of the first. In such a case, an effective stimulus of these new technologies, if desired, will require a direct government contribution to costs rather than just a loan guarantee.

A clearer insight into the risk problem can be obtained by consideration of three alternative cases.

Case I: The project is profitable at mean expected future prices but there are risks of price declines.

In this case a loan guarantee simply encourages a premature shutdown at any price below total unit costs instead of continuing to operate at prices above variable costs. The investors are protected against loss but the project is not continued.

On the other hand, price guarantees eliminate this type of risk.

Case II: The project is unprofitable at the expected price.

Normally, the project would not be undertaken but might be with a loan guarantee with an intention to default because the returns are positive in the first few years because of tax or knowledge benefits.

Case III: The risks result from uncertainty about costs rather than prices.

Again, a loan guarantee results in default and premature shutdown; but, in addition, a price guarantee is inappropriate. In this case, only direct government participation in the costs will reduce risks. Any use of adjustable price guarantees begins to look like cost plus contracting.

In practice, any project is likely to be a mixture of these cases, but in no case is a loan program an appropriate response to risky projects. It encourages their beginning but it also encourages their early termination.

Loan guarantees are usually designed for situations—such as home mortgages—where the costs of gathering information about many small lenders is very high and where a pooling of many loans reduces risks and allows for the use of average default experience as a means of charging an insurance fee. This is not the case for a few large projects where the private market knows as much or more than the government.

The fact that these are large projects does not itself create a need for a guarantee since U.S. capital markets have frequently been able to meet such needs in other areas with participatory financing.

In summary, I am most concerned that loan guarantees will significantly reduce incentives to develop viable production processes because of premature decisions to quit, limited owner equity, and their potential use as tax havens. In addition, I think it undesirable to place further burdens upon the capital markets as the means of directing resources to the energy field.

Direct government loans financed out of tax revenue would reduce competition with other capital projects. But they would also involve the problem of perverse incentives when investors can avoid the risks.

Price guarantees seem to be the most direct response to the issue of future price uncertainty, but they should include a buy-out feature based on the value of the remaining capital. Otherwise, the government might be committed to subsidizing high cost energy if alternative sources result in much lower than expected future prices. Such a price guarantee must be equal to or less costly than a loan guarantee over the life of the project.

The problem of cost uncertainty can only be met by a sharing of capital and operating cost through a joint venture as was done for the nuclear programs.

Loan guarantees, construction grants, and other subsidies to capital costs can also seriously distort the evaluation of the most economic technique when choosing between those which are capital-intensive (subsidized) versus operating cost-intensive (unsubsidized).

Finally, I wish to emphasize that my remarks are directed only at the alternative means of subsidy and not the desirability of the overall venture. I am primarily concerned that loan guarantees result in significant distortion of incentives since they are of value only in case of failure. A loan guarantee is of minimal value to the most viable projects and of great value to the most doubtful. I am not convinced, after consideration of tax advantages and the accrual of knowledge in the early years of the project, that sufficient owner equity will remain to insure repayment of the loans. I believe that price guarantees and financial participation by the government more directly address the issue of risk without distorting incentives. At present, however, the proposed form of the price guarantee proposal is too vague to judge its effect.

I would oppose the construction grant to public utilities since it encourages vertical integration of a natural monopoly and is an inappropriate special response to a general industry problem of debt capacity. Unless financed by a tax on users such grants artificially lower energy prices and discourage conservation.

Mr. OTTINGER. Thank you very much. This has raised some questions, but I think that we will hear from the other witnesses first.

Next we will hear from Mr. Laird Willott.

STATEMENT OF D. LAIRD WILLOTT

Mr. WILLOTT. Mr. Chairman, and members of the committee:

My remarks today are offered in the context of the stated general national policy of the Federal Nonnuclear Energy Research and Development Act of developing, on an urgent basis, the technological capabilities to support the broadest range of energy policy options through conservation and use of domestic resources. We believe that government, business, and consumers should join to foster the development, with all deliberate speed and resolution, of additional energy supplies from all possible sources.

In discussing the need for the proposed Federal support and loan guarantees in H.R. 12112, I will limit my comments primarily to a particular area of my firm's experience which is the financing requirements for commercial size demonstrations of high Btu coal gasification technology. The development of this technology has certain characteristics in common with certain proposed demonstrations of oil shale technology with which we are also familiar.

My personal predisposition would be to avoid Federal financial support and loan guarantees for the development of synthetic fuels, including commercial size high Btu coal gasification and oil shale projects. However, based upon the characteristics which affect the financial viability of these projects, the financial characteristics of the regulated natural gas companies sponsoring coal gasification projects and current regulatory attitudes, we have concluded that the Federal financial support and loan guarantees envisioned in H.R. 12112 will be necessary to accomplish the financing of these projects.

Coal gasification and oil shale facilities possess several characteristics which affect their financial viability. These characteristics include:

Untested technology for projects of the size contemplated;

Relatively long construction periods, lasting several years;

A very high level of capital intensity;

Regulatory decisions; and

Dependence on mining for conversion feedstock, which is subject to environmental restrictions.

The regulated natural gas industry is the primary sponsor of high Btu coal gasification projects. The unique characteristics of this industry which, in combination with the project's financial characteristics, limit the ability of gas companies to undertake these projects include the following:

Companies within the regulated natural gas industry have not been able to accumulate sufficient capital, especially equity capital, nor have they been allowed to earn a return on their existing assets which would enable them to take the type or degree of financial risks inherent in coal gasification; and

Declining reserves and curtailments of natural gas have adversely affected the ability of the natural gas industry to attract long term capital.

In order for commercial size synthetic fuel projects to compete successfully for capital funds, we believe that prior to the commencement of construction, financially acceptable assurances must be given to potential lenders that the projects will be completed and placed into

service or, if not, that their loans will nevertheless be repaid under all circumstances.

The magnitude of the capital requirements for these projects, the major risks associated with them, and the existing financial structure of the regulated natural gas industry all combine to make it impossible to satisfy the lenders' assurance requirements. It is particularly apparent that the proposed Federal loan guarantees are required in this area for high Btu coal gasification projects.

In our judgment, the Government should be given reasonable assurances that its loan guarantees will not be called upon if the projects are completed and placed into operation, similarly, we believe that equity investors must be provided with financial incentives commensurate with project risks to induce their participation. For these assurances and incentives to be met, especially for coal gasification projects, it is our opinion that all events, full cost-of-service tariffs must be approved and implemented by the appropriate regulatory authorities on both the national and local levels. These tariffs will be designed to assure potential lenders and equity investors that gas consumers will provide sufficient cash flow to operate the project and to service capital. These tariffs will also help to assure the Government that its support during a project's operational period is principally a contingent backstop to consumer commitments.

Federal loan guarantees as a contingent backstop to the consumer tariff arrangements are needed during a project's operating period because of the historical attitude of the Federal Power Commission toward all events, full cost-of-service tariffs, the current opposition of many State regulatory commissions to provisions which would enable the tracking of such tariffs, and the risks that regulatory authorities, courts or legislatures could take, or be required to take, many subsequent actions that would compromise or eliminate initial regulatory approvals of such tariff support.

We believe that the proposed Government guarantee of debt, in combination with gas user tariff support and project sponsor support in the form of equity investments, is an appropriate method by which to accomplish the financing of commercial size coal gasification facilities. In our opinion, this combination will satisfy the repayment assurances of institutional lenders during both the construction and operating periods. It should be recognized that institutional lenders are expected to provide a substantial portion of the requisite capital and that they act in a fiduciary capacity. In such capacity, they are charged with the protection of the funds of their beneficiaries, the saving and investing public. To the extent that they perceive a greater degree of risk in one project relative to the many other investment alternatives available, they cannot be expected to advance funds to that project. Furthermore, in many instances, State laws impose requirements and limitations on the type and degree of investment risk they can take.

We would now like to comment upon specific provisions in the proposed legislation.

The mandate given by H.R. 12112 mounts a very broad attack on the energy problem. It represents a very comprehensive undertaking with almost unlimited possibilities for research and development and, if well done, should result in extensive benefits to the country as a whole. The most important aspect of H.R. 12112 is that it gets the job

started—the job of developing energy technologies, including synthetic fuel technologies.

The current version of H.R. 12112 authorizes loan guarantees of up to $2 billion in 1977, and $2 billion in 1978 with a limit on guarantees to be made available to high Btu gas development of 50 percent of these amounts. These authorized amounts appear to be adequate to get high Btu gas programs underway. However, I must point out that the effort mounted by H.R. 12112 will of necessity extend over many years and will, in all probability, require ongoing support for some years for several reasons:

(A) H.R. 12112 covers a very wide range of energy technologies which could be fostered and developed.

(B) A commercial size demonstration facility for the envisioned energy technologies will be very costly. One high Btu coal gasification project of commercial development size could cost, even on a minimum basis, approximately $1 billion over a several year construction period. Construction cannot commence until all financing is arranged, and such arrangements cannot be obtained without sufficient guarantees.

(C) The financing of the essential community planning and development costs resulting directly from the demonstration facilities could utilize a significant amount of the guarantees available. Additionally, to the extent that an applicant for assistance for a commercial demonstration facility would have to advance sums to States, political subdivisions, or Indian tribes for this purpose, these payments would have to be added to the cost of the applicant's facility and funded as part of the overall financing plan for the facility.

In our opinion, it will be necessary for these payments to be guaranteed because they are subject to the same risks as the other capital invested in these projects. Tax abatements do not necessarily represent a source of capital to finance these payments because they are not realized without sufficient earnings to utilize them.

(D) The extensive number of approvals and consultations necessary for each project will involve substantial amounts of time which, during periods of inflation, will add to the cost of the demonstrations, and thereby could adversely affect their economic viability.

As a general comment, there is one additional financial incentive outside the guarantee area which I believe would be helpful to financing synthetic fuel and other energy projects. This lies in the area of additional tax incentives. Many projects will generate large investment tax credits which, to the extent the credits can be utilized to reduce Federal income taxes payable, could provide additional capital funds to finance project construction. However, because of the potential size of the credits and because of the general tax limitation that such credits can only be utilized to a maximum of 50 percent of taxes payable, many of these credits may not be used as they become available. To assure that such credits can be utilized to provide additional capital funds, I would recommend that in the case of activities of the nature to which H.R. 12112 is addressed, the tax laws be amended to allow the full use of project tax credits up to 100 percent of sponsor taxes payable.

As to the potential impact of the Government assistance proposals on our capital markets and economy, we previously testified before the House Committee on Science and Technology that, in our opinion, a $6 billion program spread over the construction periods contemplated

for synthetic fuel projects would not be expected to disrupt the capital markets when considered against the historical amounts of capital raised by the private and public sectors. We are still of that opinion for the proposed program. We also believe that the economy would benefit significantly from such a program, principally because of the overriding importance of energy to our country's economic health.

When trying to measure the impact of any guarantee program, it is important to realize that there are many factors which cannot be accurately predicted and which will materially affect future capital markets. These factors include: the capital requirements of the public sector (Federal, State, and local governments), especially those requirements arising from deficit spending; the capital requirements of the private sector; Government monetary policy; taxation policy; rates of inflation; savings rates; international balance of payments; and industrial efficiency and productivity. Because these factors are unknown, it is impossible at this time to predict with any real accuracy what the size of the capital markets or the total demand for capital funds will be over the next decade.

Estimates of the capital expenditures for the energy related industries in the next several years are extremely large by historical standards. Unless necessary tax and other incentives are implemented, current trends would indicate that internally generated fuunds for these industries will fall short of funding their historical share of capital expenditures. The balance of these requirements for funds must be met by external financing.

The Government-guaranteed securities issued in connection with any energy program would compete principally with the highest grade corporate debt securities. The net amount of all corporate debt securities issued during the 5-year period, from 1971 through 1975, was approximately $113 billion.

Based upon the size of this market, we believe that the proposed $4 billion loan guarantee program would not have an adverse effect on the corporate debt market in general or on the ability of either the energy or nonenergy industries to raise capital in the next decade.

Any Government-guarantee program, however, should not be taken too lightly, especially if it is assumed that additional guarantee authorizations will be approved under H.R. 12112 and other energy programs. The ability of companies with lower credit ratings to compete for available capital could be lessened at times. In addition, higher grade corporate debt securities could face slightly higher interest rates in order to compete with an increased supply of Government guaranteed debt.

The provision in H.R. 12112 which specifies that the concurrence of the Secretary of the Treasury must be obtained with respect to timing, interest rate and substantial terms and conditions of any guarantees should prove most helpful in minimizing any impact of the proposed program on the capital markets.

In summary, the availability of proposed loan guarantees should further the general objectives of the Federal Nonnuclear Energy Research and Development Act and, hence, should facilitate the development of additional energy sources to meet the country's needs.

I appreciate the opportunity to appear before your subcommittee and would be pleased to respond to your questions.

[The appendixes to Mr. Willott's statement follow:]

APPENDIX A

BIOGRAPHICAL SKETCHES

D. Laird Willott began work with Dillon Read as a corporate finance associate in 1963. In 1969, he was elected a Vice President, and in 1975, he was elected a Senior Vice President. Mr. Willott specializes in the energy and natural resource industries and is responsible for several of the firm's clients in those areas. In connection with these industries he has concentrated on project financial planning. With Mr. Willott at the hearing is Michael R. McClurg whose biographical sketch follows.

Michael R. McClurg joined Dillon Read in 1971 as an associate in the corporate finance department. In the following year, he was elected a Vice President. Most of his time with the firm has been devoted to the development of financing plans for energy related projects and activities. These projects include the high Btu coal gasification facilities sponsored by American Natural Resources Company and Panhandle Eastern Pipe Line Company, an oil shale project for a major oil company, a naphtha based synthetic gas project for a major gas distribution company, and a nuclear fuel enrichment joint venture between a major oil company and a technologically based industrial company.

Business of Dillon, Read & Co. Inc.

As a firm, Dillon Read has worked for many years with the regulated natural gas and the petroleum industries, providing general investment banking services including financial advice as to specific energy projects such as those involving synthetic fuel production. For example, Dillon Read is financial advisor to the American Natural Resources Company on its proposed high Btu coal gasification project. We also have been retained by Panhandle Eastern Pipe Line Company to advise them with respect to a proposed high Btu coal gasification project. Through our investment banking relationship with Texas Eastern Transmission Corporation, we have been indirectly involved with the Western Gasification Company high Btu coal gasification project. In addition, we have performed certain financial advisory services in connection with a major oil shale project.

Dillon Read has had a long and continuing association with the natural gas industry. Since 1946, when the industry began its development as a major supplier of energy, Dillon Read has raised in excess of $4.7 billion of capital for the industry. During the past five years, Dillon Read managed the sale, either publicly or privately, of $1.4 billion of natural gas company securities. Dillon Read also has completed negotiated financings and/or has acted in a financial advisory capacity to several companies in the oil industry. Over the past five years the firm has managed or co-managed a total of $2.8 billion in negotiated security offerings for its natural gas and oil company clients.

The principal activities of the firm include the development of financing programs; advice on appropriate capital structures; review and appraisal of capital markets; advice on design, amounts and timing of underwritings and private placements; organizing and managing syndicates of leading investment banking firms to underwrite issues; the private placement of securities and a wide variety of financial advisory services including corporate reorganizations and mergers and acquisitions. Dillon Read's record of negotiated financings for corporations, municipalities, and governments is summarized below for the five-year period 1971–1975:

Corporate Securities:	
Public offerings	$6,133,000,000
Private offerings	1,312,000,000
Total corporate securities	7,445,000,000
Municipal and governmental securities	2,846,000,000
Total negotiated securities, 1971–75	10,291,000,000

APPENDIX B

FINANCIAL CHARACTERISTICS OF HIGH BTU COAL GASIFICATION PROJECTS

The financial characteristics of high Btu coal gasification projects is important to understand because it provides a basis for determining the need for

government assistance on projects that are to be undertaken by the regulated natural gas industry.

The most important elements of high Btu projects for financing purposes are:

(1) The capital requirements involved.

(2) The major risks and problems associated with such projects.

(3) Federal Power Commission decisions and principles.

Capital requirements involved

Perhaps enough has been written and spoken about the vast technological and developmental costs of the large-scale synthetic energy projects of the next few years, but, the very magnitude of the price tag is a critical element in the ability to finance the job. The costs of these super projects relative to the historical costs of the sponsoring companies' in-place plant, as well as the depreciated book value of their existing plant facilities is significant. For example, a $1 billion coal gasification project represents approximately 40 percent and 33 percent of the original cost of the plant, property and equipment of American Natural Resources Company and Texas Eastern Transmission Corporation, respectively, as of December 31, 1975. It also represents approximately 56 percent and 51 percent respectively of the depreciated book value of aid of their property, plant and equipment.

It should also be carefully noted that despite the tremendous size of these gasification plants, the incremental gas supplied by one of these projects will be relatively small in comparison to the current deliveries of either American Natural or Texas Eastern. It is this inverted relationship, the requirement of huge capital commitments to provide relatively small amounts of incremental gas to existing systems, which poses critical financing problems.

Major risks and problems

The major risks and problems associated with commercial sized high Btu coal gasification projects, which could adversely affect the economic and financial feasibility of such projects, and which would be of concern to potential investors and thus must be recognized in the financing arrangements, can be separately considered as those arising during the construction period and those arising during the operating period.

Construction period risks and problems

Completion poses perhaps the most difficult of all problems attendant to the financing of these projects. The potential purchasers of debt securities are not in a position to make accurate judgments as to technological, construction, regulatory, environmental, or inflationary risks. These investors will require protection against such risks through a financially acceptable assurance that the projects will be completed and placed in service within a prescribed amount of time, or if not, that their investments will be recovered.

The major risks associated with the completion of these projects that are of concern to potential investors are:

(1) *Gasification process.*—The gasification process selected for use in the first of these proposed commercial size projects is known as the "Lurgi Process." Investors will recognize that the Lurgi Process has been commercially proven for the manufacture of medium Btu gas, and the methanation process to increase the Btu content to the desired level has been successfully demonstrated. However, there are no commercial sized gasification plants in operation in the United States, and there are no plants in operation anywhere in the world which are as large as those contemplated by certain companies in the regulated natural gas industry. Until the Lurgi Process is commercially proven in the United States, the opinion of qualified engineers will provide the sole assurance of its physical capability. Although reliance on the opinion of qualified engineers is not unprecedented for financing certain projects or activities of relatively proven capability or moderate cost, we believe that potential investors will not rely solely on such opinions as a basis for committing funds primarily because of the status of the gasification technology and the relative and absolute dollar size of the projects.

(2) *Potential time delays and cost overruns.*—These projects entail a potential for time delays as a result of the complexity of the gasification plant, the regulatory and environmental proceedings, and the long lead time required for planning, engineering and construction. Any time delays could lead to cost overruns, as would an increase in the rate of inflation beyond that incorporated into the financing plans. The risk of cost overruns is magnified by the relative and absolute size of the capital requirements.

(3) *Capital Intensity.*—As stated above, these projects are highly capital intensive. The combination of the high capital intensity and the long lead time compounds the risk of delays and cost overruns.

(4) *Nature of Construction.*—The nature of constructing these projects, particularly the gasification plant component, is such that it is not feasible to minimize the risks by a step-by-step construction process which would prove the gasification process before the full project investments are made. Once a substantial commitment is made and the long construction period is begun, there is no alternative to completion of the entire project except abandonment.

Operating Period Risks

The major risks associated with the operating period of these projects that are of concern to potential investors are:

(1) *Government Action.*—Federal, state or local government action might be taken in a number of ways which would preclude the economic operation of the projects. For example, adverse strip-mining legislation might result in the termination of the coal supply for the gasification plant, thus preventing operations. Environmental legislation might be adopted making continued operation of the projects infeasible or the cost of production so high as to make the gas unsaleable.

(2) *Regulatory Action.*—Despite acceptable initial approvals, which to date have not been granted nor is there any indication that they can be obtained, federal, state or local regulatory authorities, courts or legislatures could take, or be required to take, many subsequent actions that would not permit the projects to earn their full cost of service and would therefore impair or eliminate the ability to assure the amortization of project investment.

(3) *Force Majeure.*—The projects could experience damage or interruption of operations due to non-insurable risks such as wars, strikes, explosions and acts of God. If such events impair the operations of these projects for any significant time, there would be insufficient cash flow to service financing.

(4) *Competitive Pricing.*—Investors would be concerned about such factors as the development of new, cheaper domestic sources of energy or reductions in costs of foreign supplies, as well as the possibility of changes in the Federal government's position regarding reliance on foreign imports. If any of these possibilities occur, the cost of gas produced by those projects could become non-competitive which in turn could mean that the gas could not be sold at prices sufficient to service financing. This risk would be significantly reduced if regulatory approvals could be obtained on a basis that provided for full cost of service pricing.

Federal Power Commission Decisions and Principles

The economics of coal gasification and the ability to arrange the financing will be very much dictated by Federal Power Commission ("FPC") decisions on substitute natural gas, including coal gasification. To date, the FPC decisions have established certain basic principles in jurisdiction, pricing, and sale of "substitute" and "new source" gas in interstate commerce. The applicable FPC decisions are contained in Opinions Numbers 622 (issued June 28, 1972), 662A (issued October 5, 1972), 637 (issued December 7, 1972), 637A (issued February 6, 1973), 663 (issued September 4, 1973), 728 (issued April 21, 1975), and 728A (issued November 21, 1975).

Based on a review of the aforementioned opinions, the FPC established principles for coal gasification can be summarized as:

(1) Coal gasification plants produce "artificial gas" within the meaning of the Natural Gas Act (the "Act").

(2) The Act does not vest the FPC with jurisidictional powers over artificial gas (SNG); therefore, the coal feedstock, the gasification plant, the facilities for the transportation of the SNG when unmixed with natural gas and the sale of SNG when unmixed with natural gas are not within the jurisdiction of the FPC.

(3) The Act does vest the FPC with certificate authority over the facilities necessary to permit the mixing of SNG with natural gas, over the transportation facilities and any applicable transportation rate after mixing, and over the rate at which the SNG is sold for resale in interstate commerce after mixing with natural gas.

(4) In Opinion Number 728A, the FPC has conditioned its selling price authorization for SNG projects to a maximum fixed price which will apply to all SNG

produced after project completion and during the testing operations. Thereafter, subsequent prices would be established in Section 4 pricing procedures before the FPC; such pricing procedures include a minimum bill provision which provides a method for recovering capital invested and return on equity except for sliding-scale penalty provisions that operate if SNG quantity and BTU content fall below certain levels.

(5) Although deferred for future consideration in Opinion No. 728, the FPC has applied "incremental" rather than "rolled-in" pricing to SNG in prior decisions.

(6) Although not directly enacted for coal gasification projects, the FPC has established curtailment policies based on end-use priorities, which rang large commercial and industrial requirements behind residential and small commercial requirements.

Discussion of Federal Decisions

The FPC curtailment policies are at odds with the prescribed policies for pricing SNG when mixed with natural gas. This makes it difficult to imagine that large commercial and/or industrial users would be willing to sign long-term SNG purchase contracts, at incremental prices designed to support the gasification project financially, when such supplies could be curtailed for higher priority uses.

When totally considered, the FPC decisions and policies summarized above would not permit the arrangement of debt capital for project financing prior to the commencement of construction. The debt capital could not be arranged even if a project sponsor were willing to make substantial equity commitments and debt guarantees because the FPC decisions and policies subject a project sponsor to so many large risks, particularly given the large capital costs involved, that he may not be able or willing to commit the full amount of equity or guarantee required to satisfy lenders that a project could be completed, or if not, that the debt could be repaid.

Even with the minimum bill provision included in FPC Opinion No. 728A, it will not be possible to arrange project debt without additional financial guarantees and assurances. The minimum bill provision would not commence until a project produced gas. While such a pricing mechanism may provide a method of recovering funds invested in a project after operations have commenced and gas production has begun, we do not believe that it provides a basis for raising (as distinguished from recovering) capital to construct and complete a project. The minimum bill provision does not provide a basis for assuring lenders that a project can be completed (so that operations and gas production can commence), or if not, that their investments will be recovered. Further, there is no method of assuring lenders that the minimum bill provision for recovering investments would be maintained by future Federal Power Commissions over the operating life of a project.

Need for Governmental Assistance

Attempts to cope with the financing problems of high Btu coal gas projects have included consideration of all events, full cost of service tariffs to assure debt service and surcharges on present customers to provide a portion of construction costs. Regulatory bodies have thus far been unwilling, in part because of the risks involved, to permit these tariff arrangements. In addition, further assurances will be required as to completion, production of gas, and its transportation and sale.

Initial regulatory approvals will not be sufficient as subsequent actions of regulatory bodies cannot be predicted. Institutional lenders, primarily insurance companies and pension funds who would be expected to provide a substantial portion of the debt capital, act in a fiduciary capacity and are charged with the protection of their beneficiaries' funds. State laws impose requirements and limitations on the degree of investment risk that can be committed by institutional lenders. These lenders' requirements cannot be satisfied by relying solely on the cost of service tariffs or the credit of the sponsoring companies.

The huge capital requirements of these projects, the major risks and problems associated with their construction and operating periods, and the FPC decisions issued to date on such projects, in combination with the financial structure and characteristics of the regulated natural gas industry discussed in Appendix C, make it impossible for these projects to be financed in the absence of government loan guarantees as proposed in H.R. 12112.

Appendix C

Financial characteristics of regulated natural gas utility companies

To understand the financial characteristics of regulated natural gas companies and to appreciate their current inability to undertake the costly construction of commercial sized high Btu coal gasification projects, it is necessary to examine the Natural Gas Act and the overall evolution of the industry.

In essence, the Natural Gas Act was an attempt to regulate the natural gas industry on a basis comparable to the electric utility industry under the Federal Power Act; that is, the Natural Gas Act was intended to ultimately place the pricing of gas under a utility-type framework. At first regulation only was applied to the natural gas pipeline companies. With the passage of time, however, it became apparent that as the unregulated wellhead price of gas began to increase, regulation of natural gas pipeline companies did not fully accomplish the intended purpose of a utility type pricing structure for gas. For this reason, the courts decided in the Phillips Case that regulation of the wellhead price of gas was necessary. Consequently, in 1954, regulation was substituted for supply and demand in determining the price at which the interstate pipeline companies could purchase natural gas.

Under regulation, gas prices have been set at levels which make it extremely cheap relative to other forms of energy. This has caused both the demand for and the consumption of gas to increase rapidly. As supplies of low priced gas have been depleted, additional reserves have not been developed in amounts sufficient to offset higher consumption; as a result, shortages and resulting pipeline curtailments have arisen. Furthermore, available gas in unregulated intrastate markets is priced far above the maximum level which interstate pipeline companies are permitted to offer thereby contributing to additional shortages in interstate markets.

Despite these problems, however, the transmission industry historically was regarded by investors and lenders as possessing financial characteritics which were favorable for investment for several reasons.

First, the industry was built and financed on huge gas reserves which represented a cheap source of energy.

Second, the industry expanded at a substantial rate primarily because the regulated low price of natural gas created enormous demands. This rapid expansion in customers and consumption during the period from the end of World War II until the early 1970's formed a solid foundation for debt and equity financing.

Third, the pipeline industry traditionally has been a regulated industry both on the national level through the Federal Power Commission ("FPC") and on the local level through state regulatory authorities. While regulation has created many problems for the industry, it has provided an implied obligation for reasonable returns of and on invested capital which has given assurances to lenders and equity investors alike with respect to debt payment and rates of return on equity.

Fourth, during the 50's and 60's the industry operated in a period of what would be regarded today as relatively healthy and stable capital markets. Capital funds were available, interest rates were low, and public and institutional demand for gas company securities was high. These factors, in combination with FPC and state rate making procedures which seek to minimize capital costs and overall gas costs, led gas companies to utilize relatively large amounts of long-term debt in their capital structures because the after-tax cost of debt generally is much lower than the after-tax cost of equity.

Finally, the principal business of natural gas companies was the construction and operation of pipeline systems employing relatively low level technology for the transmission and distribution of natural gas. Activities outside the shipment of gas, such as exploration or development, were not a major element or area of capital commitment in the industry as it traditionally evolved, and thus it became identified as an industry of generally low risk.

In contrast, the industry currently is facing rapidly changing circumstances which are affecting its operating structure and financial viability. For example, in a matter of a few years, the gas supply of the industry has changed from a surplus situation to a reserve deficient status. Reserve life indexes continue to decline, to something less than ten years supply if Alaskan gas is excluded. The declining reserve picture, more than any other single factor, has caused

lenders and investors to reexamine the traditional financing patterns of the industry and has prompted them to modify their investment policy. As a consequence, the industry has virtually stopped expanding. It is currently regarded as a mature industry, forced to curtail customers in the face of shortages and significant unused pipeline capacity. Caught between sharply higher capital and operating costs and the reluctance of regulatory authorities to increase service rates and gas costs precipitiously, the industry is faced with a skeptical investment community. Lenders and equity investors alike are questioning the industry's ability to meet its high level of debt commitments plus provide a reasonable return on equity. This is especially true in connection with the highly capital intensive synthetic fuel projects that currently are being proposed.

Coupled with these changes has been the deterioration in the capital markets which has resulted not only in tighter money and higher interest rates in general, but also in the overall shortening of maturities and increased sinking fund requirements for gas company debt securities in particular. Also, as a consequence of adverse conditions in the capital markets, recent corporate bankruptcies and local government financial crisis, the question of credit has become all important. The ability to finance and raise capital at all is now a matter of credit standing, and there are companies, entire industries as well as selected governmental entities, which at certain times are not able to secure financing at any cost. Under these conditions the higher leveraged and lower credit companies and industries, such as the regulated natural gas industry, are forced to compete on disadvantageous terms with other borrowers, and at times they are foreclosed from substantial portions of the capital market.

Finally, on top of these deteriorating financing characteristics, the regulated natural gas industry has been forced by circumstances to assume an entirely new role, that is, seeking and developing its own supplies of gas. Exploration and development has traditionally been an adjunct of and financed by other companies outside the regulated natural gas industry. At this point in time, however, the regulated natural gas industry, with enormous commitments in facilities and increasing requirements to maintain existing gas deliveries, is faced with obtaining adequate supplies by its own efforts and financial commitments. In this regard, the industry has made advance payments to producers in excess of $2 billion. In effect, advance payments are interest free loans which are used to explore for and develop new gas reserves. The gas companies are able to collect the carrying cost of these payments through their rates, but they also use a large portion of their capital raising capacity in securing funds for such payments. As of December 31, 1975 the Federal Power Commission terminated the advance payment program so that any future gas company financial arrangements with producers will not be provided any assured basis for collecting the carrying costs of such arrangements through gas prices. This fact will force the gas companies to undertake higher risk financial commitments in an attempt to obtain additional gas supplies. Given the financial structure of the gas companies, the increase in financial risks may be so large as to preclude the undertaking of alternative financial arrangements to the now defunct advance payment program; this is particularly true given the prospect that nationwide allocations of gas supply could be mandated.

In addition, regulated gas companies have sought to augment their gas supplies through such other means as direct exploration activity and liquefied natural gas projects, and currently they are contemplating synthetic gas production from coal. Because of the high leverage and regulated nature of the industry, however, natural gas companies have never developed a capital structure capable of taking large scale exploratory or experimental risks for new sources

of gas. A regulated return structure has not been conducive to building an excess equity base or large cash reserves which could absorb the risk of complete loss associated with the new sources of gas supply. Moreover, this risk is not offset by a potential for greater rewards in the event of economic success or excellent management because the rate of return on equity is limited by regulatory inflexibility.

Although all of these elements have contributed to the generally reduced capital capacity of the regulated natural gas industry, it is the overall increase in the cost of doing business that imposes the most significant questions. In this regard, no element has contributed more to the uncertainty of financing capability than inflation. This is especially true in connection with the highly capital intensive commercial sized coal gasification projects that certain companies are sponsoring at this time. In short, the ability of any industry, and in particular the regulated natural gas industry, to finance huge synthetic fuel projects in vastly inflated dollars, based on a plant and financial structure of highly depreciated dollars, is exceedingly problematic. For the regulated natural gas industry, which has been traditionally highly leveraged and regulated as to equity return, the task is especially onerous. Other lower leveraged and nonregulated industries may be able to handle inflation by both increasing their leverage as well as achieving higher rates of return on risk capital. The regulated natural gas industry has no flexibility with respect to increasing its debt leverage and is effectively precluded by regulatory restrictions from obtaining higher returns on risk capital. To this extent the industry is penalized in the capital market arena.

COMPARISON OF THE 10 LARGEST NATURAL GAS COMPANIES[1]

[Dollar amounts in thousands]

	Total available operating revenues	Earnings available to common	Total debt[2]	Total preferred stock	Total common equity	Total capitalization[3]	Total debt as a percent of total capitalization
10 largest natural gas companies:							
Columbia Gas System, Inc.	$1,443,140	$102,665	$1,516,496	$100,000	$902,845	$2,579,341	58.8
Texas Eastern Transmission Corp.	1,312,033	106,819	1,290,318	138,036	762,875	2,191,229	58.9
American Natural Resources Co.	1,044,946	101,980	1,229,553	50,000	709,360	1,988,913	61.8
El Paso Co.	1,389,355	58,211	1,359,570	----------	529,540	1,889,110	72.0
Peoples Gas Co.	934,592	96,071	1,042,291	101,553	684,071	1,827,843	57.0
Consolidated Natural Gas Co.	970,564	67,735	743,150	50,000	702,007	1,495,157	49.7
Northern Natural Gas Co.	1,163,204	127,300	766,083	56,460	650,818	1,473,361	52.0
Transco Companies, Inc.	601,284	44,833	1,009,170	148,366	306,179	1,463,715	68.9
Pacific Lighting Corp.	1,098,285	42,200	820,468	110,091	504,341	1,434,900	57.2
Panhandle Eastern Pipe Line Co.	659,284	69,957	895,731	34,960	455,717	1,386,408	64.6
Total	10,616,687	817,771	10,672,758	789,466	6,267,753	17,729,977	60.2

[1] Total capitalization was used as the criteria for ranking the 10 largest companies in this comparison. Results shown are for the period ending Dec. 31, 1975. Tenneco, Inc., has been excluded because less than 20 percent of the company's revenues are derived from its natural gas operations.

[2] Total debt includes both short- and long-term debt and current maturities of securities requirements.

[3] Total capitalization excludes minority interests in subsidiaries.

REGULATED NATURAL GAS INDUSTRY CAPITAL EXPENDITURES, 1965–84

[Dollars in millions]

	Capital expenditures					
	Conventional construction expenditures [1]	Exploration and development [2]	Foreign LNG [3]	Coal gasification [4]	Arctic gas [5]	Total
Historical:						
1965	$1,935	(6)	(6)	(6)	(6)	$1,935
1966	2,374	(6)	(6)	(6)	(6)	2,374
1967	2,252	(6)	(6)	(6)	(6)	2,252
1968	2,972	(6)	(6)	(6)	(6)	2,972
1969	2,686	(6)	(6)	(6)	(6)	2,686
1970	2,507	(6)	(6)	(6)	(6)	2,507
1971	2,419	(6)	(6)	(6)	(6)	2,419
1972	2,822	(6)	(6)	(6)	(6)	2,822
1973	2,966	(6)	(6)	(6)	(6)	2,966
1974	2,920	(6)	(6)	(6)	(6)	2,920
Total, 1965–74	25,853	(6)	(6)	(6)	(6)	25,853
Projected: [7]						
1975–79	16,700	5,120	4,095	2,717	7,528	36,160
1980–84	18,400	7,990	26	15,000	450	41,866
Total 1974–85	35,100	13,110	4,121	17,717	7,978	78,026

[1] Conventional construction expenditures include general construction, underground storage, distribution, transmission, production, propane plant, and LNG storage. From 1965–74, conventional construction expenditures also include expenditures for exploration and development, foreign LNG, coal gasification, and gas from the Arctic. Data sources: AGA statistics; and IGT projection.

[2] Exploration and development expenditures include advance payments to other companies and funding of company-owned production subsidiaries. These figures are based on the increased availability of offshore leases in the Gulf of Mexico and future lease sales in the Atlantic, Pacific, and Alaskan offshore areas. Data sources: FPC schedules 1 (a, b, c), attachment B; FPC docket RM 74–4, order No. 499; and IGT Analysis of Gas Industry Exploration and Development Funding.

[3] Foreign LNG estimates show the projected capital expenditures for U.S. facilities and U.S.-owned LNG carriers; they exclude the capital funds required for foreign facilities and foreign-owned LNG carriers. These figures are based on those projects which have filed applications with the FPC. These projects include El Paso 1 and 2, Pacific Indonesia, EASCOGAS LNG, and Trunkline LNG. When additional ventures are filed with the FPC, the industry's capital requirements will increase. (Foreign investment requirements on those projects currently on file with the FPC are expected to approximate $5,180,000,000.)

[4] Capital expenditures for plants to produce synthetic pipeline gas from coal are based on 9 facilities, each with an assumed unescalated plant cost of $850,000,000 and an associated mine cost of $150,000,000, and each with a nominal capacity of 250 MMcf per day. The figures will increase as additional projects are announced but their timing may be retarded because of delays in obtaining regulatory approvals and financing, and in meeting projected construction timetables. Data sources: FPC filings; announced projects; and IGT Projections of Expenditures and Project Schedules.

[5] Arctic Gas expenditures are based upon the certification of the Arctic gas project, inclusive of the Northern Border pipeline; however, expenditures for the gas handling, gathering, compression, and conditions facilities to be built on the North Slope of Alaska, and the pipeline facilities running to west coast markets are not included. (These facilities could approximate an additional $2,000,000,000).

[6] Included as a portion of conventional construction expenditures.

[7] All projections have been adjusted for future cost increases approximating 6 percent per year.

APPENDIX D

COMMENTS ON H.R. 12112

Section 18(a) The definition of a "demonstration" facility with respect to a high Btu coal gasification project should envisage a commercial sized facility or process brought to the point where costs, reliability and quality of product are known and where conventional financing becomes possible on a comparable facility. In the case of high Btu coal gasification, a "pilot plant" will not meet these criteria.

18(b)(1) The authorized loan guarantees should clearly apply to all construction and start-up costs, including all taxes and capital and financing costs.

It is assumed that the $4 billion of authorized loan guarantees relates to the principal amount of such guarantees. It is also assumed that the guarantees on the debt outstanding on September 30, 1986, will extend to the maturity of such debt.

18(b)(3) Concurrence of the Secretary of the Treasury with regard to certain terms of the guarantees should be most helpful in minimizing any possible impact on the capital markets.

18(b)(6) The issuance of loan guarantees on the basis of competitive bidding to the extent possible must be carefully approached because of the lack of comparable criterion upon which to judge the merits of alternative projects.

18(c)(7) In the case of a facility planned to be located on Indian lands, the written consent to such location by the appropriate Indian tribe could lead to inordinate delays unless some statutory overriding provision is authorized. (See comment re: 18(e)(1))

18(e)(1) The ability of the Administrator to proceed with a project by reason of overriding national interest, even though the Governor of a State objects, should be extended to other political entities if the present language does not convey this authority. Financing cannot proceed until all such matters have been satisfactorily resolved.

Perhaps the right of eminent domain should be included.

18(e)(2) The Administrator should have exclusive authority with respect to a determination of project costs and who should pay such costs. The Administrator's determination should be binding upon the States, political subdivisions and Indian tribes; otherwise, a disparity could result from those costs recognized by the Administrator and those costs recognized by other entities. This disparity could jeopardize the willingness and/or ability of the sponsor(s) to undertake the project to the extent it must finance this disparity on its own credit.

18(g) (2), (3) and (4) It should be made clear that in the event the loan guarantees are invoked, the Administrator's recourse extends only to the project and is subrogated to the rights of the lenders to which the loan guarantees apply.

18(j) It is assumed that the fees will apply to the average principal amount of outstanding obligations covered by the guarantees.

18(k)(1)(c) The costs incurred in connection with essential community planning and development will necessarily constitute a part of the total cost of a project. In our opinion, guarantees will be necessary to finance these costs because the capital required thereto will be exposed to the same risks as the other capital invested in a project. Tax abatements are not an acceptable basis for financing these payments because the abatements are not realized without sufficient earnings to utilize them; therefore, they do not provide a sound basis upon which to depend for recovery of investment.

18(k)(5)(b) If the Administrator requires that community development and planning costs be included in the cost of a facility, such costs should be approved by regulatory authorities for rate purposes in the case of facilities sponsored by regulated public utilities.

18(w) It is assumed that the language of this subsection does not affect the provisions of 18(b) and 18(n) in any way that would compromise honoring the payment of the guarantees or operation of the separate "Fund".

General comment

It is recognized that a certain number of approvals and consultations would be necessary in order to execute properly the purposes of H.R. 12112. The following are referred to:

Secretary of Treasury: (a) consultant as to rules and regulations for guarantees; (b) concurrence required as to terms of guarantees with capital market impact in mind.

Attorney General, Federal Trade Commission: (a) comments on competitive aspects and may make recommendation against.

Governor of State: (a) must evaluate project; (b) may recommend against.

Local Political Subdivisions: (a) may review and comment; (b) receive grants for impact studies, etc.

Indian Tribes: (a) may review and comment; (b) receive grants for impact studies, etc.; (c) must give written permission.

Secretary of Interior: (a) approve use of Indian lands.

Committee on Science and Technology, House of Representatives, and Committee on Interior and Insular Affairs, Senate: (a) approval of guarantees; (b) receive reports prior to commitment of guarantee.

House of Representatives, Senate: (a) together, may reject guarantee.

Environmental Protection Agency, Federal Energy Administration, Department of Housing and Urban Development, Department of the Interior, Department of Agriculture, Department of Treasury, Advisory: (a) consultant as to comprehensive plans to implement program.

The number of persons or entities involved will, in all probability, require substantial amounts of time which, as a result of inflation, will add to the cost of the demonstrations and could adversely affect their economic viability.

Mr. OTTINGER. We will now hear from Dr. Charles J. Cicchetti.

STATEMENT OF CHARLES J. CICCHETTI, Ph. D.

Mr. CICCHETTI. Mr. Chairman, first I would like to apologize for not having a prepared statement. But the topic of the day was changed, and I was not able to quite get both my material and prepared statement together.

My purpose is limited to high Btu coal gasification, and that is also limited in terms of my concern to matters surrounding Federal and State financing and other regulatory matters.

My being here is a reflection of the serious concern that I have about natural gas shortages now and in the future in my own State of Wisconsin and, indeed, throughout much of the Midwest and the east coast.

We have learned to accept and believe that the natural gas shortage is real. We have a large number of customers who are being told this year that there will not be any gas this coming winter, and that they had better find alternative fuels.

That kind of atmosphere is one of growing concern in some of the neighboring States as well. Indeed, if we look at the 1980's, and we look at the Midwest, without Arctic gas or Alaskan gas, and if we look at that same part of the country without some of the coal gasification projects that are being proposed, we see a very real danger of having to curtail residential customers as early as the early 1980's, 1981 or 1982.

So we are quite concerned about the supply situation. At first glance, upon reading the proopsals that are being made to finance the projects that we are considering in terms of coal gasification, is that they appear to be quite incredible in terms of all the different steps and intricate places in which the regulatory commissions in the various States are being asked to change what are traditional and normal practices.

Indeed, I believe that the topic of concern today, the loan guarantees, is one of the more direct and obvious and easy to understand aspects of total financing.

What I would like to do is to review with you in some detail some of the proposals and some of the steps that are being made at the State level in terms of financing the American Natural coal gasification facility so that you can learn two things:

(1) How the loan guarantee fits with the overall nature of financing, and the other guarantees that will be required for the whole project; and

(2) So that you can get a sense of understanding that despite the problems, despite the difficulties, despite what we are being asked to consider in these matters, I believe that we have to look at them very carefully because the prospect of not having gas is quite frightening.

The first of the items that we hear about is to have a cost of service all-events tariff. That kind of a tariff is not totally new. State regulatory commissions are used to operating on a system where costs that occur are actually collected by the utility or by the pipeline. So it is not a new concept.

What is a new concept is that the State regulatory commissions and the public, and the Federal Power Commission really don't have control over the actual cost and steps in the project, and that, indeed, is a very different when you talk about cost of service, when you control the cost, as opposed to when you have to deal with those costs that are

incurred outside of the normal regulatory channels, and then you are required to pass them on.

Mr. NORDHAUS. Mr. Cicchetti, would you be kind enough to spell out, for our hearing record, exactly what an all-events tariff is, so that we have a complete record on this.

Mr. CICCHETTI. Let us suppose that you build a project. It does not work quite as well as we had expected. Or let us suppose that customers that you had expected to buy the gas, decide that they don't want to buy the gas. Or let us suppose that the project starts, and then it runs into some difficulty.

The all-events tariff would take into account these kinds of events in the way of uncertainty and risk, and obligate the wholesale customers, that is the distribution utilities, to pay the cost that the pipeline would incur in building these projects. In turn, State regulatory commissions would obligate the customers to pay the wholesale distribution customer, the utility customer, for the costs that they have incurred.

It is a multi-State and Federal combination to basically take into account most of the risks that would be involved in the construction and operation of unproven technology.

Mr. OTTINGER. Are you advocating this as an additional incentive?

Mr. CICCHETTI. I am saying that this is one of the proposals, it is one of the key ingredients to the overall financing of these projects. It is not only loan guarantees that are involved in coal gasification projects. It is also this all-events tariff that I have mentioned.

There are also several other items that are equally difficult to accept.

Mr. OTTINGER. The all-events tariff is not in this bill, is it?

Mr. CICCHETTI. It is not in this bill, but it is in the financing package, and in the proposals that are being made by the coal gasification project developers before the Federal Power Commission, and the presentations before State regulatory commissions.

Mr. OTTINGER. Do I understand correctly that the proposals are for this all-events tariff on top of 90 percent start-off guarantees and 75 percent overall guarantees?

Mr. CICCHETTI. That is correct.

Mr. OTTINGER. I do understand now, you may proceed.

Mr. CICCHETTI. Another requirement is that the pricing that takes place in terms of the structure at the wholesale level and at the retail level, that is at the Federal Power Commission level and at the State regulatory commission level, has to be on a rolled-in basis.

A lot of the issues are very much the same as the issues surrounding electricity pricing, which I know this subcommittee has considered.

Mr. OTTINGER. That is the second call for a rollcall vote, and as much as I hate to interrupt you, I am going to have to go over and vote. So we will recess for about 10 minutes, which it will take me to go over there and come back.

[Brief recess.]

Mr. OTTINGER. The subcommittee will come to order please.

Mr. CICCHETTI. One of the other key provisions of the regulatory steps that are part of the overall financing of these projects is the issue of rolled-in versus incremental cost pricing.

I guess that I have thought about the issue at some length, and I think that in part we might have more of a difference in communica-

tion than a difference in substance. I don't believe that anybody who is proposing regulatory prices for natural gas from nonhistorical sources, such as coal gasification, believes that you should price all gas sold at the price equal to the nonhistoric source, so that when it comes to calculating bills this is how much that each customer pays. They have to be rolled-in, in terms of finding out the total obligation of any customer.

For example, if you had 90 percent of the gas coming into a State at $2, and 10 percent coming into the State at $5, the overall bill that would be collected, would have to be determined on a weighted average, or rolled-in basis.

Where there is some difficulty is whether there is a requirement to make the structure of the bills reflect the same kind of canceling out of the fact that new gas is coming into the State at $5 versus the historical price, let us say, of $2.

I think that we can find ways of coming up with such a structure. I think that it would be wrong for State regulatory commissions and for the Federal Power Commission to agree in advance, and to tie their hands in trying to find such solutions.

I don't think that anybody is seriously saying that we should have anything but a rolled-in calculation of actual bills to customers. The issue is the structural question. I think that there is a greater understanding and less difficulty between parties.

But rolling-in, perhaps more extreme than I mentioned, including the actual structure, has been proposed by some gas pipeline companies that are proposing these issues for the construction of coal gasification projects as a necessary requirement.

I don't think that we can accept it. To do so would mean that we will find that we will build a lot more of these projects than would otherwise be economic.

One of the provisions that American Natural has made, which I find to be a extremely useful piece of financing and regulatory action, is something which it called a ratchet rate of return.

The ratchet rate of return, as I understand it, takes into account the fact that if a coal gasification project does not produce the full volume of gas that is anticipated, there will be an adjustment made in the amount of earnings and equity, that the equity portion of the project will be allowed to earn.

So that proceeding in steps, the ratchet of the project goes all the way down to only producing 25 percent of the gas that it was supposed to produce, the equity portion will be reduced to zero. There are steps in between the 100-percent return for equity for the 100 percent fully producing projects.

That kind of a financing step, I think, showed a great deal of insight, and showed that equity under the American Natural project would continue to retain risk. I think that this is a very good part of the overall proposal.

There are two other items that I will try to explain in terms of financing to complete my description of these matters.

One way of looking at them, or thinking about them is that it is a way for regulated companies, which do not have retained earnings the way that other corporate entities have them, to find a way of get-

ting some internal funds to finance part of the equity portion of the projects.

The loan guarantee is for the 75-percent debt, but it is the other 25 percent which would be financed by equity. Two methods have been proposed as a way of getting at some of the equity portion.

In the American Natural case, about half of the project would be funded by new issuance of stock, but the other half, or that half, would come from two sources. One is something called an allowance for funds used during construction. Basically, it is a surcharge that would be allowed to be collected by the Federal Power Commission, and the State regulatory commissions that would be involved.

This would provide funds that are something like retained earnings, but are also very much like having existing customers come up with a prepayment that will provide about 25 percent of the equity portion of the project.

Mr. OTTINGER. It is like construction work in progress.

Mr. CICCHETTI. Yes, but it has one very important difference. It is that the project itself is not something that ultimately goes into a new rate base. The project itself is outside of the rate base. It is a way of coming up with some equity financing for the overall project.

Accounting based on full cost of service and the actual construction of this projet are outside of the rate base. This means the State regulatory commission doesn't really have overall control of the total costs, or about the treatment of total costs from an accounting system, the way that they do with construction work in progress. It does not appear to me that it is part of the proposal, but I think that it is one of the things that has to be considered.

The second area is the investment tax credit. It has been proposed by American Natural that each of the distribution utilities in Michigan and Wisconsin, that would get the benefit of the coal gasification project, that they create limited partnerships or affiliates for each of the main distribution companies that would buy the gas at the wholesale level, and that they use the funds that are going into the capital structure of the investment, which will create investment tax credits under the Federal income taxes. State regulatory commissions are asked not to approve the use of those tax credits against the revenue, and income position of the actual distribution utility's main operation.

Rather than allow the advantages of the investment tax credits to drop prices for existing ratepayers, the State regulatory commissions are being asked to allow the project itself to be financed without dropping prices.

So, again, there is a system whereby current ratepayers are actually providing funds which will go into the affiliated partnership, which would go into the actual financing of the project.

If you will look at the $100 million of equity in the American Natural project, it turns out that about 25 percent or so would come form the funds used during construction—associated funds used during construction, and about 25 percent would come from the investment tax credit partnership application of funds to the main operation of the utility.

I think that one way of thinking about both of these provisions, as I said, is to think of it as a way of basically creating retained earnings for financing a project in an industry that is regulated and, therefore,

retained earnings are not part of it, for the financing of a project which will be outside of regulation, to a large extent, and which would normally have retained earnings if it were operating, and had been operating. Since it is a new venture, it does not have the advantage of those retained earnings.

When all is said and done, I think that you will find that the project itself, the projects that you are being asked to consider have some very important, and some very challenging kinds of regulatory functions that are being requested.

Most State regulatory commissions, and I have spoken to many of them on this subject, have indicated great difficulty in accepting these kinds of new steps in the form of financing the equity portion of such projects.

On the other hand, when the prospect of looking at the future without gas supplies for the residential and commercial customers is considered, and especially if the future includes any difficulties with respect to bringing Alaskan or Arctic gas into the midwest, these projects look better and better. The challenge is to come up with regulatory solution and financing solution which can help get these projects started.

The loan guarantee is a small part of the overall complexity of financing these projects, and I think that to understand loan guarantees, and to understand these projects you have to hear the other half of the story, and this is what I have tried to do.

Mr. OTTINGER. Let me try to clarify a couple of things that I am not sure about.

This legislation, I take it, does not make provision for what you are talking about?

Mr. CICCHETTI. That is true.

Mr. OTTINGER. Is what you are saying that the utilities, the pipeline companies can finance this under existing State regulations without the need for the loan guarantees?

Mr. CICCHETTI. The position that is being taken by American Natral—and I believe by some of the other ventures in this area, but I certainly know that this is true for American Natural—is that without loan guarantees all these other steps are unnecessary, because the project itself will not be financed unless the 75 percent debt that would go into the project is guaranteed by Federal loan guarantees.

All the things that I have been telling you about, in terms of problems and concerns, are really problems that are directed at the 25 percent equity part of the project.

Mr. OTTINGER. Are you saying, then, that the combination of the things that they are asking for is such that you think it is a bad financial scheme? I don't see where you are coming out.

Mr. CICCHETTI. I am not coming out directly for or against this method. What I am saying is that I have serious problems with some of these equity financing schemes, but the seriousness of not having gas is such that we are trying to find ways of improving those schemes.

The loan guarantees is something that we are being told is a step that has to be taken, or these other steps in terms of figuring out these equity financing scheme just don't matter because the project itself will be dropped.

So it is a combination. The Federal Government, in the form of the Congress, is being asked to come up with 75 percent loan guarantee. The State and the Federal Power Commission are being asked to come up with the 25-percent equity.

I have troubles with the 25-percent equity that are far greater than any difficulties I have with the loan guarantee.

So, to answer your question, I favor the loan guarantee, but I have problems about the other part of the financing. I think that we are trying to find solutions to them, especially if we don't get Arctic gas into the Midwest, because these projects are the only mechanism that we really have against cutting off residential customers who are planning on heating their homes in the early 1980's in Wisconsin and Michigan.

Mr. OTTINGER. What are the alternatives, if gas is not available?

Mr. CICCHETTI. The alternatives for new customers is that you could have fuel oil. You can have propane, particularly in rural areas. The costs are quite high, but if it is a new home, you can take that into account to some extent with insulation.

You could also have electric heat. The electric heat would require a decision to be made now among the utilities in Wisconsin and Michigan to build a larger number of nuclear-fired powerplants.

Given the lead time, if we know that the answer is no on coal gasification, and no on Arctic gas, then we have to pull out a lot of stop signs, making provisions for additional electricity, not only for heating homes, but also for backstopping the jobs that will be needed to keep the level of economic activity up where it is currently.

Mr. OTTINGER. The prime source now for heating homes in your area is natural gas?

Mr. CICCHETTI. Half the homes in Wisconsin are heated by natural gas.

Mr. NORDHAUS. I would like to sort of follow up on two pieces of testimony that we have received so far.

Dr. Bosworth expressed some concern about the possibilities of programs that are structured in a way that would provide for incentives for default, or early termination of projects.

He stated his concern in this form. If at any time the owners' equity becomes negative, the rational investor will default.

Now Dr. Cicchetti has testified with respect to the American Natural Gas project that what appears to be envisaged here is 75-percent debt financing, which would be guaranteed under the bill that we are having the hearing on today, and 25 percent would be equity. Of that equity, approximately a quarter would be derived from the investment tax credits, a quarter would be derived from the AFUDC surcharge, and 50 percent of the 25 percent, or 12.5 percent would be the equity contribution of American Natural Resource and the distribution companies which would participate in the project.

Now the question at this point is, Dr. Bosworth, if you added first depreciation in the first year, using double declining balance in the 20- and 30-year useful life, would you find that there would be a negative equity and an incentive to default in the first year under the financing structure that has been outlined by Dr. Cicchetti.

I would like Mr. Willott to respond to this also, since I assume that he has some special knowledge in this area, too.

Mr. BOSWORTH. It would depend a little bit on the financing. Here we seem to be considering, for example, a hypothetical case of the 75-percent loan guarantee, and at least 25-percent equity in the project.

Now we hear that there are other measures being taken in other areas where, in fact, the builder of the project is not putting up the other 25-percent either. So that raises it not to a loan guarantee of 75 percent, but a number that goes up to 8- and 90-percent.

Immediately, 90 requires no operation whatsoever. The 10-percent investment tax credit due to the participants puts the equity at zero.

Now, if you are assuming a 10-percent depreciation, for example, in the first year of operation, or after 1 year of operation, the required percentages are down to 80 percent. You have now 20-percent recovery of your original capital. So anything less than 20-percent equity financing, the person in the first year of operation has gotten his money back.

If you add into that the reason that we are doing these projects is because people think that they are going to learn knowledge about how to build, that is going to accrue in the first couple of years. Everything that I am going to learn about how to operate one of these plants, I am going to learn in the first couple of years.

Most of these loans are balloon type loans. No repayment of principal is made until the end of the loan period. There is only a payment on principal during the years involved, and it is not an amortized loan like the mortgage loan, necessarily.

So what you are getting into is this situation where the amount, the value of the assets is steadily declining each year because of depreciation, return on knowledge, and the investment tax credit right at the beginning, whereas the loan guarantee is going down a lot slower.

Then it seems to me extremely logical that anything approaching 75- or 80-percent loan guarantee will raise the possibility of the problem. An unviable project will give rise to negative equity.

Another question comes up, and many people will say, and I agree with them, that no default will actually occur, instead you will be left with the Lockheed situation. It is extremely embarrassing to the Government, as an administrator of the program and to the firms involved, to ever agree to go into default.

So, instead, alternative financial adjustments will be made. In the case of public utilities, the rates will be revised to reflect these costs, to make the project again profitable.

I think that once the Goverment is committed to a $1 billion project, there is no way that public relations will allow it to default. What I am saying is that technically it will be in default, and there will have to be other changes in financial arrangements to keep it going exactly the way it happened with Lockheed, because it is too embarrassing for the Government to let it go under.

Mr. NORDHAUS. I would very much like to have Mr. Willott's response to Dr. Bosworth's remarks, and also to Dr. Cicchetti's description of that particular project, which I understand Dillon, Read had a large hand in putting together.

Mr. WILLOTT. The important point that we must not forget here is that without Government guarantees and the other support proposals which were outlined by Dr. Cicchetti, the projects will never be initiated in the first instance.

This is the case because the sponsors of high Btu coal gasification projects, which represent a cross-section of the natural gas industry, must utilize a significant amount of their available equity resources just to provide the necessary equity capital to finance these projects. In other words, the project sponsors must commit a substantial portion of the equity funds they can generate and raise in the next 3 to 5 years just to supply the equity portion of the financing requirements for their coal gasification projects. We are talking about a commitment of equity to approximately 25 percent of project cost. Given the magnitude of these projects and given the possibility of cost overruns which also are expected to be financed on basis, the requisite amount of equity will represent a very substantial portion of the sponsor's total equity position.

It is true that during construction there may be loan guarantees up to 90 percent of project cost. It is also true that up to 10 percent of project cost may come from investment tax credits, but in the event of noncompletion or abandonment after completion, there will be substantial penalties to the sponsor with respect to repayment of the project's investment tax credits to the Federal Government. In addition, the project sponsors would be subject to extremely onerous reporting losses which would reflect adversely on their financial statements.

In any event, as pointed out in our prepared statement, Government guarantees are not expected to exist in a vacuum. They represent only a part of the envisaged credit support. For example, a cost-of-service tariff is still a very important aspect of this support, that is, the flow-through of all operating costs and capital costs to the ultimate consumer. That support is intended to assure the Government that its loan guarantees will constitute only a contingent backstop to consumer support subsequent to the commencement of project operation.

In addition to the financial burdens to sponsors resulting from project abandonment, the sponsors would also lose an important supply of critically needed gas. Coal gasification projects are not peripheral business activities of the gas industry but represent a new source of additional supply when delivered through existing pipeline and distribution systems to areas of the country in need of gas. Additionally, the Federal Power Commission, which has the authority to set the price on this gas once it has been commingled with natural gas, will have a certain say upon the matter if, in fact, abandonment is contemplated. For all these reasons, sponsors will have no incentive whatsoever to abandon their projects.

Mr. OTTINGER. I take it that with all of these tariffs that ought to be adopted in connection with this, at the bottom line, if there is a failure, with the all-events tariff which you are proposing be adopted, in conjunction with this, you are going to put the cost of any losses on the utility customers.

Mr. WILLOTT. Would you please repeat your question?

Mr. OTTINGER. If the project fails. Your proposal is that the cost of that failure should be borne by the utility customers?

Mr. WILLOTT. No; only a portion of the cost of the failure, the portion which would represent debt repayment over a period of time.

In the case of project abandonment, there would be no return of equity through the tariff or otherwise. It would mean that the full equity investment would be lost. Furthermore, in the case of Amer-

ican Natural Resources' proposal for a coal gasification project, the return on equity would terminate in the event project deliveries were reduced to 50 percent or less than expected deliveries.

Mr. OTTINGER. Dr. Cicchetti, how does this all-events tariff work in the situation where it does not work the way it sounds, the way that you were describing?

Mr. CICCHETTI. There are several kinds of all events. One is the event of not having the gas actually flow at the volume anticipated, such as only getting 50 percent of the gas, or 25 percent of the gas. As I recall, the equity return goes to zero at 25 percent, but it is cut pretty sharply at 50 percent. But that is only one of the kinds of all events.

The other kinds of all events that we would be concerned about, if the market for the gas dries up. It is, if gas is so expensive under these provisions of financing that customers want to go to some other form of energy. If that happens, and there are no customers for the gas, then the remaining customers would have to pay a bigger portion of the actual overall costs.

The other thing that is important to keep in mind in all of this is that if you are looking at the utility rate payer impact, they will be responsible for more than 75 percent debt. They are also, in part, responsible for having provided some of the equity that goes into the 25 percent. About 12.5 percent of the overall cost of the project comes from these prepayment types of financing.

Let us suppose that the project "cratered," and there was no money for equity. Equity, in part, at least half of the equity has come from rate payers by not having their bills lowered during the construction phase of the project.

So the amount that is actually sticking out there, is the equity part that came from the sale of new issuances from the distribution companies, and from American Natural. That is still a large sum of money. It is an $80 million risk. That is a large risk given the total assets of the companies involved.

It is not as much of a risk as it might have sounded without seeing some of these other details.

Mr. OTTINGER. Dr. Bosworth, you raised the possibility of the negative equity with the piling on of various kinds of incentives one on top of the other. How likely do you think that this is to happen?

Mr. BOSWORTH. I don't know because it requires knowledge of the specific project, and whether or not the project being conceived is actually a profitable project. If it is really a profitable undertaking, then the likelihood is very low.

I note that in the ERDA program, for the overview of this thing, it goes beyond the overview. The price guarantees and everything else would suggest to me that the real problem with these projects at present is that nobody knows what they are going to cost, sort of thing. But reasonable expectations are that they are not going to make a normal profit at market rates for the energy under normal conditions.

It would still be OK, but it is an infant industry argument. I would prefer, on the financing of these sorts of things, that the money be put right up front. That it be out in the open and clear. The Government is making how much of a contribution to these plans.

When I hear that you are going to do some through a tax on public utility consumers, but not on others. Some through taxes, some through

a loan guarantee, some through prices, I don't know how the market is able to evaluate whether this is a profitable program, or a boondog.

I would remind you that a loan guarantee is an extremely powerful weapon. The moment that the loan is guaranteed by the Federal Government, I can raise a million buggy whips, because there is no restriction from the point of view of the investor. They don't care anymore if the project is profitable.

Mr. OTTINGER. I was incredulous when you testified in favor of this thing in the first place before the Science and Technology Committee. The more I learn about it, the more incredulous I become.

You support the overall idea that the Government ought to be involved in credit allocations as opposed to the Reuss bill, for example, that would have had the Government assign priorities in terms of social need through the use of credits?

Mr. WILLOTT. Let me say that we are specifically responding to a particular bill, one with which I am familiar. I hesitate to expand into other programs or legislative proposals with which I am not familiar.

In connection with high Btu coal gasification projects, we have determined after several years of work, analysis and evaluation that companies in the natural gas industry cannot finance these projects on their credit alone. In essence, this determination is based upon the characteristics of these projects—their size, technological risk and capital intensity—and the limited amount of equity capital which natural gas companies have to support the magnitude of the capital requirements to be financed. As a consequence, we have reluctantly come to the conclusion that credit allocation or Government loan guarantees, whatever the name may be, are necessary for these specific projects.

Mr. OTTINGER. Maybe they are no damn good.

Mr. WILLOTT. Again, I am only directing my comments to high Btu coal gasification projects. Such projects are based upon years of environmental and socioeconomic work and also reflect extensive engineering studies, including testing in pilot plants. Furthermore, the gas industry sponsors are willing to risk their reputation and a substantial amount of their funds for a relatively small, but urgently needed, amount of gas.

I believe they are quite confident that the projects will work. The fact that they are not seeking Government guarantees for their equity investments indicates to me that they have a considerable amount of confidence in the feasibility and success of these projects.

Mr. OTTINGER. I assume that if we favored this particular form of energy with loan guarantees, that other competing forms of energy are going to feel very much put upon, and that they are going to come in and ask us for loan guarantees as well. Do you think that this is a good idea?

Mr. WILLOTT. I agree with you that it will most likely happen. Whether it is a good idea will depend upon the specific facts of each case. Some projects are far along and have certain identifiable merits with respect to the national policy of energy advancement, and perhaps others will be in the realm of future energy sources.

Mr. OTTINGER. How far should we go in the administration of the proposal that this be the first step in the establishment of $100 billion loan guarantee program for the development of various kinds of

energy resources, assistance to utilities, and so forth. Do you think that this is going too far?

Mr. WILLOTT. A $100 billion loan guarantee program can be regarded as large by any standard—historical or projected. The effect of such a program on our capital market is a function of more than the size of the program alone but will depend on many other factors specified in our direct statement including monetary and fiscal policy, inflation, employment and capital market conditions in general. For this reason, it is my judgment that we must evaluate the merits of various energy project proposals on an individual basis in determining whether or not Government loan guarantees should be provided.

Mr. OTTINGER. Basically, what we are trying to accomplish is to establish a principle here. Once that is established, I think that the expansion of their full desire is going to be a great deal easier, and I think that this is what they hope.

Mr. WILLOTT. I am not sure that the parties here are trying to establish a principle of loan guarantees. Loan guarantees have been established in many areas before.

Specifically, they are asking to be given consideration for loan guarantees for the advancement of energy projects which cannot be financed and built in any other way at the present time.

As to the future, Congress must evaluate each program in terms of national priorities.

Mr. NORDHAUS. A couple of questions on matters that I wanted to follow up.

You mentioned that the participants in the American natural gas project would suffer substantial losses if they walked away from it at any time. I wonder if you could refer to the table that Dr. Cicchetti has given us. Do you have a copy of it.

First of all, in examining it, do you think that it is a reasonably accurate portrayal of the intended financing arrangement.

[The table referred to follows:]

ANG COAL GASIFICATION COMPANY—EQUITY INVESTMENT BY POTENTIAL PARTNERS

[Dollar amounts in thousands; escalated at 7.5. percent per annum]

Line No.	Name	Percent [1]	External equity	Investment tax credit	Surcharge net income	Total
1	Wisconsin Gas Co	16	$12,600	$5,400	$5,500	$23,500
2	Wisconsin Natural Gas Co	7	5,500	2,400	2,400	10,300
3	Wisconsin Public Service Coop	7	5,500	2,400	2,400	10,300
4	Madison Gas & Electric Co	3	2,300	1,000	1,100	4,400
5	Wisconsin Power & Light Co	3	2,300	1,000	1,100	4,400
6	Michigan Gas Utilities Co	3	2,300	1,000	1,100	4,400
7	Michigan Power Co	2	1,600	700	700	3,000
8	Wisconsin Michigan Power Co	2	1,600	700	700	3,000
9	Wisconsin Fuel & Light Co	2	1,600	700	700	3,000
10	Subtotal	45	35,300	15,300	15,700	66,300
11	American Natural Gas Co	55	43,300	18,600	19,000	80,900
12	Total	100	78,600	33,900	34,700	147,200

[1] Based on existing annual contract entitlements.

Mr. WILLOTT. May I call on my colleague, Mr. McClurg, to comment on that.

Mr. MCCLURG. It seems to be a correct portrayal, yes.

Mr. NORDHAUS. It is a scaled down version of the project, and I have applied the 147 million. I would assume that we are talking about a total investment in the neighborhood of $600 million.

Mr. MCCLURG. On these numbers, it would be $900 million.

Mr. NORDHAUS. The actual external equity, that is, the equity contribution by the partners, would be only a little more or a little under $79 million, or well under 10 percent of the cost of the project.

Mr. MCCLURG. The external equity is $79 million. That is correct.

Mr. NORDHAUS. The remainder is obtained through investment tax credit and the surcharge.

Now, would there be any circumstances, assuming that the partners used a double declining balance method of depreciation, would there be circumstances under which they could, in the first few years of the project, walk away from it without suffering substantial loss, considering the tax benefits that would accrue in the early years both from the depletion of the coal and the accelerated depreciation?

Mr. MCCLURG. No, sir. The reason for that is three-fold.

First, the investment tax credit is recapturable by law. In the case that you are outlining, the investment tax credit must be repaid by the sponsoring companies to the Federal Government.

Second, the cash flow resulting from depreciation must be applied to the amortization of debt.

Third, I would vehemently disagree with Dr. Bosworth that we would have balloon payment in these types of projects. The lenders will not accept such an arrangement. They will require that the cash arising from project depreciation be dedicated to the amortization of their debt. They may require 100 percent of that depreciation to be applied to the amortization of the debt before equity receives any benefit whatsoever.

Mr. NORDHAUS. I wonder if you could submit for the record an analysis which would show or give us this in a little bit more detail. I don't think that we can go through all the numbers now. But if you could show us what the situation of the partners would be after taxes in the first 10 years or so of the project, it would be very helpful.

Would you be able to supply that, for us?

Mr. MCCLURG. Yes. I think we could.

[At the time the hearings were printed the requested material had not been received.]

There is another aspect of this equity situation which I would like to mention. The surcharge that you see on the schedule represents the after-tax earnings on the equity capital invested by the project sponsor. It represents an investment that has to be made by cash.

If the surcharge were not applicable or operable, the earnings would have to be capitalized and funded by additional amounts of external financing. Thus, the $147 million is the actual investment by the sponsoring company. It so happens that the surcharge is a reinvestment of the net income on that equity investment.

Mr. NORDHAUS. The surcharge is derived from——

Mr. MCCLURG. It is a net income figure that is calculated on the equity investment. The sponsoring companies have elected to reinvest the income, which means that they do not have the cash flow to service the dividends on their outstanding common stock.

Mr. NORDHAUS. According to Dr. Cicchetti, this is income that they otherwise would not have, if I understood him correctly.

Mr. CICCHETTI. I am not exactly sure myself what it is. As I understand it, the way that it was explained to me, it is a way of getting what would be profits for the affiliated companies instead of being put into the consideration of the State regulatory level in terms of figuring out how much rate payers would have to pay, instead of having it used for that purpose, the profits would be held back and reinvested into the unregulated portion of the business, so to speak.

Mr. NORDHAUS. It is an exclusion from operating revenue for purposes of State ratemaking.

Mr. CICCHETTI. I would say, basically, and the easiest way to understand all of this, it is a way of retaining the retained earnings in an industry that does not have that provision. To finance these projects, we might have to have that kind of method.

At least, this is the way that I understand the method. I am not an accountant, and I don't understand all the intricacies of these things.

Mr. NORDHAUS. At this point, probably the best thing for us to do is to ask Mr. Willott and Mr. McClurg to give us an explanation explaining the nature of the net income, and the projection of the after-tax situation for the partners in this enterprise in the first 10 years or so.

I would like to raise one other question at this point. I notice, Mr. Willott, that in the second page—the first and second pages you note that you have concluded that the Federal financial support of loan guarantees, and the provisions in H.R. 12112 will be necessary to accomplish the financing of this project. At what point did you reach that conclusion with respect to the American Natural Gas project?

Mr. WILLOTT. The point in time?

Mr. NORDHAUS. Yes.

Mr. WILLOTT. We reached our conclusion after evaluation of all other alternatives and after consideration of all financing possibilities within the framework of the private sector.

Mr. NORDHAUS. At any time, did you feel that it was possible to fund that project without the loan guarantees? Did Dillon, Read at any time advise American Natural Gas that it was possible to fund the project entirely privately?

Mr. WILLOTT. I do not believe that a formal opinion of that nature was given. However, we did evaluate all possible ways of financing in the private sector.

Mr. NORDHAUS. Let me rephrase my question. Did you at any time view it as possible to finance the project privately?

Mr. WILLOTT. We were concerned, probably from the beginning, that the magnitude of the capital requirements involved were extremely large in comparison to the financial resources of the sponsoring company.

Mr. NORDHAUS. Did American Natural Gas at any time try to obtain approval of the project on the assumption that it would be funded privately.

Mr. WILLOTT. I think that you may have to ask American Natural Resources for the answer to that question.

Mr. NORDHAUS. They will be with us later on this afternoon, and we will ask them.

Mr. OTTINGER. I think that we ought to move on, but there is one thing that I wanted to ask you.

In consideration of this matter before the Banking and Currency Committee this morning, Congressman Rousselot suggested that nonrecourse loans as suggested in this legislation, if this project were to go forward, it should have the same kind of loans that were provided to Lockheed, where the assets of the company would be on the line with respect to any default.

Would the project be feasible, and what would be your opinion, to having the recourse loan?

Mr. WILLOTT. The assets of the project will be on the line. If you are suggesting that the assets of the particular sponsor should backstop the Government loan guarantees, such a suggestion would be self-defeating. Although the gas company sponsors are willing to place substantial sums of money at risk in the form of their equity investments, they cannot prudently backstop the entire project because any potential problem, despite its improbability, could jeopardize the sponsors' financial postures and thus their ability to continue to provide service to their customers.

Mr. OTTINGER. Would it apply to Exxon, which is one of the applicants, in terms of this program?

Mr. WILLOTT. I do not believe that Exxon is an applicant with regard to this program.

Mr. OTTINGER. So your feeling is that if the assets of the sponsoring corporation were required to be put on the line, behind these projects, they would not go forward.

Mr. WILLOTT. I think that this is undoubtedly the case. They all have existing indentures and outstanding loan agreements which restrict the type and degree additional debt or guarantees they may undertake.

Mr. HENKE. Mr. Bosworth, I would like to get back to your suggestion that price guarantees would be, perhaps, more desirable for financing, than loan guarantees.

I would like to know the effects of the price guarantee in the case of failure of the project due to some sort of regulatory environmental stoppage, or litigation stoppage, which is one of the reasons why there is an attempt to establish such a program to generate information about those sorts of impediments.

How would price guarantees protect an investor in the event of a stoppage prior to any sort of operation or production from that plant?

Mr. BOSWORTH. The price guarantee only offers protection against unforeseen changes in market prices for competing fuels.

Mr. HENKE. What is the likelihood of a need for price guarantee, in your opinion?

Mr. BOSWORTH. Over the lifetime of these projects—I would like to point out to you that a loan guarantee in no way changes the risk of a project. These projects are just as risky without a loan guarantee as with a loan guarantee. All they have done is to divorce the investor from the risk, and the risk of that project is now assumed by the Federal Government.

In the private market, and I am not normally one to speak for the private market that much. It evaluates alternative proposals, and it eliminates those that are not good ideas. If you are going to guarantee a project, it is either a good idea or a bad idea, but who is going to decide that it is a bad idea. With what we have done, the risk of those projects is still there.

It is just that the Federal Government says that for some reason which the private market does not understand how risky these projects are, and they will take over the risk. I don't see any reason why that is true.

Mr. WILLOTT. May I make a comment?

There are two things that we must remember. First, the projects are not going to be financed and built without the thorough investigation by and approval of a great number of parties. In this regard the sponsoring companies have already expended considerable time, effort, and funds in establishing the technical, economic, and environmental feasibility of their projects. Moreover, it can be expected that the Administrator of the program as well as other governmental entities, such as regulatory commissions and State and local bodies, will also seek assurances with respect to the successful operation and overall feasibility of the project.

Second, the guarantee program does not protect the equity capital invested by the project sponsors. The program is designed to provide repayment assurances solely to lenders. Lenders will not invest their funds in securities which have any appreciable degree of risk. Since these projects expect lenders to provide the bulk of the capital requirements, lenders will require definitive assurances of repayment from creditworthy entities to induce their participation.

Mr. CICCHETTI. May I comment on that, too.

It seems to me that the whole analogy that Dr. Bosworth makes is missing a very fundamental point here. These are regulated firms. As regulated firms, they don't have anything like retained earnings that an Exxon might have.

The amounts of profit that they can make, and what they can do with them, are carefully controlled at the Federal and State level. Therefore, having funds available to finance these projects is a very significant matter.

Second, what is unique about these projects is there is a regulatory responsibility that is a little bit out of phase, unlike a nuclear power plant that might cost $1 billion. The State regulatory commission that approves it, is also approving the cost of service, and the collection of rates.

These projects costing $1 billion have a whole set of levels of regulation, and even portions outside of regulation, and some of these features are really features that are being developed because of that multiplicity and are out-of-phase with the notion of regulation that we have.

Finally, the total assets that are involved, that could be used as recourse, are basically equal to the total assets of the companies that are involved. American Natural has about $2 billion in total assets. These projects, when fully developed, would cost close to $2 billion, yet it would only represent 10 percent of the total system's gas needs.

We have a system being proposed with very high capital finance. We have had gas with low capital cost, relatively low capital cost, which has been available, and we see now that it is no longer available to meet our future needs.

We have to get some dollars into investment, and one way to start is a loan guarantee for the debt part, and some of these devices for the equity part.

We have to recognize that we have had a real change in the traditional way of getting gas to people, and we have to think about ways of turning it around. These companies are not companies like Exxon, or major oil companies. They are regulated, and that makes them a special case.

All of these things are not ways of getting risk transfers, or passing on subsidies. A lot of these attempts, as I see them, are ways of trying to respond to the unique nature of the gasification companies, and that is very important to keep in mind.

Mr. OTTINGER. Mr. Willott, my recollection was better than I gave it credit for. I think that the information you gave with regard to Exxon is inaccurate. I will refer you to page 124 of the committee report, which has a list of announced commercial high Btu gasification projects which have filed applications with the FPC as of December 15, 1975. The source listed is GAO Report D-76-81, May 5, 1976. It lists the Exxon Corp. as one of those companies that have announced such a project, high Btu coal gasification project.

It says, next to Exxon, "Carter well feasibility study started late in 1973. State and Federal leases are committed." There is on that page a list of other corporations, many of which are pretty well recognizable at $20 billion corporations, to say nothing of the corporations that have filed with the FPC whose average assets, as I see here, come close to $2 billion.

I wonder if you can inform us, with regard to these corporations, how many of them you do not think can afford to put up the capital, or cannot afford, at least, to commit their own assets without risking bankruptcy, behind this kind of a project with the Federal loan guarantee.

Mr. WILLOTT. Congressman, I would be very glad to look into that question, and respond specifically at a later time. At present, however, I am not that familiar with the capital resources of these companies.

Mr. HUNT. Mr. Willott, a few moments ago you said that lenders do not take risk, and they are not expected to take risk. I find this an unusual statement. Certainly, not all debt instruments that come to the market for a given period of time are traded at the same interest rate, are they?

Mr. WILLOTT. That is quite correct.

Mr. HUNT. What would explain the differential between the interest rates, assuming that they were absolutely parallel?

Mr. WILLOTT. Investors do evaluate various debt securities differently. Indeed, certain categories of lenders will accept lower credits and greater risk situations in return for a higher interest rate.

Mr. HUNT. Indeed, an equity investor would automatically feel that he had received more in this type than he would in a debt instrument.

Mr. WILLOTT. In respect of the projects to which I have addressed myself, we are attempting to structure financing arrangements involving several hundred million dollars of debt securities. To place such an amount of debt, the securities must be attractive to a broad segment of the capital market and must be designed to satisfy the requirements of large institutional lenders. These large institutions include insurance companies, pension funds, trust funds, and mutual savings banks. It should be recognized that these institutions act in a fiduciary ca-

pacity, and thus, they cannot expose themselves to the type or degree of risk inherent in these projects without Government support.

In other words, I believe that the market for high risk securities is a much smaller market than would be necessary to finance these types of projects.

Mr. HUNT. There is a risk of failure in debt instruments, is there not, other than a Government instrument?

Mr. WILLOTT. There certainly could be.

Mr. HUNT. Fine, that is all I wanted to know.

Mr. OTTINGER. I think that in the interest of time, we ought to move on to the next panel. I want to thank all three of you for coming, and contributing your time and your knowledge.

The next panel will consist of Mr. Robert McClements, Jr., president of Sunoco Energy Development Co., Dallas, Tex.; Mr. J. E. Bixby, vice president and chief financial officer of Texas Eastern Transmission Corp., Houston, Tex; Mr. Arthur R. Seder, Jr., president, American Natural Resources Co., Detroit, Mich.; and Mr. Hollis M. Dole, Washington representative of Atlantic Richfield Co., Washington, D.C.

We will start with Mr. Seder.

STATEMENTS OF A PANEL CONSISTING OF ARTHUR S. SEDER, JR., PRESIDENT, AMERICAN NATURAL RESOURCES CO., DETROIT, MICH.; J. E. BIXBY, VICE PRESIDENT AND CHIEF FINANCIAL OFFICER, TEXAS EASTERN TRANSMISSION CORP., HOUSTON, TEX.; ROBERT McCLEMENTS, JR., PRESIDENT, SUNOCO ENERGY DEVELOPMENT CO., DALLAS, TEX.; AND HOLLIS M. DOLE, WASHINGTON REPRESENTATIVE, ATLANTIC RICHFIELD CO.

Mr. SEDER. My name is Arthur R. Seder, Jr. I reside in Detroit, Mich. I am president of the American Natural Resources Co., which has been referred to in one context or another as American Natural Gas.

Today, I have filed a statement with the committee, which I ask be included in the record.

Mr. OTTINGER. It will be so included.

Mr. SEDER. My oral statement will be confined to a very brief review of our coal gasification project, and the reasons why we think the proposed Federal loan guarantee program is in the public interest, after which I will try to address some of the questions that have been raised concerning the necessity and desirability of the legislation.

American Natural Resources Co. is an integrated natural gas pipeline and distribution system. Our distribution affiliate, Michigan Consolidated Gas Co., supplies gas that retails to over a million customers in Michigan, including metropolitan Detroit, and other cities and towns.

Michigan Wisconsin Pipe Line Co., an interstate gas transmission company, transports gas from the Louisiana gulf coast and from the Panhandle-Hugoton area of Texas and Oklahoma, and from Canada, to sell as wholesale to Michigan Consolidated and 53 other gas distribution companies located in Michigan, Wisconsin, and five other Western States.

Altogether, we are the supplier of gas to an area having a population of over 8 million people.

Mr. OTTINGER. Your entire operation is either through the Federal Power Commission, or through State regulatory commissions, regulated utilities?

Mr. SEDER. The answer, for all practical purposes, is "Yes." Our two major subsidiaries, or 99 percent of our net income, are regulated either by the Michigan Public Service Commission, or the Federal Power Commission.

We are proposing to build, in western North Dakota, a coal gasification plant capable of producing about 90 billion cubic feet of high Btu gas per year. This is enough gas to heat about 450,000 homes in our service area, and would constitute about 10 percent of our present system supply.

We propose to build the plant in two phases. The first to be completed in 1981. If H.R. 12112 is enacted, and if we are awarded a loan guarantee, we would be able, we think, to begin construction sometime next year.

We are confident of our technology. We have secured the right to draw water from the Garrison Reservoir in the Missouri River. We have made our filings with the Commission, and have completed hearings on all of the environmental aspects of the case by the end of next week.

We have filed, and a draft EIS is now being reviewed by the Department of the Interior.

The fact of the matter is, however, that while we think we can finance our project with the loan guarantees proposed by H.R. 12112, we know we cannot finance without them. The central problem in financing without Government support is simply one of size.

My company's net planned investment is about $1.8 billion, and it is one of the larger gas utility systems in the country, but a relatively small company as compared with major oil and manufacturing companies.

The coal gasification plant is estimated to cost about $1.5 billion by the time it is completed in early 1980's, or roughly the equivalent of the investment my company has accumulated in the 75 years since it was formed.

If American guaranteed the debt to be issued by a coal qualification project, our system's assets and income simply do not provide the credit base sufficient to convince lenders that American Natural could pay off the loan if the project went under.

We cannot prudently agree to such a guarantee, in any event, because to do so would seriously affect our ability to raise capital for the gas supply projects, and to maintain the safety and reliability of our natural gas system.

The question is frequently asked, why, if the project is economically and technologically viable, investors are not willing to put up the necessary capital without Government guarantees.

The answer is that our system and other sponsors of coal gasification projects are willing to risk the equity capital required by the project, amounting to 25 percent of its total cost. The problem is that the other 75 percent must be provided by lenders who are unwilling to take the same kinds of risks and demand assurance of a return on their capital.

An investment of this size, and with the new technology involved, these institutional lenders are fiduciaries, as Mr. Willott just mentioned, and they simply cannot take the risks that are involved.

Our Nation's supplies of natural gas are dwindling, and our system needs service from the coal gasification to meet customer requirements in the early 1980's. Beyond that, we must establish as quickly as possible the technological and financial viability of these coal conversion processors, so that many more such plants can be constructed in the remaining years of this century.

It is for these reasons, essentially, that our company hopes that Congress will, as quickly as possible, enact a loan guarantee program that will enable firms of moderate size to continue participating in the development of high Btu coal gasification projects.

I would like to turn now to some of the questions that have been raised about loan guarantee programs insofar as high Btu coal gasification projects are concerned.

First the question is raised as to whether the deregulation of natural gas and a substantial increase in wellhead prices would not obviate the need for gas produced from coal. The answer to that is clearly, no.

While there are undoubtedly substantial quantities of potential reserves of natural gas to be discovered yet, and while deregulation would clearly increase the incentives to drill for natural gas, we see no possibility that the rate of new reserve additions would rise sufficiently to offset the decline in existing gas reserves.

Accordingly, we foresee a continually widening gap between natural gas supply and demand, even assuming considerably higher natural gas prices, and a reduction of market demand to high priority uses.

In this connection, let me briefly make three points.

(1) From discovery of new reserves totaling about 21 trillion cubic feet per year, in the years 1964 through 1967, new reserve additions in the lower 48 States have fallen into an average of only about 9 trillion cubic feet in each of the last 5 years.

Production of gas is at a level of about 20 trillion cubic meet annually, leaving a supply gap of about 11 or 12 trillion cubic feet per year. While deregulation will certainly help to narrow this gap, the need for supplemental supplies is clear and unmistakable.

(2) Whatever the estimated potential of undiscovered reserves, it will take a long time to discover and produce them. Those larger schools, and those easiest to find and produce have long since been discovered. What is left are the smaller reserves, the deep reserves, the reserves located under the ocean beds, and those located in remote and unhospitable Arctic regions.

So while the potential reserves of natural gas may be there, it will be increasingly difficult, costly, and time consuming to find, produce, and market.

(3) While the initial price of gas produced from coal will be higher than domestic natural gas, coal gas has several distinct advantages over the long term.

First, its cost will remain virtually constant over the 25-year life of the gasification plant, and may even decline. Where the cost of natural gas, and every alternate fuel will continue to increase, at least

at the rate of general inflation. Thus the cost of coal gas will undoubtedly be a bargain before the plant is half depreciated.

I should add that our system does not contemplate that we will be serving any low priority boiler fuel loads with gas produced from coal. The supplemental supply will be required to meet residential and small commercial market requirements.

The question is sometimes asked whether the need for loan guarantees does not necessarily imply that the projects are uneconomic, and whether the loan guarantee program is not, in essence, a subsidization of private utility business.

The answer to both questions is no. The coal gasification project we have proposed is economically feasible, and will provide a return on capital to both debt and equity investors.

As I have stated, the market for the product will clearly be there. The rolled-in prices of synthetic gas can be sold competitively with other fuels. The equity investor, that is our company, is willing to risk its investment. The difficulty is that the lender, the institutional investors who must supply the debt capital cannot afford to risk large sums of money, which are involved, on a brand new enterprise, never before tried in this country.

This does not mean that the lender does not believe that the project is technologically and economically viable. It simply means that until enough plants have actually been built, and demonstrate their viability, the lenders as fiduciaries cannot afford to provide the very large sums required.

Another question sometimes asked is whether it would not be advisable to construct low Btu coal gasification plants at lower cost. It should be understood that low Btu gas cannot be mixed with natural gas and, therefore, cannot be transported and distributed in existing gas pipelines and distribution systems, or consumed in homes and commercial establishments.

Its only use is an industrial fuel. For that reason, low Btu gasification plant would not meet the needs for a large supplemental supply of gas to meet residential and commercial needs.

I would like to skip, in the interest of time, and just end with the sort of question that has been raised as to whether, if the need for loan guarantees arises because the investment required is so large in relation to the size of gas utility systems, some other segment of industry might be better equipped to undertake these projects.

I think that this may have relevance to your questions about Exxon and some of the others, Mr. Chairman. I think it is significant that all of the high Btu coal gasification projects now proposed, are sponsored by gas pipelines and distribution systems.

We are trying to implement these projects not because of the financial rewards, but because of our responsibility to provide gas to the market areas we serve. In short, it is not the kind of a project that a company undertakes based merely on the evaluation of the economic risks and rewards.

We doubt seriously, therefore, that any other segment of industry would be interested in sponsoring projects of this kind. For one thing, since the gas will be mixed and distributed with regulated natural gas, the price of the gas will necessarily be regulated. It is highly unlikely that any unregulated segment of industry would be willing to under-

take projects of this kind with a regulated return, and none have done so.

The necessary implication of the question is, if companies cannot finance these projects without Government support, companies having much larger financial resources should do the job.

This would mean, as a practical matter, that it would be taken over by the major oil companies, if by anyone.

In summary, the people who have gone forward in coal gasification projects are basically the gas transportation and utility systems, who are willing to operate in a regulated environment, and at a fixed rate of return. Also, those that have the service obligation to particular customers in market areas.

However, these companies cannot raise the debt capital required for the first few plants without Government support. We respectfully request that the loan guarantee program be enacted so that we can go forward promptly with the development of this urgently needed source of energy.

[Mr. Seder's prepared statement follows:]

STATEMENT OF ARTHUR R. SEDER, JR., PRESIDENT OF AMERICAN NATURAL RESOURCES CO., DETROIT, MICH.

My name is Arthur R. Seder, Jr. I reside in Detroit, Michigan and I am President of the American Natural Resources Company.

American Natural is the parent company of an integrated natural gas pipeline and distribution company which is the principal supplier of gas to the States of Michigan and Wisconsin. Its two principal subsidiaries are Michigan Consolidated Gas Company, a gas distribution company serving Detroit, Ann Arbor, Grand Rapids, Muskegon and other areas of Michigan, and Michigan Wisconsin Pipe Line Company, an interstate gas transmission company which transports gas from the Louisiana Gulf Coast and from the Panhandle-Hugoton area of Texas and Oklahoma to the Great Lakes region. Michigan Wisconsin, which is regulated by the Federal Power Commission, sells gas at wholesale to Michigan Consolidated and 53 other gas distribution companies. Michigan Consolidated is regulated by the Michigan Public Service Commission.

Michigan Consolidated Gas Company sells gas at retail to over 1,000,000 consumers in the State of Michigan and the American Natural System as a whole supplies gas to an area having a total population of over 8,000,000 people.

A newly formed subsidiary of American Natural, ANG Coal Gasification Company, proposes to construct and operate a coal gasification plant in west central North Dakota capable of producing about 90 billion cubic feet per year of high-Btu gas capable of being transported, sold and used intermixed with natural gas. That amount of gas would supply about 450,000 consumers in Michigan or Wisconsin with the fuel needed to heat their homes for a year.

As I have indicated, the American Natural system serves a very populous and industrially important section of the United States. As an integrated system, involving both the transmission and distribution segments of the gas business, we have always felt a particular obligation and responsibility to provide adequate gas supplies to consumers in the areas we serve. We were pioneers in constructing pipelines to tap reserves offshore in the Gulf of Mexico; we were the first system in the Midwest to purchase gas from Canada and are the largest purchaser of Canadian gas east of the Rockies; we operate one of the largest underground gas storage complexes in the country; and we were instrumental in initiating the project to transport natural gas from Alaska to the lower 48 states.

Our efforts on behalf of our customers have, through the years, been quite successful, with the result that we were among the last of the interstate natural gas pipeline systems to curtail its customers. However, more than four years ago we recognized that we could not hope to purchase new reserves of natural gas in quantities sufficient to replace the volumes being produced and sold each year, and that supplemental supplies must be developed if we were to continue to meet our obligations to consumers in the areas we serve.

Accordingly, after considering various alternatives we concluded that, in addition to stepping up our efforts to explore for natural gas and to construct a pipeline to transport Alaskan gas to the lower 48 states, we must begin the process of developing a project to convert coal into a natural gas equivalent. Our system therefore made a detailed study of the various gasification processes and an extensive survey of the availability of large quantities of coal and water in the United States. Following the completion of these studies, we concluded that we should proceed with the acquisition of coal leases and options in North Dakota, with the filing of an application for use of water and with the preliminary design of a coal gasification plant employing the Lurgi process, which had been developed in Germany and is presently used in commercial-scale plants in South Africa and elsewhere.

After completing extensive engineering, environmental, legal and financial studies, we filed an application with the Federal Power Commission in March of 1975 requesting authority to transport and sell gas produced at the coal gasification plant to the distribution companies served by the American Natural System. We subsequently advised the Commission that we propose to construct the plant in two phases, with the first phase to be completed in about 1981 and the second following several years thereafter.

Hearings on our application before the FPC will be completed next week except for consideration of the Environmental Impact Statement, and we are hopeful that a final Commission decision can be issued by about the end of this year, with construction to commence in the summer of 1977.

While we have gone forward with all of the engineering, technical, legal and regulatory work required to mount our project, the fact of the matter is that while we think we can finance our project with the loan guarantees contemplated by H.R. 12112, we know that we cannot finance without them.

The central problem in financing without Government support is simply one of size. My company's net plant investment is about $1.8 billion, which makes us one of the larger gas utility systems in the country but a relatively small company as compared with major oil and manufacturing companies. The difficulty is that a single coal gasification plant of the size contemplated is estimated to cost about $1.5 billion by the time it is completed, or roughly the equivalent of the entire investment my company has accumulated in the 75 years since it was formed.

Even if American Natural guaranteed the debt to be issued by our coal gasification project, therefore, our System's assets and income simply do not provide the credit base sufficient to convince lenders that American Natural could pay off the loan if the project went under. And we could not prudently agree to such a guarantee in any event because to do so would seriously affect our ability to raise capital for other gas supply projects and to maintain the safety and reliability of our natural gas system.

We are as dedicated as anyone to the proposition that private industry should not become dependent upon government support for the financing of new projects. But in this case, there is just no other way, given the size of the projects and the areas of concern to investors.

The question is frequently asked why, if the project is economically and technologically viable, investors are not willing to put up the necessary capital without Government guarantees. The answer is that our System and other sponsors of coal gasification projects are willing to risk the equity capital required by the project, amounting to 25 percent of its total cost. The problem is that the other 75 percent must be provided by lenders who are unwilling to take the same kinds of risks and demand assurance of a return of their capital.

Why are they concerned on this score? You may already have heard all or most of the reasons, but I will briefly refer to the principal areas of concern:

Investors worry that the gasification process may not work, though we are confident that it will. We intend to employ the Lurgi process and we have successfully tested the coals we propose to use. But these plants will be larger than any other Lurgi plant in the world and will employ a methanation process to increase the Btu content of the gas to pipeline quality, which has not yet been proven in a commercial size coal gasification plant. Until a plant of this size and capability is proved in the United States, lenders simply will not take the risk that the process will perform as the engineers say it will.

Second, in a project of this novelty and magnitude, investors worry about governmental actions that might delay construction or interrupt production. They fear that, conceivably, new mining laws might cut off our coal supply; new

environmental laws might make the project more expensive; regulatory delays could result in construction cost overruns, and so forth.

Investors, of course, worry about the price of the gas to be produced as related to alternative fuels. What if the foreign oil cartel breaks up or otherwise lowers prices? What if new and cheaper sources of domestic energy are developed? In that case, would regulatory agencies continue to approve rates that include the higher cost gas produced from coal, and, to the extent gas is used by commercial and industrial customers, could it be sold in competition with oil?

I should emphasize that lenders may well feel, as we do, that these events are highly unlikely, but they are nevertheless unwilling to take the risk that they might happen.

In this connection I should emphasize, in view of claims made by opponents of the legislation last year, that the loan guarantee proposal in no way protects the sponsor's equity investment—the 25 percent that American Natural would provide toward financing the project. The guarantee only goes to protect the individual, the pension fund, the insurance company or the bank that otherwise would refuse to provide the debt capital needed to finance the other 75 percent of the cost of the project. I should add that the earnings we would receive from our equity investment in the coal gasification project would be regulated on cost of service principles by the Federal Power Commission. We thus have none of the protections of the loan guarantee program and at the same time are limited to a regulated rate of return on our investment.

Is coal gasification economically justifiable in light of the high investment costs and cost of the gas produced? We may as well make no bones about it—the gasification process will produce fuel that, by the standards of the past few years, will be very expensive.

If our project were in operation today, and had incurred the costs that we are currently projecting, it would be making gas costing over $3.00 per thousand cubic feet. That is considerably more than the average national wellhead price of natural gas or the equivalent price of oil. But there are two considerations we think militate strongly on the side of proceeding promptly with the development of a coal gasification industry.

First, while the initial cost of the gas produced is high, the price of the project will remain stable—and may even decline—over the life of the plant. This results from the fact that a very large proportion of the cost of the product represents return and amortization of the original investment, which will decline steadily over the years. This reduction in cost should largely, if not entirely, offset increases in costs of operating the plant and purchasing coal. Thus, within a few years after the plant begins operation, it may well be one of the least expensive sources of energy available anywhere.

Second, the nation's natural gas reserves are declining and will continue to decline until they are exhausted. This means that millions of consumers in this country will be forced to shift to other fuels, and billions of dollars of investment in appliances, furnaces and utility facilities will be wasted, unless substitute gas supplies can be provided. Furthermore, there is no acceptable substitute fuel available. Coal is not environmentally acceptable for household or commercial use and would involve overwhelming transportation and distribution problems. Substitution of oil for gas would further increase our dependence on foreign energy sources and would also require major new transportation and distribution facilities. Electricity is far more costly to generate, whether from coal or nuclear supplies, than the cost of gas produced from coal.

In short, coal gasification carries a high initial price tag but promises to be a dependable, relatively inexpensive source of energy in the long run.

We have paid very great attention to the environmetal consequences of coal gasification and are convinced that it provides an environmentally acceptable means of producing a very desirable end-product.

We propose to use surface mining methods—stripmining—to extract the coal. But in western North Dakota, the land is relatively level and thus easily graded to original contour. Furthermore we will be operating under what is probably the most stringent stripmining law in the nation. The requirement is simple: we must restore the land to its original productivity. This will cost upwards of $1,500 per acre for land that sells for less than $300 an acre, but we are prepared to satisfy the requirements of the law.

I hope Congress will bear in mind that passage of H.R. 12112 is not going to give corporations carte blanche to construct, to mine, to operate manufacturing facilities under whatever conditions they find most convenient or profitable. The list of permits and conditions, Federal, state and local, is almost endless.

One environmental consideration, I think, that should not be lost on any of us is the burning characteristics of the fuel we intend to produce.

We call it "synthetic gas" but it will have precisely the same chemical composition as methane, the principal ingredient of natural gas.

And when transported to our population centers, it will burn as cleanly and as efficiently as natural gas.

It is for these reasons, essentially, that our company hopes that Congress will, as swiftly as possible, enact a loan guarantee program that will enable firms of moderate size to continue participating in the development of high Btu coal gasification projects.

Mr. OTTINGER. Thank you very much, Mr. Seder.

I have just one particular question before I get to the testimony.

What did you say the assets were of American Natural Gas?

Mr. SEDER. They are about a gross of $2.5 billion and a net, after depreciation, of $1.8 billion.

Mr. OTTINGER. $2.5 billion?

Mr. SEDER. Billion, yes—1.8.

Mr. OTTINGER. And counsel points out to me there are a number of partners in this enterprise with you that have various percentages of the project. Do you have information with respect to their assets?

Mr. SEDER. In the first place, I would like to clarify that. This is a proposal which we have in a very tentative stage to involve the distribution customers of our system as equity partners and sponsors in the project. None of them has agreed to do so.

We are merely exploring the question, and we talked to both the Michigan Commission and the Wisconsin Commission to ascertain their attitude on various of the questions involved from a regulatory standpoint and companies subject to their jurisdiction becoming involved in something of this kind, so that, this is not a proposal that has been made or agreed to by anyone.

It is not currently pending before any regulatory agency, and the American Natural System at the present time is the only sponsor of the project.

Mr. OTTINGER. If you went forward on the basis that was presented to us, you would put up 55 percent?

Mr. SEDER. Yes, sir, that is right.

Mr. OTTINGER. Utility would put up 45 percent and, therefore, it would not just be your assets to which——

Mr. SEDER. That is right, I would suspect that the total assets of the companies involved there other than American Natural would be in the neighborhood of $2.5 or $3 billion.

Mr. OTTINGER. Thank you very much.

I think we will go ahead and get the rest of the testimony before we go into questions.

Mr. OTTINGER. Mr. Bixby, would you like to go next?

STATEMENT OF J. E. BIXBY

Mr. BIXBY. Thank you, Mr. Chairman.

The point I would like to make first in my brief and informal remarks is that the committee does need to pay careful attention to the distinction between those synfuels which are covered by the guaranteed loan proposal, which are sponsored by regulated public utilities, and those which are attracting the interest of other companies who operate primarily in a nonregulated atmosphere.

This distinction has economic differences that are substantive. I think the suggestion that perhaps has been heard in the committee room with respect to the degrees of risk which sponsors of these synfuels projects should be willing to take can be judged in the context that, for a public utility company, its ability to accept risk is severely limited by the fact that it is legally precluded from earning a reward commensurate with an undue risk.

From the standpoint of those disincentives to complete that we have heard some mention of this afternoon, by reason of the loan guaranty program—I think Mr. Seder touched on this point—I simply want to reemphasize it. The coal gasification sponsors, by and large, are not looking for the opportunity to make an incremental profitable investment, whether it simply be to grab the tax goodies and run, or whether it be to earn a higher return.

Speaking for Texas Eastern, one of the cosponsors of the Wesco projects, I would be perfectly delighted if Exxon would like to build this plant and sell us the gas at the outlet thereof, or in the alternative, if someone is concerned about the fact that we may earn some money on our investments by reason of leaning on a Government loan guaranty, I would be perfectly delighted to have the Government build the plant and sell us the gas.

I have no hangups whatsoever about the degree to which there is direct Government involvement, because the situation that we find ourselves in now is that Government has assumed massive authority but has accepted very little responsibility.

Mr. OTTINGER. Would you be prepared to have the cost of these plants, if we go ahead with this legislation, that your equity would not be included in the rate base?

Mr. BIXBY. No, sir, I did not say that at all. I said I would be perfectly willing to not make the investment and simply buy the gas.

What I am saying is, I do make the investment. The limit to which I can earn on that investment is legally limited by the application of regulation. Whether I have taken a risk that is commensurate with the reward is what the financial market is going to impose on me.

I think the point that I would like to make here is that, from the standpoint of what this particular legislation says, or whether it does not say anything, the acid test is going to be whether or not it does provide financing for a plant which produces coal gasification.

We can argue and we can have opinions, and they are all pretty well academic, because, in the final analysis, lenders, who are going to be putting hard money up, are going to make the decision as to whether or not the aggregate package is sufficiently attractive to induce that investment.

Mr. Chairman, you made a reference earlier in the day, as I recall, to a credit allocation proposal. Absent something of that sort, investors, whether they be lenders or equity investors, do have a free choice, and there are lots of attractive areas, relative to what we are looking at, that would give them a better sense of satisfaction investment-wise than perhaps a highly risky, low-return type investment.

I prefer, I think, at this point, to simply pass on to the other members of the panel and give the maximum amount of time that you would like to take for questions.

[Mr. Bixby's prepared statement follows:]

STATEMENT OF J. E. BIXBY, VICE PRESIDENT AND CHIEF FINANCIAL OFFICER, TEXAS EASTERN TRANSMISSION CORP., HOUSTON, TEX.

Thank you for the opportunity to appear before your committee as it considers H.R. 12112, providing additional assistance to the Energy Research and Development Administration for the advancement of non-nuclear energy research, development, and demonstration. I appear in strong support of the objectives of this bill, particularly with respect to high-Btu coal gasification.

Texas Eastern Transmission Corporation is engaged in several phases of the energy business, but its largest segment is the operation of two interstate gas pipelines regulated by the Federal Power Commission. In this role it serves the Midwest, Mid-Atlantic and New England sections of the country through its Eastern System, and the Midwest and Southern California areas through the Western System, operated by a subsidiary, Transwestern Pipeline Company. Both systems have suffered from serious shortages of gas supply and have found it necessary to curtail deliveries to customers for the past several years. Because we anticipated the shortage of traditional supplies, we have for many years been working on every alternative source of supply that appeared to offer any real promise of supplementing our natural gas sources. We have long been convinced that high-Btu coal gasification was a virtual necessity, and we have therefore committed much time, effort and money to pursuing this alternative.

It should be beyond any question that the nation has an endemic energy problem, notwithstanding the fact that there is no clear-cut "crisis" at the moment. It should be equally clear that policies and practices which have helped create the problem do not offer hope of curing it. The problem is enormously complex, but the fact that solutions are difficult and unpalatable does not justify prolonged failure to act, particularly when such a failure could endanger the future security and economic well-being of the nation. It is my view that there is no single solution to our energy problem. Among the appropriate answers should be the deregulation of new natural gas supplies and the decontrol of oil prices, a step-up in energy conservation efforts and improvements in energy use efficiencies, and a number of other moves to improve the supply-demand ratio of our present energy sources without ever-growing and dangerous reliance on imports. At the same time, we must also intensify our efforts to develop alternative sources, such as synthetic fuels, which will enable us to make sure that our national future is not compromised.

H.R. 12112 is a start, and in my judgment, the start is already long overdue. In making the decision to start, however, we are not making an irrevocable decision to travel a particular path indefinitely. The program is, after all, a demonstration program, and as such will provide much valuable information as to the kinds and quantities of synthetic fuels which should be developed in the future. The route represented by H.R. 12112 should not be viewed as a freeway without off-ramps. Further, H.R. 12112 should not be considered as an "either/or" choice to some other "solution" to our energy supply problem. It is my view that it will be almost impossible for us to do too much in providing for a reasonably secure energy supply, and I can't imagine that we will provide too much energy for the needs of a sound economy. If that is the result, however, the extra cost can easily be justified as insurance against the risk of national catastrophe.

Among the various synthetic fuels on which research, development, and demonstration work is being done, high-Btu coal gasification is somewhat unique. First, it involves the utilization of the nation's most abundant hydrocarbon resource—coal. Second, there is an established technology (the Lurgi process) by which a pipeline quality gas can be produced. Third, the product of a demonstration facility can be immediately used to alleviate a serious shortage of natural gas which is well on its way to becoming critical, and the facility could simultaneously serve as a testing ground for technological improvements. Fourth, the proposals for high-Btu coal gas facilities of which I am aware have all been sponsored by regulated utilities, so that there should be no concern about any "excess" profits from such projects.

The project with which my company is associated is noteworthy in at least two respects. One, it is the most advanced high-Btu coal gasification project in the country, and, two, the major portion of its output would be directed to an area of the country which has one of the most critical needs for supplemental gas supply, namely Southern California. The project is a co-venture between units of Transwestern Pipeline Company and of Pacific Lighting Corporation of Los Angeles. The plant would be located on the Navajo Indian reservation southwest of Farmington, New Mexico, and would produce 250 million cubic feet a day of pipe-

line quality gas from coal deposits located on the reservation which would be developed by Utah International. The project is known as Western Gasification Company, or WESCO. It represents an investment, exclusive of mine development costs, which in January 1, 1975 dollars was estimated at $853,000,000, and which in completed-cost dollars will run well in excess of one billion dollars. If it could be assumed that construction could start this year, plant start-up operations could begin during 1980. It is now clear that construction cannot begin this year, but the timetable is of great importance, since Pacific Lighting has testified on the public record that they expect to have an inadequate supply to serve all of Southern California's highest priority demand (the residential and small commercial customers) as nearly as 1978 or 1979. A report by the Staff of the California Public Utilities Commission released in February, 1976 indicates curtailment of high priority service throughout the state would begin in the early '80's, in the absence of deliveries from supplemental sources. The supply represented by the WESCO project appears to be the earliest significant addition in sight for the Southern California market, which would receive about three-fourths of WESCO's output.

In addition to alleviating otherwise certain delivery curtailments, the WESCO project and related mining operation offers substantial benefits to the Navajo Nation, one of the most economically depressed parts of the country. Job opportunities will peak near 4,000 during the construction period and operations will require about 1,000 employees. Preferential hiring policies and technical training programs are provided to maximize employment of Navajos. The project will also represent in excess of $6,000,000 annually during operations for the Nation through payments for royalty and resources utilization. Further, socio-economic and environmental concerns have been and will continue to be fully recognized in the construction and operating phases of the project.

The original application to the Federal Power Commission for the WESCO project was filed over three years ago. Conditions are contained in the FPC amended certificate recently issued, but at least we have a basis for determining what else is necessary to make the project financially viable and even an unconditioned certificate would not have permitted financing. Environmental requirements are largely met and plant site lease negotiations with the Navajo Nation are at a very advanced stage. All in all, WESCO has just about everything ready to go—except financing. The ability to finance such a project is obviously critical, and the kind of assistance contemplated by H.R. 12112, in my opinion, is absolutely necessary if we are to go forward with commitments of the magnitude required for such a project.

Before discussing the need for financial assistance for coal gasification, perhaps we should ask the questions "Why gasify coal? Particularly, why not wait until the newer gasification technologies are ready? Why not use coal in another form?" In addition to the earlier point that coal is the country's most abundant hydrocarbon resource, these answers are relevant:

1. Gasification is the most environmentally acceptable method of using coal and the most efficient use of energy values and of capital.

2. Availability of high-Btu coal gas will permit consumers to better utilize the billions and billions of dollars now invested in gas appliances, distribution systems and transmission facilities.

3. New gasification technologies will provide only limited potential cost savings since they will affect only a portion of the required facilities; meanwhile, by waiting, inflationary pressures on total costs would probably more than offset the savings.

4. As compared to use in new electric generating plants, coal in gasified form is a conservation factor because it is about twice as efficient and uses much less water. Coal gas energy costs are estimated to be only about half the costs in the form of electricity.

5. The U.S. needs to establish its national readiness, willingness and ability to provide physically for its energy needs on a basis other than importing, even though the indicated price might not be the lowest on today's market.

6. It is quite probable that the first coal gasification plant that is built of a size to demonstrate economic and technical viability will produce the lowest cost gas we will ever see and that the plant's initial production cost might be its highest cost.

The last two points deserve some amplification. Much of the reluctance to embark on a serious commitment to synthetic fuels seems to be the fact that the future cost of the synthetic is judged to be clearly excessive when compared to today's price for traditional forms of energy. Even though this compares apples and oranges to some degree, the major flaw in this approach is the failure to

credit synthetics with an adequate "independence" value. Applied to coal gasification as illustrative of a currently viable alternative to vulnerable imports of energy, a risk/reward analysis would conclude that any "excess" cost really represented a quite reasonable national energy insurance premium. If it develops that other measures are indeed adequate to elicit large new supplies of traditional forms of energy or that our national security is never exposed to a repeat embargo, then we will have incurred the cost of a synthetic fuel capability needlessly. Even in such an unlikely case, this unnecessary cost would be a drop in the bucket as a part of our total energy bill. On the other hand, a failure to provide a timely synthetic capability which turned out to be needed might well lead to national disaster. In my judgment, such a trade-off is unthinkable. The implications for national security and for the total economy simply do not permit this kind of gamble.

The statement that the lowest cost gas would probably come from the first plant reflects the heavy fixed-cost component in high-Btu coal gas (about two-thirds of total cost). Even though we do not expect a return of the double-digit inflation which helped to skyrocket plant cost estimates, neither are we expecting inflation to disappear. Thus, the highly capital-intensive nature of coal gasification and the continuing rise in the required capital investment will tend to offset savings from economies and technological improvements which might be available in later plants. The peaking of costs during initial production is possible because of Federal Power Commission regulatory practices and, again, because so much of the total gas cost is capital-related. The FPC will set rates for coal gas in interstate commerce on the same depreciated-original-cost type of rate base it has always used. As depreciation is experienced, the rate base declines and the return declines with it. This decline may well be enough to offset increases in more variable costs and almost certainly would result in the initial cost being higher than the average cost over the project life.

You may ask why, given all of the advantages and benefits of coal gasification I have listed, such a project cannot be financed without government assistance. Although the answers are somewhat more complicated, they may be summarized as follows:

1. The sheer magnitude of the capital cost and the extended construction period.

2. The lack of financial capacity of project sponsors to attract the necessary capital on their own and a particular inability to take the completion risk.

To illustrate these relationships, let us assume for arithmetic simplicity that the WESCO project will cost $1.2 billion when completed and that the equity portion of capital will be the 25 percent required upon completion by the provisions of H.R. 12112. This equity would thus amount to $300,000,000 of which Transwestern's half would be $150,000,000. The problem becomes clearer when this amount is compared to Transwestern's total net worth of just over $120,000,000 at December 31, 1975. The magnitude of the equity capital commitment should make it quite apparent that debt capital cannot be attracted by sponsor company credit capacity and that financial backstopping of some kind by a financially credible party is absolutely essential.

The three to four years required to reach initial operations of a gasification plant intensifies the completion risk significantly and further precludes sponsor financing as such. It has been suggested that if appropriate regulatory actions were taken to assure investors that the total costs would ultimately be paid for by consumers, capital would be forthcoming to finance such projects without involving the government at all. Such views may be more wishful thinking than realistic analysis, because the existence of regulation is simply not an adequate base on which to finance on a true "project basis" capital requirements of the magnitude involved. On the contrary, investors are well aware that the Federal Power Commission, for example, cannot bind its successors on future rate treatment and they are wary of the rules being changed while the game is still in progress.

The completion risk is a serious concern for project sponsors because it is a serious concern for investors. In addition to regulatory worries about rates, investors worry about lawsuits, or legislation or technological problems preventing completion of the plant or its uninterrupted operation at design levels. We are confident of our technology, of course, but it does represent a scale-up that has not yet been demonstrated to the satisfaction of investors. We do not think these fears will be realized, but investors need and demand assurance and we are not financially able to give it to them.

H.R. 12112 contains provisions which we think may well permit financing of high-Btu coal gasification facilities and we therefore strongly support it and urge

its passage. There may be imperfections in the bill and there are currently different ways to accomplish a given purpose, but there is an urgency in at least getting started that I hope the members of the Committee can appreciate and can convey to their colleagues.

The loan guarantee approach contained in H.R. 12112 is an appropriate one for a high-Btu coal gasification project, and in my opinion the government will never spend a single dollar making good on that guarantee. The availability of loan guarantees up to 90% of total costs during construction and start-up is an especially important provision in reducing the completion risk to hopefully acceptable levels so that the ultimate purpose of building projects is actually accomplished. It is worth re-emphasizing that the regulated utilities sponsoring high-Btu coal gasification projects are able to accept limited risks only, because regulation precludes their ability to earn rewards commensurate with greater risks.

In conclusion, I urge your favorable consideration of an impetus to synthetic fuels as represented by H.R. 12112. We very much need to get a start and we cannot wait for another stduy or a new analysis to measure every change in circumstances or we will never begin. Coal gasification can be accomplished now on a basis completely consistent with the objectives of the National Environmental Policy Act, with state and other local environmental and development standards, and with Navajo Nation objectives. I freely confess bias, but I think our WESCO high-Btu coal gasification project in many ways could be one of the most significant accomplishments available in helping to solve our long-term energy problems. Such projects must inevitably be built and continued delay only assures higher costs to consumers. We need your help in getting under way and I hope we will have it very soon.

Thank you again for the opportunity to express our views on this very important matter.

BIOGRAPHY OF J. E. BIXBY, VICE PRESIDENT AND CHIEF FINANCIAL OFFICER, TEXAS EASTERN TRANSMISSION CORP.

J. E. Bixby is Vice President and Chief Financial Officer of Texas Eastern Transmission Corporation and of its subsidiaries and is a member of various company management committees. He is directly responsible for the comptroller's, treasurer's and corporate secretary's functions.

A native of Houston, Mr. Bixby joined Texas Eastern as Assistant Treasurer in 1956, was promoted to Treasurer in 1957 and was named a Vice President in 1963. He was made Vice President and Comptroller in 1965 and assumed his present duties in 1967. Prior to joining Texas Eastern, Mr. Bixby was employed by State National Bank of Texarkana, Arkansas, Hughes Tool Company (interrupted by service in the Merchant Marine) and W. S. Bellows Construction Corp. of Houston.

Mr. Bixby is a graduate of the University of Houston and holds Certified Public Accountant certificates in Texas and Louisiana. He is a member of the national, state and local professional accounting organizations, of Financial Executives Institute and of various industry organizations. Included in his industry service was a term as chairman of the Gas Industry Finance Committee of American Gas Association. Outside his company, he serves as a director of Southern National Bank of Houston and of Medenco, Inc. He is also a member of the Financial Analysts Federation and a past president of the Houston Society of Financial Analysts.

Mr. OTTINGER. We will do that and now take Mr. McClements.

Is Congressman Teague your Congressman?

Mr. BIXBY. No; he does not represent my district. Mr. Archer represents my district.

Mr. OTTINGER. Mr. McClements.

STATEMENT OF ROBERT McCLEMENTS, JR.

Mr. MCCLEMENTS. Thank you.

Good afternoon. I am Robert McClements, president of Sunoco Energy Development Co. of Dallas, Tex., a wholly owned subsidiary of Sun Co., Inc., of St. Davids, Pa.

We are pleased to have this opportunity to share with you our views on the outlook of producing synthetic fuel from oil shale. I will do this by speaking directly to the three questions that were posed, namely these:

(1) Is it economically feasible to produce synthetic fuels from oil shale?

(2) What would be the environmental consequences of producing synthetic fuels from shale?

(3) Is Government assistance necessary for the production of synthetic fuels from shale?

I will preface my response to these questions by pointing out that Sun is a participant in the White River shale oil project, which was formed to develop the "Ua" and "Ub" Federal oil shale leases in the Uintah Basin in Utah. Sun's share of the cost of the successful bids for these tracts was $52 million. We have also spent some $4.5 million for engineering and environmental work associated with oil shale development over the past 2 years.

We have no proprietary process position in oil shale, and our interest is based solely on its potential for becoming a viable business able to stand on its own feet in the marketplace.

Now, looking at the first of the three questions, is it economically feasible to produce synthetic fuels from oil shale?

In the present situation, our answer to this question must be no. It simply is not possible today to design, construct, and operate an oil shale facility to produce synthetic fuel that could compete with conventional petroleum at current world oil prices.

This fact was demonstrated clearly in a comprehensive study recently completed by one of the Nation's largest and most experienced engineering firms. This study indicated that synthetic oil would have to sell for more than $20 per barrel, in 1975 dollars, to yield a 15-percent return on investment on a 100-percent equity investment basis.

A second difficulty is the huge amount of capital——

Mr. OTTINGER. $20.70?

Mr. MCCLEMENTS. In excess of $20 per barrel.

A second difficulty is the huge amount of capital required for constructing synthetic fuel facilities. For example, it is now estimated that the capital required for a 100,000-barrels-daily plant would exceed $1.5 billion, again, in 1975 dollars.

Further, we anticipate that synthetic fuel from shale will be even less competitive in the future. Realistically, we must expect that price escalation for synthetic oil produced by a capital-intensive and labor-intensive oil shale plant will be greater than escalation in the world price for conventional oil.

Those, briefly, are our thoughts on the question of the economic feasibility of producing synthetic oil from shale. And I should add that even this outlook is based upon very optimistic assumptions about the future. We have some concerns that could make the shale oil outlook even less promising, and I want to share these with you.

First, we feel that the present level of technology development is unsatisfactory for proceeding into a commercialization program. Up to the present time, the technology associated with oil shale retorting has been demonstrated only at the pilot plant or semiworks level. The

scaleup to new commercial-size units carries an extremely high level of technical risk.

Second, a commercial-size oil shale facility will require the close integration of a series of large, complex operations involving new technology. Each section of the total complex must operate with a high degree of reliability to maintain desired production levels. The probability of obtaining the necessary degree of reliability is jeopardized by the certainty that continuing process and equipment development will be required.

Third, the magnitude of the investment in a shale oil plant and the required long life of the facility demand stability in the political and regulatory outlook. Today, however, the public policy climate is highly uncertain. And continuing uncertainty about the future course of public policy could prove to be a serious impediment to synthetic fuels development.

Finally, timing uncertainties pose further difficulties. Very long leadtimes are involved in the development of synthetic fuel facilities under the best of conditions, and these considerations are further complicated by delays in approvals, environmental reviews and continuing litigation.

Now, moving on to the second question, what would be the environmental consequences of producing synthetic fuel from oil shale?

Oil shale facilities will, without question, impact their local environments in a number of ways. Substantial amounts of time and money have already been spent in studying and defining these impacts, and in preparing to deal with the problems that will be faced. And many millions of dollars will be required in the future to prevent or mitigate environmental pollution.

A variety of environmental facilities and programs will be necessary. These will include complex and costly facilities for air, water, and solid waste control. They will include programs for the rehabilitation preservation, and management of environmental resources, including the revegetation of disturbed lands, the management of fish and wildlife resources, and the protection of objects of historic and scientific interest. And still other programs will be necessary for the prevention and control of fire, accidental spills, and other hazards to public health and safety.

During all project operating stages, it is planned that plant units will be operated within the limits of the Federal new source performance standards for air pollution control. All sources of project-generated emissions will be identified and facilities will be provided to insure compliance with regulations governing air quality.

Solid wastes will be disposed of in sanitary landfills which will be planned and operated to minimize erosion. All disturbed surfaces will be revegetated. And saline or toxic drainage will be prevented from contacting ground and surface water resources.

Processed shale will be disposed of in canyons or other surface depressions. These disposal systems will be designed in such a way that all surface and subsurface runoff from the processed shale will be intercepted and prevented from entering any natural drainage courses.

A detailed plan was recently completed for the environmental control of the oil shale project that our company is associated with. This plan outlines predicted environmental impacts from the construction

and operation of the facility and includes the proposed procedures for eliminating or mitigating potential resource pollution. We would be happy to make this detailed study and plan available to any interested party.

I want to stress that the major concern of the design engineer in the environmental area is the uncertainty of standards of regulations that he must use as design criteria. In this respect, the enactment of the new source emission standards—the so-called "no significant deterioration" standards—now being debated in Congress could preclude the development of our country's oil shale resources.

Turning now to the third question, is governmental assistancme necessary for the production of synthetic fuel from oil shale?

On the basis of the economic realities that I described earlier, we believe that Government assistance is necessary in developing the Nation's oil shale resources. This view reflects our conviction that at the present time synthetic fuel from oil shale cannot be produced to compete in the market with conventionally produced oil. The required investment of more than $1 billion, coupled with the existing technical, environmental, and political uncertainties, preclude the possibility of a significant oil shale industry emerging solely from the private sector.

At the same time, we are convinced that oil shale development is essential to strengthening the longer term energy position of the Nation and that the orderly development of an oil shale industry must have high priority in our overall national energy picture. The enormity of the resource alone singles it out as one of the strongest contenders for the role of a major alternative source of liquid hydrocarbons to supplement our declining oil reserves.

Accordingly, we feel it is essential that a program be designed to make possible joint public-private development of the Nation's vast oil shale resources.

As a first priority, such a program should provide for the demonstration of a variety of competing infant technologies. In other words, rather than initially building very large plants, we suggest the emphasis be placed on constructing a number of smaller modules with equipment that could be utilized in commercial operations. Such modules would not only make possible the demonstration and evaluation of alternative technologies, but would also provide a basis for predicting capital, operational and environmental costs.

Initially, each module would consist of a minimum number of units. But each would be designed so as to make possible the construction of additional units if the program was judged to be successful.

We anticipate that the cost of each module would be in the $100 million to $200 million range. This level of costs, upon which no return could be expected, clearly indicates the need for joint industry-government funding through the stage of technology demonstration.

If a module successfully demonstrated a new technology, and if economic conditions permitted, then the Government's interest could be acquired by the industry partner under previously agreed-upon terms. In this way, the facility could become the core of a truly commercial venture.

Before closing, I want to inform you that I previously testified in more detail on these matters before the House Committee on Science and Technology. Rather than repeat all of the material here, I am in-

cluding a copy of that testimony with this statement for the information of the committee.

In conclusion, let me reiterate these points. In the light of large capital requirements and the technological and environmental difficulties that must be overcome, we feel that synthetic fuel produced from shale could not compete in the market with conventional oil today. Accordingly, we feel that some degree of Government assistance in shale oil development is required. And we have recommended a relatively short-term program of industry-government cooperation to advance this development effort through the technology demonstration phase.

Beyond this, we suggest to you that the longer term viability of a shale oil industry will depend largely on the nature of our national public policies on energy.

Thank you.

Mr. OTTINGER. One question at this point, Mr. McClements. When you testified before, you came down disproving H.R. 12112, "It was then written on the grounds that the financial assistance was inadequate." You said, further, "The major provision of the bill, that is, the provision for loan guaranties for these commercial demonstration facilities, are neither timely nor appropriate in terms of technological and economic uncertainties that exist today. The loan guaranty does not deal with the basic difficulty in the shale oil development. The basic difficulty is the size the investment requires, coupled with the existing policy, technical-financial uncertainties, effectively forecloses the initiation of such project as commercial undertakings."

Do you still feel that this bill is inadequate as it presently is drawn?

Mr. MCCLEMENTS. If I might, sir, clarify one point.

We object to H.R. 12112 in its previous form as it relates to oil shale. Our comments were strictly relative to oil shale.

Mr. OTTINGER. I did not intend to imply anything else.

Mr. MCCLEMENTS. Yes, sir.

Mr. OTTINGER. What I am asking, are you now testifying in favor of the bill as it is now drawn?

Mr. MCCLEMENTS. The answer to that specific question is yes, sir, we feel the recent modifications of the bill, with the emphasis on the demonstration of the technology, is the proper route rather than the emphasis on commercialization as included in the original bill.

Mr. OTTINGER. We will explore that a little later.

I wanted to make that clear on the record.

Mr. BIXBY. I was told by my associate I neglected to ask that my prepared statement be included in the record.

Mr. OTTINGER. It will be so included.

We have Congressman Wirth from Colorado with us now.

The last witness on this panel is Mr. Hollis Dole, Atlantic Richfield Co. If you have a statement, we also will be glad to put that in the record.

STATEMENT OF HOLLIS M. DOLE

Mr. DOLE. Thank you very much. I am Hollis Dole, the Washington representative for Atlantic Richfield Co. Prior to my accepting this responsibility just last April, I was general manager of a four-com-

pany venture, Colony Development Operation, which is actively engaged in oil shale research and development activities and has been for several years. Atlantic Richfield serves as operator for the group, which includes Ashland Oil, Inc., Shell Oil Co., and the Oil Shale Corp., frequently known as TOSCO.

I am here today to express Atlantic Richfield Co.'s views on the immediate need for a joint industry-Government synthetic fuels commercial development program and the role Government incentives can play in fostering the early construction of synthetic fuel projects.

Knowledgeable forecasters in the energy field predict a widening gap between expected domestic energy demand and domestic supply for the foreseeable future and at least to the end of the century. A harbinger of this occurred during the second week in March, when oil imports exceeded domestic oil production.

As this Nation struggles with its energy problems, it should be obvious that a prime objective of a policy should be to improve our energy self-reliance. In Atlantic Richfield's opinion a sufficiency of domestic energy production will come to fruition only if this Nation actively pursues the several options available to us: Increased exploration for oil and gas both onshore and offshore, accelerated utilization of coal and nuclear energy sources, development of synthetic fuels, and greater research in the development of energy sources such as solar, wind, fusion, and the like.

Another prime objective is a vigorous national energy conservation program. Conservation is the only option that can have immediate results but, like all of our options, it is only part of the solution to the country's energy problem. We are fortunate to have several options but it is an imperative to our national strength that we vigorously pursue all. A strategy that does not take full advantage of all options will likely result in a decrease in U.S. energy self-sufficiency and a subsequent increase in oil imports.

With this brief mention of the Nation's energy situation, I would like now to focus my remarks on the stimulus I feel would initiate shale oil production, a potentially significant domestic energy supply source.

Although the technology is well advanced, commercial shale oil plants have not been built in the United States because of the past availability of cheap conventional oil, both domestic and foreign, recent unprecedented inflation in the construction industry and present artificially depressed energy prices resulting from Government-controlled oil and gas prices.

There is no question in my mind that if the first few commercial synthetic fuel plants are to be constructed in the near future, Government incentives must be established. Federal aid is in the public good because of the huge size of the oil shale resource and the need to move definitively to understand on a commercial basis the technology, the economics, the environmental, and social impacts of synthetic production.

In October of 1974, Colony Development Operation suspended its plan for a mid-1975 construction start of a 50,000-barrel-per-day commercial oil shale complex on private lands in northwestern Colorado. A key reason for the suspension was the debilitating increase in construction cost during the year. A 50,000-barrel-per-day oil shale complex is now estimated to cost in excess of $1 billion when development

expenditures and reserve values are included in the total estimate and is more than three times the cost estimate of 1973.

Even though oil shale economics are discouraging, we believe that oil shale holds as much or more potential than other synthetic fuels. Based on our analyses of relative costs of hydrocarbon production, finding new conventional oil and gas remains less expensive than synthetic fuels but the cost of shale oil is less expensive than the conversion of coal to oil or gas.

I do not have to tell this committee that there is an urgent need not only to develop additional conventional oil and gas but also to develop and demonstrate at commercial scale the production of oil and gas from coal and oil shale.

It is an established principle in our country to provide inventives to foster the growth of new industries or to maintain the viability of existing industries that are in the national interest. These incentives have taken numerous forms but clearly the most effective have been ones which tend to ameliorate risks so that the investment motive would still function.

Atlantic Richfield is convinced that a few early oil shale projects should be candidates for joint industry-Government funding in order to evaluate the impacts of oil shale development. We submit that the broad program objective would be to define the potential of oil shale through private enterprise and Government risk-sharing in order that shale's role in future energy supply would be more precisely known. This, we feel, would allow Congress and the administration to provide better energy planning for the people of the United States.

As an example of a possible useful approach, we find constructive the incentives concept embodied in last year's lead synthetics fuels bill, S. 598. A 75-percent nonrecourse loan, backed by the Government, coupled with a permanent extension of the investment tax credit at a rate of at least 10 percent for synthetic fuel plants, could provide the financing mechanism necessary for the construction of the first few commercial oil shale plants to demonstrate available technologies.

Quite clearly, the greater the amount of the investment tax credit rate, the more favorable the economic impact would be on the project with a corresponding reduction in the amount of Government assistance in the form of loans. A joint industry-Government synthetic fuels program should not imply nor suggest that continued Government participation will be expected by industry after these first few plants are in operation.

If the economics and the impacts prove to be as favorable as we expect they will be, a climate conducive to the attraction of long-term financing will be established. This, of course, assumes free market conditions in the energy sector and rational processes allowing environmental decisions to be made in a reasonable time frame.

Atlantic Richfield supports the concept Congress is considering in H.R. 12112. However, the restriction of the loan guarantee in section 18(b)(1) that ". . . no loan guarantee for a full-sized oil shale facility shall be provided under this section until after successful demonstration of a modular facility . . ." should be eliminated, and we strongly urge revision of section (5)(A) of the bill to include both single full-size retorts and multiple retort commercial plants. Selection between these alternatives should be the free choice of industry

and a reflection of the specific next step requirements of the developer and his confidence in the state of the retort technology to be employed in the project.

In Colony, Atlantic Richfield has carefully weighed a host of factors and believes, for several reasons, that the next logical step is the construction and operation of a commercial size shale oil plant. A single full-sized retort cannot take advantage of economies of scale that are possible in a commercial plant and cannot be built materially faster than a commercial plant. Obviously more can be gained by learning from a commercial size plant than can be learned by extrapolating from a module. I even question the exercise of extrapolation. It is answers we need, not more estimates.

The benefits to be derived from a commercial synthetic fuels program for early oil shale projects are substantial in terms of national energy policy and resource development. However, it must also be understood that the leadtimes associated with full-scale commercial oil shale development are long. It takes 6 to 9 years to acquire and evaluate reserves, complete the environmental impact statement process, perform engineering design, obtain necessary permits, and construct a commercial oil shale plant. Opting to develop a single-train retort first will add up to 5 more years to the leadtime associated with a commercial plant.

The magnitude of shale oil reserves—several hundred billion barrels—justifies a near-term commercial scale construction program so that the Nation can move more quickly and confidently toward appreciable production from oil shale.

Mr. Chairman, this concludes my formal presentation as it applies to H.R. 12112. However, in any discussion on the development of oil shale, I believe it is absolutely essential that the environmental and socioeconomic impacts be addressed.

Actually Colony was studying these impacts before the National Environmental Policy Act became law. We have spent over $3 million in these studies and have turned out an environmental impact analysis of 3 volumes with 17 appendixes by over 100 consultants. A draft environmental impact statement has been prepared and subjected to public review. Presently the final EIS is being put into final form and is expected to be issued this year.

I have incorporated in my written testimony a short description of this work. I would be pleased to read it into the record at this time. However, if in the interest of time the chairman would prefer that I not take the time of the committee and would give me the assurance that it would be included in the record, this will complete my oral statement. On the other hand, if you would prefer, I will continue and read it into the record.

Mr. OTTINGER. We will be glad to include it in the record in order to give time to questions.

Mr. DOLE. Thank you.

[The balance of Mr. Dole's prepared statement follows:]

Any industrial development which creates population growth causes some socioeconomic impact whether this growth occurs in urban or rural environments. The construction of two or three commercial shale oil plants over the next five to eight years in the Piceance Basin will have no more impact socioeconomically on the Western Slope region than would expansion of the skiing industry or the construction of one major consumer goods manufacturing facility. An analysis

of the employment trends in the Mesa, Garfield and Rio Blanco tri-county area of Colorado over the past decade shows that unless industrial or tourist related complexes of some magnitude are built soon, the Western Slope region will suffer the socioeconomic problems inherent to any economically depressed region.

As a venture which is dependent upon having a supply of dedicated, skilled and experienced employees available to build its plant and staff it over the long term, Colony Development Operation has long recognized both the potential problems and its responsibility to the community in which its plant is to be located. We have conducted extensive studies and plan to create a new community near the proposed plant site to avoid adverse impact on the nearby communities and the creation of numerous temporary settlements scattered along the Colorado River. We appreciate the socioeconomic implications of our proposed endeavor and believe the local community agrees with us that the potential impacts of our development are manageable.

The environmental aspects of oil shale development have received intensive attention and publicity over the past several years. Environmental demonstration programs have been conducted as well as numerous in-depth studies in the areas of air quality, water quality and ecology. Consequently, we have high confidence in our ability to design and construct environmentally acceptable facilities.

I would like to point out that this could be the first major new industry to be started after the passage of the National Environmental Policy Act, the Clean Air Act, and the Federal Water Pollution Control Act Amendments of 1972 and therefore subject to the rigors of examination and compliance of these laws right from the beginning. It will not only be conforming to the laws that Congress has passed, but also to the desires of the people that the environmental consequences of industrial development be minimized. The activities of private industry have been such that oil shale will be developed environmentally right the first time and will not have to undergo the expensive retrofitting that other industries find themselves facing today.

Mr. OTTINGER. Let me start a little bit with the broadest approach to this, and that is the proper role of Government in the development of energy resources in its relationship to business. If I am not incorrect, you all represent multibillion-dollar corporations and probably among those who cheer the loudest when the President gets up and says, "We want to get the Government out of our hair, out of our business," and makes similar such statements.

Yet the four of you are coming in and asking for the Federal Government to subsidize your operations, which inevitably would get the Government involved further into your affairs. I would just like to hear a little bit about how all of you rationalize that.

Mr. BIXBY. First, keep in mind that two of us have no hope whatsoever of getting the Government out of our hair.

Mr. SEDER. Regulation is our business and both of us are advocating the extension of the Federal Power Commission jurisdiction specifically to coal gasification plants. We think that in this particular area it is very much like the construction of an electric generating plant, which no one remotely suggests should be excluded from public service commission jurisdiction.

I think that there are areas of industry that require public regulation and there is absolutely no possibility of its being ended. So we are in that area right now.

Mr. BIXBY. I think that supports the multiplicity approach that H.R. 12112 provides to the administrator, Mr. Chairman. This is the point I was trying to make in my informal remarks. This is a distinction that should properly be kept fully in mind throughout the consideration of this legislation.

Mr. MCCLEMENTS. I would like to strongly emphasize that this recommended program for joint Government-industry development

of shale oil resources is not indeed an invitation for the Government to move into our normal area of business—quite the contrary. Nor is it a suggestion of a giveaway of public money to private industry. Rather, we view it as a suggested means of achieving a goal that is really vital to all Americans.

The strength of the U.S. economy is directly dependent upon adequate supplies of energy. Today we depend on foreign oil for about 37 percent of our liquid hydrocarbon. It is reliably estimated that that will grow to some 50 percent by 1985.

Accordingly, we view it as essential that we begin now to develop our large domestic resources of nonconventional fuel such as oil shale. This cannot be accomplished by private industry since synthetic fuels cannot compete in the marketplace.

In this situation and in the light of the vital importance of energy to the strength of our economy and all Americans, we feel that the Government does indeed have the basic role to play in synthetic fuel development.

Mr. OTTINGER. We had a witness who represents the coal industry testify before us. He was very candid; he says that if anybody tries to tell you that a loan guarantee is not a Government subsidy he is trying to pull the wool over your eyes.

I think there is no question the lower rate of interest that is obtainable, the fact you can attract capital to what you say here before us now is not an economic venture without this kind of assistance——

Mr. MCCLEMENTS. We say it is noneconomic venture in oil shale even with it.

Mr. SEDER. If I may address myself to that question, Mr. Chairman, to the extent there is a subsidy which results in lower costs and therefore lower product cost in the case of high Btu coal gasification, that goes directly to the benefit of the consumer. It does not change the return to the equity investor a bit.

Mr. OTTINGER. I understood you quite clearly to say you expected these plants to be included in the rate base.

Mr. BIXBY. I am saying, there the costs reasonably and prudently incurred, including the cost of senior capital, are a direct translation into the consumer's bill. If the bill includes interest at 12 percent, that is what he pays for; with a loan guarantee, it is 8 percent. That is all he pays for.

Mr. OTTINGER. I understand that an equity investor in your company will get his rate of return on a larger base.

Mr. BIXBY. No, sir, that is not true. The equity return will be computed on its actual dollar amount at the prescribed rate which the Federal Power Commission will determine.

Mr. SEDER. And that has no relation as to whether they involve loan guarantees or not.

Mr. OTTINGER. Assuming this program could not go forward but for the loan guarantee, this enables you——

Mr. BIXBY. That is precisely why I made the point that we are not looking for this as an incremental investment opportunity. I would prefer someone else do it. We have more than we can say grace over now with what equity we have to invest.

Mr. DOLE. I would certainly agree with Mr. Seder and Mr. Bixby that the Federal Government is in our business, and it will be more and more as the years go on. We invite that. However, we, as a private

company, have many investment opportunities, not only oil shale, and we have a limited amount of capital. And where we place that capital is certainly going to be a matter of free choice.

Furthermore, since the Federal Government owns 80 percent of the oil shale resource and 70 percent of the land, it would not at all be unusual, as I noted in my statement, and be in the best interest of the people of the country for the Federal Government to embark upon projects such as this; we see supplies of conventional oil and gas, coal and the like, that we can place our money in that can give us the rate of return that is needed.

As also noted here by other speakers of the panel—there is no assurance in the fact—it is quite unlikely that the rate of return or an oil shale plant would be an acceptable one if there was one.

So, consequently, in the long-term interest because of the large ownership by the Federal Government of these lands, because of the need of energy for our country for many years to come, I certainly think this is in the best interest of the Government and it speaks well to the industry-Government relations that have worked so well in the past.

Mr. OTTINGER. I kind of wish the President could be here to hear this.

It had been my previous disposition, as a relatively liberal Congressman, to feel that the Government's proper role in this area was to assist in the research and development of new resources of energy, bringing them to the point of demonstration; if they were sound as they were developed under Government-industry auspices, they could be picked up by private industry.

This represents a major departure for us because here we would have the Government entering into financial subsidization of commercial-size production units. And, Mr. Dole, you just testified you thought the modular approach was inadequate so far as shale oil was concerned; you would like to see the bill revised so the Government would be financing commercial-size plants in the shale oil business. And that gives me one of the major difficulties I have with this legislation.

I read in the Daily Sentinel of Grand Junction, Colo., that ERDA has just awarded a contract to the Parajo Co. for a demonstration plant of oil shale in Colorado. I just wonder: Why isn't this an adequate role for the Government to demonstrate this technology? Why do we have to go and finance full-size commercial plants? Why can't we do demonstrations on a pilot basis and extrapolate from that the kind of environmental problems, the kind of financing problems, what the cost of the initial project would be instead of getting the Federal Government involved in financing a full-scale production, which is something that we have not done before and which, I think, poses much greater dangers?

Mr. DOLE. Mr. Chairman, I would be glad to respond to that. In the first place I want to emphasize and note that the testimony that has been presented here has been that it is for the first few commercial-scale plants.

Mr. OTTINGER. We are told that in nuclear. Look how deep we are into that.

Mr. DOLE. Let me also clarify, Mr. Chairman, that we also believe that the module concept is good. However, depending upon the free

choice of the companies, their confidence in the technology and what they think is their proper role within the oil shale picture, I think that the choice should be free whether they should go to a commercial plant.

And certainly you can call these commercial plants, if you want to deal in semantics, demonstration plants because there has never been a commercial shale oil plant built and we do not know as precisely as we would like what the economics are, what the technology would be, nor what the various impacts would be.

Consequently I do want to make it crystal clear that what we are talking about is the need for Government assistance if these things are going to be built in the foreseeable future. If not, then I think you will find that industry will be perfectly happy to take on the building of shale oil plants when that time comes, when they become the primary investment opportunity for the companies in the energy business.

Mr. OTTINGER. One of the major questions we face in this legislation—I think perhaps the major question—is the degree of urgency and whether it is wise for us to finance the commercial production of what you say would be uneconomic on the marketplace at the present time with the technology that is not fully developed, where progress is being made, so we may indeed be financing obsolete technology.

Mr. DOLE. Mr. Chairman, I certainly think we have struck on the basic policy question that is facing the people of the United States, Congress, and the energy industry, and that is the urgency to develop energy resources. At least Atlantic Richfield feels—and I know there are many others that join with us in the feeling—that the development of energy policy that will bring out a large quantity of domestic energy materials is essential.

As I pointed out in my testimony, we have several options that we can take advantage of. One of these is the huge oil shale resource that occurs in northwestern Colorado, northeastern Utah, and southwestern Wyoming; and certainly, with a resource of this size, it is in the best interest of the Federal Government to know: Is it truly a resource or is it a reserve?

And, because of this, I think that the urgency speaks to not only the new technological materials in oil shale, coal gasification, coal liquefaction but to all areas of energy policy.

Mr. DINGELL. The Chair observes that the time of the gentleman from New York has expired. I thank the gentleman from New York for assisting the Chair in running the hearing.

The Chair recognizes the gentleman from Colorado, Mr. Wirth.

Mr. WIRTH. Mr. Dole, I was interested in your comments on the modular development, which, you know, absorbed a great deal of attention in the Committee on Science and Technology.

I assume what you are expressing is the view of Atlantic Richfield, is that correct?

Mr. DOLE. Mr. Wirth, that is correct. I have made that quite clear throughout all of my testimony.

Mr. WIRTH. Is that also the view of the Colony Group?

Mr. DOLE. You would have to speak to the individual members of the Colony Group to determine what they feel.

Mr. WIRTH. Have you done any kind of a census of the industry as a whole as to its view on the modular versus commercial scale operations in oil shale?

Mr. DOLE. Yes, Mr. Wirth. It would be my evaluation of the consensus that they would prefer to see the emphasis placed on modular. And with that, I have no objection.

What I am saying is that, Atlantic Richfield has confidence in the technology that we have developed over a period of years, that we feel going to the modular concept would not really contribute all that much. It would not give you the true answers as to the impacts, economic, technological, social, environmental and the like.

Mr. WIRTH. Therefore, Atlantic Richfield would presumably be willing to go to the 50,000 barrel-a-day approach, is that correct?

Mr. DOLE. If Atlantic Richfield were to find that this was the investment that they felt was proper at this hypothetical future time and if Atlantic Richfield were to go into oil shale, we would go into it at this scale, yes, sir.

Mr. WIRTH. How would we know if anybody in the industry would take advantage of the kind of incentives you are asking Congress to develop?

Mr. DOLE. By the same token, Mr. Wirth, how do we know as a company in making an investment of this size and in the building of a plant over a 3-year period of time what the new regulatory aspects of the various administrations, what the new laws, what the economic conditions of the country, would be?

I can assure you that we would give these all the evaluation needed and a decision would have to be made at that point in time.

Mr. WIRTH. Significantly more caution is reflected by most of the industry during the hearings of last fall and this winter in advocating the modular approach. I think they felt there were tremendous risks involved for themselves and for the Public Treasury and that going on a modular approach would appear to be financially and technically a more prudent approach.

Mr. DOLE. I think this, Mr. Wirth, is typical of the energy industry, the oil industry. That is, they find it difficult to agree on the time of day.

Mr. WIRTH. We have pretty strong agreement. I would not agree with that. I think there was a very fair agreement from almost all the people that did testify.

Mr. DOLE. And yet, here we are not going along with the crowd.

Mr. WIRTH. I am not suggesting you are going along with the crowd or not, whether or not that is important. I am only reflecting that in the testimony that the Science Committee heard, very significant attention was paid in the oil shale area, and I just wanted the record to show at this point that what you reflected in response to my question, that most of the people in the industry were interested in modular and not the commercial approach——

Mr. DOLE. If I may, Mr. Wirth, let me emphasize here that we are not against the modular approach. It is our opinion that the right way to go is the commercial way. We feel there should be room for both.

Mr. WIRTH. Some of us are having a very difficult time saving even the modular approach, Mr. Dole.

I was wondering if we might just very briefly, Mr. Chairman, get a response from Mr. Seder or Mr. McClements. I think Mr. Seder

would be more appropriate on the subject of the potential of modular development in the coal gasification business. This came up briefly in earlier testimony.

I was wondering if you all had paid any attention to the prospects or possibility or public policy potential of going a modular approach in the coal gasification area versus the full commercial size described in H.R. 12112?

Mr. SEDER. We have scaled back our project from its original dimensions to what we feel is the smallest practical size project for several reasons.

In the first place, you have to have a certain size of output or certain amount of output to justify building a pipeline to take that to market. So, it is not just a question of the size of the plant, but the pipeline facilities by which it is transported to market must be economically feasible, too, so that a certain size plant is necessary for that purpose.

I think, more fundamentally, particularly in the case of coal gasification, the major problems that prevent our financing conventionally are not so much the technological ones.

Actually, as you perhaps know, there are plants using the Lurgi process that we propose to use around the world. There is a fairly good sized one in South Africa.

As a matter of fact, we have sent coal from North Dakota to be tested in that plant in very large quantities. So that, the major questions are not technological, but rather the questions of the effect on the environment, the cost at which a plant of that kind can be constructed in the United States.

There are some questions of scale-up of the so-called methanation step, which results in the high Btu aspect of the gas.

Mr. OTTINGER. Would the gentleman yield at that point?

Mr. SEDER. Just to complete—I think, in order to finance a commercial-size plant conventionally, a commercial-size plant has to be built first, because the major problems are not alone in the technological area but in the economic, environmental, political arena.

Mr. WIRTH. I think we will come back to the questions of the differences between coal gasification and oil shale. I think it is very clear in previous testimony that in oil shale there were very significant technological issues, the Atlantic Richfield testimony to the contrary. Most of the testimony—particularly that from Sun Oil, who made a very convincing statement about the experiences in the Tar Sands area—indicates a need to proceed cautiously in the area of oil shale rather than trying to go to a full-scale development. Mr. McClements, when you testified in Boulder, Colo., last fall, that was the gist of your statement. You are still sticking by that testimony?

Mr. MCCLEMENTS. Yes, sir, we are.

Mr. WIRTH. I remember that was very good. I just wanted to make clear we were talking about two very different kinds of technologies and sets of problems in the oil shale area versus the coal gasification area.

I think Mr. Ottinger wanted to ask you further questions.

Mr. MCCLEMENTS. I would add some comments to Mr. Seder's.

In oil shale for surface retorting, there are six competing technologies. There is no clear leader, in our mind, to the leading technology. That is not the case in coal gasification.

As we understand, all proposed plants envision using this same technology. However, we would still support the basic concept of a number of plants to provide a broad base for the industry so that the development of the technology becomes one point, but, also, another extremely significant point is the development of the broad base of people and organizations and resources that can respond.

Mr. OTTINGER. If I may, at this point, Mr. Seder, you said there are plants using the same technology in Europe and Africa, is that correct?

Mr. SEDER. Yes.

Mr. OTTINGER. Are those high Btu plants?

Mr. SEDER. They are low Btu plants. As I indicated, the area where some scale-up is involved is in the increase from the low Btu to a high Btu classification, which is referred to as methanation.

Mr. OTTINGER. I see; there are no high Btu plants in operation then?

Mr. SEDER. No.

Mr. OTTINGER. And is there a significant difference in the process so far as the environmental or the economic factors that are concerned between the low Btu and the high Btu processes?

Mr. SEDER. I think not.

Mr. BIXBY. I think this is a question, Mr. Ottinger, that investors are ultimately going to judge. I think perhaps this observation ought to be injected into this discussion. And in Mr. Seder's case, for reasons he has outlined, the scale-back in the size of the plant has been proposed. In the case of the Wesco project, such a scale back has not been proposed.

This represents, I think, a melding, if you will, of what we have considered to be engineering, operational, socioeconomic and financing optimization.

We think that this scale does need to be demonstrated. It does need to be judged in its socioeconomic impacts, its environmental impacts, which, I think, perhaps, is an analogy to what Mr. Dole is saying, that the technology is sufficiently reliable, that there is no real, dead loss type of technological risk in going to a size which will measure to the optimum the various peripheral considerations that do have to be judged.

I think our feeling is in the final analysis that in order to create a private sector financeability for plants of this size, we do have to demonstrate plants of this size in order to induce investors to rely on what has been demonstrated. There are a lot of people who are willing to invest in the second coal gasification plant.

Mr. WIRTH. If the gentleman may yield for just a minute.

Does that mean we might do well to have one coal gasification plant authorized in the bill rather than—as I understand—the current two?

Mr. BIXBY. I think not, Mr. Wirth. In this sense, there are simply—between the project sponsored by American Natural and the project proposed by Wesco, there are different coals involved. Demonstrations have been made of these coals that they are, say, susceptible to the Lurgi process. They are susceptible to the methanation.

Mr. WIRTH. And will the two coals being demonstrated in the two proposed projects cover the waterfront, so to speak? Are we to be expected to look at a different kind of coal——

Mr. BIXBY. I will have to say I am not technically qualified to say how many coals ought to be demonstrated. My guess is, from the standpoint of getting a start, which is all H.R. 12122 attempts to do, that would be adequate to consider the two plants that are incorporated, as I understand it, in ERDA's "what if," would probably constitute a sufficient demonstration.

Mr. WIRTH. I thank the gentleman.

Mr. OTTINGER. The gentleman has the time. I would like him to yield for just one further question.

Mr. DINGELL. The time of the gentleman from Colorado has expired. The gentleman from New York is recognized.

Mr. OTTINGER. ERDA is at the present time financing a number of both pilot plants and demonstrations under a program of 50–50 participation with respect to the demonstration plants; I believe, two-third, one-third, with respect to the pilot plants.

What is it that we can learn from these full-scale, commercial plants that could not be learned from the operation of the pilot plants, in terms of the effect on the environment, in terms of the technology or the economics of the program?

Mr. SEDER. I think that these demonstration plants are demonstrations of technology primarily. They are very much smaller than the kind of commercial scale plants that we are talking about, and what the people of the areas involved are interested in, for one thing, is a demonstration of the effects on their local environment of the construction of a plant of this size.

And just to follow that hypothetical example, what the lender, what the investor, is concerned about is the reaction of the local citizen to the construction of a plant of that size in his area. So that, what we have got here is not essentially the technological program, for which a demonstration plant is the appropriate response, but rather the necessity for developing commercial scale plants which an investor can look at. They see that they work. They see that they were built within reasonable cost estimates. They see that they have not had an inordinate effect on the environment. They see they are accepted locally. Those are the kinds of considerations that lead investors to decide that they will invest.

There is just one other point, Mr. Ottinger, you referred to the nuclear plant situations. Nuclear plants are being built today without loan guaranties that produce energy costing a lot more per dollar of investment than coal gasification plants. But the reason they are built is because the Government provided an enormous amount of front-end money to the nuclear industry before a single commercial nuclear plant was built. That is why investors now feel reasonably confident in putting money into nuclear plants.

Mr. OTTINGER. If AGA presently has a high gas process which was financed by ERDA in Chicago and it is producing 1.5 million cubic feet a day, why can't you get the information from that kind of a demonstration? It will tell you what the costs are. It will tell you what the environmental problems are. It will tell you what the technological problems that remain to be solved are.

Mr. SEDER. That is an experimental plant. One and a half million is to be compared with 250 million in the case of the plants that we are

talking about. One and a half is to be compared with 250. What you get there is simply a demonstration and a testing of one particular process.

Mr. BIXBY. To the best of my knowledge, Mr. Ottinger, none of the units involved in that demonstration are commercial size.

Mr. OTTINGER. What I am saying is, why can't you learn what has to be learned from these demonstration plants?

Mr. BIXBY. I am sure the engineers could answer why you cannot build a scale model and put it into a full production mode. It has been the experience of industry all over the world that this is a fairly unreliable process.

Mr. OTTINGER. If you have the full-scale processes to which you refer, the plants to which you referred in Europe and South Africa, why can't the data be obtained, so far as you need data from a full-scale operating plant, from those plants?

Mr. BIXBY. Certain of those units are acceptable, and, in essence, updated versions of them would be involved in both the American Natural and the Wesco project. All the ingredients that go into a full commercial sized group of units have never been demonstrated anywhere. I think this was the point we were getting to earlier.

Gasification units of commercial size are operating satisfactorily in South Africa producing a medium level of Btu content. The methanation process has been demonstrated in Scotland to upgrade that particular process to a high Btu level. Nowhere have these been demonstrated in conjunction with each other, and the problem that we have encountered is that American investors tend to want to know a whole lot more about it than it worked in South Africa and another piece of it worked in Scotland.

Mr. SEDER. Again, that addresses only the technological problems which, in our view, are probably the less difficult, so far as satisfying investors are concerned.

Mr. BIXBY. We are satisfied to put up the equity on our judgment on the basis of technology. Lenders are not willing to put up the rest of it.

Mr. OTTINGER. Even though the same information is available both on a demonstration scale in this country and on full-scale operation. I realize we are just talking about natural gas, synthetic gas, at the present time, not oil shale.

Mr. MCCLEMENTS. I really think that is not the case of either one. The magnitude far exceeds what has been done anyplace in the world.

Again, going back strictly to oil shale, here we have a very complex heat exchanger at the front end of a plant, solid mix condition we have to deal with. To use a very earthy example, it might be feasible to suck on a half-inch corn cob pipe and things work very well. Relate that to the pilot plant stage, the production that goes into a 6-inch corn cob pipe to sell in the same marketplace is a different problem. You have to build one and try it because it is a problem here that does not lend itself to scale-up.

Mr. DINGELL. The gentleman from New York is recognized.

Mr. OTTINGER. Mr. Wirth suggests a question which I think has a great deal of legitimacy to it. Rather than finance two commercial size plants to test the two different kinds of coal, which is what, I believe you said, Mr. Bixby, was the main reason——

Mr. BIXBY. I said that was a reason.

Mr. OTTINGER. Why can't we just build one plant, considering these are $1½ billion plants, and transport the other kind of coal to it?

Mr. BIXBY. I will have to confess to an inadequate amount of technological information to know whether you can process two different kinds of coal through the same plant. I will revert to the answers in which I said one of the reasons for justification for more than one plant would be at least the demonstrations in differences in coals.

Perhaps Mr. Seder can add some to that.

Mr. SEDER. Plants are designed very specifically to a particular kind of coal. We have taken extensive coal samples we propose to use. They have been shipped to Germany for test in the Lurgi laboratories. They have been sent to South Africa, to the plant in South Africa, and the design of the plant is based on the specific qualities of the coal involved.

In addition to that, however, as Mr. Bixby has indicated, and we are back on the technological aspect of it again, the investor, I suspect, is a lot more willing to go along with our evaluation of the technology of this process than they are with respect to the environmental aspects, the socioeconomic aspects and a lot of other aspects. And what we have got here are several areas of the country; in Mr. Bixby's case, New Mexico, and in our case, North Dakota. They are different coals. They are different areas. They involve different reclamation aspects. So there are a lot of things that can be developed as a result of the construction of at least two of these. It may well be that before a plant of this kind could be built in the East using eastern coal, that a demonstration would have to be made of the viability of that project.

Mr. DINGELL. Would the gentleman yield?

Mr. OTTINGER. Yes.

Mr. DINGELL. Didn't you point out to us, though, that the problems were not technological in character but were socioeconomic?

Mr. SEDER. I said they include technological, but I think at least equally important, economic and socioeconomic, environmental and so on.

Mr. DINGELL. Mr. Bixby indicated, however, that the problems were not technological, but were social and economic; am I correct?

Mr. BIXBY. I do not think I indicated that was exclusively the case. In response to Mr. Ottinger's clarifying question with respect to the differences of coal at the behest of Mr. Wirth, I said that was one of the things, we sought: demonstration. I think there was an earlier comment, perhaps from Mr. Dole or perhaps from Mr. McClements—I really do not recall right now—about the need to determine whether or not we have a usable resource or whether we simply have a far distant reserve.

I think that perhaps there is a great deal more confidence in the Congress with the ability of a push-button policy to be translated into an in-place technical capability than is the fact. The leadtimes that we are talking about in any of these things are apparently not well understood, and the assumptions that we have all the time in the world to reach these decisions, I think, is simply largely overestimated.

Mr. OTTINGER. I must say I find it terribly mystifying if you can send the coals over to Germany and South Africa and see how it works technologically, that you cannot find out what the environmental consequences are from the operation of those coals and those plants as well.

Mr. SEDER. I can give you an example of the problems. When a large company in Michigan decided to build a synthetic gas plant, which would use liquid hydrocarbon from Canada as feedstock rather than coal, but nevertheless, translated those into gas which it could distribute to its customers, it used a British process that had been developed many years ago, had been in commercial application in England for a number of years. They simply took those designs and scaled them up, and it was not a major scale-up.

I do not know exactly what the relationship was, but it was not more than 1 to 2, I suspect. When that happened, and they tried to build the plant on the basis of the scale-up, they ran into all sorts of problems and ended up in having to redesign the plant from scratch. That is what we are talking about.

Mr. OTTINGER. There is no scale-up involved here, as I understand it. That South African plant is the same size——

Mr. SEDER. The scale-up from the South African size to our size is certainly in the same ratio of the scale-up of the SNG plant that I was talking about from the English version to the Michigan version.

Mr. BIXBY. Only partly tongue in cheek, perhaps Mr. Wirth could also testify why we were able to ship skiers and skaters to Austria but you could not do it to Colorado. I am simply serious about this. Ecological, environmental, socioeconomic impacts of these projects are every bit as important in demonstration as the technological——

Mr. WIRTH. I should reply. I think the issue is not so much what the skiers were going to do to the economy or the environment, but rather how much they were going to cost the taxpayers to have them and everybody else here.

Mr. BIXBY. That is correct, Mr. Wirth. I am sure that is why there are specific provisions in H.R. 12112 addressing themselves to socioeconomic impact of the plant.

Mr. WIRTH. If the gentleman would further yield, you were talking about startup time and your feeling that you can press a button, and the plant would happen. I think just the opposite.

Again, last winter and last fall, we had some very convincing testimony in the oil shale area in favor of going the modular route. If the modular experience justified going to a commercial mode, the testimony agreed that a modular approach rather than going to full scale immediately, would ultimately get the job done thoroughly and quickly.

I think there is an understanding of the startup and time frames you were referring to.

Mr. BIXBY. I think there is an equal understanding of the difference between oil shale and high Btu.

Mr. WIRTH. That is what we are trying to get out of here.

Mr. BIXBY. It is very important, Mr. Wirth.

Mr. OTTINGER. Mr. Bixby and Mr. Seder, you both indicated there were major differences with respect to public utilities participating in this kind of a program, and uncontrolled industries. Public utilities had different kinds of problems with respect to reserves available for investment with respect to their freedom to act.

Do you think we ought to restrict this legislation to the participation by utilities?

Mr. BIXBY. I would not suggest that it be so restricted, but obviously it would have no inhibiting effect on our particular projects or those types of projects.

Mr. OTTINGER. In your application, have you asked for this kind of—I forget the word—the tariff that would see to it that all the cost of this program——

Mr. SEDER. Cost to service.

Mr. OTTINGER. Yes.

Mr. SEDER. Yes; we have. But I think you should be very clear as to what cost to service does and does not do. Cost to service simply permits the recovery of cost as long as everything is going along all right and reflects a minor difference in cost automatically without the necessity for going in for a rate increase each time. However, it does not.

Mr. OTTINGER. Is that the same of all events—that is what I was looking for—all events tariffs?

Mr. SEDER. All events, if they were truly all events, would presumably cover you in all respects. But nobody has suggested covering the equity sponsor, for example, with respect to its risk, and Dr. Cicchetti indicated under both the proposal that Mr. Bixby has made and the Federal Power Commission has acted on and in ours, if the plant does not operate at its design capacity, the return on equity is reduced to the point where if it is not operating at even minimal output, why, there is no return on equity whatever.

So that even if the plant is operating, the equity sponsor has a risk involved, and then there is the overwhelming and overriding risk that if the plant is not completed for some reason or is abandoned for some reason—whether it is an earthquake, war, or simple inability of the process to work—why, the equity sponsor loses everything.

We face the prospect if everything does not go as we expect it to, that we will lose our entire equity investment.

Mr. OTTINGER. Which could come, I take it, if the testimony of Dr. Bosworth is correct; to virtually nothing, with the writeoffs of various kinds.

Mr. BIXBY. Keep in mind Dr. Bosworth was talking about some of cash to represent the equity. He was not talking about whether or not that cash was at risk of loss. Dr. Bosworth was either suffering from some misinformation or a failure to make that distinction.

Mr. DINGELL. The time of the gentleman has expired.

Gentlemen, maybe I can help out here. In the project Mr. Bixby supports and the project Mr. Seder supports, essentially in each instance, an all-events tariff has been requested. Is that correct?

Mr. BIXBY. Actually what we have asked for is that the Commission state unequivocally that what is done in normal regulation will inevitably be done in this case.

Mr. DINGELL. I am trying to get at a specific question here. You have essentially asked for an all-events traiff, have you not?

Mr. BIXBY. That is right. The Natural Gas Act, subject only to the test of reasonableness and prudence in the incurred cost, you would be permitted to recover the cost.

Mr. DINGELL. That is true in the case——

Mr. SEDER. Mr. Chairman, an all-events tariff does not imply you get the equity return under all events. Quite the contrary.

Mr. DINGELL. Could you give us the abbreviated submissions you have made on each of these projects, if you please.

Mr. SEDER. Yes.

Mr. DINGELL. Gentlemen, in each instance you have also asked for surcharges on users to raise capital, have you not?

Mr. BIXBY. Not in our instance.

Mr. DINGELL. You have not, Mr. Bixby?

Mr. SEDER. I want to correct a misapprehension of a previous witness which is, this is not a contribution by the consumer to the project. What it is is a return on equity which we have asked be made during the construction period rather than being deferred until the project is completed; which is the usual procedure, but there is no question on any part that we are entitled to that return. It is a question of when it is paid, and we have suggested that the financing of the project can be enhanced if it is made during the construction period.

Mr. DINGELL. Essentially you have suggested that there be a surcharge on users for the purpose of raising capital.

Have either of you gentlemen included in your planning the idea that the project should be included in the rate base through the necessary amendments to the Natural Gas Act?

Mr. SEDER. We have proposed legislation which would extend Federal Power Commission Natural Gas Act Jurisdiction to plants of this kind, but whether or not that is done, Mr. Chairman, the cost and the rate base aspect of this thing will be fully regulated by the Federal Power Commission because they ultimately have the disposition over the receipt and sale of this gas.

Mr. BIXBY. Specifically, Mr. Chairman, the Federal Power Commission has in pendency a rulemaking as a matter of determining whether their policy should be to include construction work in progress in rate base. At this point, as Mr. Seder says, a coal gasification facility is not jurisdictional and as such, does not constitute rate base.

Mr. DINGELL. Gentlemen, perhaps I could direct this question to each of you. Did either of your companies at any time propose to constuct the project entirely with private financing?

Mr. SEDER. We filed an application, Mr. Chairman, in which we tried to cover all of the risks and did not base our application on the availability of Government support because there was no Government support.

Mr. DINGELL. When did this take place?

Mr. SEDER. This took place, in our case, a year ago last March.

Mr. DINGELL. That was your March 5 filing before the Federal Power Commission?

Mr. SEDER. Yes. But the point of the matter is that there is absolutely no way—and I have so testified before the Federal Power Commission—that we can go forward on that plan without Government support, and I think Mr. Bixby's company——

Mr. DINGELL. How about you, Mr. Bixby?

Mr. BIXBY. Ours is a little different, Mr. Chairman. First, we filed the application in February 1973 asserting at that time that the Federal Power Commission should have jurisdiction over the facilities. We finally wound up in the Supreme Court upholding the Federal Power Commission that the facilities were not jurisdictional under the Natural Gas Act. We considered at that time that this jurisdictionality had some valid, although perhaps not clearly ennunciated, financing significance, because the Natural Gas Act does require cer-

tain statutory overt findings based on a series of statutory tests to determine whether or not these facilities are required.

At the time we filed, based on the size of the project cost that we then envisioned, we thought it was possible with specified tariff comfort with jurisdictionality which says hopefully to an inventor——

Mr. DINGELL. This is included in the rate base?

Mr. BIXBY. Yes.

Mr. DINGELL. So the investor can understand there will be a payout?

Mr. BIXBY. He now has a body of case law, if you will, on a regulation of such a facility to rely on in terms of his evaluation that this company, on those costs, can perhaps be financed with no other support than simply a clear case of regulatory equity.

Mr. DINGELL. Has anything changed that?

Mr. BIXBY. Yes.

Mr. DINGELL. What?

Mr. BIXBY. The size of the project. The escalation of double digit inflation during that 3-year period has produced the kind of cost increases you have here referred to, I am sure, on a number of other energy oriented or otherwise capital intensive projects.

Mr. DINGELL. Could both you and Mr. Seder indicate to us at what time your companies decided you could not proceed with the project without Federal assistance?

Mr. BIXBY. That was probably right on the margin of deciding that by the time we finished the Federal Power Commission proceeding, approximately a year after the filing, but that would have made it, let's say, the early part of 1974.

Mr. DINGELL. The early part of 1974?

Mr. BIXBY. Yes.

Mr. DINGELL. Mr. Seder, when did your company decide you could not proceed without Federal——

Mr. SEDER. Here is the way we looked at it.

Mr. DINGELL. Can you please help me by answering my question.

Mr. SEDER. I did not decide that we either could or could not finance without Government support when we filed the application. What I wanted to do was to get an application on file that made the best presentation we could give under the present circumstances, which were there was no Government support. I went ahead on that basis.

Mr. DINGELL. Is it fair to say at that point you had to recognize that the Federal Power Commission could not have granted that kind of an application, or could they?

Mr. SEDER. They could have.

Mr. DINGELL. They had not decided that it was a feasible project, or whether it had financing and capacity to deliver the service. If you could not get financing, you could not deliver the service you projected.

I find myself being driven, regrettably, to the view that you may have filed on a project that you did not think you could carry forward.

Mr. SEDER. Mr. Chairman, we had every intention of going forward with it, and if we had gotten a certificate, we would have tried to finance it privately. But if you will permit me to conclude the answer, Mr. Chairman, we had from the very start grave apprehensions as to whether we could finance it privately, and as the cost continued to go up and as the problems inherent in going forward with the project of this kind became more predominant, we concluded that we could not.

Mr. DINGELL. Did you indicate any of these apprehensions to the Federal Power Commission in your filing?

Mr. SEDER. Not in the filing, but in my testimony I did. In fact, I said in my testimony on cross-examination that I thought we could not go forward without Government support. So did our financial advisers.

Mr. DINGELL. At what time, what date, what place?

Mr. SEDER. I have been testifying for 6 months or more over there.

Mr. DINGELL. Give us your best recollection, if you please.

Mr. SEDER. I would have to consult the record.

Mr. DINGELL. It would be helpful if you would do that.

Are you familiar with the document entitled, "American Natural Program for Coal Gasification," dated June 1975?

Mr. SEDER. Yes.

Mr. DINGELL. With the list of contents—project description, content appraisal, feasibility, cost facilities, finance plans, marketability?

Mr. SEDER. Yes.

Mr. DINGELL. Referring most specifically to "marketing plan," does "marketing plan" direct itself, in any fashion, to the question of financing?

Mr. SEDER. No, that has to do with where the gas would go, as I recall it.

Mr. DINGELL. The financing plan, does that have anything to do with the financing of the project?

Mr. SEDER. I do not understand the question.

Mr. DINGELL. Let me be very precise. In this document we are now discussing relating to "financing plan" and relating to American Natural's plans for coal gasification, did you, in the financing plan section, make any reference to Government financing?

Mr. SEDER. I do not recall if there is anything in hereabout financing. Perhaps you could direct my attention to it.

Mr. DINGELL. The second page of the table of contents says, "Financing Plan." The page referred to says "Proposed capital structure plan in mined data, 11.3 percent; equity, 15 percent; total capitalization, leverage lease and/or debt, 100 percent, 100 percent, 100 percent."

Is there any mention in there of Government guarantee?

Mr. SEDER. No, Mr. Chairman. That is simply the kind of financing plan that we would propose whether we had Government guarantees or not.

Mr. DINGELL. Who is this document prepared for?

Mr. SEDER. This is prepared as a means of talking document, so far as the State commissions are concerned, our customers were concerned, an effort to try to explain, as best we could, the basic elements of our plan.

Mr. DINGELL. I am curious. Is Government financing or Government guarantee important to an investor or to a State regulatory body?

Mr. SEDER. Dr. Cicchetti indicated, representing the State of Wisconsin, it was important in the sense that it provided some assurance that the project might be built and provide gas for his State. So I guess it is important to them if it means the difference between the project being built.

Mr. DINGELL. Does it mean the difference between the project being built and not built?

Mr. SEDER. It does.

Mr. DINGELL. When did you and American Natural Gas become aware of the Synfuels Task Force recommendations regarding the loan guarantee program?

Mr. SEDER. I do not recall. We knew that when the task force recommendations came out, that was the first specific knowledge that I had of it.

Mr. DINGELL. How about you, Mr. Bixby?

Mr. BIXBY. Mr. Chairman, my recollection is that it was perhaps in the range of 2 years ago, perhaps not quite that long, when the interagency task force hired contractors to make surveys and conduct interviews of the wide spectrum of energy companies as well as others, all of which constituted input into the task force deliberations. And my best recollection is that it was the summer of 1974 when we first had awareness that such an effort was going on.

Mr. DINGELL. Were the judgments of either of your companies not to proceed with private financing influenced, to any extent, by the prospect of obtaining Federal loan guarantees, gentlemen?

Mr. SEDER. No, sir. And if there are no Federal loan guarantees, these projects simply will not be built.

Mr. Chairman, there has been a learning process involved here. We did not start out with 100-percent knowledge of every aspect of this project, and this was true not only in the financing filed but in the technologic field and the environmental field and so on.

When we first devised our financing plans and thought about the possibility of financing, we did not know all of the answers. There has been a learning curve here which we have been on and which brought us to reality in many respects. This is one of them.

Mr. DINGELL. Gentlemen, had you ever discussed the guarantees by the Federal Government in the course of deciding the project was not feasible with private financing?

Mr. SEDER. Did we ever discuss?

Mr. DINGELL. Had you ever discussed availability of Federal financing in the course of deciding the project was not feasible with private financing?

Mr. SEDER. The question of whether it is feasible with or without is obviously related.

Mr. DINGELL. You say they are or are not?

Mr. SEDER. They are related.

What I mean to say is if you cannot finance it without Government guarantees, why, obviously the answer is that if you are going to go forward with the project, you have to have some Government support. If that is the thrust of your question, perhaps it is not.

Mr. BIXBY. I think I would put it the other way. We came to the conclusion it was going to require Government financing because we concluded it could not be financed privately.

Mr. DINGELL. Gentlemen, the Chair has to call a recess. There is a vote on the floor. We will return just as quickly as we can. I apologize to you for this departure. We will be back as quickly as we can.

The committee will stand in recess briefly.

[Brief recess.]

Mr. DINGELL. The subcommittee will come to order.

The Chair recognizes counsel, Mr. Nordhaus.

Mr. NORDHAUS. There are a couple of things I would like to clarify for the record on the coal gasification part of the bill. My understanding, from Mr. Bixby's testimony, was that the assets of the project that you envisage as being financed by the bill would not be included in the rate base for purposes of determining your rates under the Natural Gas Act; is that correct?

Mr. BIXBY. I should say for the purpose of determining the price at which the gas was being sold in interstate commerce, Mr. Nordhaus, those dollars would be reflected. The distinction I was trying to make is the facilities were not subject to the jurisdiction of the Federal Power Commission and as such, did not constitute a rate base legally.

Mr. NORDHAUS. Is the same true of your project, Mr. Seder?

Mr. SEDER. Yes. This is a technical distinction without a difference, because both the Wesco project and ours proceed exactly as if the Federal Power Commission had complete jurisdiction over the plant from the input of coal to the sale of the gas, and what we are saying is that we are treating it as if it were in-rate base for purposes of establishing the price at which the gas can be sold to the jurisdictional pipeline, and we have both indicated to the Federal Power Commission that we will be subject to their controls so far as the return is concerned, so far as review of cost to determine whether they are prudently and reasonably incurred, and so on. This is a distinction without a difference.

Mr. NORDHAUS. But technically, the project is not in your rate base, but you are saying that the transfer price between your coal gasification subsidiary and your interstate pipeline is regulated as if it were in your rate base?

Mr. SEDER. Yes.

Mr. NORDHAUS. And would this be as a condition of getting FPC approval of a tariff you would intend to charge for that gas? What is the jurisdictional hook here?

Mr. SEDER. The Federal Power Commission has jurisdiction over the receipt, transportation and sale of gas once it is commingled with natural gas. We structure our sale point so that at the point where the gas is sold, it is commingled with natural gas; therefore, the Federal Power Commission has jurisdiction over that sale price and, therefore, they have complete control over the price at which that gas is received by the interstate pipeline.

Mr. BIXBY. Perhaps I can illustrate it this way, Mr. Nordhaus. If there were a plant, a nonregulated company in New Mexico and a customer in California who is willing to pay the cost of that gas, the plant and the pipeline to California, could be built without any Federal Power Commission say-so under existing law.

Mr. NORDHAUS. Let me go to one other question.

As I understand it, the financing of both of these plants would be what I understand as on a nonrecourse basis. In other words, that you would set up separate subsidiaries to operate the coal gasification plants if the subsidiaries defaulted on their debt obligation, the lenders, who are the Federal Government, which would be subrogated to the rights of lenders, would have no recourse against the assets of the parent corporation for any of the participants in the project; is that correct?

Mr. SEDER. Yes.

Mr. BIXBY. Only to the extent that investment in the project itself is represented by——

Mr. DINGELL. What then would be the level of the risk of each of the companies involved?

Mr. SEDER. All of the equity that we had invested in the project, $147 million in the case of our project——

Mr. DINGELL. And Mr. Bixby?

Mr. BIXBY. In terms of dollar magnitude, Mr. Chairman, it would obviously be a function of the total cost to the plant. It would be 25 percent under the legislation as it now stands. The plant is in operation; the 25 percent of it would have been represented by equity investments.

Mr. DINGELL. It would be 90 percent if you defaulted during the construction stage?

Mr. BIXBY. Yes, sir.

Mr. DINGELL. And started over?

Mr. SEDER. Under the bill, if ERDA guaranteed 90 percent. They can guarantee up to 90 percent.

Mr. DINGELL. In either instance, gentlemen, would your companies start these for less?

Mr. BIXBY. I would make the effort, Mr. Chairman, I mentioned earlier—I am not sure if you were in the committee room or not—regardless of what my opinion might be or those of committee members or what the legislation finally said, the acid test is going to be, can you actually finance and build such a project, because investors are not necessarily bound by the legislation as a condition under which they have to make an investment.

Mr. DINGELL. I am aware of that. We cannot put a gun to their head.

Mr. BIXBY. What I am saying, it is going to have to be conditions under which financing can be accomplished.

Mr. DINGELL. That is a very good point. But you have not——

Mr. BIXBY. I said I would make the effort to do it.

Mr. DINGELL. Thank you.

Mr. NORDHAUS. If the legislation required the guaranteed loans to be on a recourse basis against the parent companies, would your companies go ahead with it?

Mr. BIXBY. I would consider that to be no guarantee.

Mr. NORDHAUS. It is a guarantee of the lender. Isn't one of the points that was made in the testimony is that the lenders do not feel the assets of the company are great enough to support the obligation of that magnitude now, so the lenders are guaranteed?

Mr. BIXBY. The pipeline sponsor of our share of the Wesco project, Mr. Nordhaus, is Transwestern Pipeline Co., which is a subsidiary of Texas Eastern and which is the company which operates the pipeline to California and the Midwest.

I think my statement indicated at year end 1975, the total net worth of Transwestern was $120 million. If we assume, just for the purpose of illustration, the plant is going to cost $1.2 billion, then the equity is going to be $300 million and Transwestern's half of it is going to be $150 million. My very simple arithmetical explanation is that if that were a recourse loan, I do not think anybody will lend.

Mr. NORDHAUS. Even if it were guaranteed by the United States, a lender would not lend money because the assets of the borrower——

Mr. BIXBY. No; what I was saying is that if it were to be only Transwestern, I do not know that you would make the loan, because the total assets of Transwestern—you wouldn't make the guarantee that the total net assets of Transwestern would not support anything.

If you are looking for Texas Eastern to bail out the U.S. Government, it is possible it could be done mathematically but I would under no circumstances make such an obligation.

Mr. SEDER. My answer is the same, Mr. Nordhaus. The implication of your question is that after the Government had paid off the lenders on its guarantee, it went against the assets of the sponsoring companies, including the assets of the parent companies. In no circumstances could we agree to do that because, if we did so, the American Natural Resources System would be out of the gas business. We would have no means by which to continue to explore for natural gas, to participate in the Arctic Gas project or to maintain our facilities safely, so that we would be out of business.

Mr. OTTINGER. It kind of sounds like you have not much confidence in the success of the project.

Mr. SEDER. We are talking about a hypothetical in which the project has cratered and I am saying that, given that hypothetical—which is what we have to consider when we determine whether we will agree to a recourse loan—the risks are so astronomical that under no circumstances, given our obligations to the consumer as well as to the investor, could we agree to it; it would be absurd.

Mr. OTTINGER. You would still get the benefit of the lower interest rate of the Government-guaranteed loan that way.

Mr. BIXBY. The consumer does, Mr. Ottinger.

Mr. SEDER. We do not get one nickel's worth of benefit out of the lower interest rate; that flows right through to the consumer.

Mr. BIXBY. May I correct a statement I think I made in answer to the chairman's question. The comment I made—in the summer of 1974 we talked to the group surveying on behalf of the interagency task force; I was told at the recess it was not technically correct. It was a survey which was being conducted by the Government but it was not the interagency task force, which actually was not formed until early 1975.

Mr. HUNT. Mr. Seder, in the proposal being put forward by the American Natural Resources Co., there will be a coal mine or coal extraction process associated with this, will there not?

Mr. SEDER. Yes.

Mr. HUNT. That will be under the same corporate title as the coal gasification project?

Mr. SEDER. No; that will be done by a nonaffiliate.

Mr. HUNT. So, basically, the coal mining operation, as you see it, will be done by an affiliate and if indeed——

Mr. SEDER. No; a nonaffiliate.

Mr. HUNT. Another corporation?

Mr. SEDER. North American Coal Co.

Mr. HUNT. And there will be no guarantee associated with their operation or would they be borrowing and also seeking a Federal loan guarantee?

Mr. SEDER. No; they would not. Let me correct that statement. A portion of the mine facilities, mainly the larger—no; that is not quite

right. The nonmovable facilities, such as roads and things of that kind, would be financed by us. By "us," the American Natural System. We finance them and then, in effect, the cost of those facilities are subtracted from the cost of services that North American charges us. That part of the debt would be under the loan guarantee.

Mr. HUNT. That part of the debt would be?

Mr. SEDER. As I recall it. I may be incorrect in that.

Mr. HUNT. Would you also be lending this coal extraction company money, perhaps, to buy equipment?

Mr. SEDER. We would finance it in the first instance. That is the arrangement. Then it is transferred under a so-called leveraged lease for most of the facilities.

Mr. HUNT. Could you explain a leverage lease to us? It is important to determine what basic assets would be covered by the loan guarantee; and if indeed the coal mine operation is not covered by it, it leaves less for the Government, in the case of a crater, to move gas.

Mr. SEDER. The leveraged lease, which covers the main part of the coal mine facilities, is entered into when the project is completed, construction is completed, and you are ready to go into operation. And what happens is that the facilities are transferred, the legal title to the facilities is transferred to a leasing company—there are many leasing companies around the country—and they in turn lease the facilities back to the coal mine for an annual payment—rental payment, in effect.

Mr. HUNT. How much money, basically, of your proposal would be tied up in supporting the coal mining operation?

Mr. SEDER. On an escalated basis, we have assumed that about $100 million out of $750 million would be in the coal mine and that would not be subject, in effect, to the guarantee.

Mr. HUNT. Yet if there were a financial disaster or if the process did not work out as you had hoped, who would maintain title to those assets? Would that be the equity share or could the lenders be able to move against those properties?

Mr. SEDER. The lenders would have the physical properties within their control. They consist of haulers, trucks, steam shovels, and things like that. They would simply levy on those properties.

Mr. DINGELL. In each instance, Mr. Bixby and Mr. Seder, can you tell us what the project company would hold in the way of assets? Would it hold simply the physical structure of the new plant or the new plant and the ground underneath it or the new plant and the coal reserves? Just what would constitute the holdings of the company?

Mr. SEDER. Mr. Chairman, the company holds the plant and the ground underneath it.

Mr. DINGELL. How about the coal?

Mr. SEDER. No.

Mr. DINGELL. What would be the case in your company, Mr. Bixby?

Mr. BIXBY. It would hold the plant, the lease rights to the plant site, the contract rights for the purchase of coal, and a 60- to 65-mile pipeline to remove the coal gas and the water line coming to the plant site.

Mr. DINGELL. Maybe Mr. Seder could tell us: Would the pipeline or any other facility be included in the project in your case?

Mr. SEDER. No, sir, the pipeline, as we have proposed it, would be owned by Great Lakes Transmission Co. or, if the Arctic project

is built in time and the northern border pipeline part of that project is construed across North Dakota, we would simply feed the gas into that pipeline.

Mr. DINGELL. Would the guarantee go to any portion of the construction pipeline?

Mr. SEDER. No sir.

Mr. DINGELL. Thank you. Mr. Nordhaus. Mr. Hunt.

Mr. HUNT. Let me ask one more question, if I may.

There is no indefiniteness in the bill as to when one would shift from a 90-percent loan guaranty to a 75-percent loan guaranty. When would you anticipate upping your equity share? Would you anticipate doing this after the shakedown on the flow of the first Btu of gas?

Mr. BIXBY. My recollection of the bill, Mr. Hunt, was that it anticipated a testing period. Initially, operation—I have forgotten the precise language that was incorporated—but it would in essence be that point of time which, for the Federal Power Commission's purposes, we would proclaim that we were in operation and from that point forward our tariffs were in effect and our equity return was subject to the ratcheting down that the Federal Power Commission order imposes.

Mr. HUNT. But at this point, there is no definite criteria——

Mr. BIXBY. I do not think anyone knows the facts sufficiently to say when precisely that might be.

Mr. HUNT. I know the financial community loves to plan——

Mr. BIXBY. The engineer certificate, the plant has performed according to specifications, is now operable, it does not do anything as simple as picking a date out of the air.

Mr. HUNT. That is why I was asking if there were any specific operating transfer criteria.

Mr. BIXBY. In the case of the Wesco project, it has inherent in it the triggering of the penalty provisions for inability to operate. Now, from the standpoint of the preoperating period, there is prescribed in our Federal Power Commission certificate now a specified price, or, if you will, a credit against the cost of the plant by reason of selling those test volumes of gas in the startup period.

Mr. HUNT. Do you have any estimate of how long that will be beyond the flow of first gas? Two years, 1 year?

Mr. BIXBY. I would certainly hope that startup period would not exceed 1 year. I really do not have any basis for judging, and I do not think anyone else does. Hopefully, no more than 6 months. Obviously, this is a function of what happens when we get it all finished and turned on.

Mr. HUNT. In line with this, I would appreciate it if you could give me a brief description of how you plan, financially, to move from a 10-percent equity position to a 25-percent equity position.

Mr. BIXBY. Frankly, I have not come to grips with it yet. There are many unanswered questions. One of the things I considered is the possibility of some preferred stock being brought into the capitalization. Whether this would be feasible or not, I just do not know.

Mr. HUNT. From your own standpoint, Mr. Bixby, would your corporation at that point have sufficient cash to retire the necessary amount of debt, or do you feel that you would have to go to the market for financing to retire that debt?

Mr. BIXBY. My presumption is, we would never have that much cash lying around. As a utility, I think it has been alluded to adequately before on the record, we do not generate just a whole lot of reserves on account of we are never allowed to make quite that amount of money. So, certainly, some financing would be contemplated, and it is simply a question at this stage of not having any basis on which we would forecast how it would be done since we do not know when we are going to start. We are talking about a period of 3 to 4 years after the ground is broken.

Mr. HUNT. It occurs to me that, since you were getting gas out at something like $4.50 Mcf. and the market price for the other form of natural gas from the ground was considerably lower, your company might experience some difficulty in raising the necessary capital in the market to go from the 90-percent to the 25-percent level.

Mr. BIXBY. I would find that fairly unlikely. Regardless of what happens to deregulation, reregulation, or otherwise, the cost of flowing gas at a point in time when we could possibly get coal gas into our system is going to be a substantially greater number than we are now experiencing.

Basically, we have no difference now between certain sources of gas coming on at prices twice what other sources of gas, older wells, are flowing at prices, let's say, that are half of what a new well is. The order of magnitude perhaps is not great, but the relationship is great; that is, I think, some day we are going to find in southern California, for example, they are going to curtail priority 1 and 2 customers before we can possibly get that gas there.

Mr. HUNT. I noticed in your statement, on page 4, you made some estimates as to when the residential users would be curtailed. Were you anticipating any flow of gas, of LNG, either from Alaska, or Indonesia——

Mr. BIXBY. We are anticipating flows of gas from almost everything known to man. Unfortunately, the earliest is going to be Wesco, assuming we can get off the dime.

Mr. HUNT. Mr. Seder, could you address the problem that I brought up relative to the refinancing, when you would expect to do it and what mechanisms you might anticipate?

Mr. SEDER. To the extent we have considered the problem, I think, our expectation was that we would have a permanent debt financing up to at least the 75-percent level, and up to the extent we exceeded that, it would be a temporary bank loan financing, or some temporary financing of that kind, which we would take out with equity capital when the plant became operational.

Insofar as our ability to do is concerned, when you roll the price of this gas in with our other gas costs, with our phased construction approach this represents only 5 percent of our total supply, so the effect on the end price of gas to our customers is not that significant.

Mr. HUNT. If you were not permitted to roll it in and you were asked to go to some incremental pricing system, do you think that would inhibit

Mr. SEDER. No one has suggested that there would be incremental pricing at the distribution level. No one has suggested that. We would not go forward if that were a condition of the certificate.

Mr. HUNT. Fine.

Mr. BIXBY. I would like to point, Mr. Hunt, on this, if you are, in fact, curtailing priority 1 and priority 2 customers at that point, what difference does it make if it is incremental or rolled in?

Mr. HUNT. I have difficulty in seeing the future as well.

Mr. McClements, am I correct, the Sun Oil Co. has had some experience in Canada——

Mr. MCCLEMENTS. Yes, sir.

Mr. HUNT. Am I also correct that there are three Government bodies participating in that venture?

Mr. MCCLEMENTS. No, sir, that is in the syn crude operation.

Mr. HUNT. And you have no participation in that?

Mr. MCCLEMENTS. No, sir, we do not.

Mr. HUNT. It seems they have put it together as an alternative financing mechanism—at least in Canada. If there are three Government agencies in on a full partnership basis as an alternative to loan guarantees, would you find a serious objection to the Government coming in on the full partnership basis. It is my understanding, that most risk ventures are first capitalized by basic venture equity capital and this program does have some risk associated with it, does it not?

Mr. MCCLEMENTS. Again, speaking specifically at the present time, I do not think that would be an appropriate move to proceed with the so-called commercial client, depending upon the equity investment by the Government partner.

Mr. HUNT. They would have the Government as an equity partner.

Mr. BIXBY. As I indicated earlier, Mr. Hunt, I would welcome it. If you want the whole thing, you can. I am perfectly happy to be a customer only.

Mr. DOLE. Mr. Hunt, I would have to see what the arrangement would be before we could ever make a decision on that.

Mr. HUNT. But you have no direct objection to the participation of the Government on an equity basis?

Mr. DOLE. Well, as I mentioned earlier in my testimony, why the Federal Government appears to be getting into the business more and more. It would depend upon what the arrangements might be.

Mr. HUNT. Thank you very much.

Mr. DINGELL. The Chair recognizes minority counsel.

Mr. HENKE. I would like to follow up a comment made earlier today by Dr. Bosworth in his testimony. He contends that with the loan guarantees structured with limited owner equity and the use of tax havens that there would be an incentive to default prior to project completion, or at least reduced incentives to develop viable production processes.

I wonder if any or all of the panel would care to comment.

Mr. BIXBY. On the contrary, our incentive to go forward is the supply, not the investment opportunity, and regardless of what the equity involvement were, we are not going to default if it means cutting off the supply. I don't care how attractive he thinks it is, frankly his conception was based on either misunderstanding or, perhaps, a rather widely generic allegation that might have been true in an economics classroom, but not in the real world.

Mr. HENKE. Mr. Seder?

Mr. SEDER. I have nothing to add to that.

Mr. HENKE. Anyone else?

Mr. Dole?

Mr. Seder, is a favorable regulatory ruling on surcharges and things such as rollins in terms of pricing of the synthetic fuel a prerequisite for the project to go forward even if loan guarantees up to 75 percent were available?

Mr. SEDER. Yes. We have taken the position that we do not feel that that we can go forward without both the construction surcharge and also the cost of service tariff.

Mr. HENKE. Is Mr. Bixby's position the same?

Mr. BIXBY. We have not reached that firm a conclusion primarily because basically all we are talking about is what price the customer is going to be required to pay. If he wants to pay the cost earlier in the proceedings and eliminate the cost from the later part of the proceedings, that's fine. We think it makes sense. It would help in the financing and the raising of the cash.

Whether or not it, in and of itself, represents the difference between economic feasibility or not I kind of question, but no, we have not reached a decision. I think our application was made on the basis that we would have a normal capitalization of interest during construction, which obviously adds to the capital costs the consumer has to pay off.

It is basically no different from—you know, you don't pay near as much money if you pay all cash for your home. If you finance it, then you have to pay a lot more money out in interest, and that is basically where this comes out.

Mr. OTTINGER. One thing I would like to clarify there, if I could, and that is when you refer, Mr. Seder, to cost of service tariffs as a condition, is that the same as or in addition to a requirement for all events tariff?

Mr. SEDER. Cost of service tariff, as we have been using it, simply means that there are automatic adjustments to reflect differences in cost from month to month. It is no different from traditional ratemaking concepts. It simply is an automatic reflection of changes in cost, which we think are essential in the case of the coal or gasification project.

Mr. OTTINGER. So on top of that, you also want some kind of all events protection that would——

Mr. SEDER. Well, I don't know where this all events comes in. That was someone else's term. But as I said, what we have asked for are some events, which is to say that if we are making full production out of the plant, we would expect to get a full return. If the production declines, our return declines. So it is not all events in that circumstance.

Mr. OTTINGER. As I understand it, a good many of the pipelines at this point have their own construction companies or construction subsidiaries. Would you plan to use your own subsidiaries in the construction of any of these projects?

Mr. SEDER. No.

Mr. BIXBY. I know of no pipelines that have their own construction subsidiaries.

Mr. OTTINGER. Is that the case with you as well?

Mr. SEDER. Yes. We are dealing with independent engineering construction firms.

Mr. OTTINGER. I have no further questions, Mr. Chairman.

Mr. SEDER. Mr. Chairman, would you indulge me for just a moment?

Mr. DINGELL. Certainly.

Mr. SEDER. To go back to our colloquy before the brief recess, insofar as this question of our desire to have Government loan guarantees and the timing and so on is concerned, I have been trying to reflect as to why it would be in our interest to have Government loan guarantees if we had any other way of financing the projects, and for the life of me, I cannot think of any.

If we could finance these projects conventionally, could get the kind of debt that we need to go forward, I would be tickled to death to go forward without a Government guarantee because that means, to that extent at any rate, I do not have the Government involved in my business.

So if we could have gone forward on that basis, I would have been delighted to do so and the terms under which we as equity sponsors are concerned would have constructed and operated the plant certainly would have been no more onerous than with the Government in the picture.

Now, as I indicated to you before the recess, we have been concerned about our ability to finance without some form of Government support for a long time, almost from the inception. Whether we could or not was not a question of black and white, yes or no, but something that we had to test and try to resolve as time went on, and I have, during this whole period of time, I have talked to the FEA people on a number of occasions about various forms of Government support including insurance programs and so on. So this has been, as I tried to indicate earlier, a learning curve on our part, and I am sure we started out with the proposition that we hoped that it could be financed without Government support, but as time went on, we became more and more convinced that it was required.

But to get back to my initial point, I really cannot see any reason why we would want Government support if we could do it without. It is just really a question, from our standpoint, Mr. Chairman, whether we get the project or not, and as Mr. Bixby has said, if there were some other way, including full Government ownership of the plant, we are not looking at this as an investment opportunity that we necessarily want to go forward on.

What we are interested in is the product that it produces for our market areas.

Mr. DINGELL. Have either you or Mr. Bixby explored other mixes of Government assistance?

Mr. SEDER. Yes: I have——

Mr. DINGELL. For example, partnership and purchase agreements, or the possibility of Government assistance through mechanisms like some sort of a part interest in the undertaking, or Government direct loans—have these possibilities been explored?

Mr. SEDER. I have not gone into any detail in my own thinking on any of those specific possibilities. I thought at one time about the possibility of some kind of Government-sponsored insurance programs similar to the insurance program applicable to the Overseas Investment Corporation which, in effect, insures against losses resulting from Government takeover by some foreign government.

However, after a good deal of reflection, why the loan guarantee program seemed to be the most feasible, given the fact that it was the one that was most known to the Government and mainly to the investment community.

Mr. OTTINGER. Where did the loan guarantee program come from? Who made the proposal initially, do you know?

Mr. BIXBY. Well, it is included, I think, Mr. Ottinger, in the arsenal of tools which were produced by the interagency task force that studied the whethers and the whys and the hows of the development of synthetic fuels. As far as the particular piece is concerned, I do not know. I think Mr. Seder has touched on the point that it was perhaps considered for the type of project that we are discussing, the utility operated, high Btu coal gas facility, considered to be the least burdensome to Government which would accomplish the financing that could not be accomplished otherwise.

And other than that, to respond to the chairman's question, in the interagency task force conversations during the time that these inputs were being had, yes, we discussed a whole variety of alternatives. This seemed to be, in the final analysis, I guess, the one that appeared to fit this type of project best.

Mr. DINGELL. Gentlemen, Mr. Seder indicated that there are certain burdens for management associated with these Government loan guarantees.

Could you briefly indicate, each of you, (A) what those are and (B) what level you could tolerate for a viable project?

Maybe you would want to start first, Mr. Seder.

Mr. SEDER. Well, Mr. Chairman, I think all you have to do is to go through the bill and you will see all of the various requirements put on the Administrator of ERDA, first of all before he can approve the guarantee, and then all of the things that he must do thereafter, and as I understand it, ERDA is in the process of considering regulations for the administration of this legislation which I am sure will enlarge the statutory requirements ten- or fifteenfold.

If I were guaranteeing several hundred million dollars, well I would want some pretty stringent requirements in there too. So I cannot say all of them, but I am sure that ERDA is going to be looking at every detail of these projects and following it on a daily basis, virtually, to determine whether our costs are being overrun, whether we are making changes in plans and a lot of other things.

Mr. BIXBY. I think my answer would be very similar, Mr. Chairman. As I indicated earlier, we have no objection to the Government doing the whole thing, which I assume would add some additional burden to that which is now proposed by the Federal Power Commission. I am sure that there are a lot of great guys over at ERDA. It is not among our ambitions necessarily to start dealing with them in the intimacy that we do with the Federal Power Commission, but I think that will be the result of entering into such a program.

Other than that, there is, you know, I guess if one agency is bad, three is three times as bad. Maybe it is geometric, I am not sure.

Mr. DINGELL. Mr. McClements?

Mr. MCCLEMENTS. We really have not been advocating the Government becoming involved in managing the oil shale business. However, as we pointed out, we do not feel that there will be any significant prog-

ress made and developed in the synfuels industry unless there is, indeed, involvement by the Federal Government.

We do feel that it is the responsibility of the Government to insure that our national requirements in the areas of energy are indeed carried out. And with that premise, we have got to say from a national interest standpoint the Government indeed has a significant and responsible role to play.

Mr. DINGELL. Mr. Dole?

Mr. DOLE. Mr. Chairman, there is no question in my mind but that oil shale is going to be developed some time. The question is, when is sometime?

Now, if private industry is to develop oil shale, it is going to be developed at that time when it becomes the best possible energy investment that they can make. The size of the resource, what it could mean to this country and whether or not it actually is a resource I think is the question. And it would seem to me that after 60 years of research in the oil shale business that it is time we find out now, and it is to the public good that we do find out and I think that if you would build a few plants at this time then we would be in a position to carry on at that time when oil shale does become a dire necessity.

Mr. DINGELL. Gentlemen, the committee thanks you very much.

You have been here a long time, and you have answered difficult questions. We appreciate your courtesy on these matters. We are grateful to you, and we thank you all.

Our last witness is Mr. Wheeler. Since there is a vote on the floor, the subcommittee will have to recess briefly, Mr. Wheeler. We will hear from you just as quickly as we can get back. I thank you, and I apologize to you.

[Brief recess.]

Mr. DINGELL. The subcommittee will come to order.

Our next witness is Mr. Edwin Wheeler, president of the Fertilizer Institute.

Mr. Wheeler, we apologize for keeping you. You may consider yourself recognized. If you would identify yourself fully for purposes of the record, we would be glad to receive your statement.

STATEMENT OF EDWIN M. WHEELER, PRESIDENT, THE FERTILIZER INSTITUTE, WASHINGTON, D.C.

Mr. WHEELER. Thank you, Mr. Chairman. I, too, can read the clock. I know that the staff is weary and I will try to undertake the toughest assignment that any lawyer has, that of being brief.

I am Edwin M. Wheeler, president of the Fertilizer Institute located here in Washington and I am a full-time, paid executive for the association. The association represents all of the anhydrous producers in the United States and the relevance of that will become apparent in a few minutes.

I would ask the Chair's permission to insert my statement.

Mr. DINGELL. Without objection, your statement will be placed in the appropriate place in the record, and we will recognize you for such summary as you choose to give.

Mr. WHEELER. Mr. Chairman, I am sorry that Congressman Ottinger did not return, because it is fairly clear that he and several others of the

committee are concerned about the general philosophy surrounding this bill, vis-a-vis whether or not the U.S. Government ought to become involved, as it were, in guaranteeing these loans.

Mr. DINGELL. Well, let me just make this comment. There is a question of whether the Federal Government should be involved in making guarantees of these loans or any loans, how much they should be, whether there is an alternative method of financing, and how the public interest is going to be protected.

Now, it is pretty obvious that we need the energy, but we have a responsibility to ask hard questions here, and that is what we are trying to do.

Mr. WHEELER. I agree, and the only thing, of course, that is frustrating is the getting together the total number of bills and that is going to be the answer to the energy thing. We are not going to have one, nice simple package. There are going to be multiple bills and God forbid, multiple more hearings, but in our industry, we support this bill because we have had experience where the U.S. Government has been the progenitor.

The Tennessee Valley Authority is a classic. The Tennessee Valley Authority got into the fertilizer business in 1919 and to this day is a major producer of fertilizer that the Congress of the United States has appropriated money for.

In the last several years, they have established a new 60,000 ton a year urea plant. They built a 45,000-ton anhydrous ammonia plant, and so forth.

So when Mr. Ottinger makes the statement that the Government has not been engaged in that type of activity, his mind has slipped on that particular point.

From those plants have grown——

Mr. DINGELL. Were these financed loan guarantees, or was it the Federal Government that put it out, or——

Mr. WHEELER. Straight appropriations.

Mr. DINGELL. Straight appropriations.

Mr. WHEELER. But at the time there was great concern, particularly on the last round of appropriations, about the U.S. Government "philosophically" getting into the business.

Out of those appropriations, though, the point I want to make, has come every modern fertilizer being used, and that basically the issue the witnesses ahead of us were talking about is to get the technology to the plant stage.

We know from personal experience with TVA, for example, that a small plant is not the same as a big plant, and that until you get that plant built and onstream, you really do not know what woes you have inherited or what great progress you have made.

So that I wanted to make that statement in the opening shot to let the committee know that our industry is not fearful of U.S. Government intervention and/or participation. Our concern with the bill, and our support for the bill, as is true with many other users, is the question of adequate gas supply.

I do not appear here as an expert to take H.R. 12112 apart section by section, but to express to the Chair our great concern about the end product, namely the natural gas.

It is too late in the day to make us all agronomists or chemists, but I want to say briefly that fertilizer in the United States provides 30 percent of the total Nation's food output. There are three components: nitrogen, potash, and phosphate. The last two components are mined.

Already the United States is now 75 percent dependent on Canada for our potash supply, our own reserves having been literally exhausted, and those mines are now subject to a new law passed in Saskatchewan calling for government seizure and the loss, of course, of our control over it, and the loss of our investments.

So we are vulnerable to the tune now of 6 million tons of potash a year coming from Saskatchewan.

We are in great shape on phosphates. Anhydrous ammonia is the basis for all nitrogen used in the world. It is 82 percent nitrogen. The farmers in Michigan can use it direct in the gaseous stage or it can be converted by a complex process in the product known as urea and ammonia nitrate.

The feedstock for this ammonia is natural gas. None of the 90 U.S. plants are designed or built to use any other feedstock, or, for that matter, any other processed material.

In an oversimplified situation, the hydrogen is removed from the gas and combined with the natural nitrogen in the air and it runs through an $80 million plant and on the far end, out comes the nitrogen.

To show you the extent of U.S. industry, and more particularly agriculture, I brought with me several charts that we will look at quickly.

In this current year, our industry is capable of producing 19 million tons of ammonia a year. As you can see, the additions are coming on to 1977 with an extra 3,340,000 tons up to 22.4 million and it levels out to 1978 to 23,300,000 tons of ammonia. Seventy-five percent of that goes to agriculture. The balance goes to synthetic fibers. It is a major industry and the consumption of gas is enormous.

The thing that bothers our industry is whether or not this generation of plants built at terrific expense are going to get gas, and what is going to happen in this period when it is apparent that no further gas is available?

One of the earlier witnesses this afternoon referred to the fact that priority I and II users in California eventually are going to be affected. We believe now that all three of our big plants in California are going to be shut down in the not too distant future.

We can see from this next chart a slowly building trend line through the gas curtailment in the last few years which we have done a weekly study on, and you can see that trend line going up.

Two events here, of course, prevented reaching the earlier forecast of the 450,000-ton bracket; one was the mild weather and the other the unfortunate situation of the U.S. economy running slow as well as the unfortunate situation of some of the heavy, principal users of natural gas, such as the glass industry, being more adversely affected by the building slowdown.

To give you an idea of our needs, this last chart is designed on the left-hand margin in terms of billions of cubic feet. Currently, this year, the plant will use 668 billion cubic feet of natural gas.

When the new units come on in the next 18 months, and they are building, we will level out our annual consumption in our industry,

just for the ammonia, at 820 billion cubic feet per year. So that you can see what our concern is in the subject before the committee.

It is interesting to note in the plant expansions occurring in 1977 and 1978, all of those plants are located on uncontrolled, intrastate gas. So our real concern, then, is not only to keep these plants onstream, but what do we do about feeding the country in the years ahead.

The alternative is one, in my judgment, that is frightening. We can, if the Congress decides to prolong the agony, we can begin to eye construction of plants in the Middle East, but we do not choose to do so, because we think it is inherently dangerous for the future well-being of this country to be dependent on the Middle East flared gas for the simple reason that the Arabs have well learned the lesson of an oil embargo and an embargo on nitrogen would bring the country to its knees.

So what we are saying in supporting H.R. 12112, it is not the greatest piece of legislation in the world, but at least it starts to move us in the right direction. If the President of the United States were to sign this bill in the morning, it would be at least 3 to 5 years before the first fume of gas came through one of these new plants, and only then would our companies be able and willing to hook on to that gas which requires an additional leadtime to build a $80-million plant.

So that what I want the committee to understand is that we and many of the users support this legislation because we have to begin to take action. These are feedstocks. They are not used to heat the buildings. The product is made from it. We have no other alternative open to us, and we would hope that the committee, by approving this legislation, would begin to get the United States moving toward self-sufficiency.

I think there cannot be any doubt, there need be no proof in my judgment that we are moving in the 1980's to a very, very difficult situation and the solution in the 1980's lies now, not in the 1980's, so that we urge you to carefully consider this legislation and get it moving through the channels so that industry who is going to build these plants will get going.

I cannot stress to the committee how important it is to our country, to our farmers. A big chunk of that production is farmer-owned co-ops, not privately held plants.

Thank you.

[Mr. Wheeler's prepared statement follows:]

STATEMENT OF EDWIN M. WHEELER, PRESIDENT, THE FERTILIZER INSTITUTE

Mr. Chairman and members of the committee, on behalf of The Fertilizer Institute we are pleased that we have been given an opportunity to make some observations on H.R. 12112 which relates to providing loan guarantees for commercial sized demonstrations of new and or improved energy technology.

By way of explanation, The Fertilizer Institute is the national trade association for the producers, manufacturers, miners, retailers, and brokers and traders—our over 315 members cover the full spectrum. Included in our membership are virtually all of the major producers of nitrogenous fertilizers in this country.

It is generally accepted by all authorities that the use of commercial fertilizer in the United States enhances our food production not less than 30 percent. Were a person to confine his observations to the nearly 90 million acres of corn planted in the country then the results that would flow from the use of nitrogen would run well above this 30 percent figure. While I neither plan to make the Committee experts in the field of chemical engineering or agronomy it is neces-

sary first to set the scenes so that the Committee will understand our tremendous concern over energy supplies.

All nitrogen in the United States is produced with natural gas used as a feedstock. It is true that any other hydrocarbon can be used as a feedstock but it so happens that all of U.S. technology is based on this resource. Overseas, except in the Mideast, the bulk of the anhydrous ammonia produced comes from either naphtha or other petroleum-based products. It should be noted that the surge of new plants announced and under construction in the USSR and Peoples Republic of China are all natural gas feedstock plants. From ammonia comes products familiar to some of you known as urea and ammonia nitrate. Farmers can use the anhydrous ammonia in its natural state or these other products depending upon their own crops and particular circumstances. From the very beginning I hope the Committee will understand that without additional and continuing supplies of natural gas there is no way in which the country can feed a growing population or for that matter, a growing world population.

On the back of this statement is Chart I, entitled "U.S. Anhydrous Ammonia Capacity." I invite the Committee's attention to the fact that in the current calendar year of 1976 total ammonia production in the United States at the end of this year will be about 19 million tons. The hatch mark in the column for 1976 shows the figure 304 and this is an addition to capacity of 304,000 tons. The Committee can see that in 1977 the industry is going to bring on a tremendous new tonnage now estimated to be 3,340,000 tons. The farmers used 75 percent of the anhydrous ammonia produced in the nation. The balance of it goes into various industrial products, the chief user of which is synthetic fibers. The basis for synthetic fiber production in the U.S., interestingly enough, is the same anhydrous ammonia that our farmers use. The leading producer of anhydrous ammonia in the United States is CF Industries, a farmer-owned cooperative, who are also members of our association.

Basically, anhydrous ammonia is produced by a very complex chemical process of extracting the hydrocarbon from the gas and combining it with a natural nitrogen found in the air (NH_3). A new ammonia plant is estimated to cost now at about $80 million for a 1,500 ton a day unit. The investment of the industry either in being or soon to be on stream is tremendous and that whole investment is up for grabs if we fail to come up with sufficient natural gas. Our industry has the feeling much like a man driving across the desert at night and watching his gas gauge slowly go down while being unable to locate a filling station.

As you can see from Chart II, we have experienced a rather erratic but nevertheless slowly growing pattern of curtailment due to natural gas. We had estimated a much higher loss this current fiscal year but due to mild weather and the sharp cutback of other industries that are substantial natural gas users we lost but 250,000 tons of production. Many have questioned if there is a natural gas shortage; however, our industry has no doubt that there is. We think people fail to realize that we were "blessed" with not only a mild winter and unfortunately had high users of natural gas curtailed due to the general economic softness in the country. It is foolish to plan for this to be other than a one time "happy" coincidence.

To indicate the magnitude of our use Chart III clearly shows the current and future forecasted uptake of gas. Again, using 1976 as the base year one can note that the ammonia industry alone will use 668 billion cubic feet just for ammonia production. When one compares this with the total national output of 22 trillion cubic feet one can see our concern for anything that affects gas supply. I would only point out to the Committee that the figures are steady for 1978–79–80 simply because there are no indicated plants announced for construction in that period of time but, in any event, it is clear that we will level out at well over 800 billion cubic feet per year for the foreseeable future. This use is for U.S. sited plants only.

Assuming, as we do, (1) that the prospects for additional gas supplies in its natural state are not to be greatly expanded and assume that (2) the homeowners and others will prefer the ease and cleanliness of this resource, we would like to point out that several rather dangerous things are at hand due to the nation's inability to get together on an energy policy. If we are not able to produce natural gas or a synthetic product in the country then the nation is going to be forced to build new nitrogen plants in the most volatile areas of the world, politically speaking. All of us are familiar with the wasted and flared gas of the Mideast but it is my personal judgment over the long pull that it is too risky for the farmers of the United States and indeed the country's population to prom-

ise its food production on this area of the world. We have seen what an oil embargo, even over a short period of time can do to the country, but I would shudder to think in the 1980's if we were faced with a nitrogen embargo were plants to be built in that part of and were we to incur the displeasure of some Mideastern shiek.

THE RISK IS SIMPLY TOO GREAT

While we discuss the Mideast always the question comes up, "What about Canadian sources?" There are several plants to be built in Alberta but those plants are 51 percent owned or controlled by Canadians. In addition we have found that the Canadians have been just as active in moving up energy prices as have those in the Mideast and any of you who represent a state from among those tier of states along our northern border know how rapidly the price of Canadian natural gas has risen. In addition, we in the industry have been stunned by the Province of Saskatchewan announcing that they are going to take over all or part of the mines that produce another vital nutrient, potash, so that one can imagine how reluctant our industry is to consider any further development in Canada. So always it comes back to the need for answers that lie within the continental limits of the United States.

We have testified before the Senate and House several times and at length on the proposition that new natural gas discoveries should not have price control on that gas. We recognize that we could be paying a much higher price for the gas but if one has a plant valued at from $50 to $80 million sitting out in the country he does not particularly feel like quarreling over the price of the feedstock! We honestly believe that the way to maximize drilling everywhere within the continental U.S. is to immediately decontrol newly discovered natural gas. We continue to be amazed at some of the arguments made against decontrol. Consider, as we did, that when the oil companies bid slightly less than ¾ of a billion dollars for drilling rights in the area west of Tampa, Florida, and south of Mobile, Alabama, that we thought our answers were at hand. Many geologists felt that the natural gas in this area would be high in sulfur content and that was perfect for us. The production of phosphates with huge plants located near Tampa requires large amounts of sulfur and sulfuric acid. On the other hand, the Gulf coast area would be an ideal place to build ammonia plants. Our dreams and the oil company plans were for naught. After spending additional millions of dollars, no gas or oil was discovered in that area. Now many hope and pray that large amounts of gas will be found off the east coast. I would remind people, however, that this same high feeling was evident prior to the first drill rig striking a dry hole in the Florida-Alabama offshore areas. My point is here, that this is a very high-risk business requiring millions of dollars and certainly decontrol would do two things: 1. It would immediately encourage all out drilling; and, 2. It would hopefully give us, as an industry and our country, the promptest relief in obtaining new gas supplies and proven reserves.

But all this is not enough. We have for some time been urging rapid development of coal gasification based primarily on coal. For example, we have met with the Tennessee Valley Authority's Board of Directors and they are seeking funds even at this moment to get underway with a long-term study and research project relating to alternate feedstock sources for these ammonia plants present and future. We think it is imperative therefore that a bill such as the one the Committee is considering today be adopted and without delay.

Many people have been critical of a proposal to guarantee this type of project but I think it is so patently obvious that were tremendous sums invested leading to final production only to have Canada or the Mideast, or for that matter Venezuela, drastically cut the price of fuel it wond make these investments totally worthless. I can think of no other industry which faces a similar threat. To me the guarantee is nothing but an insurance policy to prevent these overseas energy countries from destroying a fledgling new industry.

Six billion dollars in a guarantee form is insignificant when it involves the nation's ability to survive—to feed itself. What a pittance when our way of life indeed our lives are involved.

Every one of us has decried the lack of an on-going, strong energy policy in this country. In retrospect we should have all realized that there would not be one nice neat package that would solve the problem, rather it would come in several measures such as the one the Committee has before it. We urge the immediate

and favorable action of the Committee on H.R. 12112 because every day of delay in getting underway in what is admittedly a very large program, places this country and its population in greater danger of the thing that all of us would shudder to think of, the loss of food production.

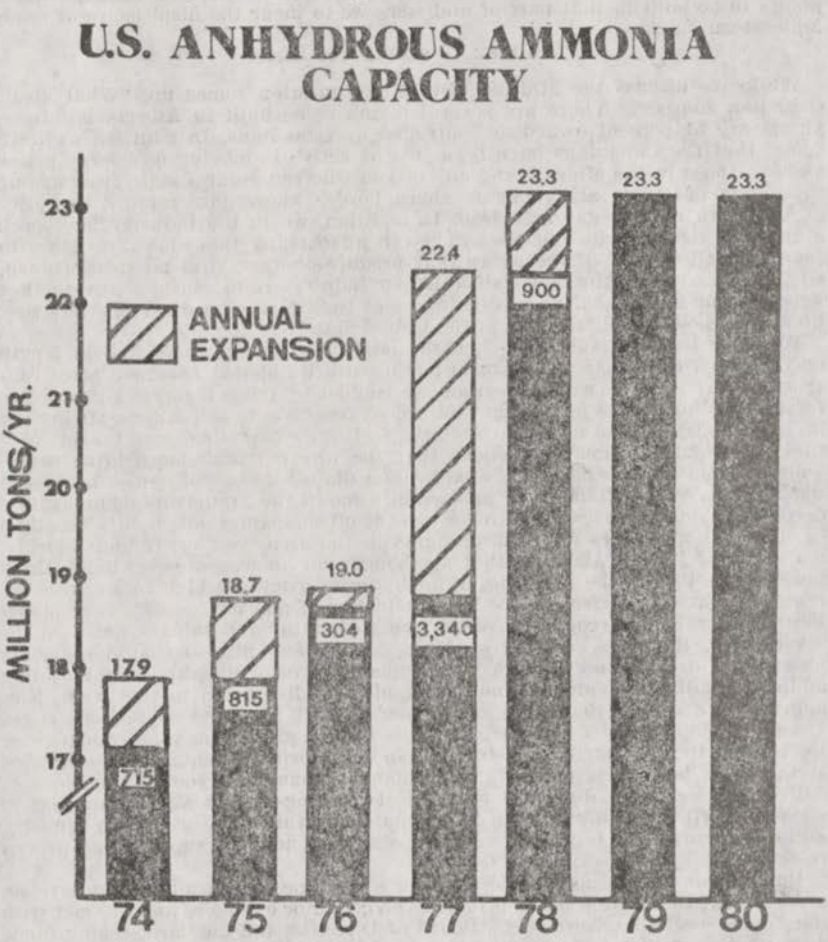

CHART I

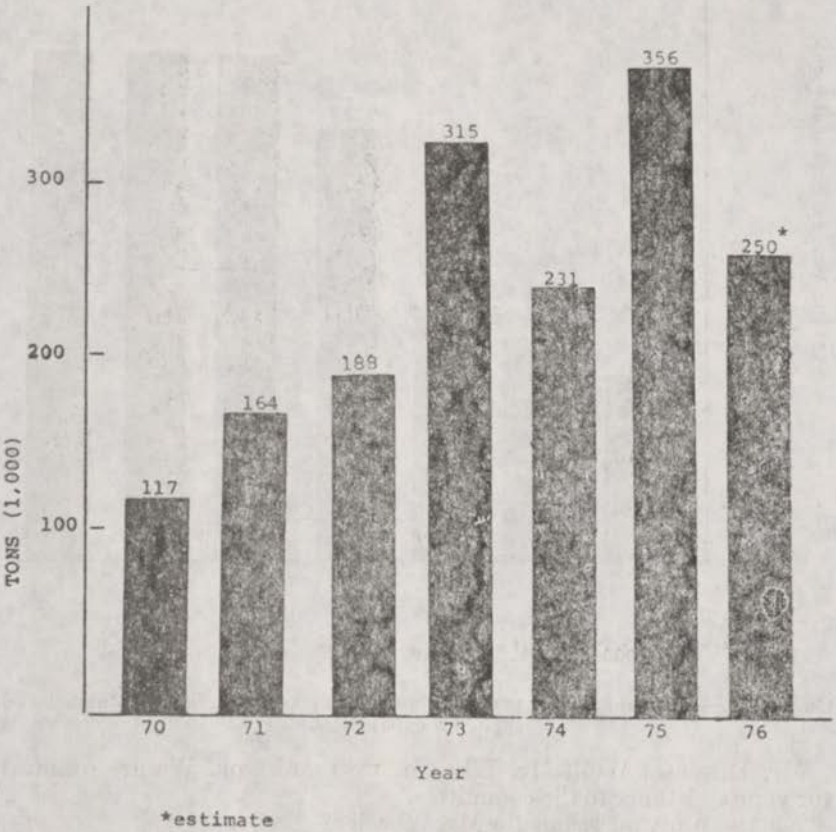

CHART II.—Anhydrous ammonia production losses due to natural gas curtailments.

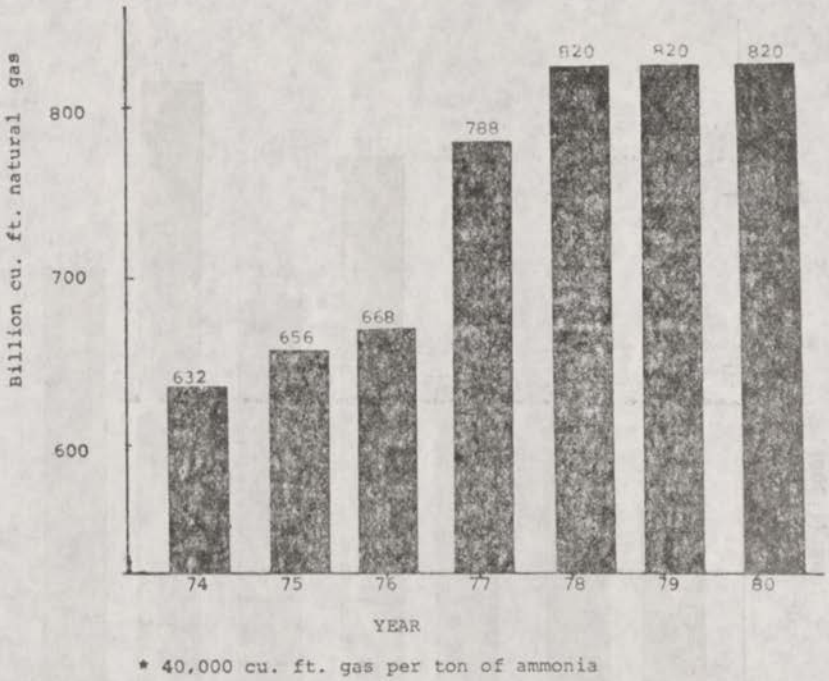

CHART III.—Natural gas* for projected ammonia production based on announced capacity expansions.

Mr. DINGELL. Well, Mr. Wheeler, we thank you. We are grateful for your assistance to the committee.

Are there any questions for Mr. Wheeler?

Mr. Nordhaus?

Mr. NORDHAUS. Mr. Wheeler, one of the questions which has been raised in a general way with respect to the proposed gasification projects in the bill is the question of why they can't be privately financed, and there are a number of questions of risk that have been raised with them.

Another question that has been raised is, if these projects are completed, the question is at what price will they be able to produce the gas.

Now, for a number of the projects, the indications are that the delivered price of the gas would run around $4 per thousand cubic feet. Now if it were—I guess the first question is, Would the members of your industry be willing to buy the gas at that rate? Would they be willing to buy it at $4 a thousand cubic feet, or would they go to alternative—if it were priced to them at that price, would they go to alternative sources?

Mr. WHEELER. You don't have an alternative. If you have an $80 million plant sitting out in Keokuk, Iowa, and have no feedstock.

Mr. NORDHAUS. The next question would be the price that this gas is anticipated to come on line at is not a real deterrent as far as you are concerned.

Would the members of your industry, if they were given some assurance of supply from these projects be willing to participate in the financing of them?

Mr. WHEELER. Not until they see one of them run. There has been one plant built in India based on gas and that plant has been shut down, being converted to naphtha, and the two plants in Greece have never been a success. There is one new unit that started with a lot of hoopla in South Africa and it has been a mechanic's nightmare.

So the industry is really waiting to see if they can produce the gas on a continuous basis.

Bear in mind, now, you are talking about an ammonia plant that produces 1,500 tons of material a day, runs 24 hours a day. Any interruption of feedstock and you have a colossal mess on your hands, so that they are interested in proven, major flows of gas. Every ton of ammonia takes 40,000 cubic feet of gas.

So they are not going to make a move until they see one of these——

Mr. NORDHAUS. The testimony we have had on high Btu gas was that there was almost no uncertainty, technologically. The uncertainties were almost entirely in the regulatory, environmental, and socioeconomic areas. I gather that you dispute this?

Mr. WHEELER. I heard that testimony, but we have seen the experience of the plants elsewhere. I grant you that India might not be a good place for a test.

Mr. NORDHAUS. There is a plant in Scotland, for instance, and one in South Africa that are almost of the size of the plants we are talking about here.

Mr. WHEELER. I am aware of that, and I just came back from an international meeting in England about a week ago and that South African plant was being discussed. Our people will not touch that thing until we see proven technology produce the gas.

Mr. NORDHAUS. Once the technology was proven, in your view, would your members be willing to help put up the capital?

Mr. WHEELER. I do not know; I could not say. We are talking about 5 years from now, and that is very difficult to say.

Currently, I doubt if there would be any interest in it.

The loan requirements on our own plants anymore—require for example a new ammonia plant has to have a minimum cashflow or this accelerates your payments, and so forth, and I do not know at the present state where the industry just fed about $1,750 million in expansion over the last 2 or 3 years whether they would be willing to take on even a greater magnitude of debt or not.

Obviously, you have got another problem in this thing on the antitrust question of participation, and last but not least, as I indicated earlier in the testimony, the two biggest ammonia producers in the United States are the co-ops.

Mr. NORDHAUS. Would they be willing to contract for the output of these plants at $4 or $5 an Mcf?

Mr. WHEELER. Not until the interstate market straightens itself out. I have some plants that are still on 30-cent gas. Their old contracts will run out in the next several years.

Now, obviously, the question is much different if you have a plant sitting in Helms, Calif., with no gas.

To be sure, I have met your question, the simple answer is, I don't know.

Mr. HUNT. Mr. Wheeler, it was brought to my attention in the GAO report that there are low Btu gas possibilities as far as the production of ammonia.

Mr. WHEELER. There is, Mr. Hunt, but these plants are all engineered for high Btu and they, at this point, cannot be retrofitted for a low or a medium Btu gas. No; because it would be a herculean undertaking.

You have to understand an ammonia plant looks like a plumber got drunk and didn't know when to stop. It is a very complex operation, and they would have to go in there and just rebuild the plant.

Mr. HUNT. The Indian operation that you made reference to, was that running on high or low Btu gas?

Mr. WHEELER. I am confident it was low Btu.

Mr. HUNT. I notice in the GAO report that there are some 16 plants now in operation around the world which are, as I say, almost exclusively used for the production of ammonia.

Mr. WHEELER. The Government of India is converting that plant to naphtha.

Mr. HUNT. So, from the standpoint of converting to a low Btu gas or a medium Btu gas, you feel it would require such immense retrofit that one might as well start at the absolute——

Mr. WHEELER. Yes. Let me give you a classic example. As the gases flow out of a tremendous compressor driven by about a 4,000-horsepower electric motor, it goes into a sneak preview of hell called a reformer furnace. The reformer furnace has to run at a steady 1,750 degrees to get the conversion to occur.

If you switch to a low Btu gas, then you are going to have to just completely rebuild the reformer furnace from the bottom, because you are going to have to shove a lot more gas through it to get that heat.

Mr. HUNT. The major constraint then is the capital investment that is now in place and the problems associated with retrofit?

Mr. WHEELER. That is the reason I do not have a Rolls Royce.

Mr. HUNT. I can understand that.

If I can go one step further, what percentage of the ammonia nitrate or the ammonia production in this country does come from gas? You may have mentioned that in your testimony.

Mr. WHEELER. All of the anhydrous ammonia in the United States is produced from natural gas.

Mr. HUNT. And urea?

Mr. WHEELER. Yes. The plants are built together, Mr. Hunt, and it is a matter of adding CO_2 to ammonia to convert it to urea.

Mr. HUNT. Fine.

Thank you very much.

Mr. DINGELL. Mr. Wheeler, we thank you for your assistance to the committee.

Mr. WHEELER. Mr. Chairman, thank you very much for letting me wind up this evening.

Mr. DINGELL. Well, I am not sure that you wouldn't have been more pleased if we had heard from you earlier, but we did our best.

Mr. WHEELER. Thank you.

Mr. DINGELL. The subcommittee will stand in recess until 1:30 tomorrow.

[Whereupon, at 7 p.m., the hearing was adjourned, to reconvene at 1:30 p.m., Thursday, May 26, 1976.]

SYNTHETIC FUEL LOAN GUARANTEES

THURSDAY, MAY 27, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE.
Washington, D.C.

The subcommittee met at 1:30 p.m., pursuant to notice in room 2123, Rayburn House Office Building, Hon. Richard L. Ottinger presiding, Hon. John D. Dingell, chairman.

Mr. OTTINGER. The subcommittee will come to order.

Today we are resuming our hearings on sequential referral of the Science and Technology Committee of H.R. 12112, a bill to provide loan guarantees for the production of synthetic fuels.

The chairman of the Committee on Science and Technology, Hon. Olin E. Teague, is unable to testify at this time. He was scheduled to do so, but he has legislation on the floor, and he asked if his statement might be submitted for the record, so without objection it will be inserted in the record at this point as though read.

STATEMENT OF HON. OLIN E. TEAGUE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. TEAGUE. Mr. Chairman, I welcome this opportunity to appear before your committee to testify on behalf of H.R. 12112 as reported, the loan guarantee program for synthetic fuels which was reported from the Committee on Science and Technology on May 12. The proposal contained in this bill has been the subject of extensive hearings before our committee in this Congress, and the language that is in the bill before you is the product of many months of work. This work began in the last session of Congress after the Senate passed a loan guarantee provision, section 103, as part of the Energy Research and Development Administration authorization bill, H.R. 3474.

Mr. Chairman, before addressing the need for this legislation, I thought I should first review for the committee the genesis of this legislation, since it is a subject which has come up in the House before. Last year, the Senate Interior Committee, chaired by Senator Henry Jackson, included a loan guarantee provision which became known as section 103. That section provided for $6 billion in loan guarantee authority and included a program to produce synthetic fuels from coal and oil shale and to support enterprises seeking to utilize renewable energy resources on a commercial scale to generate power or heat. The text of the Senate amendment came from an earlier legislative package which was sponsored by Senator Jennings Randolph which

is referred to as the Synthetic Fuels Act of 1975, S. 2066, introduced July 8, 1975.

The executive branch initiative on a synthetic fuels program was enunciated some months earlier by President Ford in his 1975 state of the Union message. At that time, the President proposed a national synthetic fuels commercialization program capable by 1985 of producing 1 million barrels of synthetic fuels and shale oil per day. After the ERDA authorization bill passed the Senate by a vote of 92–2, the House conferees were faced with the consideration of a loan guarantee program in the conference on which no work had been done in the House. Therefore, we delayed the conference committee meeting until such time as our subcommittees had an opportunity to look at the program and to hold some hearings of their own so that we would have a better base of information about what the program contained before going to conference.

As a result of this work by our subcommittees last fall, we heard more than 100 witnesses, and have printed three volumes entitled "Loan Guarantees for Commercial Size Synthetic Fuels Demonstration Plants" which were hearings conducted by the Subcommittee on Energy Research, Development, and Demonstration (Fossile Fuels), chaired by Ken Hechler, and four volumes entitled "Loan Guarantees for Solar Energy Demonstrations," "Geothermal Energy Research, Development, and Demonstration," and "Loan Guarantees for New Energy Technologies—Capital Formation," and "Loan Guarantees for Energy Conserving Technologies," which were hearings conducted by the Energy Subcommittee chaired by Mike McCormack. After these hearings the conferees met and put together a much improved legislative provision. At this time, too, we coordinated with other House committees to do everything we possibly could to overcome their objections and incorporate their suggestions.

In this session, we have held six full committee hearings on H.R. 12112, and spent many exhaustive hours perfecting the language in markup sessions before reporting it out of committee on May 12 by a vote of 27 to 8. The report that accompanies our bill, H.R. 12112, reflects this effort. To sum up the work of our committee in receiving testimony, we have heard from a host of witnesses who represent Federal, local, and State government, industry, financial institutions, labor, environmental groups, Indian tribes, and other individuals, associations, and groups.

Mr. Chairman, we feel that our hearing record is exceptionally complete. We are proud of the work that we have done; we feel that it is thorough and the program contained in the bill, H.R. 12112, is not hastily conceived or developed with narrow vision. It is a broad-gage program which will permit construction of a few large plants at a size large enough to determine the economic and environmental questions that surround them. In addition, it provides for community impact moneys to make sure that people and the regions of the country that may be affected are considered as well.

Mr. Chairman, this leads me into a discussion of why the committee believes that this loan guarantee program is required in order to initiate demonstrations at full size of promising energy technologies. It is true that since the Arab embargo of 1973 some of the pressures for moving ahead quickly have relaxed. Today the gasoline flows into automobile tanks of Americans at a price which is only slightly above

those preembargo days in 1973, and we were blessed with a mild winter. The wasteful overconsumption by our citizens continues.

We feel that the time to get started so that we have the technology capable of producing energy is now. We will need the technologies which can be built to produce synthetic fuels from coal, from oil shale, from urban waste, from the Sun, and from geothermal resources. What we need now is to give the kind of financial assistance to the private sector to begin this task by building a few plants to demonstrate that the technology can be made to run and that it can be made to run in an attractive economic and environmental way.

The committee has not created a large program, although the figures seem high; $4 billion does not build that many full-size plants, since each high-Btu gasification plant is estimated to cost roughly $1.2 billion. As we said in our report accompanying H.R. 12112, our limited program will result in about 24 different demonstrations to provide the experience and information needed. What we have heard from witnesses over and over again—witnesses from industry who have testified—is their statement that they are not in a position to finance the first-of-a-kind plants.

There are at the present time a number of serious impediments to private sector commercialization of synthetic fuels. The uncertainties surrounding future prices of world oil have a substantial effect on the investment climate for those facilities which would then be competing against foreign oil which would be underpriced. And in addition to the financial risks and capital costs, there are numerous environmental uncertainties because of regulations that must be met as well as questions concerning the adequacy of available labor and materials. Our bill provides a means for the Government to reduce the risks sufficiently to allow these projects to proceed. Through the loan guarantee mechanism, the Government minimizes its involvement as well as minimizing the cost to the budget.

In addition to the assistance to the industry, the committee deliberated at great length to provide the necessary social and economic impact assistance to reduce the impacts that concern people—the impact of the host communities and on the regions of the country which have the resources but do not have the same kind of infrastructure and labor resources that exist in the more populated areas of this country.

Mr. Chairman, this is just one of the many programs which this Congress must pursue to meet the challenge posed by our dwindling supplies of oil and natural gas. While enhanced recovery and conservation measures will augment our supplies in the near term, they will not increase our supplies of these energy sources in the long term, by the year 2000. This program will provide the start for synthetic fuels which will be needed in this Nation by the end of the century. This is the conclusion of not only numerous industrial energy consumers who testified before us, but also the conclusion of two Presidential Commission reports—one in 1952, the Paley Commission Report, and the other in 1975, the Inter-agency Task Force on Synthetic Fuels. Both reports concluded that this Nation will need to augment its energy mix with synthetic fuels by the year 2000.

Mr. Chairman, the legislation that we have reported out of our committee has broad based support not only in the committee itself,

but from the National Governors' Conference, from labor, from the industrial community, from energy users, and from the financial community. The bill is one that I think your committee will find is worthy of support. If there is anything that our committee and its staff can do to assist you further in your consideration, we would be happy to help you in any way we can. Thank you.

Mr. OTTINGER. We will proceed then to hear Mr. Don S. Smith, the Commissioner of the Federal Power Commission. We are pleased indeed to have you before us today. We would appreciate it if you would identify the people who are with you, and we will take the full statement you have provided for the record. Hopefully, you will be able to summarize that and then we will proceed to questions. Thank you for being with us.

STATEMENT OF DON S. SMITH, COMMISSIONER, FEDERAL POWER COMMISSION; ACCOMPANIED BY LEON WAHRHAFTIG, MANAGER, SYSTEMS OPERATION DIVISION, BUREAU OF NATURAL GAS; WILLIAM W. LINDSAY, Ph. D., ASSISTANT CHIEF, OFFICE OF ECONOMICS; D. JANE DRENNAN, ATTORNEY, OFFICE OF SPECIAL ASSISTANTS; AND DANIEL GOLDSTEIN, ATTORNEY

Mr. SMITH. Thank you, Mr. Chairman. I am Don S. Smith, Commissioner of the Federal Power Commission. I am accompanied here today by Leon Wahrhaftig, who is Manager, Systems Operation Division, Bureau of Natural Gas; Dr. William W. Lindsay, Assistant Chief, Office of Economics; D. Jane Drennan, an attorney with the Office of Special Assistants; and Dan Goldstein, attorney with the Commission.

Mr. Chairman, let me say at the outset that, whereas my testimony is generally supportive of the loan guarantee program, neither the Commission nor I, as a Commissioner, have ever accepted as an absolute proposition that projects cannot be built without federally guaranteed financing.

It is true that in the cases before us the parties have made that representation, and proffered certificates, in instances where we have progressed to that point, have not yet been accepted.

However, the Commission's position has been that it has no control over whether Federal financing will be supplied or not, and the matter stands at that stage before us.

Mr. OTTINGER. Do you feel that the companies could finance that without Federal assistance?

Mr. SMITH. The regulatory environment, Mr. Chairman, almost a necessity is the traditional one which involves financial institutions and their willingness to finance, the willingness of the regulatory companies to expend their own funds, and the interest of the ratepayer.

Consequently, our efforts are generally within that framework, and in each of the cases the certificates that the Commission has issued have been those it thought would be acceptable, taking into account the public interest protection that it is obligated to protect.

In other cases involving special projects, the issue of Federal financing as a necessity has been raised, as the Commission proceeded.

We have felt it would be self-defeating, as far as we are concerned, to say that construction depends on a nonexistent form of assistance.

Mr. OTTINGER. I am not sure what your answer was, whether you do think that this is——

Mr. SMITH. I am saying we have to process the cases as though there is no Federal financing, because there isn't. In determining the financial feasibility of the project and the rate of return necessary to support the project, we work toward a rate which will be self-sustaining without Federal financing.

Mr. OTTINGER. You may proceed.

Mr. SMITH. The applicant then can accept a certificate or not. As we read the legislation before you, Mr. Chairman, H.R. 12112, it would make available up to $1 billion per year for 2 years for loan guarantees on high Btu coal gasification projects. This is essentially the only aspect of the bill that would impinge upon the Commission's jurisdiction, inasmuch as it is the synthetic fuel which interstate pipelines will hopefully use in interstate commerce.

The jurisdictional aspect of the problem to the Federal Power Commission has been worked out over the past 4 years in a series of cases. These cases are set out, commencing on page 4 of my testimony. The Commission was obliged to determine the jurisdictional implications of synthetic gas products of a manufacturing process which converted naphtha feedstock into synthetic gas with a high Btu content. The Commission determined that this was not natural gas within the context of the Natural Gas Act. That being the case, it then went to the legislative intent that Congress had in promulgating the act, to determine what its jurisdiction was in this instance. It concluded that the Commission's jurisdiction extended to natural gas unmixed with artificial gas and any mixture of natural gas and artificial gas.

Consequently, the coal gasification project came before the Commission. The same reasoning was applied. Therefore, the feedstock, the coal gasification plant, the facilities used for the transportation of the artificial gas when unmixed with natural gas, and the sales thereof when unmixed are not within the Commission's jurisdiction.

Only at the point where the synthetic gas is mixed with a natural gas in a jurisdictional pipeline does the Commission's jurisdiction attach.

The findings in opinion 663, which was the coal gasification case, were later affirmed by the U.S. Court of Appeals for the District of Columbia Circuit in *Alice Henry, et al.* v. *Federal Power Commission.*

In our judgment, the jurisdictional question was fairly well settled. In one later case, the same reasoning was applied to a new feedstock, animal waste, and the Commission has recently completed processing of that particular case.

At present, there are five applications which are pending before the Federal Power Commission, and I believe, Mr. Ottinger, that in your work and in the committee's work, the particular projects have been examined fairly carefully.

The projects are: The Transwestern Coal Gasification Company; Pacific Coal Gasification Company; and Western Gasification Company. That is set out on page 8 of my statement.

This particular project has undergone very considerable admin-

istrative work before the Federal Power Commission, which culminated in its issuance of opinion 728.

After the issuance of that opinion, the applicant and many of the parties, including the State of California, asked for rehearing and reconsideration of the order, and on November 21, 1975, the Commission issued opinion No. 728–A. I have attached that opinion to the testimony and commend it to your attention, particularly the fairly lengthy discussion of the minimum bill and sliding scale provisions which were evolved.

Mr. OTTINGER. I hate to interrupt you for 1 minute, Mr. Smith. Unfortunately, we have a quorum call on the floor of the House. I will try to get back within the next 10 minutes if you could bear with us.

We will recess for approximately 10 minutes.

[Brief recess.]

Mr. OTTINGER. We will resume. I am sorry for that interruption. Please proceed.

Mr. SMITH. Mr. Chairman, my staff concurs with you that I did not answer your question at the outset of the hearing, and I would like to try it again, if I may.

Mr. OTTINGER. Certainly.

Mr. SMITH. If I could refer you in my testimony to page 5 of the second attachment, which is opinion and order on rehearing in 728–A, in the middle paragraph on that page the Commission addressed the issue which was raised for the first time on rehearing by Transwestern. It concurred with the State of California that Federal assistance in financing the project was essential.

In our discussion there, it concluded: "As Transwestern has stated that the viability of the project depends on its receipt of this form of aid, over which this Commission has no control, we recognize the probability that this project may be delayed for some period of time. We reserve, however, the right to review any plan of financing when it has reached final form."

After the issuance of that opinion, the applicants did not initially accept the certificate and filed an application for 6 months' extension of time to determine whether they would accept the certificate.

Mr. OTTINGER. What date was that? My inquiry being whether or not this legislation had been introduced by Senator Jackson at that point or not.

Mr. SMITH. The opinion date was November 21, 1975. The filing, at which point the applicants in California asserted that Federal financing was necessary, was in August of last summer.

Mr. OTTINGER. August of last year?

Mr. SMITH. Last year.

Mr. OTTINGER. So it would appear at the time at which they decided that Federal financing was necessary was the time that it appeared that it might be available.

Mr. SMITH. I don't know when the first availability would have occurred. I might also comment that there were two assertions made in the opinion on rehearing. One was an assertion which had been rejected in the initial order, and that was an essentially all-events tariff or "hell-or-high-water" rate which would cover any eventuality as far as lender and dead-end equity investors are concerned. The Commission did not accept that, and the rate it devised was considerably short

of covering all eventualities. That particular issue is before us in all of the cases, and the Commission is yet to——

Mr. OTTINGER. Did they ask for both an effective construction work in progress tariff, so that——

Mr. SMITH. No; construction work in progress was not involved. The type of rate would include startup rate provisions and the minimum bill provisions to some extent would afford a return on investment, even during downtime and during the startup period, which the Commission declined to give. Under the circumstances of the case, since the Commission does not have jurisdiction over the plant, construction work in progress cannot under present law be allowed.

Later, I comment on provisions of the Senate bill, S. 3422, which would give the Commission jurisdiction over the plant, and, if enacted, the construction work in progress issue would become an issue——

Mr. OTTINGER. Under the tariff they requested, if there were a loss on the project, they wanted—and you denied them, I take it—a tariff which would have enabled them to transfer the entire loss to the consumers.

Mr. SMITH. Yes, sir.

Mr. NORDHAUS. Could you explain—we may be jumping ahead of your testimony—could you either now or in the course of your testimony explain how the tariffs that the Commission approved worked in the event of failure of the plant to perform as the applicant said it would? If you are going to get to it later, do it in the course of testimony.

Mr. SMITH. I think on page 13 there is a discussion of the Commission's treatment of the minimum bill provision. The applicants had requested a minimum bill, which would essentially permit a recovering of funds, investment funds, should the heating value and/or the Btu content of SNG fall below the projected levels.

This proposal was rejected by the Commission, and the minimum bill provision set out on page 13 was promulgated in 728–A. It was, as you will see, a sliding scale, which reduces the return on equity in the event that plant output falls below expectations.

Mr. OTTINGER. Do I understand correctly that this decision was made before there was contemplation of loan guarantees? What I am asking for is: Was this minimum bill provision intended to be used in conjunction with loan guarantees?

Mr. SMITH. No. That is why I had some difficulty answering your first question. The Commission's order was designed to make a feasible project with adequate investor protection as best we could devise in the absence of Federal financing.

Then, when the parties returned to the Commission and said that, without Federal financing, even with the certificates given, with the conditions imposed upon them, there would be no project.

At that point, it became something out of our control.

Mr. OTTINGER. Now, the companies that came in yesterday said they wanted both Federal financing and this kind of tariff protection. What would the Commission's attitude be toward that?

Mr. SMITH. I am sorry, sir.

Mr. OTTINGER. They said they wanted both the Federal loan guarantees and the kind of tariff protection that is discussed here. They would like both. I wondered what the Commission's attitude would be toward that.

Mr. SMITH. I have also appended the Commission order that I think most nearly answers that question, Mr. Chairman. It was issued several days ago, and it is the last attachment to my testimony. It is Opinion No. 763. This was the *Calorific* case whereby the cow manure will be converted into natural gas.

The Commission again confronted the question of what type of tariff it would allow and dealt with the company's request that a tracking and an automatic escalator provision be granted. The Commission did not do so, and I think paragraph 19 on page 6 incorporates that discussion.

I suppose, to summarize, I would say that in all the supplemental supply SNG cases that we have before us, some form of all-events tariff has been requested. The Commission in the cases it has decided until now has not acceded to that request.

Mr. OTTINGER. This program, if it were to go forward—it seems to me particularly concerning if you have loan guarantees for, say, 75 percent. The whole thrust of the program is to assure that the companies have some stake in this and some equity. If in fact, they have no risk of loss, if they lose that equity, it is entirely recoverable from consumers, then it seems to me we are not carrying out what was the intent of the legislation. If that is not in prospect, then we are asking the companies indeed to—except as far as the tax laws intervene—to take some risk.

Mr. SMITH. I think the no-risk eventuality would occur only through a combination of both. The equity exposure to at least the 25 percent would remain, and that could be fully protected only by several regulatory actions both with respect to rates and, in the event the plants became jurisdictional, with respect to what it would do after a project failed and the property was no longer used and useful. The Commission has not yet shown an indication to have the complete recovery of investment through the rate structure at present, in the series of cases I have given you.

Mr. OTTINGER. We might well consider putting a provision in this legislation which would prohibit the granting of either—they haven't called it construction work in progress. Counsel, do you remember what they call——

Mr. NORDHAUS. They said it was a surcharge that allows for construction—funds used during construction. These were the industry representatives yesterday. They pointed out that technically it wasn't construction work in progress because the physical assets were not properly rate-based since the facility was nonjurisdictional, but I got the impression—this is in the context of the American Natural Gas proposal, and I am not sure that the surcharge they were talking about was one that would be imposed by the distribution companies at the State level or whether it was something that they were considering having the FPC impose.

Mr. OTTINGER. What I want to get at is this. If we put a provision that would prohibit any construction work in progress to the rate or in the all-events tariff which would allow them to recover any losses, that would not be inconsistent with the FPC's findings and the FPC wouldn't find any difficulty with that.

Mr. SMITH. I am not—one of the difficult points in the cases we have had is whether protection should extend to a return on equity as opposed to a rate structure which would return the equity which would

allow the investor to recover equity in the event the project did not work.

I think the Commission's decision, particularly in 728–A, with the minimum bill provision, indicated that it did not feel compelled to devise a minimum bill provision which would afford a return on equity in all events.

Mr. NORDHAUS. Commissioner Smith, one of the things that we would like to clear up for the record is exactly how the tariff which the Commission approved works. Now, my understanding is that, if the plant—just take an example. A plant produces 5 percent of its projected output instead of 100 percent. Under the tariff that the Commission approved, there would be a reduction in return on equity. Presume we would go down more or less to zero.

Now, the investor—there would still be depreciation. In other words, my understanding is that it would still permit a tariff that was high enough to permit investors to recover their equity as such, even though they didn't get any return on it. Is that the way it would have worked?

Mr. SMITH. Yes, I think so.

Mr. NORDHAUS. If you had more precise——

Mr. SMITH. The return on equity would go down until you tripped the penalty provision. That is, in the event that the output falls below a 25-percent load factor. Then all return on equity and related taxes would be eliminated.

Mr. NORDHAUS. But they would still get the equity as such. Would they still get a tariff which would reflect—would include depreciation, which would in fact give them back their equity, though give them no return on it? That is what I am not clear on.

Mr. SMITH. I am not sure. I can clear that up. The rate devised is the rate the pipeline will be entitled to charge, or whoever is producing the gas. The investment is made in a nonjurisdictional facility, at least the bulk of it, and any depreciation, of course, would be taken outside of the jurisdictional scope.

The rate, of course, is that which provides the funds against which the plant would be depreciated, and the rate is designed to recover all cost, including all the depreciation costs.

Mr. NORDHAUS. So, in the event that the plant didn't work at all or worked at a very small percentage of capacity, the pipeline would still be authorized to purchase some small amount of gas at a rate which woud be sufficient to cover depreciation and operating expenses for the plant, even though it wouldn't give investors any return on their equity.

Mr. SMITH. Down to the 25 days no output provisions.

Mr. NORDHAUS. What would happen then?

Mr. SMITH. Nobody gets anything.

Mr. NORDHAUS. Even though——

Mr. SMITH. The minimum bill provisions would apply, except during the breakdowns or no output situations which lasted more than 25 days.

Mr. NORDHAUS. If you had a very small output from the plant, the minimum bill provisions would continue to apply?

Mr. SMITH. Down to a 25-day outage.

Mr. NORDHAUS. Twenty-five day outage of the plant. So, when you say an "outage," you mean a complete outage or a reduction below some low——

Mr. SMITH. Complete outage.

Mr. NORDHAUS. So, if the plant went along at 5 percent of capacity forever, you would be—the pipeline would be obligated to pay for the gas at a rate which would be sufficient, which might be $20 per Mcf, enough to permit the plant—permit the investors in the plant to at least get back their investment plus operating costs necessary to produce that 5 percent of capacity.

Mr. SMITH. Yes, sir. I think it would have that effect. But let me correct that. They would be entitled to file to make that recovery, but they would not be automatically entitled to it. It would require a section 4 proceeding to get over the base rate plus fixed escalations which would be set. In other words, in the event that occurred, the Commission would have before it not only evidence that the costs amounted to what they were asserted to be, but also whether the additional costs were prudently incurred and that the total rate were a just and reasonable rate.

Mr. NORDHAUS. This woud have to be done on the Commission's motion or the motion of——

Mr. SMITH. The motions of the parties.

Mr. NORDHAUS. If nobody came in——

Mr. SMITH. The Commission's orders set out that the party has the right to make a section 4 filing, as its costs become known, rather than estimated.

Mr. NORDHAUS. This is a right that any party would have, even if—well, under any tariff approved by the Commission, is that correct?

Mr. SMITH. Yes.

Mr. NORDHAUS. So even if the plant weren't limping along at 5 percent of capacity, somebody could come in——

Mr. SMITH. They could come in and make a filing. The rate applied for, however, has generally been to have automatic cost adjustments in it which do not require section 4 filings. They are put in automatically as they occur by whatever formula is approved.

Mr. NORDHAUS. Thank you very much. It has been very helpful for clarifying the record on that point.

Mr. SMITH. Mr. Chairman, briefly on pages 15, 16, 17, 18, and 19, I discuss the other filings which the Commission has before it. The cases that are presented, I think, illustrated the financing problems that the companies have, and I attempt to set out my understanding of what the financial problems and lack of investor confidence might be on page 21.

These range from the truly enormous amounts of capital that are required to build the projects, the fact that the projects are frequently much more capital-intensive than the net worth of the companies which propose to put them in service.

There are problems associated with the construction phase. The lengthy period of construction provides opportunities for the favorable climate which supported initial investment to change. Delays can and do lead to cost overruns, and inflation can increase beyond the point where the initial investor may have calculated the inflation to be.

And there is the process itself, the Lurgi process. A broad spectrum of engineers and scientists, as well as the technical staff of the FPC, believe it highly probable that the facility will operate as designed

and within reasonable financial operating parameters. The Commission has officially adopted this view, but the fact remains that a full-scale plant of the size and type contemplated has yet to be built and operated. Until it is done, I think it is certainly reasonable to anticipate investor reluctance to invest—to finance the project.

There is another question which relates to investor risk, and that is whether the output of the facility will be marketable at currently projetced prices in the mideighties. There are such issues as to whether the existence of the OPEC cartel will remain as it is now at the time the funds must be committed.

There are regulatory and rate structure questions which have not been resolved. Important among these are the investor risk and ratepayer exposure which are involved in the question of whether supplemental supplies should be priced on an incremental or rolled-in basis.

I have attempted to set out, Mr. Chairman, commencing on page 23, just what the incremental basis and rolled-in pricing issue is, and the arguments that are made on both sides.

The impact on ratepayers is significant depending on the Commission's choice of pricing mechanisms, and the choice further affects the risk to be accorded to the investor.

Mr. OTTINGER. If I might ask at that point, is it possible to keep the synthetic gas rate segregated so that you can tell how much you are paying for that synthetic gas?

Mr. SMITH. Yes, sir, and that has been done in some of the import cases. It is possible to establish an incremental rate for the supply. The company then goes out and finds gas consumers who are willing to contract for firm supply of the gas at that rate. While it is true that it is intermingled and you don't have the physical identification of the synthetic with the natural gas, the incremental pricing can be done.

There are, of course, administrative and jurisdictional problems, particularly as far as the FPC is concerned, because the end use pricing is generally done by a State or other regulatory body and at the point where it is sold to the distribution company or to the direct sale customer. This Commission no longer controls that. Consequently, we could be in favor of incremental pricing, but the distribution companies might prefer to roll it in through their rates.

Mr. OTTINGER. Could you require it to be imposed as a condition of the sale?

Mr. NORDHAUS. Could you require in approving any one of these projects to require that any distribution company which buys the gas would have to adopt a particular incremental pricing policy as a condition of receiving it? That would be within your jurisdiction, wouldn't it?

Mr. SMITH. It is my opinion that such a condition on the certificate granted by this Commission is—would be legally sustainable.

Mr. OTTINGER. Has the Commission ever imposed that kind of a condition in any other circumstance?

Mr. SMITH. No, we have not, Mr. Chairman. After the conclusion of a description of the incremental versus rolled-in pricing issue, my testimony concerns itself with the import of the FPC's being given jurisdiction over the plant. It is very likely that this jurisdiction, the conferral of this jurisdiction, would reduce the investor risk involved and thereby instill investor confidence in synthetic gas projects.

Section 27 of Senate bill 3422 would confer this jurisdiction. Under that proposal, the FPC would have authority to certificate the production, sales, and transportation of synthetic natural gas in a manner similar to that now applicable to natural gas.

With this jurisdiction, the plants could be included in rate base and the investors would be allowed a reasonable rate of return on their investment. In the event of a plant failure, however, the unrecovered investment in the plant that was no longer useful would ordinarily be removed from the rate base.

The question whether the write-off should be charged against consumers or stockholders would then become the subject of an adjudicatory proceeding. The write-off would take the form of an annual amortization deduction either above the line, so that it would be in? cluded in the pipeline's cost of service, or below the line, in which case it would be charged against stockholders' equity.

I did not cover in my prepared statement, Mr. Chairman, one other impact of conferring jurisdiction upon this Commission, and that would very likely be the environmental implications of the FPC then becoming the lead agency in preparing the environmental impact statement. In most of the applications so far, another agency constitutes the lead agency and our environmental responsibilities, as far as preparation of the NEPA statement, is somewhat different than it would be after the passage of legislation which gave the Commission jurisdiction over the plant.

If jurisdiction were conferred upon the Commission over the gasification plants, in view of the size of the projects in relation to the size of a typical pipeline company, the manner in which construction work in progress is treated for rate purposes by the Federal Power Commission will be of considerable significance.

I set out on the bottom of page 26 and carrying over into page 27 the implications of construction work in progress. Most of these will be finalized when the Commission acts on a rulemaking proposal it has as to the extent to which CWIP's should be allowed as an earning item in the rate base.

On page 29——

Mr. OTTINGER. In accordance with footnote 9 then, you have not made a decision on how to treat that so far.

Mr. SMITH. Yes, sir; that is correct. The rulemaking is pending before us at present. An allowance for funds used during construction is afforded a utility with plant which is not yet used and useful.

Mr. OTTINGER. Would you think that determination ought to be different if there are 75-percent loan guarantees than if a plant were built entirely with utility money?

Mr. SMITH. I couldn't answer that for two reasons, Mr. Chairman, The rulemaking is before us and we have to act on it.

Mr. OTTINGER. What I am asking you is: Does your rulemaking reach that issue? Is your rulemaking only going to address itself to fully financed—fully utility financed programs, or is your ratemaking procedure going to address itself to a situation where there is 75 percent——

Mr. SMITH. Until a few minutes ago, it probably would not have dealt with that issue. In the proposed rule the Commission put out for comment, there was no distinction made in—between Government guaranteed loans and those which were not.

Mr. OTTINGER. Since you are going to have to be making a decision on these questions, would it be easier for you to have staff comment on these issues?

Mr. SMITH. On the particular issue of whether the CWIP implications would be different in the event you had Government guarantees of loan, I would ask Dr. Lindsay if he would have any comment.

Mr. LINDSAY. Certainly it is the case that one of the reasons that has been advanced by those who want to put construction work in progress in the rate base is that it will assist them in financing, that they are having financing difficulties, that this will improve cash flow and enable them to finance supply expansions better than they otherwise would, and certainly, to the extent that they are receiving a Government guarantee, I would think that their financing difficulties would be, to that extent, reduced, so that Government loan guarantees, I think, would constitute an argument against CWIP, at least to that extent where that was an issue.

Mr. OTTINGER. Do you anticipate that the rulemaking proceeding that presently is before you with respect to construction work in progress will address the situation where there is substantial Government financing?

Mr. LINDSAY. As Commissioner Smith said, up to this point, I don't know of any reference specifically to Government loan guarantees up to now.

Mr. NORDHAUS. Would it be possible to include this discussion in the record of the rulemaking proceeding the way it has been raised, or is it too late?

Mr. SMITH. It would have to be renoticed.

Mr. NORDHAUS. Too late. One other question on this question of FPC jurisdiction over synthetic gas facilities. Would extension of FPC jurisdiction to these facilities trigger the applicability of section 7(h) of the Natural Gas Act which provides the certificate holder with eminent domain—Federal eminent domain authority?

Mr. SMITH. Yes; it would.

Mr. NORDHAUS. Am I correct in thinking this would have the effect of overriding State land use law to the extent that it was inconsistent with the approved certificate?

Mr. SMITH. Yes: that would be the effect.

Mr. NORDHAUS. Thank you.

Mr. SMITH. Mr. Chairman, my conclusion, as I stated at the beginning, is supportive of the bill. I believe that the Federal loan guarantees is a rational way to approach it. There is no question but what it will very greatly facilitate the rate at which operational facilities are in place and the rate at which they become able to make a gas supply contribution.

The supply increments that the coal gasification plants will be able to generate is not large when compared with the national gas consumption. However, the additional supply increments would be extremely important and of enormous economic value.

It is also clear that additional increments are going to be needed from this source in order to protect the very large investment the Nation has in the pipeline distribution system. We know from sad experience that, as throughput drops, the capacity costs increase. People are paying more for less. This trend can be substantially altered by a large synthetic gas capability which would also maximize our use of our coal resources.

I have included here some comments on the relationship between the Administrator granting his loan and the Federal Power Commission certification proceeding. They will, of course, relate to one another. The administration's decision on whether a particular project meets the criteria established by the act will be influenced by the terms of this certificate. The Commission may have granted it. On the other hand, the existence of Federal loan guarantees, which will be learned only at a later time, would have its influence on the rate decisions, rate design and rate level decisions the Commission makes.

Consequently, I would contemplate in the manner set out in my testimony conditional certificates which, when financing was firmed up, would go back to the Commission for final action.

Thank you very much.

[Testimony resumes on p. 333.]

[Mr. Smith's prepared statement follows:]

STATEMENT OF DON S. SMITH, COMMISSIONER, FEDERAL POWER COMMISSION

Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify before this Committee on the subject of Federal loan guarantees for demonstration of new energy technologies.

H.R. 12112, as reported by the Committee on Science and Technology, would make available up to $1 billion per year for two years for loan guarantees on high Btu coal gasification projects. This is of particular interest to the Federal Power Commission, since coal gasification is at present the most promising of the fossil fuel conversion technologies because of our vast coal resources and because it is the synthetic fuel wherein the Commission's jurisdiction is likely to be invoked. Loan guarantees would inject a new element into Commission rate and public convenience and necessity decisions.

The predicted shortages of natural gas led the Commission to establish, as part of the National Gas Survey initiated in 1971, a Supply Technical Advisory Committee, which included a Synthetic Gas-Coal Task Force. This Task Force was asked to evaluate the technical and economic aspects of coal to gas conversion, to review the current and probable future state of the technology and to submit projections through the year 1990 relating to probable costs and commercial availability of gas produced from coal. The following table summarizes the Task Force's "best guess" projections of the cumulative number of plants, synthetic gas production capacity, and plant investment for the years 1975, 1980, 1985, and 1990.

Year	Projected plants in operation	Production capacity trillion cubic feet per year	Cumulative plant investment (billions)[1]
1975	None	None	None
1980	5	0.4	$1.73
1985	16	1.3	5.87
1990	36	2.9	13.90

[1] Excludes costs of associated mine. Historically, mine investment has been about 10 percent of total plant investment.

It is interesting to compare the Task Force's 1980 projections of five plants producing .4 Tcf at a plant investment of 1.73 billion dollars with what now appears to be the case. If the five plants include the three pending before the Commission at present, these three alone would require a plant investment of 2.7 billion dollars, substantially more than projected.

The Commission has established a Synthesized Gaseous Hydrocarbon Fuel Task Force as part of the continuing National Gas Survey effort. This Task Force will facilitate our continued evaluation of the technical and economic aspects of the conversion of coal, oil shale, liquid hydrocarbons, and other organic materials to synthetic gas.

In order to access the value of the quantities of synthetic gas which are capable of being produced, these quantities must be related to the anticipated need for

supplemental gas supplies. Synthetic gas will not be produced in sufficient volumes to completely offset the anticipated shortfalls of natural gas supply. Yet, synthetic gas, even in relatively small amounts, will provide critical and much needed increments of gas supply.

The declines in production levels from traditional gas supply sources, necessitating curtailments of natural gas by interstate pipelines, have endangered and in many instances impaired the continuation of adequate service to America's gas consumers. It is unlikely that large increases in production from present reserves in the lower 48 States can be achieved. Near-term increases in imports are unlikely, and in the long-term, uncertain. Experience teaches us that reliance on imports has its price, and I further believe that a domestic syngas capability will favorably affect import terms. Thus, if supply is to be increased significantly, it should come from accelerated development of new reserves from conventional supply areas and from commercial scale production of synthetic fuels. It is now clear that the technological, financial, environmental, and institutional problems related to the production of synthetic fuels must receive early attention due to the extremely long lag times which will be associated with this newly emergent industry and the earliest possible resolution of these problems will be required in order to reap the timely benefit of synthetic fuel supplies.

Before specifically addressing the merits of Federal loan guarantees under H.R. 12112, I would like to set forth the present regulatory responsibilities of this Commission with respect to coal gasification and other synthetic fuel projects.

In the past four years, the FPC has decided a number of questions concerning its jurisdiction over the production, transportation and sale of synthetic natural gas produced from various feedstocks. In 1972, the FPC, in Opinion No. 637,[1] determined that the synthetic gas products of a manufacturing process which converts naphtha feedstock into synthetic gas of a high Btu content was not "natural gas" within the meaning of the Natural Gas Act.[2] This decision was essentially based on the following factors. First, the process employed involves naphtha feedstock and naphtha does not contain methane, the principal component of natural gas. The process of transforming naphtha into methane involves a manufacturing process which rearranges the molecular structure of the feedstock. The Commission found that that which was produced by the manufacturing process could not be equated with that which occurs naturally.

Having determined the end product to be artificial gas, the issue became whether Congress, in establishing the Commission's jurisdiction by virtue of promulgation of the Natural Gas Act, intended to include within the FPC's jurisdiction synthetic or artificial gas. After an evaluation of the legislative environment out of which the act[3] was promulgated, the FPC concluded that the clear intent of Section 2(5) of the Act was to extend the Commission's jurisdiction to: (1) natural gas unmixed with artificial gas; and (2) any mixture of natural gas and artificial gas. By exclusion, gas which is artificial, *i.e.*, that which is manufactured, is outside the Commission's jurisdiction. The FPS found that: (1) the construction and operation of a plant for synthetic gas production are nonjurisdictional acts; (2) the synthetic gas produced is not natural gas as a matter of law; (3) the transportation and sale for resale of synthetic gas while unmixed with natural gas is nonjurisdictional. The Commission further found, however, that where synthetic gas is introduced into a pipeline and commingled with natural gas, the interstate transportation and sale for resale of the mixture is clearly jurisdictional.

In 1973, the Commission again faced questions concerning its jurisdiction over synthetic gas. This time, the questions concerned the Commission's jurisdiction over the production, transportation and sale of unmixed synthetic gas produced from coal. In Opinion No. 663,[4] the Commission concluded that coal gasification plants produce artificial gas within the meaning of Section 2(5) of the Natural Gas Act and, therefore, the feedstock, the coal gasification plant, the facilities used for the transportation of the artificial gas when unmixed with natural gas, and the sales thereof when unmixed are not within the Commission's jurisdiction. The FPC further concluded that only when mixed with natural gas in a jurisdictional pipeline does the mixture become jurisdictional. Its decision again was

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[1] 48 F.P.C. 1216 (1972).

[2] Section 2(5) of the Natural Gas Act defines natural gas as ". . . either natural gas unmixed, or any mixture of natural and artificial gas.

[3] See H.R. 5423, 74th Cong., 1st sess. (1935); H.R. 11662, 74th Cong., 2d sess. (1936 H.R. 4008, 75th Cong., 1st sess. (1937).

[4] 50 F.P.C. 651 (1973).

based upon an examination of the gasification process, the conclusion that the process clearly results solely in the production of artificial gas, and the legislative history behind the Gas Act demonstrating Congressional intent to exclude from the Commission's jurisdiction artificial gas which has not become mixed with natural gas. It should be noted, however, that the Commission's regulatory authority over pipeline rates to resale customers requires continuous monitoring of the cost of artificial gas, when commingled with natural gas, to the pipeline.

The FPC's findings in Opinion No. 663, *supra*, were affirmed by the United States Court of Appeals for the District of Columbia Circuit in *Alice Henry, et al. v. Federal Power Commission*, 513 F. 2d 395 (July 28, 1975). The Court therein agreed with the Commission's jurisdictional analysis and concluded that under the Natural Gas Act, the Commission does not possess any jurisdiction over any aspects of synthetic or artificial gas until such gas is commingled with natural gas.

THE CURRENT STATUS OF APPLICATIONS BEFORE THE FPC—PROPOSED COAL GASIFICATION AND OTHER SYNTHETIC FUEL PROJECTS

At present, five applications are currently pending before the Federal Power Commission. These are summarized below:

(1) Transwestern Coal Gasification Company, Pacific Coal Gasification Company, and Western Gasification Company; Docket No. CP73-211; Filed February 7, 1973.

In this docket, Transwestern Pipeline Company filed for authorization to construct and operate about 67 miles of 36" pipeline and related facilities for the transportation of approximately 250,000 Mcf per day of gas derived from a coal gasification project in San Juan County, New Mexico, and for the resale of such gas in a commingled stream in interstate commerce. Certification authorization was also sought for tap and valve facilities at the point of interconnection between the 67-mile pipeline and Transwestern's existing system. The coal gasification facilities were the subject of a separate application in Docket No. CP73-212, filed by Transwestern Coal, Pacific Coal, and Western Gasification. In Opinion No. 663, *supra*, the Commission concluded that the gasification plant and the 61-mile pipeline were nonjurisdictional, so that only the connecting tap and valve and the transportation of SNG by Transwestern Pipeline remained as the subject of Docket No. CP73-211.

On November 16, 1973, an amended application was filed in CP73-211, wherein Transwestern Coal and Pacific Coal sought authorization for the sale of SNG directly to Transwestern Pipeline customers, Pacific Lighting Service and Cities Service Gas Company, with Transwestern Pipeline seeking to provide the required transportation service. On April 21, 1975, the Commission issued Opinion No. 728 (Attachment), wherein it approved the proposed project subject to certain conditions. One of the major problems the FPC faced in reaching its decision in Opinion No. 728 was the overall financial viability of a coal gasification facility. The applicants, in the proceeding before the FPC, had asserted that the viability of the project depends, of course, on its financing and its financing depends on the FPC's approval of a full cost of service tariff regardless of the amount of gas delivered. The applicants asserted that a full cost if service tariff was the sole means by which the applicants could be assured of recovering all prudently incurred costs and expenses plus a reasonable return on equity in a prompt manner. Under a full cost of service tariff, they maintained that the Commission staff will have full access to all cost data on a continuing basis for review purposes. Other parties to the proceeding, especially the Public Utilities Commission of the State of California, disagreed and asserted that Commission certification of the jurisdictional aspects of the proposal should be conditioned to provide initially for a firm rate which would assure the applicants a just and reasonable price for the gas, while at the same time providing adequate protection for the consumers against imprudent and improper expenses. The Commission adopted the California proposal as the most viable method of pricing this new source of supplemental supply.

Applications for Rehearing were filed by the principal parties to the proceeding. The applicants asserted that the conditions imposed by Opinion No. 728 foreclosed the investment of capital by the private sector and further asserted that they would be able to obtain the necessary funds only if the Commission approved a cost recovery mechanism which would assure immediate recovery of all reasonable costs in producing each unit of coal gas.

Several parties proposed modifications and amendments to Opinion No. 728. Specifically, it was proposed that the initial rate should be increased from $1.38 to $2.50 per Mcf for deliveries during the testing period based on the 1975 coal contract amendment and the revised coal cost estimates. The Commission was also urged to adopt a minimum bill provision which would allow the full recovery of the cost of service attributable to the operation of the gasification plant. In other words, the minimum bill proposed was analogous to a tariff provision allowing the company to recoup all costs plus a return on equity of 15% except for a penalty provision which would have limited application.[5]

A significant aspect in the Commission's consideration of Opinion No. 728 was the parties' desire for Federal assistance in financing the project. The parties asserted then and continue to assert that the project will not be built without Federal participation. Transwestern has stated that Federal participation is necessary to cover all residual exposure, *i.e.*, risk of possible costs overruns, plant shutdowns and extended operations at abnormally low load factors which remain after the assumption of certain specific, ascertainable and acceptable risks by the applicants and the consumers. In addition, Transwestern wants the Federal Government to guarantee that if the project is not completed for any reason, construction lenders and investors will recoup their investment. In its pleadings, the California Public Utilities Commission for the State of California has asserted that there should also be a form of a guarantee by the Government to pay all or part of the costs of the project in excess of those that would justify a stated price per Mcf. The California Commission believes that the ratepayer needs the assurance that his cost for coal gas will not escalate beyond a certain level. All of the parties agree, however, that the Federal Power Commission should reserve the option to review the submitted financing plan. Applicants asserted that this would avoid any questions being raised in the future as to whether any particular financing plan is in the public interest and involves obligations reasonably and prudently incurred.

On November 21, 1975, the Commission issued Opinion No. 728–A (Attachent). Therein the Commission increased the initial rate from $1.38 per Mcf to 2.50 per Mcf, based on updated cost evidence, although it found that this rate will not allow a full recoupment of all costs plus a reasonable rate of return on equity. However, the Commission reasoned that the pricing mechanisms established in Opinion No. 728 would alleviate this problem.

The Commission also rejected the minimum billing provision proposed by the applicants on the basis that it inadequately protected the ratepayers; however, in order to assist the financiability of the project, the Commission devised a tentative minimum bill provision which would permit a recovering of funds should the heating value and/or content of SNG produced fall below the projected levels. The minimum bill provision devised was essentially a sliding-scale penalty provision which would operate as follows (Op. 728–A at 4):

If the plant output should fall below a seventy-five percent load factor, the return on equity and related taxes should be reduced by one-third or a level of 10 percent. If the output should fall below a fifty percent load factor, the return on equity and related taxes should correspondingly be reduced another third or to a level of five percent. In the event that the output falls below a twenty-five percent load factor, all return on equity and related taxes should be eliminated. Correspondingly, should the heat content of the SNG fall below 950 Btu per cubic foot for a period exceeding 25 days, the return on equity should be proportionately reduced.

In Opinion No. 728–A, the Commission also stated, in response to the assertions that Federal financing is a necessary prerequisite to the project, that it would review any plan of financing when such plan reaches final form and further re-evaluate the above-referenced minimum bill provisions. Accordingly, the Commission conditioned the authorization granted in Opinion Nos. 728 and 728–A to review any proposed financing plan.

The certificates issued in Opinion No. 728 have not as yet been accepted. The applicants have recently filed a request for a six-month extension of time in which to accept the certificates. Applicants state that this additional time is needed in order to formulate a plan for financing and again reiterate that Federal financing is most likely a prerequisite to the construction of the project.

[5] The proposed penalty provision provided for zero return on equity in the event that the load factor is reduced to 25 percent for a period of forty-five consecutive days for all deliveries subsequent to the aforementioned period.

(2) El Paso Natural Gas Company; Docket No. CP73–131; Filed November 15, 1972.

El Paso proposed to construct a coal gasification complex on the Navajo Indian Reservation near Burnham, New Mexico, for the conversion of coal into high Btu pipeline quality gas. In order to implement this project, El Paso sought a certificate of public convenience and necessity for (a) a mainline tap and valve to connect the proposed coal gasification complex to its Southern Division System; and, (b) transportation and sale of synthetic gas produced from coal and mixed with natural gas.

The project is designed to convert approximately 25,000 tons of coal per day into some 250,000 Mcf per day of synthetic pipeline gas, for use by El Paso in supplementing its declining gas supply. The indicated cost of the SNG to El Paso was initially estimated at approximately $1.51 per Mcf.

Subsequent to the completion of hearings, briefing, Administrative Law Judge decision, and exceptions thereto, El Paso requested that the Commission hold in abeyance any final decision on its proposal in this docket, and on April 21, 1975, the motion to defer a decision was granted. The matter so rests, and no decision will be forthcoming until El Paso informs the Commission of its coal lease arrangements.

(3) Michigan Wisconsin Pipeline Company and ANG Coal Gasification Company; Docket No. CP75–278; Filed March 26, 1975.

Applicants seek authorization for sale by ANG to Michigan-Wisconsin of 250,000 Mcf per day of SNG produced from coal at a complex in Mercer County, North Dakota; and construction and operation by Mich-Wisc of pipeline and compressor facilities to enable it to receive and transport such gas to its existing customers. This proposal is currently in hearings before an Administrative Law Judge.

(4) Natural Gas Pipeline Company; Docket No. CP75–147.

In this docket, Calorific Recovery Anerobic Process, Inc. (Calorific) proposed construction of plant facilities which will convert waste material into methane gas. Calorific has entered into a contract with Natural Gas Pipeline Company (Natural) whereby it will sell the gas produced at a base price of $1.33. Natural intends to use this new source of SNG to augment its overall system supply and will purchase up to 3,500 Mcf per day, with an option to receive higher volumes, if available.

The production of this gas will entail the anerobic digestion process with several modifications. This basic process has been utilized in municipal waste treatment plants for many years. Although the plant process goes beyond the presently implemented state of technology, Calorific and Natural are confident of its success.

The projected cost of the project is about $4 million.[6] Calorific is willing to assume the risk of construction of the facility without Federal assistance. On May 24, 1976, the Commission issued Opinion No. 763 (Attachment) in which we granted a certificate of public convenience and necessity authorizing the sale and transportation of the SNG commingled with natural gas at a total rate of $1.55.[7]

The base price approved by the Commission is subject to adjustments as defined by three formulas. The first is a construction escalation formula, operable only once, on the day gas is first delivered or capable of being delivered. The second formula relates to the operation escalation and takes into account consumer prices. The third formula, also an operation escalation formula, is operable on an annual basis and takes into account annual delivery volumes.

The cost of this new supply will be recovered by Natural on a rolled-in basis. Natural had also proposed to pass through the increased costs resulting from the above adjustments automatically through either its purchased gas adjustment provisions or research and development cost-tracking provision. In Opinion No. 763, the Commission rejected this proposal finding it contrary to the public interest since the initial rate would be adjusted without FPC review and the FPC would be foreclosed from making any necessary rate adjustments other than prospectively.

The Commission recognized that the initial rate may not allow full recovery of all costs during the period commencing plant operations and provided that (Op. 763, at 9):

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[6] The plant itself will cost approximately $2.9 million and the pipeline to be constructed by Natural to connect the plant with the existing interstate system will be about $930,000.

[7] Natural will pay Calorific $1.33 per Mcf which it will pass on to its ratepayers in conjunction with the cost of transportation of $.22.

Upon the commencement of initial deliveries from Calorific, Natural Gas Pipeline may file a revised tariff schedule under Section 4 of the Natural Gas Act in order for the Commission to make a determination of the just and reasonable rate. Any difference between costs reasonably and prudently incurred and the initial rate of $1.33 shall be amortized at a rate not exceeding .05 cent per Mcf, over a period of one year or more.

(5) Natural Gas Pipeline Company of America, Docket No. CP75-364; Filed on June 13, 1975.

This proceeding is similar in many respects to the previous proposal involving Calorific. Natural Gas Pipeline Company (Natural) requests authorization to construct and operate facilities for the receipt into its existing pipeline system of artificial gas to be purchased from ERA, Incorporated. The purchases contract specifies a base price of $1.30 per Mcf subject to escalations which Natural again seeks authorization to recover through its purchased gas adjustment clause on a rolled-in basis. No action has been taken as yet on this proposal.

THE EFFECT OF VARIOUS COSTING TECHNIQUES INVOLVED IN GASIFICATION PROJECTS

As can be seen, one of the most important issues facing the FPC with respect to the synthetic gas proposals is how to price the supplemental supply of gas in a manner which provides applicants the necessary financing to construct and operate the projects, ensures the applicants a just and reasonable price for the gas, and protects the consumers against imprudent and improper expenses. The companies who have applied for Commission authorization to sell and transport SNG from the coal gasification process have uniformly asserted that they are incapable of acquiring the requisite capital to construct the facilities through conventional means. As a result, they have requested full cost of service tariffs, regardless of the amount of gas delivered. The Commission has not chosen to adopt these tariffs, however, due to its concern that the rates may escalate beyond the zone of reasonableness to the detriment of consumers.[8] The rate methodology chosen by the Commission has one possible drawback, however, and that is a potential inhibiting of investor confidence in these projects insofar as total recovery of costs are concerned. This lack of investor confidence in the private sector seriously threatens the progress of these projects.

There are a number of other interrelated characteristics which affect the viability of these projects. The capital requirements of these facilities are truly enormous when compared to the value of the plant-in-service. The estimated $1.6 billion cost of a 250,000 Mcf/day facility of the size contemplated by those companies with applications pending before us exceeds the depreciated book value of the plant-in-service of most of the interstate pipeline companies. For the largest pipeline systems, a 250,000 Mcf/day increase in supply would not be a major increment.

Of major concern to investors are those problems associated with the construction phase. The lengthy period of construction provides opportunities for the favorable climate which supported initial investment to change. For example, construction delays can lead to cost overruns as can an increase in the rate of inflation beyond that contemplated in the project financing. Of course, all of these problems are exacerbated by the magnitude of capital commitment required.

Moreover, plant design does not lend itself to modular construction. As a result, the only alternative to completion of the facility is total abandonment.

Finally, there is the Lurgi process itself. While a broad spectrum of engineers and scientists, as well as the technical staff of the FPC, believe it highly probable that the facility will operate as designed and within reasonable financial operating parameters, and while the Commission has officially adopted this view, the fact remains that a full scale plant of the size and type contemplated has yet to be built and operated. It is not difficult for me to understand the reluctance of investors to commit funds to a project of such massive scale without actual operating experience as a guideline.

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[8] Because the costs of supplemental supplies have risen, necessitating subsequent filings for rate increases, and because of the inherent problems involved in an open-ended rate where there is a decrease in the load factor, the Commission cannot, if the rates are found to be excessive, rely solely on prospective relief. As the Supreme Court stated in *Atlantic Refining Co., et al. v. Public Service Commission of New York, et al.*, 360 U.S. 378, 392 (1959):

> If unconditional certificates are issued where the rate is not clearly shown to be required by the public convenience and necessity, relief is limited to Section 5 proceedings, and . . . full protection of the public interest is not afforded.

Once the plant is constructed and operational, the elements of risk shift primarily into the political and governmental arena. Governmental action in the environmental area, for example, could vitally affect the coal supply by driving up the cost of this feedstock to uneconomic levels or terminating it entirely. Shifting air or water quality regulations, particularly at the state level, could likewise increase operating costs and lower plant efficiency. Exposure of plant and feedstock to state and local tax changes adds another element of uncertainty. And, uncertainty over regulatory policy at the state and Federal levels, as we at the FPC are painfully aware, can make investors extremely wary.

Finally, there is the question of whether the output of the facility will be marketable at currently projected prices in the mid-eighties. The pressure of the OPEC cartel has been a fact of life in recent years and has vitally influenced the rate of increase in energy prices. Whether the cartel will remain dominant through the life of the plant or whether other factors, now uncontemplated, will be overriding are crucial considerations to investors, particularly those who act in a fiduciary capacity.

Investor risk and ratepayer exposure are also involved in the Commission's consideration of the question of whether such supplemental supplies should be priced on an incremental or rolled-in basis. The impact upon ratepayers is significant depending on which pricing mechanism is chosen and the choice further affects the risk to be accorded a project by investors.

Proponents of incremental pricing argue that supplemental gas supplies should be costed separately at its incremental cost plus a share of transportation costs and priced under separate rate schedules to the pipelines' customers on the basis of such incremental costs. Only by such pricing, it is argued, will avoidance of discrimination (subsidization) and misallocation of resources be assured. It is also argued that incremental pricing will enable distributors to evaluate whether it is in their best interests and the best interests of customers to contract for a fully costed supplemental supply or seek other alternatives. Finally, incremental pricing is claimed to have advantages from a conservation standpoint.

Proponents of rolled-in pricing have responded to these arguments in a variety of ways. With respect to misallocation of resources, it is pointed out that pricing in the gas industry is already misallocating resources to the extent that prices are being charged that are far below the marginal costs of a supply that would result in market clearance rather than a large and growing shortage. They dispose of conservation argument by pointing out that the conservation incentive is lost unless the gas is priced incrementally to the retail customers, an undertaking which appears to present substantial administrative difficulty. In response to the argument that distributors should have "freedom of choice" to seek cheaper alternative supplies, it is argued that most pipeline customers are not large enough to undertake projects of sufficient size to achieve scale economies. Thus, by impairing the ability of pipelines to engage in supplemental supply projects, incremental pricing will discriminate against all but the largest of the pipeline's customers. To the assertion that rolled-in pricing discriminates against high priority customers, incremental pricing supporters concede that while this may be true for a few years, supplemental gas projects provide high priority users with assurance of supply when needed in later years which in the nature of gas supply insurance for high priority users.

The manner in which this controversy is resolved, in individual proceedings, impacts upon the risks accorded to supplemental gas supply projects by investors with the possible effect of further reducing, without Federal assistance, the financial viability of major supplemental supply projects.

One approach to reduce the risk involved and thereby instill more investor confidence in synthetic gas projects is to confer upon the Commission jurisdiction over synthetic natural gas, in the manner of Section 27 of S. 3422. Under that proposal the FPC would have authority to certificate the production, sales and transportation of synthetic natural gas in a manner similar to that now applicable to natural gas. With this jurisdiction, the plants could be included in rate base and the investors would be allowed a reasonable rate of return on their investment. In the event of a plant failure, however, the unrecovered investment in the plant that was no longer useful would ordinarily be removed from the rate base. The question whether the write-off should be charged against consumers or stockholders would then become the subject of an adjudicatory proceeding. The write-off would take the form of an annual amortization deduction either "above the line", so that it would be included in the pipe-

line's cost of service, or "below the line", in which case it would be charged against stockholders' equity.

In view of the size of projects for the manufacture of synthetic natural gas in relation to the size of a typical pipeline company, the manner in which construction work in progress is treated for rate purposes by the Federal Power Commission will be of considerable significance. If an existing pipeline embarks upon a project for coal gasification, the project will become a part of the pipeline's rate base in a manner similar to ordinary pipeline facilities. Under present procedures, such property does not become a part of the rate base until it goes into service. Prior to that time, it is included in construction work in progress (CWIP) and accumulates an allowance for funds used during construction (AFUDC). Thus, when CWIP is capitalized and placed into service, it includes AFUDC accumulated during the entire period of construction. In this way, rates charged to ratepayers do not include any payment related to the project until it goes into service. The utility companies in general would prefer that investments in CWIP be included in rate base as incurred. This would have the effect of eliminating any need to capitalize AFUDC. It would mean that rates would be somewhat higher during the period of construction of such a project but somewhat lower after the project went into service since there would then be no need for return and taxes on accumulated AFUDC.[9]

If the FPC is not granted certificate authority over the construction and operation of gasification plants—in which case gasification plant investment would not be in the rate base—the synthetic gas might be sold with a provision for a minimum bill similar to that established in Opinion No. 728-A to cover the carrying cost on the plant investment. The minimum bill provision would become operable when output was curtailed or stopped because of production problems.

In sum, the capital intensiveness of these developing technologies, combined with investor uncertainty over inflation, high interest rates, governmental energy policies, and, in the case of gas producing technologies, lack of FPC jurisdiction, has cast a pall over the application and demonstration of these advanced technologies. The obstacles to large-scale financing of gasification plants cannot be overcome simply by augmenting the flow of internally generated capital. Because the technology of pipeline quality gasification has not been demonstrated and since we lack assurances that production costs will not require a price level unacceptable to the markets, corporations are asking that they be afforded substantial protection against the loss of their capital before they will invest in these plants. Protection against loss is necessary regardless of whether the capital is internally generated or borrowed from investors. Of the several possible methods of providing the needed protection against capital loss, loan guarantees of the type that are the subject of today's hearing would be the most effective. Loan guarantees would spread the risks involved more evenly, would insure the viability of the projects and would allow the continued protection of consumers who must begin to rely on supplemental supplies.

RECOMMENDATIONS AND ANALYSIS

H.R. 12112 would authorize loan guarantees to demonstrate full scale, commercial size facilities to convert fossil fuels, including coal to synthetic fuels. I believe it to be a very desirable and much needed program, one that is necessary in order to not only insure that such development materializes but also to accelerate the rate at which technologies progress.

In analyzing the bill, I am pleased to observe that up to 50% of the monies to be available can be allocated to High Btu coal gasification projects. As this Committee is well aware, a coal gasification project is extremely expensive. The proposals before the FPC illustrate that a project cost of at least $1 billion will be standard. It is far from certain that these projects will go forward without some Federal assistance.

H.R. 12112 permits federal loan guarantees of up to 75% of the total costs of the projects. This is significant in two respects. First, quite obviously, it enhances the viability of the project by encouraging financial commitments from the private sector of the economy. Second, and equally as important, it could reduce the impact upon the consumers who will rely on the synthetic gas since

[9] At present, the Commission has before it the issue of the proper ratemaking treatment of CWIP under consideration in Docket No. RM75-13.

the cost of debt will be reduced according to the amount of federal participation. For purposes of gauging the effect on ratepayers of Federal guarantees, the Commission's Staff assumed that the cost of Federal guaranteed debt would be comparable to the cost of debt issued by the Tennessee Valley Authority (TVA). TVA debt at the time of the comparison was selling to yield approximately 9 percent. On the other hand, the cost of debt projected in the ANG application is 10.75 percent. FPC Staff calculates that a reduction from 10.75 to 9.0 percent would lower the projected cost of ANG synthetic gas by an average of about 5.5 cents per Mcf over the life of the debt, resulting in a total reduction in cost of gas purchased from ANG of about $97 million. The actual reduction per Mcf would range from about 11.4 cents to .1 cent over this period.

One aspect of the bill troubles me, however, and that is the standards governing the Administrator's determinations on the guarantees. Any project which results in the transportation and sale of commingled synthetic gas and natural gas in interstate commerce must be scrutinized by the Commission through its certification process. As demonstrated by Opinion Nos. 728 and 728–A, the most difficult problem in the certification process is the pricing issue. How the Commission establishes an initial rate and any subsequent rate for the sale of coal gas will be affected by any federal guarantees, since the presence of guarantees will affect not only debt costs but is likely to reduce financial risks which would otherwise have to be reflected in returns. Accordingly, while the Administrator's decisions will be influenced by the FPC's certification and rate action, the Administrator's action in granting or denying loan guarantees would be factors shaping the Commission's final action.

Under the specific provisions of H.R. 12112, Section 18(c) (1) through (7), the Administrator can guarantee an obligation only if the Administrator is satisfied that the federal assistance applied for is necessary to encourage financial participation. Moreover, the Administrator must be reasonably assured of repayment and any private financial commitments are subordinated to the federal obligation. Taking all of this as a whole, I would recommend a process whereby loan guarantees are conditioned upon the applicant obtaining from the FPC a conditional certificate of public convenience and necessity, under Section 7 of thhe Natural Gas Act, for the *production*, transportation and sale of synthetic gas prior to final approval of the loan guarantee. This would entail extending FPC jurisdiction to synthetic gasification production facilities. The Commission's current regulatory authority over interstate pipeline rates to resale customers for SNG requires continuous monitoring of the cost of artificial gas to the pipeline, at which point it is commingled with natural gas. As such, the Commission of necessity must review many economic, environmental, and technical feasibility aspects of synthetic production facilities in approving the commingled transportation and sale of the SNG, underlying the need for supply and pricing of the gas. Accordingly, it would be appropriate for the FPC to examine not only the transportation and sale aspects of an SNG proposal, but also the production aspects as well, in terms of certification. In fact, intensive review of all aspects of the project has been necessary, without regard for jurisdictional limitations, since the rate to be determined is controlled by the costs of production. Moreover, the conditioned certificates issued by the FPC would provide guidance to the Administrator as to the technologies involved, the dimensions of the project, approximate costs and other financial aspects involved, and a tentative rate for the sale of gas.

The tentative rate established by the Commission could include a cost of capital slider so that the rate could be adjusted depending upon the impact of the federal guarantees on the cost of debt for the project. The intensive review of financial and technological feasibility that is already necessary by virtue of the Commission's certification process would accomplish two goals. First, it would facilitate the Administrator's determinations under Section 18(c) (1) through (7). Second, the public would receive full assurance, prior to any guarantees that the projects receiving such guarantees are serving the public convenience and necessity and are best adopted to develop, conserve, and utilize the nation's resources.

In conclusion, I support Federal assistance as provided for in Section 18 of H.R. 12112, as reported by the Committee on Science and Technology. Such a loan guarantee program in concept can provide the much needed incentives to give this high-cost, relatively high-risk technology the boost necessary to make these facilities a reality, and I do not think it need become permanent. If the projects are successful, continuation of the guarantees will not be necessary. If they are not, continuation of the guarantees will not be justified.

My rationale for this conclusion is two-fold. First, there is the need for the gas. The social cost of converting present gas consuming equipment to alternate fuels is truly enormous. This, of course, assumes that such fuels are available, at any price. The additional increments of gas these facilities can provide can mitigate these costs to a certain extent. Secondly, the natural gas transmission system which has been constructed in this country over the last 30 years is truly a national resource and should be maintained. The present pipeline system offers advantages not enjoyed by any other transportation system. For example, the Committee is aware of several applications before the Commission in which natural gas pipeline companies are seeking to convert part of their unused capacity to carry crude oil or petroleum products. New technology may produce new fuels such as hydrogen or other non-fuel substances which can be transported most economically by pipeline.

Coal gasification facilities of the type this bill encourages would provide one means of increasing thruput sufficient to amortize the cost of the pipeline system. As the gas supply dwindles, the unit cost of delivering an Mcf of gas must inevitably rise to cover pipeline costs.

I urge your favorable consideration of H.R. 12112.

United States of America, Federal Power Commission

DOCKET NO. CP73-211

TRANSWESTERN COAL GASIFICATION COMPANY; PACIFIC COAL GASIFICATION COMPANY; AND WESTERN GASIFICATION COMPANY

OPINION NO. 728

Appearances

James W. McCartney, Jack D. Head and Joseph F. Weiler for Transwestern Pipeline Company

K. R. Edsall and E. A. Tharpe for Southern California Gas Company and Pacific Lighting Service Company

B. E. Potts, Alfred O. Hall, Daniel R. Hopkins, Dale A. Wright and Harold L. Talisman for Cities Service Gas Company

C. Frank Reifsnyder, Samuel Shephard Jones, G. Scott Cuming, Richard S. Morris and Richard Owen Baish for El Paso Natural Gas Company

John P. Mathis, J. Calvin Simpson and William H. Booth for The People of the State of California and Public Utilities Commission of the State of California

John F. Harrington, Thomas F. Brosnan, Lawrence Robertson, Jr., and Steven M. Beattie for Tucson Gas and Electric Company

William D. Braun for the Staff of the Federal Power Commission

United States of America, Federal Power Commission

Before Commissioners: John N. Nassikas, Chairman; William L. Springer, and Don S. Smith.

DOCKET NO. CP73-211

TRANSWESTERN COAL GASIFICATION COMPANY; PACIFIC COAL GASIFICATION COMPANY; AND WESTERN GASIFICATION COMPANY

OPINION NO. 728

Opinion and Order Granting Certification of Transportation and Sale of Gas Produced From Coal

(Issued April 21, 1975)

SPRINGER, Commissioner.

This is the first coal gasification case to come before us for decision. Coal gas is of major importance to the nation's capacity to produce energy today and in the future. The case itself poses a multitude of issues for our review and decision; however, the central questions are jurisdiction, pricing, the distribution

of risk between the company and the consumers, the need for the project and the natural gas and synthetic gas supply alternatives.

I. PROCEDURAL HISTORY

On February 7, 1973, under Docket No. CP73–212, Transwestern Coal Gasification Company (Trans Coal), Pacific Coal Gasification Company (Pacific Coal) and Western Gasification Company (Wesco) applied for certificates of public convenience and necessity to authorize the construction and operation of coal gasification facilities in San Juan County, New Mexico, and the sale of approximately 250,000 Mcf per day of gas derived from a coal gasification process, hereinafter referred to as SNG, for deliveries to be made at the outlet of the plant facilities. Concurrently therewith, Transwestern Pipeline, a subsidiary of Texas Eastern Transmission Corporation, in Docket No. CP73–211, filed for authorization to construct and operate approximately 67 miles of 36 inch pipeline and appurtenances for the transportation of such SNG and for the resale thereof in a commingled stream in interstate commerce. Certificate authorization was also sought for tap and valve facilities at the point of interconnection between the 67-mile pipeline and Transwestern Pipeline's existing system near Gallup, New Mexico.

On September 4, 1973, we issued Opinion No. 663 [1] in which we concluded that the coal gasification facilities and the 67-mile pipeline were not within our jurisdiction and therefore dismissed the application in Docket No. CP73–212. We also dismissed Transwestern's application in Docket No. CP73–211 insofar as it related to the 67-mile pipeline facility. Our opinion did not affect that portion of the application which related to the connecting facilities or the transportation of SNG after the commingling with natural gas.

Thereafter on November 16, 1973, Trans Coal, Pacific Coal and Wesco (Applicants) filed an amended application seeking authorization for the two coal companies to sell the SNG directly to customers of Transwestern Pipeline, Pacific Lighting Service Company (Pacific Lighting) and Cities Service Gas Company (Cities). Transwestern Pipeline sought authorization to provide the required transportation service.

Eight days of hearinggs were held in December 1973, and February 1974. On June 13, 1974, the Presiding Administrative Law Judge William L. Ellis issued the initial decision granting the certificate contingent on specific conditions. Briefs on exceptions were filed by Pacific Coal, the Public Utilities Commission of and for the State of California (CPUC), El Paso Natural Gas Company (El Paso), Cities, Transwestern Pipeline and Staff. The Pipeline Coal Gasification Committee filed an untimely petition to intervene in conjunction with a brief on exceptions.[2] Briefs opposing exceptions were filed by Transwestern, El Paso, CPUC, and Staff. Oral argument was held on March 14, 1975.

II. THE PROPOSED PROJECT

The proposed coal gasification plant is to be located on the Navajo Reservation in northwest New Mexico. It will be capable of converting approximately 25,000 tons of coal per day into 250,000 Mcf of SNG daily, having a Btu content of approximately 970 Btu per cubic foot. During the hearing, the plant, including the 67-mile connecting pipeline, was estimated to cost $447,000,000 based on mid-1973 estimates. Pacific Coal and Trans Coal have purchased from Utah International sufficient coal and water supplies to operate the plant for a period of 25 years.

Pacific Coal and Trans Coal each will own 50 percent of the plant's output. Pacific Coal will sell its SNG to Pacific Lighting whereas Trans Coal will sell one-half of its volumes to Pacific Lighting and the remaining volumes to Cities. The sale to Pacific Lighting will be made at an existing delivery point on the Arizona-California border, near Needles, California and the sale to Cities will be made at existing delivery points in the Panhandle areas of Texas and Oklahoma. The rates charged by Trans Coal and Pacific Coal to their purchasers will include transportation charges paid by them to Transwestern Pipeline. Based on mid-1973 cost figures, the calculated price per Mcf of the SNG to be produced in the Wesco plant would be $1.317 including transportation costs; however, projecting infla-

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[1] *El Paso Natural Gas Company, et al.*, 50 FPC 651 (1973). Appealed *Alice Henry, et al.* v. *F.P.C.*, D.C. Circuit No. 73–2090 on jurisdictional and environmental issues.

[2] The committee consists of 10 natural gas pipeline systems which are actively studying or have announced plans to construct and operate coal gasification plants in the Western United States.

tion of 20 percent to 25 percent. Applicants estimated at time of hearing that the 1978 cost will range from $1.60 to $1.70.

The coal gasification complex will utilize the Lurgi gasification process. The process involves the reaction of coal, steam and oxygen under high pressure and temperature to produce a crude gas which, on a dry basis, consists primarily of hydrogen, carbon dioxide, carbon monoxide and methane. The crude gas is cooled and scrubbed with water and then delivered to the methanation unit which increases the heating value of the SNG to approximately 970 Btu per cubic feet.

The Lurgi process is currently the only coal gasification process with proven commercial experience. The methanation process, developed in conjunction with the Applicants, is alleged to be technically and commercially feasible and has been used in smaller units worldwide on experimental bases. It is estimated that thermal efficiency of the Lurgi gasification process is 87 percent whereas the overall efficiency of plant operation is 70 percent.

Coal and water are the two basic feedstocks for the proposed coal gasification project. Trans Coal and Pacific Coal have entered into an agreement with Utah International which will provide adequate supplies of these resources for the twenty-five year plant life. Utah International will supply the coal requirement from coal produced from its leasehold on the Navajo Reservation in the Four Corners Region of northwestern New Mexico. The base price under the contract, is 26.24 cents per million Btu for all coal delivered; however, the price is variable as it consists of eight components designed to reflect periodic changes in supply costs and economic conditions.[3]

Approximately 8200 acre-feet of water will be used annually by the project in order to produce 250,000 Mcf of gas per day. Utah International has assigned to Trans Coal and Pacific Coal an undivided interest in its water contracts with the United States covering the purchase of water from the Navajo Reservoir and the San Juan River.[4] Trans Coal and Pacific Coal will pay Utah International $7.00 per acre-foot for all water they are entitled to use in the project. Applicants estimate that the water used yearly represents only 1 percent of all the water in the upper basin of the Colorado River system which has been allocated to consumptive use in New Mexico in accordance with the Colorado River Compact of 1922.

The requested action of the F.P.C. is not a major federal action warranting the preparation of an environmental impact statement under the National Environmental Policy Act. Nor have any parties or litigants raised environmental issues in this administrative proceeding. The Bureau of Reclamation of the Department of Interior however is preparing a Final Environmental Impact Statement (EIS) in order to assess the impact of the entire project upon the existing environment. We have received a copy of the Draft EIS and are preparing our comments thereon as to the need for supplemental supplies of pipeline gas. In addition to the filing of the Final EIS with the Council on Environmental Quality, there are several actions which must be completed by Federal and state agencies before the Wesco plan may be implemented.

The primary federal approvals which must be received from the Department of Interior are these:

(1) Bureau of Reclamation must approve Wesco's plan as provided in the water service contract;

(2) U.S. Geological Survey must approve the mine development plan; and,

(3) Bureau of Indian Affairs must give written approval of all land leases, rights of way, and access roads negotiated with the Navajo Tribe for the plant and the associated facilities.

None of the parties have asserted that an environmental impact study is required prior to our certification of the construction and operation of the Wesco plant as has been argued in the companion coal gasification case, El Paso Natural Gas Company, Docket No. CP70-138. The primary distinction between these cases is that Wesco has been able to obtain commitments for adequate supplies of both coal and water from Utah International, which previously received the requisite authorizations from the Department of Interior. In short the purpose of the Bureau of Reclamation's EIS for the Wesco project is to assess the impact of the proposed utilization of these licensed resources rather than to determine whether the requisite authorizations should issue ab initio and thereby allow the

[3] On March 7, 1975, the parties amended the Western Gasification Agreement No. 1, dated 1973, whereby the base price of the coal was increased from 20.8 to 26.240 cents per million Btu.

[4] Under the contracts with the Department of the Interior, Utah International has rights to 44,000 acre-feet per year of water and has assigned up to a maximum amount of 11,000 acre-feet of its supply for use in the construction and operation of the plant.

use of previously uncommitted water and coal for energy production, as is the case in El Paso.

III. NEED FOR NEW SUPPLY

The SNG to be produced will be used to meet the requirements of customers on the systems of Southern California Gas Company (Southern California), an affiliate of Pacific Lighting, and Cities Service Gas Company (Cities). Three-fourths of this project supply, or 187.5 MMcf per day, will be purchased by Southern California and one-fourth, or 62.5 MMcf, by Cities.

Transwestern Pipeline was able to meet its contractual demands in 1973 by purchasing short-term and emergency supplies of gas, but began curtailing in January, 1974. Transwestern projects the following level of curtailment in the years in which the plant will become operative: [5]

	Million cubic feet			
	Annual requirements	Annual supply	Annual deficiency	Percent of curtailment
1978	383,250	265,542	117,708	30.0
1979	383,250	239,500	143,750	37.5
1980	383,250	219,290	165,960	43.7

The output from the plant will utilize approximately twenty-five percent of Transwestern's pipeline capacity and thereby offset the projected levels of curtailment and reduce the Transmission costs resulting from underutilized pipeline facilities.

Southern California is the nation's largest natural gas distribution company providing natural gas service to the central and southern parts of California. Submitted testimony projects that in 1979 there will be an insufficient supply of natural gas to meet the requirements of the highest priority customers which under the California system are usually residential customers.

There also will not be any gas available in 1979 for the "regular interruptible retail" class of customers which includes commercial and interruptible users. This class is composed of hotels, schools, and restaurants which provide employment in the California area. Furthermore, should 1977 be a cold year, curtailment of these customers could then occur.

It is further noted that in 1970, natural gas fulfilled 95% of the fuel requirements of the "regular interruptible retail" class of customers. Although this group is now required to have the capacity of burning alternative fuels, such fuels are not available in sufficient quantities for annual use to maintain all industry and commercial enterprises. It is also significant to note that none of the new supplemental supplies will be used as boiler fuel for utility electric power generation in southern California and that the Applicants specifically so state.[6]

The Applicants estimate that the total annual gas supply available to Southern California Gas Company in 1981 from existing sources will be less than half of that available in 1972. There has been a drastic decline in the availability of California produced gas which has aggravated the shortage. Applicants further project that three coal gasification plants would be required to bring deliveries on Southern California's system in 1978 up to the 1974 level.

The projected supply of 62,500 Mcf per day for Cities will be used to offset projected curtailments in the existing system, not to enable Cities to render any new service. Cities renders natural gas service to Texas, Oklahoma, Kansas, Missouri and Nebraska. Cities projects that for the period of 1977–81, all of the SNG will be used on peak days to reduce curtailment of priority one customers; however, the curtailment of this class will not thereby be eliminated. From the foregoing, we conclude that this project is an absolute necessity for the consumers in California and the Midwest, absent the availability of equivalent sources.

IV. JURISDICTION

A primary question that confronts us is whether the proposed sales by the Applicants is subject to the Commission's jurisdiction. Relying on Opinion No. 663 [7], Staff asserts that the Commission is without jurisdiction. Staff argues that

[6] Initial Brief, p. 26.
[5] Transwestern Pipeline Company 1971 FPC Form 15.
[7] *El Paso Natural Gas Company, et al.*, Opinion No. 663, 50 FPC 651 (September 1973).

the following statement in the opinion precludes us from regulating the sale, ". . . there can be no such thing as the sale of synthetic gas mixed with natural gas".[8] Staff admits that when the coal gas is introduced into the Transwestern Pipeline and mixed with natural gas the total supply becomes natural gas.

In its Brief opposing Exceptions, Transwestern asserts that the Commission settled this issue in Opinion No. 663 wherein the Commission stated:

We exercise certificate authority over the interconnection facilities necessary to permit mixing of the artificial gas with the natural gas, over the transportation facilities and any applicable transportation rate after mixing, and over the rate at which the artificial gas is sold for resale in interstate commerce after mixing with natural gas.[9]

In Opinion No. 663, we stated the jurisdictional boundaries of our regulation of synthetic natural gas and intended to do so clearly. In the instant case, the sales to Pacific Lighting and Cities will occur after the SNG and natural gas have been mixed within Transwestern's pipeline and are therefore clearly within the parameters of our jurisdictional boundaries.[10]

Staff attempts to buttress its argument by asserting that the sale is not subject to curtailment. It further argues that because Pacific Coal and Trans Coal do not own jurisdictional facilities, they cannot make jurisdictional sales.[11] Neither argument is persuasive or relevant to the issue of whether the sales are jurisdictional. The Staff's argument with respect to curtailment is somewhat confusing. It is implicit that a supplemental supply source offsets curtailment and the Applicants herein have made this argument.

The second argument regarding jurisdictional facilities is also unclear. We have addressed this issue directly in Opinion No. 663 wherein we stated that we would exercise certificate authority "over the rate at which the artificial gas is sold for resale in interstate commerce after mixing with natural gas". The fact that we have not assumed jurisdiction over the project itself does not foreclose our asserting jurisdiction over the rate to be charged to the purchasers.

In conjunction with the jurisdictional issue, we are confronted with the problem that Cities will not receive the SNG which it purchases but rather will receive gas through displacement deliveries. Although Cities will purchase 62,500 Mcf per day from Trans Coal, it will actually receive displacement deliveries from the seller at two delivery points. The total output from the coal gasification plant will be delivered through a commingled stream to Pacific Lighting.

In the Initial Decision, the Presiding Judge issued a certificate allowing Transwestern Pipeline Company to transfer and deliver to Cities "at the existing points of delivery in Texas and Oklahoma, a quantity of natural gas equal in heating value to the quality of coal gas"[12] referred to in their agreements. In its brief on exceptions, Cities asserts that the Judge erroneously concluded that Cities would not purchase SNG from Trans Coal. Cities maintains that the certificate prescribed by the Judge should be amended to expressly authorize the sale of SNG by Trans Coal directly to Cities.

Cities argues that the receipt of displacement gas will place it in the same position as the physical receipt of SNG volumes and further that the necessity of cross-hauling natural gas and SNG will be eliminated. That Cities will not physically receive the SNG, does not, in Cities' view, bar or preclude a sale-purchase transactions between Cities and Trans Coal.

The only other party to the proceeding to address this issue is Transwestern who supports Cities' position. Transwestern argues that as there is no legal difference between natural gas and a mixture of natural gas and coal gas; therefore, there should be no conceptual difference between Cities' and Pacific Lighting's transactions.

By order issued May 29, 1974, the Commission deferred consideration of a separate application filed by Cities, in Docket No. CP74-185, to construct facilities to transport volumes of gas purchased from Trans Coal. Transwestern, Cities, and

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[8] Brief on Exceptions, p. 3.
[9] 50 FPC 651, 664.
[10] The jurisdictional issue presented herein is distinguishable from that in *Columbia LNG Corporation*, Opinion No. 699, 50 FPC 1252, reh. den. Opinion No. 699-A 50 FPC 1943 (1973). In the latter case, the sale of the SNG occurred at the tailgate of the reforming plant unmixed with natural gas and was therefore clearly outside the Commission's jurisdiction.
[11] *The Saturn Oil and Gas Company* v. *F.P.C.*, 250 F. 2d 61 (10th Cir. 1957), cert. denied, 355 U.S. 956 (1958).
[12] Mimeo, p. 47.

Pacific Lighting have agreed that should such authorization not be issued by the Commission or should Cities not accept it, Pacific Lighting should be entitled to purchase Trans Coal's entire portion of the plant output. They argue that the certificate authorization should be conditioned accordingly and Cities' interest in the project would thereby be protected while any source of possible delay or uncertainty would be removed.

We find that the certificate should be amended as suggested by Cities. A denial of the certificate would endanger Cities receiving the additional supply of gas and would operate as a penalty to its customers whereas the allowance of the displacement deliveries will eliminate unneeded transportation expense.

IV. PRICE

The central issue in this proceeding is the pricing of the SNG. Pacific Lighting and Cities have agreed to purchase the entire plant output on a cost of service basis. The proposed tariff provides that these buyers shall pay monthly the sellers' total cost of service, including a 15% return on equity, regardless of the amount of gas delivered. Non-delivery for any reason, including force majeure, does not relieve them of their obligation.

The Applicants have asserted that the foregoing pricing provision is a prerequisite to the method of financing this operation, which they have termed "project financing". Project financing guarantees the investors the recoupment of all monies invested in the project by the end of the initial 25 years of plant operation. Specifically, the plan for financing proposes the issuance of 25-year bonds worth $342 million at a hypothetical rate of 8½ percent and the subscription to $114 million of stock by Pacific Coal and Trans Coal. The plan provides for the bonds being sold to institutional investors on a private placement basis. The capital structure will therefore consist of approximately 75 percent debt and 25 percent equity.

Fifty-seven percent or $72,606,000 of the estimated annual cost of service is fixed costs which include depreciation, taxes, and return. The annual operation and maintenance expenses, $51,548,000 or 43 percent of the cost of service, are subject to inflation. It is noted that the coal contract is included as a variable item. The Judge, however, estimated that if the latter expenses increased 40 percent over the next 10 years, the total cost of service would increase only 17.2 percent.

The Applicants vigorously assert that the viability of the project depends on its financing and its financing depends on the Commission's approval of a full cost of service tariff. They argue that they are incapable of acquiring the requisite capital through conventional means so that the project must be economically self-sufficient in order to attract sufficient capital on terms favorable to the investors. They argue further that any additional conditions that this Commission may attach to their proposal to protect the consumers against future cost increases will in and of themselves increase the financing costs by causing the interest cost to rise. A full cost of service tariff is the sole means by which the Applicants say that they can be assured of recovering all prudently incurred costs and expenses plus a reasonable return on equity in a prompt manner. Under a full cost of service tariff, they assert the Staff will have full access to all cost data on a continuing basis for review purposes.

In the Initial Decision, the Judge ordered that within 6 months of the proposed start-up date, the parties should submit a proposed price which would operate as the initial rate until a subsequent filing was made pursuant to Section 4. In deriving this pricing mechanism, the Judge reviewed prior Commission decisions on supplemental supply programs,[12] which disallowed cost of service tariffs and established fixed initial rates.

The Judge prescribed the following conditions, stating:

> (K) (1) While it would be premature now to pinpoint a specific price, by the time the works are nearing completion and *within six months of the proposed start-up date, the parties may readily compute an initial price per Mcf* or, preferably, per MMBtu, and *submit it for immediate and final approval by the Commission*, along with a memorandum detailing how it was computed and reciting also the final financing arrangements that have been made. That initial rate will control as the filed tariff until it shall be changed under the authority of the Natural Gas Act.

[12] *Distrigas*, Opinion No. 613, (1972); *Columbia LNG*, Opinion Nos. 622 and 622–A, (1972); *Algonquin SNG*, Opinion Nos. 637 and 637–A, (1972–1973); *Tecon*, Docket No. CP72–100, Order dated Feb. 25, 1974.

(2) *If increases are later found to be required* to recover the cost of service, the interest and the equity return contemplated, the new rate may be computed and filed as an increased tariff, subject to review and control here under Section 4 . . . (emphasis added).[14]

The Judge was unconvinced by the Applicants' argument that project financing was essential. Rather he compared the project to the building of toll roads, bridges or pipelines which have historically been financed by conventional means. He concluded that full cost of service treatment was inappropriate and a just and reasonable rate should be established. He was, however, unwilling to speculate about the level of the rate and directed the parties to make a filing which appears to allow the Applicants to charge initially whatever price they are able to justify.

Staff concurs in the Judge's rejection of the full cost of service tariff. Staff asserts that the Commission's continuing surveillance over the rates charged under a full cost of service tariff would be legally insufficient because if the Commission found the Applicant's rates to be excessive, its single course of action would be to institute a Section 5 proceeding which would grant only prospective relief. Citing *Catco*, Staff asserts further that the Supreme Court effectively expressed its disapproval of full cost of service tariffs in the following statement:

If unconditional certificates are issued where the rate is not clearly shown to be required by the public convenience and necessity, relief is limited to Section 5 proceedings, and . . . full protection of the public interest is not afforded.[15]

Staff foresees that if there were a severe and pronounced decrease in the load factor, an open-ended rate would thereby be created under a full cost of service tariff which would escalate automatically and indefnitely. This is a risk which we cannot ignore.

Staff maintains further that a finding of public convenience and necessity is impossible unless a rate condition is attached to the Applicants' certificates. Citing the Commission's decisions in other synthetic gas supply cases, the Staff maintains that a rate conditions is "absolutely necessary to protect the public interest." Staff asserts that the Judge failed to comply with the court's requirement set forth in Catco as to giving "a most careful scrutiny and reasonable reaction to the initial price proposals." Staff further objects to the Judge's provision for an initial rate filing six months prior to commencement of operation on the basis that the filing could not be suspended and the initial rate would be reviewable only in subsequent Section 4 proceedings.

CPUC took an active part in the proceeding and advocated a pricing mechanism which differed from that proposed by the Applicants, Staff or the Judge. CPUC proposed that the certificate should be conditioned upon an initial rate of $1.32 for all sales occurring during the start-up period. Those costs attributable to the start-up period, which are not recovered by the sales, shall be amortized over the life of the project and recovered through rates established in a subsequent Section 4 proceeding.

CPUC joined Staff in its arguments against a full cost of service tariff and took exception to the Judge's resolution of the price issue due to its lack of clarity. The project itself will require a period of testing before it is capable of sustained full production, therefore CPUC asserts that it is necessary to distinguish between the commencement of the testing operations and the commencement of full scale production. The Judge did not define the phrase "start-up date" which he used in directing the Applicants to file an initial rate.

CPUC maintains that if the Judge intended the "start-up date" to be the beginning of the testing operations, the initial price would have to be determined without information as to the plant's performance and without provision for recovering excess costs. On the other hand, if the Judge intended the "start-up date" to mean full scale operation, he did not make provision for the sale of gas produced during the testing period. To eliminate this apparent ambiguity in the initial decision, CPUC advocates that the Commission should establish an initial price of $1.32 per Mcf for the testing period and provide for a Section 4 rate hearing to be commenced during the testing period.

CPUC objects to the Staff proposal on pricing on the basis that the Staff proposal would require the Commission to make an accurate determination of the cost of producing the SNG three years before the sales commence. CPUC agrees that Catco is applicable to the extent that the Commission must analyze costs

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[14] Mimeo. p. 42.

[15] *Atlantic Refining Co., et al. v. Public Service Commission of New York, et al.*, 360 U.S. 378, 392 (1959).

and make a determination as to whether the sale will be in the public interest, however, CPUC maintains that the Presiding Judge has done this. Although CPUC agrees with Staff that initial price should be set out in the certificate, it asserts that its proposal is a more effective pricing mechanism which fully complies with *Catco*.

CPUC cites Judge Levant's Initial Decision in El Paso Natural Gas Company, Docket No. CP70–138, as containing a pricing provision essentially similar to their proposal in this case. El Paso's contracts set an initial price of $1.40 per Mcf during the "start-up period" (or testing period) which precedes the date of the First Regular Delivery. Judge Levant directed El Paso to make a rate filing pursuant to Section 4, no later than 30 days prior to the date of the First Regular Delivery, setting forth the cost of gas to be purchased and the actual costs incurred during the start-up period. Based on these figures, the Judge found that the initial full production price could then be realistically determined.

This is the first major coal gasification project to be constructed in the United States. Neither Pacific Lighting, the corporate parent of Pacific Coal, nor Transwestern Pipeline can guarantee repayment of the sums involved. In order to encourage investors to participate in a project of this experimental nature, which is non-jurisdictional, we recognize that they must receive some assurance of recovering their investment.

Furthermore, we are acutely aware of the need for this country to develop its own sources of energy. The coal gasification process is a means by which the United States may attain a greater measure of energy self-sufficiency and reduce its vulnerability through dependence on foreign markets. Coal gasification is one of the few potentially commercial means of developing a supplemental supply of gas from domestic resources.

In the preliminary draft of the Natural Gas Survey [16] the dimensions of the current gas shortage are graphically depicted. The report concludes that not only are significant deposits of gas becoming harder to find. We are mindful however that over the course of the past two years there have been extensive drilling efforts to find new natural gas supplies to meet economic demand.[17] The report also sets forth the current levels of curtailment and their impact upon the nation's consumers, providing little encouragement that the supply outlook will brighten.

In December, 1974, the Staff issued a report [18] in which it concluded that "conventional U.S. gas production has reached its peak and will be declining for the indefinite future . . . (which) means that from hereon we must make do with less gas in absolute terms." [19] In conjunction with declining production, Staff foresaw increased reliance on supplemental supplies. It is evident that only by encouraging both domestic exploration for natural gas and development of the commercial technology for producing synthetic gaseous fuel can the total gas supply be increased. Therefore in approaching the pricing issue, we feel compelled to review it from a new perspective and to consider our previously enunciated policies as relevant, but not controlling.

We have carefully reviewed our prior decisions on supplemental supply projects. Without exception, we have attached a fixed rate to each certificate authorizing the sale of supplemental supplies. We have reaffirmed this policy on numerous occasions.[20] In all of these cases, we have refused to adopt the cost of service methodology due to our concern that the rates might escalate beyond the zone of reasonableness to the detriment of the consumers. Our concern has proven to be real because the costs of supplemental supplies have risen and the Applicants in the foregoing cases have subsequently filed under Section 4 of

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[16] "The Current Gas Shortage," Chapter 5, Vol. 1, issued June 27, 1974.

[17] "Gas Supply Indicators", OEC Staff Quarterly Report, Third Quarter (1974); "Quarterly Review of Drilling Statistics for the United States," American Petroleum Institute.

[18] A Realistic View of U.S. Natural Gas Supply, Staff Report.

[19] *Ibid.* p. 20.

[20] *Columbia LNG Corporation, et al.*, 47 FPC 1624 (1972); 48 FPC 723 (1972); *Algonquin LNG, Inc.*, 48 FPC 1216 (1972); *El Paso Natural Gas Company, et al.*, Opinion No. 663 (September 1973); *Tecon Gasification Company, et al.*, Docket Nos. CP72–100, et al., Initial Decision issued August 30, 1973, affirmed Feb. 25, 1974.

the Natural Gas Act for increased rates. As we have indicated, the same danger exists in this case.

We find that the CPUC proposal is the most viable method of pricing this new source of supplemental supply for it provides a means of ensuring the Applicants that they will receive a just and reasonable price for the SNG while providing adequate protection for the consumers against imprudent and improper expenses. We therefore find that our certification of this project should be conditioned to provide for an initial rate of $1.38 Mcf [21] which will apply to all SNG which is produced during the first six months of the testing operations. Although we are aware that this initial rate will not allow the Applicants to recover their full costs during the testing period, we further provide herein that all excess cost should be amortized over the life of the project and recovered through the rates subsequently established in a Section 4 proceeding. In so doing, we are providing a means by which the Applicant will recoup all reasonable and prudent costs that are incurred. In the event that the Applicants are unable or unwilling to make a Section 4 filing at the end of the initial six month testing period, they may elect to file for an extension of the $1.38 rate. In providing for the foregoing, our intention is to keep informed as to the progress of the plant and its operations during the testing period. We believe that this overall pricing mechanism will allow the Applicants to assure their investors that they will recover the costs incurred plus a reasonable rate of return on their investment in this project.

During oral argument, counsel for Transwestern Coal Gasification Company introduced the coal supply contract amendment as an exhibit. He asserted the necessity of having the contract amendment as part of the evidence in this proceeding; however, urged us to do so without reopening the record. It was suggested that a motion could be served on all parties and if there should be no answers within the period provided for response, the contract amendment would be accepted into evidence. The Commission approved the proposal.[22]

On March 21, 1975, the Applicants filed a motion to supplement the record with the amendment of March 7, 1975. Western Gasification Agreement No. 1 and a two page tabulation of revised cost estimates as of January, 1975. None of the parties objected to the aforesaid motion and we will therefore allow both exhibits to become part of the record.

The amendment to the coal contract is based on the same concepts as the original contract. It provides for a fixed base price for coal for the life of the contract which escalates in accordance with indices reflecting the cost experience in the coal mining operation. The contract amendment increases the base price from 20.8 cents per million Btu to 26.24 cents per million Btu in addition to modifying various components of the indices.

We have independently reviewed the terms of the contract amendment and conclude that the contractual arrangements are reasonable and in the public interest and that the SNG price may properly reflect all changes in the price of coal which result from the application of the contract formula, with a single exception. Section 7.1 of the amended contract provides that the methods for adjusting the base price may be revised upon the request of either party in the event that "extreme or radical changes in economic factors and conditions from those existing on January 1, 1975," occur "by reason of events or circumstances beyond their reasonable control". It is apparent that this provision will become operative in only highly unusual situations. In approving the March 7, 1975 amendment, we herein reserve the right to review any future modifications to the present contractual provisions that may result from the operation of Section 7.1 and determine whether they are reasonable and in the public interest.

We find that the cost of coal as established in the contract amendment should be a component of the initial rate. In determining the amount of the component, we have estimated what price of the coal would have been in mid-1973 under the amended contract. We have found that the original coal component of 24.523 cents per Mcf would have been approximately 30.936 cents per Mcf or 6.423 cents

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[21] In establishing a rate of $1.38, we have assumed a Btu content of approximately 970 Btu per cubic feet.

[22] Oral argument, Tr. 1672.

per Mcf more under the provision of the contract as amended. We therefore find that the initial rate should be $1.38 per Mcf.[23]

During oral argument the Applicants indicated that the cost estimates based on mid-1973 costs submitted during the administrative hearing were no longer realistic estimates of what the price level of SNG would be when full operation of the Wesco plant commences in 1979. Applicants submitted revised cost estimates as of January, 1975 which we have received into evidence in this proceeding. During oral argument counsel for the Applicants asserted that these costs were submitted for the primary purpose of illustrating the effect inflation has had on the original mid-1973 cost estimates submitted during the hearing. Based on this showing of a dramatic increase of the estimated costs over the 18 month period, counsel argued that the Commission should certificate the project without further delay so as to minimize any further increment in costs due to inflation. Counsel for the Applicants did not assert that the revised cost estimates represented a reliable base on which to establish the price level for the SNG, when plant operations commence. The ultimate just and reasonable rate will be prescribed by the Commission based upon evidence presented in a Section 4 proceeding under the Natural Gas Act when the full cost of service of this project is capable of being reduced to reasonable certainty.

In its answer to the Applicants' motion to admit these revised costs and the amended coal contract, Staff did not object to their receipt into evidence. Staff, however, cautioned the Commission that it was essential for the Commission to attach conditions to this certificate which would protect the consumers from excessive cost burdens. In adopting the aforementioned pricing mechanism, we have implemented Staff's pricing proposal, as modified by CPUC, and thereby provided an appropriate means of assuring that the consumer will receive the supplemental supply at the lowest reasonable price.

We are cognizant that the present and future requirements of the Midwestern and California consumers require that we encourage the development of alternate energy supplies. We are also aware that the price level established for these supplies must be compensatory so as to elicit these supplies. However, we are unable to accurately determine at this time what level of pricing would allow the Applicants to recover their full costs plus a reasonable rate of return.

We are therefore unable to establish a fixed initial rate for "regular deliveries". By the same token, we are also unable to provide for a full cost of service tariff which would allow us to make only prospective adjustments to the price. Our regulatory responsibilities require us to review the proposed price of the SNG from the Wesco project.

We are concerned about the Applicants' argument that the regulatory lag which accompanies Section 4 filings will jeopardize the financing of the project. In view of the projected shortage for the markets herein involved, which will result from increased levels of firm service curtailments, we can only anticipate that any responsible future Commission would act in an expeditious manner so

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[23] (1) Under the original contract, the components of the coal price were these :

	Original Contract
Adjusted Base Price	22.457¢
4% State Tax	.898¢
5% Contingency	1.168¢
	24.523¢

(2) The base price under the original contract is deducted from the adjusted base price to determine the impact of the escalation provisions. To approximate the impact of the escalation provisions upon the base price of the amended contract, we use the following equation :

$$\frac{22.457¢ - 20.8¢}{20.8} = \frac{1.657¢}{20.8} \times \frac{X}{26.24} = 2.090¢$$

(3)

	Amended Contract
Base Price	26.240¢
Adjusted Base Price (26.24+2.09)	28.330¢
4% State Tax	1.133¢
5% Contingency	1.473¢
	30.936¢

(4) The differential between the price of the coal under the two contracts is set forth and the appropriate adjustment is made to the initial rate.

30.936¢	$1.317
—24.523¢	.064
6.423¢	$1.381

as to minimize unnecessary delay and thereby preserve the public health and safety and avoid economic hardship.

Incremental pricing

Although the parties to the proceeding did not consider the issue of how the supplemental supply should be priced to a purchasing distributor, it is an issue which we believe should be addressed in future rate hearings involving both Cities and jurisdictional suppliers of Pacific Lighting. Three-fourths of the project supply will be purchased directly by Pacific Lighting at its incremental price at the California border for delivery solely within the State of California at rates to be approved by CPUC. The question of incremental pricing is therefore not relevant to this portion of the supply which is in fact incrementally priced to the distributor.

On the other hand, Cities intends to use this additional supply of 62,500 Mcf per day to offset projected curtailments for its entire system which provides service to various distributors in a five state area. We are foreclosed from considering the issue at this time because it is not part of the record in this case.

We are constrained to put the parties on notice that both the issues of incremental pricing and the protection of purchasers of SNG at the incremental price from the curtailment of supplies so purchased will be considered in subsequent rate and curtailment proceedings, of Cities and the jurisdictional suppliers of Pacific Lighting.[24] We intend to provide sufficient flexibility for future Commissions to review the allocation of this supplement supply with respect to end use requirements of the customers.

V. RATE OF RETURN

The appropriate rate of return is also an issue in this proceeding. The Applicants urge that a return of 15 percent on equity is both reasonable and necessary for the project's viability. CPUC and Staff argue that the rate is excessive and should be no higher than 13 percent, Transwestern's current rate of return on equity permitted by the Commission. They assert that the risk to equity investment does not approach the level of risk assumed by natural gas producers but is comparable to that of pipeline operations.

The rate of return on equity is a function of the relative riskiness of the proposed investment. By adopting the pricing mechanism we have herein with respect to this coal gasification project, we have injected an additional element of risk for prospective investors. Our disallowance of a full cost of service tariff operates as a refusal to guarantee potential investors that they will be able to recoup immediately all monies invested, however the adopted pricing mechanism assures them that they will receive a fair return on prudently incurred reasonable costs, subject to protection of the consumer interest for plant production below anticipated levels, as more fully defined below.

We are aware that prospective investors will not view the Wesco project as having an equivalent risk to that of a pipeline. In light of the nature of the project and the importance of its construction, we find that a rate of return on equity of 15 percent is reasonable and necessary.

VI. PENALTY

Under circumstances involving total or partial failure of the plant output, the Presiding Judge attached the following specific condition:

> The price is required to be reduced by the amount of any return on the common equity included in the contract price, applicable from and after any period when, for 30 consecutive days, energy production has fallen below 50 percent of the promised supply (250,000 Mcf per day at approximately 970 Btu/cu. ft.) and continuing as long as production so falls short.[25]

All the parties to the proceeding agreed that the penalty provision was unfair in that the elimination of return on equity coupled with a fixed unit rate would constitute a double penalty. Both Staff and CPUC suggested alternate penalty provisions based on reductions in the heating value of the gas produced and/or the load factor. Transwestern objects to the imposition of any form of penalty arguing that it is contrary to the concept of "project financing" and thereby endangers the viability of the project. Transwestern also argues that it would penalize Applicants for developments completely beyond their control. In its Brief Op-

[24] *Columbia LNG Corporation, et al.*, 47 FPC 1624 (1972); 48 FPC 723 (1972); 491 F. 2d 651 (5th Circuit 1974) remanded an issue of incremental pricing. The remanded administrative hearings have been completed and the proceeding is in the briefing stage.

[25] Mimeo, p. 43.

posing Exceptions, Transwestern challenges the proposed level of 970 Btu as being arbitrary and not based on any record showing of the effect of delivery of less than 970 Btu content gas. It is noted that the record is devoid of any evidence concerning the minimum required level of Btu content for pipeline quality gas.

Related to the penalty provisions is the issue of minimum bill. In Opinion No. 622–A, Columbia LNG Corporation, et al., we incorporated a provision which enabled the seller to bill the buyer for all out-of-pocket expenses in the event the seller was unable to deliver any gas for a period exceeding one day. In that proceeding, the Commission also rejected the Applicants' proposed full cost of service tariffs however found that a minimum bill provision was "required by the public convenience and necessity as an equitable apportionment of the risk between customers and stockholders and in order to assure the financing of the project on reasonable terms to the consumer." [26] Staff has suggested that a similar provision be incorporated in this certificate. We are aware however, that the imposition of the foregoing provision would have to be coordinated with the imposition of any form of economic penalty resulting from a reduction in heating value of the SNG produced and/or the production level so that the magnitude of the latter penalties would not be greater than that under a minimum bill which becomes operative where there is a total failure of deliveries. If this were not done, the Applicants' incentive to continue deliveries would be reduced.

Due to the experimental nature of the project, it appears premature to establish penalty provisions at this time. In our view, we could more realistically assess the merits of establishing a minimum bill or penalty provision when the testing operations have commenced. At the juncture the Applicants would be able to submit data and reasonable forecasts of the Btu quality and the quantity of SNG to be produced. We would then also be better able to assess what is reasonable in terms of consecutive days without service, reduced service, and reduction in Btu content.

Staff advocated another proposal on brief which relates to the foregoing discussion. In the event that the plant does not produce its design capacity, 250,000 Mcf per day, or the Applicants are unable to deliver the total quantity of the gas, Staff suggests that Pacific Coal and Trans Coal be required to file curtailment plans with the Commission to provide for the allocation of the remaining production. Transwestern answers that the delivery obligation of the gasification companies are expressed in terms of percentages of output rather than absolute numbers. Thus even if the plant is not operating at design capacity, neither Trans Coal nor Pacific Coal will be in a position where they are unable to deliver the certificated quantity to their customers, i.e., the daily proportionate share of the SNG. We find no merit in the Staff's proposal.

Abandonment

During the proceedings, Staff suggested that there is a danger under Section 7(b) of the Natural Gas Act that the Applicants could abandon deliveries under certain circumstances. In the event that deliveries fall below the design capacity of 250,000 Mcf per day, Staff asserted that Transwestern should be required to seek abandonment authority for its natural gas service. In order to foreclose any possibility of abandonment, Judge Ellis conditioned the grant of the certificate to require the Applicants to execute and file a trust declaration that, to the extent the plant facilities were amortized through receipts from the sale of gas, legal title to such amortized portion would be held in trust for the perpetual use and benefit of California and Midwest consumers.

In its Brief on Exceptions, Transwestern stated its intent not to abandon the facilities or discontinue sales and suggested that the following condition be attached to the certificate in lieu of that proposed in the Initial Decision:

Neither Applicants nor any successor assignee of applicant shall voluntarily abandon the operation of the plant facilities necessary for the sales authorized hereunder or discontinue such sales until such time as the Commission has, after due hearing, found that the continuation of such sales is unwarranted or that the present or future public convenience or necessity permits such abandonment.

The foregoing language tracks Section 7(b) of the Natural Gas Act and provides adequate protection to the consumers. We therefore find that the certificate should be conditioned accordingly.

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[26] Opinion No. 622–A, 48 FPC 723, 730.

Preempted capacity

In its Brief on Exceptions, Staff argues that the Applicants' certificates should be conditioned to require the coal gasification companies to pay for any new facilities which might be required as a result of the pre-empted capacity of the pipeline. It is anticipated that the project supply will utilize approximately twenty-five percent of Transwestern's pipeline capacity. Staff's concern is that a new cheaper source of supply might become available to satisfy demand at a price lower than that projected for the coal gas. However, Staff states the following:

But in the absence of evidence that at the time the proposed coal gasification project comes on line there will be domestic production sufficient to eliminate the forecasted shortfall of supply at prices below that of the synthetic gas produced from coal, and in the absence of other less costly alternative (Tr. 498), the Commission Staff supports the grant of a certificate as hereinafter conditioned. On this record Applicants' proposal represents the cheapest additional increment of gas currently available to applicants.[27]

Staff, in conjunction with the other parties, recognizes the positive benefit that this additional supply will bring to the consumers. Although this supplemental supply will result in more efficient utilization of existing pipeline capacity today, Staff advocates the imposition of a burden on the Applicants' should the domestic energy situation change. We find no merit in this suggestion.

The Commission further finds:

(1) Transwestern Pipe Line Company is a natural gas company subject to the jurisdiction of the Natural Gas Act; and its receipt of coal gas into its line at a point near Gallup, New Mexico, its transportation of mixed natural gas to its terminus at the California border, its delivery of the quantity of mixed gas equal to the coal gas received, are required by the public convenience and necessity.

(2) Transwestern Coal Gasification Company and Pacific Coal Gasification Company will, upon the inception of their respective sales for resale of mixed natural and coal gas become natural gas companies subject to the jurisdiction of the Natural Gas Act as hereinafter set forth; and their sales and deliveries are required by the public convenience and necessity.

(3) The conditions hereto attached are required by the public convenience and necessity.

(4) Transwestern Pipe Line Company's transportation tariffs T–1, T–2 and T–3 are acceptable for filing.

(5) The revised "Comparison of Cost Estimates" admited in evidence by our order of in this proceeding shall not be a basis of calculation of the initial rate herein established.

(6) The initial rate should reflect the change in coal costs established by the Amendment of March 7, 1975, Western Gasification Agreement No. 1, between Utah International and Transwestern Coal Gasification Company and Pacific Coal Gasification Company admitted in evidence by our order of

(7) The initial decision should be adopted as the decision of the Commission except as modified and supplemented by this Opinion and Order.

The Commission orders:

(A) Certificates are hereby issued to Pacific Coal Gasification Company and Transwestern Coal Gasification Company authorizing them to make the transfers, sales and deliveries, and to build, connect, maintain and operate the facilities proposed and required to effectuate the transfers, sales, deliveries and transportation so authorized.

(1) Pacific Coal Gasification may sell to Pacific Lighting Service Company, at the Arizona-California border near Needles, California, a quantity of mixed natural gas equal to Pacific Coal's delivered share of the coal gas output from the gasification plant proposed to be constructed by the Applicants in New Mexico.

(2) Transwestern Coal Gasification Company may sell to the following:

(a) Pacific Lighting Service Company, at the Arizona-California border near Needles, California, a quantity of mixed natural gas equal to one-half of Transwestern Coal's share of the coal gas output from the gasification plant proposed to be constructed by the Applicants in New Mexico; and

(b) Cities Serices Gas Company, upon the issuance by this Commission of required authorization. One-half of Transwestern Coal's share of the

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[27] Initial Brief, p. 8.

coal gas output from the gasification plant will be delivered and transferred to Transwestern Pipeline Company, into their main line near Gallup, New Mexico, for the account of Cities. Cities will receive displacement deliveries at existing Transwestern Pipeline delivery points in Harper and Beaver Counties, Oklahoma, and Hemphill County, Texas. The three-party sale to Cities is contingent upon the corresponding final action in Cities' certificate application in Docket No. CP74–185. Should such authorization for any reason not issue or should Cities for any reason not accept any such authorization, then Transwestern Coal is authorized to sell all of its portion of the project gas to Pacific Lighting Service Company.

(3) Transwestern Pipeline Company may—

(a) transport, in its existing pipe lines, from a connection point near Gallup, New Mexico to its delivery point at the California border, a quantity of mixed natural gas equal to the coal gas received from Pacific Coal and Transwestern Coal to the Pacific Lighting Service Company;

(b) transfer and deliver to Cities Service Gas Company, at the existing points of delivery in Texas and Oklahoma, a quantity of natural gas equal in heating value to the quantity of coal gas referred to in sub-paragraph (2) (b) above, all in effectuattion of the three-party natural gas sales contracts among Transwestern Coal, Transwestern Pipeline Company and Cities Service Gas Company;

(c) file, place into effect, and charge accordingly its proposed rate schedules T1, T2. and T3; and

(d) credit its deliveries pursuant to clauses (2) (a) and (b) against the contract demand authorizations provided in its currently effective service agreements with Pacific Lighting Service Company and Cities Service Gas Company.

(B) The authorizations provided for in paragraph (A) are subject to the following terms and conditions:

(1) Pacific Coal Gasification Company and Transwestern Coal Gasification Company initiating service and sale for resale at a rate of $1.38 per Mcf during the first six months of the testing period. At or before the end of the six month period, Pacific Coal Gasification Company and Transwestern Coal Gasification Company shall file a revised tariff rate schedule under Section 4 of the Natural Gas Act or request an extension of the initial rate of $1.38 per Mcf, stating the grounds on which such extension is necessary. Any difference between costs reasonably and prudently incurred and the initial rate of $1.38 shall be amortized over the remaining life of the contracts.

(2) If a Section 4 filing is not made prior to completion of the testing period it is incumbent upon the Applicants to make such filing within 90 days from the commencement of the first regular delivery in order for the Commission to make a determination of the just and reasonable rate.

(3) Pacific Coal Gasification Company and Transwestern Coal Gasification Company shall neither cause nor permit the transfer or assignment of their respective interests in this project to any other party in which they do not exercise a controlling interest, without prior approval of the Commission.

(4) Notwithstanding any other condition herein attached, in the event of failure of the gasification process, in whole or in part, Pacific Coal Gasification Company and Transwestern Coal Gasification Company shall cause prompt action to be taken by all reasonable means to mitigate any losses and to credit any benefits derived from such actions.

(5) Pacific Coal Gasification Company and Transwestern Coal Gasification Company shall, at all times, make available to the Commission their books and records.

(6) Pacific Coal Gasification Company and Transwestern Coal Gasification Company shall not hereafter permit, without prior Commission approval, the further amendment or revision of the coal or synthetic gas sales contracts.

(7) No later than six months prior to the initiatiion of sales and services authorized herein, Pacific Coal Gasification Company and Transwestern Gasification Company should submit for Commission approval a tariff rate schedule and executed service agreements covering sales and services certificated by Paragraph A, or resulting from such certification.

(C) The authorizations granted herein shall not take effect as to the construction of any facility, or the transportation and sale of any commingled coal gas, until those necessary federal, state and local authorizations for the construc-

tion of the coal gasification project have been secured, and a copy of each has been submitted to the Commission.

(D) The general terms and conditions set forth in the Commission's Regulations under the Natural Gas Act and particularly those contained in Parts 154 and 157.20 thereof shall attach to the certificate issued herein.

(E) The facilities authorized herein shall be constructed and placed in actual operation, and the proposed sale and delivery of gas authorized herein shall commence on or before December 31, 1979.

(F) The initial decision is adopted as the decision of the Commission as supplemented and modified by this Opinion and Order.

By the Commission.

KENNETH F. PLUMB,
Secretary.

United States of America, Federal Power Commission

OPINION NO. 728-A—DOCKET NO. CP73-211

TRANSWESTERN PIPELINE COMPANY; TRANSWESTERN COAL GASIFICATION COMPANY; PACIFIC COAL GASIFICATION COMPANY; AND WESTERN GASIFICATION COMPANY

OPINION AND ORDER ON REHEARING

United States of America, Federal Power Commission

CERTIFICATES; COAL GASIFICATION

Before Commissioners: Richard L. Dunham, Chairman; William L. Springer, Don S. Smith, and John H. Holloman III.

DOCKET NO. CP73-211—OPINION NO. 728-A

TRANSWESTERN PIPELINE COMPANY; TRANSWESTERN COAL GASIFICATION COMPANY; PACIFIC COAL GASIFICATION COMPANY; AND WESTERN GASIFICATION COMPANY

OPINION AND ORDER ON REHEARING

(Issued November 21, 1975)

SPRINGER, Commissioner.

On April 21, 1975, the Commission issued Opinion No. 728, in the above docket, in which it granted a certificate of public convenience and necessity, authorizing the transportation and sale of coal produced by the Transwestern Coal Gasification Project. Applications for rehearing were filed May 21, 1975, by the People of the State of California and the Public Utilities Commission of California (California), Transwestern Coal Gasification Company, et al. (Transwestern or Applicants) and El Paso Natural Gas Company (El Paso). California requested that rehearing be granted for purposes of further consideration thereby allowing California ninety days in which to confer with the other parties and to file any additional pleading. Transwestern supported California's petition however it urged that the time allotted for additional filing be limited to 60 days. On June 2, 1975, the Commission issued an order granting the applications for rehearing and allowed California to make supplemental filings within 60 days of the order whereupon other parties to the proceeding would be allowed 15 days in which to respond.

After agreement was reached on the major points, on August 7, 1975 California submitted its filing proposing specific amendments to Opinion No. 728. Transwestern and Cities Service Gas Company (Cities), the other principal parties in the proceeding, filed responses which essentially supported California's position. Specifically, California proposed that the initial rate established by the Commission should be increased from $1.38 to $2.50 per Mcf; the suspension period should be reduced from five months to one day; a minimum bill should be established whereby Transwestern would be allowed to recoup all costs plus a return on equity of 15 percent; and, finally the issuance of the certificates should be conditioned upon the Commission reviewing the financing plan for the plant.

The principal parties maintain that if the Commission does not modify Opinion No. 728 as they propose, the project will be abandoned. We have closely reviewed the proposed adjustments in assessing whether these modifications could be

implemented without impinging on the consumers' rights. We have attempted to balance the interests of all parties while simultaneously continuing to encourage the development of the facility which would be the first coal gasification plant in the United States. Our review and conclusions thereon follow.

California has recommended that the Commission establish a price of $2.50 per Mcf for deliveries during the testing period subject to the same conditions set forth in Opinion No. 728. Transwestern maintains that a price of $2.50 takes into account the 1975 coal contract amendment and revised cost estimates. The foregoing updated costs and contract amendment were submitted to the Commission during oral argument in March, 1975. A procedure was established whereby the Applicants filed a motion to supplement the record on March 21, 1975 to which none of the parties objected thereby allowing the evidence to become part of the record. The Commission then estimated the cost of coal in mid-1973 under the term of the 1975 contract amendment and in so doing increased the initial rate for the coal gas from $1.317 to $1.381.

In establishing the aforementioned rate in Opinion No. 728, the Commission did not reply on the 1975 revised cost estimates but accepted them as illustrating the rapid increase of operating costs. The parties now assert that the costs have risen so dramatically since the filing of the initial application that the proposed price of $2.50 will not allow them to recover their costs during the testing period but will reduce the amount which must be amortized over the life of the plant and thereby the size of the burden on ratepayers.

We are acutely aware the construction costs of these facilities are rapidly increasing in conjunction with the cost of the feedstock, coal. None of the parties to the proceeding objected during oral argument to the Commission's proedure for allowing these costs to become part of the record. Nor did they respond to the motion dated March 21, 1975 or the pleadings on rehearing. We therefore conclude that the parties to the proceeding have waived their right of cross-examination.

Based on the foregoing, the proposed initial rate of $2.50 per Mcf is appropriate and in the public interest. We recognize that this price level does not and will not allow the full recoupment of all costs plus a return on equity; however, we have provided a pricing mechanism in Opinion No. 728 which will so provide subsequent to the commencement of plant operations.

California and Transwestern have proposed that the pricing mechanism itself should be modified. Specifically the parties maintain that the Section 4 pricing procedure as established in Opinion No. 728, should include a minimum bill provision and should eliminate the possibility of a five month suspension period. Both adjustments to Opinion No. 728 are asserted to be essential to the financeability of the project.

In Opinion No. 728, the Commission considered the feasibility of establishing a minimum bill provision and concluded that it would be more appropriate to determine its desirability after the plant's testing operations had commenced. Transwestern and Cities assert that the Commission Opinion must set forth a specific minimum bill provision so that the method of recovering monies invested in this project is thereby established. In its filing dated May 21, 1975, Transwestern attached tariff sheets which contained a minimum bill provision which Transwestern maintains is in the form acceptable to the financial community. The proposed minimum bill provision contains the same provisions as the regular tariff and thereby provides for the recoupment of all costs plus a return on equity of 15 per cent. Only in a limited situation would a penalty provision be triggered thereby eliminating the return on equity. The proposed penalty would provide for a zero return on equity in the event that the plant's load factor is reduced to 45 per cent for a period of forty-five consecutive days for all deliveries subsequent to the aforementioned period.

We have concluded that we cannot accept the proposed minimum bill provision for it inadequately protects the ratepayers. It would allow the Applicants to bill its customers for all costs plus a return on equity despite a substantial reduction in heating value and/or content of the SNG produced. We are aware however that our rejection of a minimum bill provision would possibly preclude the financing of the plant. Therefore we have reviewed the record and have devised the following minimum bill provision which we find adequately balances the parties' interests.

Transwestern has projected an estimated gas production of 250,000 Mcf per day at an annual load factor of 91 percent. We believe that a sliding-scale

penalty provision, comparable to that set forth by the Presiding Judge in the El Paso proceeding, would more realistically apportion the risks between the ratepayers and the investors.[1] Therefore, if the plant output should fall below a seventy-five percent load factor, the return on equity and related taxes should be reduced by one third or a level of 10 percent. If the output should fall below a fifty percent load factor, the return on equity ad related taxes should correspondingly be reduced another third or to a level of 5 percent. In the event that the output falls below a twenty-five percent load factor, all return on equity and related taxes should be eliminated. Correspondingly, should the heat content of the SNG fall below 950 Btu per cubic foot for a period exceeding 25 days, the return on equity should be proportionately reduced.

Although Transwestern has proposed that return on equity should be eliminated only after a forty-five day period has lapsed, the length of time appears unreasonable. Furthermore the Applicants did not provide any basis for their proposal. We find that a period of twenty-five (25) days would allow sufficient time for the Applicants to repair the facilities yet would allow an added measure of protection for the ratepayers.

As we have indicated, we are willing to modify Opinion No. 728 so as to assist the financeability of the project if we are able to do so without endangering the public interest. The Applicants state that the suspension period under Section 4 must be limited to one day in conjunction with the establishment of a minimum bill provision so that the timely recovery of costs can be assured. Section 4 allows the Commission the necessary flexibility to vary the length of the suspension period depending on the relevant facts of a particular rate increase. In this proceeding, the Section 4 rate filings will be based upon costs which have been incurred and not upon estimates of costs to be incurred in future periods. As the costs will have been ascertained, it would appear appropriate to reduce the suspension period to one day so that the Applicants should be able to recover all costs reasonably and prudently incurred without experiencing any regulatory lag. The Applicants however will retain their burden of establishing that all costs are reasonable subject to refund. Despite the foregoing, future Commissions may find it in the public interest to suspend for a longer period of time as provided under the Natural Gas Act.

In their filings, Transwestern and California have asserted for the first time that federal assistance in financing this project is essential. They maintain that the project will not be built without federal participation. We are aware that several bills are now before Congress which would authorize the federal government to provide loan guarantees for the construction of coal gasification facilities. California has also urged that the federal government should guarantee the ratepayer that the cost of the SNG will not escalate above a certain level. None of the proposed legislation has been enacted and therefore federal financing is not yet available for Transwestern. As Transwestern has stated that the viability of the project depends on its receipt of this form of aid, over which this Commission has no control, we recognize the probability that this project may be delayed for some period of time. We reserve however the right to review any plan of financing when it has reached final form.

Although both Transwestern and California state that the federal government must assume that portion of the risk which the ratepayers are unable to assume, the amount and form of federal assistance which they seek is not clearly set forth in their filings. Pending the receipt of federal aid, the apportionment of risk cannot be clearly defined. Therefore at the time we review a proposed financing plan, it will be necessary that we re-evaluate the provisions of the minimum bill set forth above.

In its filing dated August 25, 1975, Transwestern proposed that the certificates issued herein be further conditioned upon the Commission's review and evaluation of the environmental consequences of the project. Applicants suggest that this Commission should solicit comments from the parties with regard to the Final Environmental Impact Statement published by the Bureau of Reclamation, Department of Interior, to be reviewed by the Commission.

In Opinion No. 728, the Commission outlined its participation in the preparation of the Final Environmental Impact Statement (EIS). The Commission staff addressed solely those areas of FPC jurisdiction and expertise relating to natural

[1] *El Paso Natural Gas Co.*, Docket No. CP73–131, issued June 21, 1974.

gas development, production, transmission and use in comments submitted to the Department of Interior in May, 1975. The Bureau of Reclamation had been designated the lead agency in the environmental review of this project and the Commission did not interpret its role as a major federal action thereby warranting the independent preparation of an environmental impact statement. Furthermore, none of the parties to the proceeding raised any environmental questions.

Despite the foregoing, the Commission will further condition the certificates to provide for an independent assessment of Interior's EIS. We shall therefore provide herein for a notice to be filed in the Federal Register upon the release of the Final EIS by Interior. Any parties to the proceeding or interested federal, state, and local government agencies may file written comments. The Commission will then review the statement and submitted comments and weigh the environmental consequences.

The Applicants also raised several minor issues. In Ordering Paragraph (D), the Commission imposed on the Applicants the requirement of accepting the certificates within thirty days after Commission action on the application for rehearing. In its filings, Applicants have requested that they not be required to accept the certificates until six months after the issuance of this order, reserving the right to seek an extension of time. Applicants contend that they need the additional time in order to seek the requisite financing and approvals from California. We find the request to be reasonable and concur that the time allotted should be extended.

In addition, Applicants have requested that Ordering Paragraph (B)(6) be amended to clearly set forth the Commission's intent to reserve the right to review any future modifications of the coal contract and to determine whether they are reasonable and in the public interest. We shall gladly oblige. In order to clarify any imprecise language, we state herein that the initial rate established does not include the applicable charges for transporting the coal gas from the point of its receipt on Transwestern Pipeline's system to the Pacific Lighting and Cities' delivery points.

The Commission finds:

The grounds for rehearing set forth in the petition filed by the above-named petitioners do not warrant any change in Opinion No. 728 dated April 21, 1975, except as set forth below.

The Commission orders:

The petitions for rehearing of Opinion No. 728 dated April 21, 1975, filed by the above-named petitioners are denied with the exception that

(A) Ordering Paragraph (B)(1) of the Opinion shall be amended increasing the initial rate of $1.38 per Mcf to $2.50 per Mcf.

(B) Applicants shall submit within 60 days of this order revised tariffs which provide:

(1) a proportional reduction of return on equity provided in the synthetic gas contract, in the event of failure to deliver gas having a heat content of 950 Btu per cu. ft. for periods in excess of 25 days, as hereinbefore set forth; and

(2) a sliding-scale reduction of return on equity provided in the synthetic gas contract, in the event of failure to maintain deliveries, for periods in excess of 25 days, at load factor levels of at least 75 percent based upon design day operation of 250,000 Mcf per day, as hereinbefore set forth.

(C) The authorizations granted herein shall not take effect until the Commission has reviewed the two following documents and determined that such are in the public interest:

(1) proposed financing plan and

(2) the Final Environmental Impact Statement prepared by the Department of Interior and the comments thereon.

(D) Ordering Paragraph (D) is hereby amended to allow the Applicants six months from the date of this order to accept the certificates issued herein.

(E) Ordering Paragraph (B)(6) is hereby amended to reserve the right of the Commission to review any future modification of the coal contract and to determine whether such modification is reasonable and in the public interest.

By the Commission

KENNETH F. PLUMB,
Secretary.

United States of America, Federal Power Commission

OPINION NO. 763—DOCKET NO. CP75–147

NATURAL GAS PIPELINE COMPANY OF AMERICA

OPINION AND ORDER GRANTING CERTIFICATION OF TRANSPORTATION AND SALE OF GAS PRODUCED FROM WASTE

APPEARANCES

Paul Mallory for Natural Gas Pipeline Co.
John M. Mee for Thermonetics Inc., & Calorific Recovery Anerobic Process, Inc.
William Koerner for the Staff of the Federal Power Commission.

United States of America, Federal Power Commission

Before Commissioners: Richard L. Dunham, Chairman; Don S. Smith, John H. Holloman III, and James G. Watt.

NATURAL GAS PIPELINE COMPANY OF AMERICA

DOCKET NO. CP75–147—OPINION NO. 763

OPINION AND ORDER GRANTING CERTIFICATION OF TRANSPORTATION AND SALE OF GAS PRODUCED FROM WASTE

[Issued May 24, 1976]

SMITH, Commissioner.

THE PROPOSED PROJECT

1. This proceeding involves the proposed construction of plant facilities which will convert waste material into methane gas (SNG). Calorific Recovery Anerobic Process, Inc. (Calorific) proposes to construct facilities near cattle feed lots in the vicinity of Hooker, Oklahoma. It has entered into a contract with Natural Gas Pipeline Company of America (Natural) whereby it will sell the gas produced at a base price of $1.33 per Mcf, subject to Btu adjustments and certain escalations, and Natural will reimburse Calorific for any new or additional taxes imposed on the delivery of gas. Natural will take delivery of the gas at the tailgate of the plant and will purchase up to 3,500 Mcf per day, with an option to receive higher volumes, if available.

2. In order to deliver the Calorific SNG into Natural's system. Natural proposes to build approximately six miles of 6-inch gathering pipeline, measuring facilities, and two 500-horsepower compressor units at an estimated total cost of $930,000. The SNG will not be commingled with natural gas in the gathering system prior to the injection of the gas into Natural's existing transmission facilities. Natural intends to use this new source of SNG to augment overall system supply and not to support any new service.

3. A contract between Natural and Calorific was entered into on October 4, 1974, setting forth the above conditions. Should regulatory approval be given in the form satisfactory to both parties, Calorific will then attempt to obtain a plant site and enter into the construction of the project. The term of the foregoing contract is for 25 years.

4. The production of this gas will entail the anaerobic digestion process. Essentially, animal waste is taken from the feed yard and mixed with water which is then subject to a clarification process to increase the concentration of organic solids. The feedstock is then placed in closed tanks called digesters which are sealed to prevent the presence of oxygen. In the digesters, two types of bacteria begin to operate on the feedstock. Acid-forming bacteria work upon organic matter and excrete acid. Methane-forming bacteria function to convert acid to methane gas. The digestion will result in methane gas, carbon dioxide and traces of nitrous oxide and hydrogen sulphide. Solid waste remaining after the operation of the bacteria may be processed to create fertilizer.

5. The basic process of anaerobic digestion is one which has been utilized in municipal waste treatment plants for many years. The most important modifications of the established process by the instant proposal will be in the adjustment and careful control of the environment within the digester. Although the plant designed for Calorific goes beyond present technology, the Applicant and Calorific are confident of its success.

PRICE

6. The base price of $1.33 per Mcf is subject to adjustments, as defined by three formulas contained in the contract, based on certain indexes published by the Bureau of Labor Statistics. The first formula, with reference to construction escalation, takes into account the wholesale prices of construction, machinery and equipment, and the hourly earnings of contract construction workers. This formula applies proportionately as to 52.63 percent of the $1.33 base price. The construction escalation formula is operable only once and provides for an adjustment resulting from increases in actual construction costs 14 months after the contract's execution.

7. The second formula relates to the operation escalation and takes into account consumer prices. This formula applies proportionately to 40.60 percent of the $1.33 base price. It is also operable only once, on the day gas is first delivered or is capable of being delivered. Finally, the third formula, also relating to operation escalation, is identical to the second formula except that it takes into account annual delivery volumes. If the volumes delivered during the preceding 12 months exceed 819,802 Mcf, the price decreases proportionately as to 54 cents of the $1.33 base price. The price does not change as a result of annual deliveries totaling 819,802 Mcf or less. This formula becomes operable on an annual basis commencing 15 months after the date of the initial delivery. In all three formulas, the base indexes used are those for the month of October 1974, the date the contract was executed.

8. Natural's proposal is to treat this new supply on a rolled-in basis with respect to recovering the cost thereof. The impact on Natural's average cost of gas is estimated to about 0.1 cent per Mcf assuming the purchase of 1,000,000 Mcf annually. Calorific will bear the risk and financing burden associated with this project.

9. The base price, estimated construction cost of the facilities and the cost of transportation were unchallenged by the Staff or any of the parties. The Administrative Law Judge meticulously analyzed the cost of this supply, concluding that although the computation was "excessively cautious", a base price of $1.33 was reasonable and in the public interest. He also approved the rolled-in pricing of the supply.

10. Staff proposed that Natural should be allowed to include a maximum 24 cents per Mcf in its overall cost for the transportation of gas to its transmission system. Upon review, the Judge concluded that the rate was excessive as it was premised on a 60 percent load factor. The Judge determined that 22 cents per Mcf was appropriate based on the Applicant's estimated deliverability of 819,802 Mcf per year.

11. In its brief on exceptions, Staff objected solely to the transportation rate established by the Judge arguing that the initial decision would allow Natural to amortize any transportation costs in excess of the 22 cent per Mcf rate. Staff characterized Judge's provision as allowing for "open-ended rate treatment" which would place all risks upon the consumers. In its brief on exceptions, Natural made no exception to the Judge's finding. Based on our review we find that the threat of unlimited escalation by Staff appears to be more imaginary than real.

TRACKING

12. It is implicit in the foregoing than when deliveries commence, the contract price will exceed the base price of $1.33 per Mcf as a result of escalation of factors in the three foregoing formulas. In its initial petition, Natural requested specific authority to pass through increases in the contract price either through its tariff's purchased gas adjustment provision or research and development cost-tracking provision. Staff opposed any form of tracking authorization in the case of artificial gas. In its reply brief filed with the Administrative Law Judge, Natural proposed as a compromise measure that it should be permitted to make effective an initial rate which would reflect the cost in accordance with the agreement and to track such costs for the first 12 months of deliveries. Thereafter, it proposed that any increased cost of the gas will be recoverable through normal Section 4 rate filings by Natural.

13. The Judge found that tracking authorization for changes in the cost of purchasing Calorific's gas and transporting it to Natural's transmission system would not be in the public interest. He therefore provided for Natural to file changes in its rate with the Commission in accordance with Section 4 of the

Natural Gas Act with a single exception. Within 15 months of its first receipt of methane from Calorific, he allowed Natural a one-time-only adjustment to flow through changes in its cost of purchased gas. Specifically, he provided that Natural would file a verified statement covering the first 12 months of deliveries which would set forth five specific factors covering monthly and annual volumes received and monies paid for SNG and cost of trnsporting SNG. Should such computation result in a cost in excess of the base price plus transportation costs, the Administrative Judge proposed that the difference should be amortized over a period of one year or longer in the pipeline's overall rates at a rate not exceeding .05 cent per Mcf.

14. In its brief on exceptions, Natural has characterized its request for a tracking provision to be the principal contested issue. Natural argues that the tracking of the cost of gas is the rule and not the exception. In arguing this point, Natural asserts the public interest mandates the Commission to grant the relief requested by Natural.

15. Natural argues that the Commission should encourage this pilot project because it will contribute to our energy resources, remove a pollution problem, and advance the technology of anaerobic processing. Natural argues further that Calorific bears the risk and financing burden of this plant. The inter-state consumer pays only for the gas actually delivered and the price thereof will increase only in accordance with the Consumer Price Index. Natural also asserts that the Calorific plant will enable it to use existing unused pipeline facilities and alleviate existing curtailment to its customers. Natural maintains the price for the Calorific gas company compares favorably with that of SNG, LNG, Canadian gas, and gas from the unregulated intrastate market.

16. Natural further argues that unless the PGA clause rate treatment is permitted, Natural is precluded from recovering its costs. It asserts that it would have to absorb the full cost of the gas in excess of average gas cost pending the effective date of a major rate case. It advocates as an additional reason the research and development nature of this project. Natural maintains that the Commission has adopted a policy of encouraging pipelines to invest in research and development and that thereby Natural should be allowed to place into effect rate changes without suspension reflected as research and development expenditures.

17. Natural objects to the procedures established by the Judge whereby it could amortize possible cost increases experienced in the first 15 months of operation. As the price adjustment provisions of the purchase contract do not permit Calorific automatically to flow through all cost increases, Natural argues that the consumers are protected from price increases which would exceed the level expected in light of inflation. Natural asserts that the consumer price index is a "rather stringent ceiling" on price increases for Calorific and that there is no potential for abuse or runaway escalation that would justify denying to Natural full recovery of its costs or require continued monitoring of operating experience.

18. In its brief opposing exceptions, Staff asserts that the Commission has never allowed the automatic recovery of costs through tariff or tracking provisions. Staff further asserts that Calorific bears the significant project risks and that the risks that Natural may bear are de minimis in nature. Staff further finds that Natural's arguments as to delay in recovering costs "illusory" as Natural is not precluded from filing to recover any increases in the cost of the Calorific supply at any time it would deem appropriate.

19. Although Natural maintains that it is essential that it have some form of tracking authorization during the first year of plant operations; we are unable to establish an independent standard for this project. The proposed tracking provision presents an issue which has been before us in many supplemental supply projects. In all of our prior decisions, we have established an initial rate due to our concern that the future rates might escalate to a level which would be detrimental to the consumer.[1] We recognize that the Applicant and Calorific have attempted to minimize the potential danger to the consumer by providing for an annual adjustment of the price limited to fluctuation of the Consumer Price Index. We cannot however substitute the Consumer Price Index for the performance of our regulatory responsibilities of determining whether a new higher rate is just and reasonable and in the public interest.

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[1] See, for example, Opinion Nos. 728 and 728–A, *Transwestern Coal Gasification, et al.*, Docket No. CP73–211 (April 21, 1975; November 21, 1975); Opinion Nos. 622 and 622–A, *Columbia LNG Corporation, et al.*, Docket No. CP71–68, *et al.* (June 28, 1972; October 5, 1972); Opinion Nos. 637 and 637–A, *Algonquin SNG, Inc., et al.*, Docket Nos. CP72–35, *et al.*, December 7, 1972; February 6, 1973.

20. We are committed to a policy of encouraging the development of suplemental supplies in order to offset the diminishing national gas supply. In order to offset the diminishing national gas supply. In order to encourage investors to participate in projects such as the one before us, we are aware that they must be given some assurance that they may recoup their investment and a reasonable to return thereon without undue delay. We do not anticipate that our rate review under Section 4 will cause an unconscionable amount of delay in the recovery of the investment proposed herein. In minimizing regulatory lag it is foreseeable that future Commissions will exercise their discretion so as to suspend any proposed rate increases for a period less than five months. This Commission cannot however limit the discretion of future Commissions with regard to the length of the suspension period as proposed by the Presiding Judge.[2]

21. Although the Presiding Judge stated his intention to follow the rate treatment established in Opinion No. 728, Transwestern Coal Gasification Company[3] he made several modifications which are incompatible with the limitations prescribed therein. The proposal to allow Natural to flow through costs which occur during the first 12 months of operation (in its cost of purchased gas) in a one-time-only adjustment is unacceptable. This provision would allow Natural to adjust the initial rate and transportation rate without Commission review. The Commission would be foreclosed from making any adjustments to the rate itself other than prospectively. We specifically disallowed the granting of a certificate of public convenience and necessity without the condition of a specified initial rate in Opinion No. 728.[4]

22. In the instant case, we find that our certification of this project should be conditioned to provide for an initial rate of $1.33. We are aware that this initial rate may not allow Natural to recover its full costs during the period of commencing plant operations. We shall therefore provide herein that Natural may make a Section 4 filing after the start up of the plant's operations. All excess costs which are found to be reasonably and prudently incurred prior to the initial Section 4 filing shall be amortized in Natural's overall rates at a rate not exceeding .05 cent per Mcf and recovered through the rates subsequently established in the Section 4 proceeding.

The Commission further finds:

(1) Natural Gas Pipeline Company of America is a natural gas company subject to the jurisdiction of the Natural Gas Act, and its receipt of methane gas into its line near Hooker, Oklahoma, and its transportation and sale of the methane gas are required by the public convenience and necessity.

(2) The conditions hereto attached are required by the public convenience and necessity.

(3) The initial decision should be adopted as the decision of the Commission except as modified and supplemented by this Opinion and Order.

The Commission orders:

(A) Natural Gas Pipeline Company of America is hereby issued a certificate of public convenience and necessity for the interstate transportation and sale of commingled methane gas and natural gas, subject to the following terms and conditions.

(1) No later than six months prior to the commencement of the purchase of the Calorific gas, Natural Gas Pipeline shall file an amendment to its purchased gas adjustment clause contained in its tariff to reflect the costs of methane gas purchased from Calorific at $1.33 per Mcf.

(2) No later than six months prior to the commencement of the purchase of the Calorific gas, Natural Gas Pipeline shall file an amended tariff to reflect the cost of transporting the methane from Calorific to Natural Gas Pipeline's system at $.22 per Mcf.

(3) Upon the commencement of initial deliveries from Calorific, Natural Gas Pipeline may file a revised tariff schedule under Section 4 of the Natural Gas Act in order for the Commission to make a determination of the just and reasonable rate. Any difference between costs reasonably and prudently incurred and the initial rate of $1.33 shall be amortized at a rate not exceeding .05 cent per Mcf, over a period of one year or more.

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[2] Initial Decision, mimeo p. 22.
[3] See Footnote 1.
[4] *Atlantic Refinery Co., et al.* v. *Public Service Commission of New York, et al.*, 360 U.S. 378 (1959).

(B) The general terms and conditions set forth in the Commission's Regulations under the Natural Gas Act and particularly those contained in Parts 154 and 157.20 thereof shall attach to the certificate issued herein.

(C) The initial decision is adopted as the decision of the Commission as supplemented and modified by this Opinion and Order.

By the Commission.

KENNETH F. PLUMB,
Secretary.

Mr. OTTINGER. Thank you, Mr. Smith. Are you familiar, or is the FPC staff familiar, with the Wesco application?

Mr. SMITH. Yes, sir. The 728 and 728–A series that I set out and attached to the testimony did involve that application.

Mr. OTTINGER. Can you advise us what percentage of the product from that Wesco project as it was submitted would go to residential as opposed to electric utility and, third, industrial customers in southern California?

Mr. SMITH. Before referring the question to Mr. Wahrhaftig, the projections made to the Commission essentially dealt with the California demands at the time it was contemplated the project would be completed and sustaining a significant output, which was in the early 1980's. At that time, the California users were projected to have curtailed essentially all the electric load and most of the boiler fuel industrial load. Consequently, it would be essentially for the priority 1 users, because their projected gas supply, even with the new increment, would not be enough to serve all customers accorded that priority.

May I confirm that?

Mr. OTTINGER. Did that take into account the supply of Arctic gas?

Mr. SMITH. Yes.

Mr. OTTINGER. I take it it would be the Commission's position that, even were that not the case, it probably wouldn't make so much sense to use synthetic fuel gas for industrial uses at this time in view of the fact that we are running out of gas pretty much on a national basis.

Mr. SMITH. Yes, sir. It is becoming painfully apparent that at the time the synthetic supply of gas increments would come onstream, taking into account the end use profile of the Nation generally, that there will be very little left over for boiler fuel use, either electric or industrial. In other words, it is a problem that will take care of itself, I think, by that time.

Mr. NORDHAUS. Could—This is just a request for information for our hearing record. Could you supply for the committee the list showing the earliest date on which each of the principal applicants on these synthetic fuels plant applications told the Commission that it would not be possible to finance their project without Federal loan guarantees?

Mr. SMITH. Yes, sir.

[The following material was received for the record:]

The following is a list of FPC synthetic fuels projects and the dates on which the principal applicant indicated that it would be impossible to build the project without loan guarantees:

(1) El Paso Natural Gas Company, FPC Docket No. CP73–131, No filing.

(2) Transwestern Pipeline Company, et al., FPC Docket No. CP73–211, August 25, 1975.

(3) Michigan Wisconsin Pipeline Company, et al., FPC Docket No. CP75–278, January 22, 1976.

Mr. OTTINGER. You say in your statement here that you would recommend a process whereby loan guarantees are conditioned upon the applicant obtaining from the FPC additional certificate of public convenience and necessity under section 7 of the Natural Gas Act.

Have you prepared language for an amendment that would require that?

Mr. SMITH. We haven't, Mr. Chairman. We could if you would——

Mr. OTTINGER. Would you supply us with your suggested language for that and any other amendments that you might recommend? We plan to be marking up, because of the time limitation that was placed on us by the Speaker of the House in this referral, in the subcommittee next Tuesday, June 1st. If you could get something to us, we would appreciate it.

Mr. SMITH. Yes, sir, I can, and I appreciate being asked.

[The following material was received for the record:]

SUGGESTED AMENDMENT TO H.R. 12112

The following suggested language for amendment to H.R. 12112 allows two approaches which would provide that loan guarantees for high Btu synthetic gas projects be conditioned upon the applicant obtaining from the FPC a conditional certificate of public convenience and necessity under Section 7 of the Natural Gas Act.

ALTERNATE A:

Sec. 18(c)(8): "the Administrator has reviewed and is satisfied with the terms of the certification issued by the FPC or is satisfied that an acceptable certification will be forthcoming."

Sec. 18(aa): "The Federal Power Commission is empowered, at the request of the Administrator and applicant, to issue a conditional certificate to facilitate the Administrator's functions under subsection (c). Terms of such a conditional certificate are left to FPC determination consistent with their fulfillment of the terms of the Natural Gas Act."

ALTERNATE B:

Sec. 18(c)(3): "the Administrator has determined that there will be a continued reasonable assurance of full repayment; In reaching this determination, the Administrator is empowered to issue a conditional loan guarantee or conditional commitment to guarantee having determined that the other criteria set forth in this section have been satisfied, pending the issuance of such certification and the fixing of such rates as may be required by the Federal Power Commission, following which the Administrator may issue an unconditional guarantee or commitment to guarantee having determined that this requirement has been satisfied."

Mr. OTTINGER. I want to thank you very much for your very helpful testimony.

Mr. SMITH. Thank you, Mr. Chairman.

Mr. OTTINGER. Next we have a panel of technical witnesses: Mr. George Percival, director of the British Gas Corp., International Gas Consultancy, Ltd., Stamford, Conn., Mr. Fletcher Byrom, chairman of the board of Koppers Co., Inc., Pittsburgh, Pa.; Ms. Kathy Shreve, acting project director, solid waste ammonia project, the Office of Management and Budget of the city of Seattle in Washington; and Ms. Marilyn Romans, director of corporate planning, Fusion Energy Corp.

Will those panelists—at least that who are here—come forward? It would be helpful if you would identify yourselves so I know who is who and which is which.

We have switched the order of the technical panel and the environmental panel. I would like to advise the people who are on the environmental panel, because of time problems of some people on the technical panel, and I do hope that the people on the environmental and consumer panel can stay with us.

I know at least in the case of Mr. DeLoss it means he has been waiting around here a good deal of time. He was here yesterday. We apologize for that imposition.

Would you identify yourselves?

STATEMENTS OF A PANEL CONSISTING OF GEORGE PERCIVAL, DIRECTOR, BRITISH GAS CORP., AND U.S. RESIDENT DIRECTOR, INTERNATIONAL GAS CONSULTANCY, LTD., STAMFORD, CONN.; FLETCHER L. BYROM, CHAIRMAN OF THE BOARD, KOPPERS CO., INC., PITTSBURGH, PA., ACCOMPANIED BY THOMAS KEELING, VICE PRESIDENT AND DIRECTOR; KATHY C. SHREVE, ACTING PROJECT DIRECTOR, SOLID WASTE AMMONIA PROJECT, OFFICE OF MANAGEMENT AND BUDGET, CITY OF SEATTLE, WASH.; AND MARILYN ROMANS, DIRECTOR OF CORPORATE PLANNING, FUSION ENERGY CORP., PRINCETON, N.J.

Mr. PERCIVAL. George Percival, International Gas Consultancy.

Ms. SHREVE. Kathy Shreve.

Mr. BYROM. Fletcher Byrom from Koppers Co. in Pittsburgh.

Mr. OTTINGER. All right. Is Ms. Marilyn Romans with us?

[No response.]

Mr. OTTINGER. I think we will have to make Ms. Romans an environmentalist then.

We will be glad to receive any statements that you might have in full for the record. Mr. Percival, why don't we start with you. You may proceed as you feel most convenient.

STATEMENT OF GEORGE PERCIVAL

Mr. PERCIVAL. Mr. Chairman, my name is George Percival. I am the director of International Gas Consultancy, Ltd., a wholly owned subsidiary of the British Gas Corp., which is the nationalized fuel gas industry of Great Britain, and my post is U.S. Resident Director of International Gas, and my responsibility is to provide technical support for the technology which is being utilized in the United States which originated at British Gas Corp., particularly in connection with the production of substitute natural gas.

I understand that you are interested in learning something of the activities of the corporation in the field of coal gasification development under pressure, and in that connection particularly to learn something of the work that is being pursued at the Westfield development center in Scotland.

I think it might be helpful, if this is permitted, Mr. Chairman, to begin with a little background of the corporation's involvement with coal gasification as a means of producing a fuel gas for sale and dis-

tribution to consumers, and perhaps lead up quickly to the way in which this facility in Scotland is being utilized now.

The corporation, which was initially based upon coal for the production of fuel gas for some 100 years, has always been a strong supporter of innovative work in the field of coal gasification, and one of its commitments was to consider the replacement of the traditional means of producing gas from coal, namely by pyrolysis or carbonization, in order to remain competitive in the face of increasing efficiency of other fuel producers, such as electricity and oil.

One of the areas which it investigated was the pressure gasification of coal, based upon the original Lurgi process, which had been developed in Germany during the late 1930's and which was not entirely suitable for the production of fuel gas in Britain, mainly because it would handle a relatively narrow type of coal. Second, it produced a fuel gas which had a heating value lower than that which was currently being distributed in the country. And, third, there was obvious scope for improving the performance under the British conditions, and these were the objectives of the corporation in adopting the process and attempting to improve on it by carrying out development work.

One area of development was to increase the heating value of the gas produced by the process to make it compatible with existing fuel gas, and this led to the development of a catalytic methanation process, so that gas from the Lurgi process could be distributed directly without the addition of enrichment from other hydrocarbon sources.

The second was to make it adaptable to British coals or more adaptable, and, in this connection, work was pursued by changing the conditions of gasification to extend the range of coals which the basic Lurgi process would handle, and this approach led to the so-called slagging ash mode of operation, which, by virtue of the change of gasification conditions, also substantially increased the specific output of a given size of gasifier and made it generally more attractice to the particular conditions in Britain.

About 10 years of development work was devoted to this particular program between the period 1954–64, when, because of rapidly changing conditions in the supply of feedstock suitable for gas production, the development work was overtaken by, first of all, a prolific supply of relatively low cost hydrocarbon feedstocks emanating from refineries constructed in Europe after World War II, and, second, in the early to mid-1960's, the discovery of substantial deposits of natural gas off the Continental Shelf of the North Sea.

Consequently, the development work on coal gasification processes was abandoned in 1964–65. However, by this time, Britain had constructed two Lurgi plants, one having a capacity of some 40 million cubic feet per day of medium calorific value gas and the second with the capacity of some 50 million cubic feet per day. One of these was located at Westfield and the other in an area in the industrial midlands of the country.

The Westfield plant was operated for 14 years, between 1960–74, and the plant located in the midlands for about 6 years, terminating in 1969. Both plants were taken out of service because of the impact of the distribution of natural gas in the country, and, consequently, upon the economics of operating any kind of manufacturing plant.

However, before the plant in Westfield was shut down, there were obvious opportunities for carrying out experimental and development work which would be of interest to the United States, because at that time consideration was already being given to using the process for converting coal in the United States to fuel gases.

As a consequence, before the plant was finally shut down, three programs of work were initiated. Two of these programs, Mr. Chairman, have been completed, and the third is still in progress.

The first of these programs, which was sponsored by the Office of Coal Research in conjunction with the American Gas Association, was to study the performance of a number of American coals in the standard Lurgi process, by transporting samples of these coals from the United States to Britain and conducting carefully conceived and monitored tests to discover how or whether they could be successfully gasified by the Lurgi process.

The second of these programs which was in a sense a corollary of the first was sponsored and managed by the Continental Oil Co., who, together with 15 sponsoring American companies, picked up the methanation technology that I referred to having been developed in the early 1950's by British Gas and used it to demonstrate that it was possible by this process to produce not merely an enriched product gas, but in fact a supplemental pipeline gas having properties which were compatible with those of natural gas.

This was a $6 million program lasting some 2 years, and it terminated with a demonstration of the production of synthetic gas, not from American coal, which was not part of that original program, but from similar British coal, and in fact the product was distributed to the Scottish consumer for a period of 2 months, and the performance of this product gas was monitored to see whether it was indeed truly compatible with pipeline gas.

The comparative success of this program, Mr. Chairman, then encouraged a second group of sponsors, all American companies representing the oil pipeline and utility area of the industry, to suggest that British Gas continue the development of its program of adaption and improvement of the basic Lurgi process by increasing the scale of the slagging operation at the Westfield plant.

By this time, the plant had reached the end of its planned commercial life as a fuel gas producer and was due to be taken out of service and would eventually have been scrapped. However, British Gas decided that this was a unique opportunity to put this facility, as it were, in the international field, and it agreed to restaff it with rearch and technical personnel and to maintain it as a viable, but uncommitted, facility totally dedicated to the development of coal based gasification processes.

The program which hopefully will result in the successful development of a slagging mode of operation to commercial scale is a 3-year program costing $10 million and has now completed 2 years from the outset.

Mr. Ottinger. Could you tell us what slagging is? Is this production of high Btu gas as well? "Slagging" is not a term that I am familiar with.

Mr. Percival. I will explain that term, Mr. Chairman. In the standard Lurgi process, the inert content of the coal is removed from the

base of the gasifier as an ash. In other words, a solid. And the temperatures and conditions of gasification in the gasifier have to be controlled, such that the ash will in fact remain in that form.

Some coals require different operating conditions in order to achieve this. It is a function of the fusion temperature of the ash.

The object of slagging is to operate the gasifier such that under normal conditions the ash is fused and will flow from the gasifier as a liquid, very much in the nature of a blast furnace operation.

Hence, by approaching the removal of the ash in this way, it is possible to widen the range of coals which can be handled by operating under these conditions, so that in the slagging mode the gasification conditions are such that the ash flows away as liquid. In the dry ash mode, the ash has to be removed by mechanical device and separated as a comparatively dry powder.

The manufacture of pipeline gas is not dependent on whether the gasifier is operated as a dry ash or as a slagging ash gasifier because the production of pipeline gas depends on a series of further treatment stages downstream of the gasifier in order to produce the appropriate hearing value and appropriate combustion characteristics.

This program, as I mentioned, is now in the final phase of development, and, subject to agreement by the sponsors, there are plans for carrying out development work on these downstream stages in order further to improve the potential of the process for manufacture of pipeline gas.

Perhaps I should mentioned now how the advantages of slagging compared with dry ash mode are appreciated by the operator. First of all, as I mentioned, it tends to widen the range of coals that can be utilized, and, in a sense, it is a complementary development to that of the existing Lurgi dry ash gasification mode.

Superimposed on that is the possibility of operating at higher thermal efficiency, and also very much higher gasification rates, and the overall effect of this development is to reduce the capital cost of plant and to improve its thermodynamic performance by increasing thermal efficiency.

These, therefore, are the objectives of the slagging program.

Concurrently with this development program, the Conoco Coal Development Co., which is one of the sponsor of the work at Westfield, has offered the technology to the Energy Research and Development Administration as one of the competing processes, in response to that body's RFP for a demonstration plant to produce pipeline gas.

Therefore, subject to our performance or the performance of the technology in that competition, there is already a prospect of further development of the process along those lines, but I emphasize that at this point the work that has been conducted at Westfield is, of course, of a private commercial nature and the information which flows from these programs of work is confidential to the sponsors, and they will participate in such commercial exploitation that may take place subsequent to and in the event of a satisfactory termination of the development program.

That, Mr. Chairman, briefly is the scope of work in the field of coal gasification development which is being undertaken by British Gas on behalf of American industrial companies who are between them representative of the fossil energy field of the United States.

Mr. OTTINGER. Let us go off the record for a minute.

[Off the record.]

Mr. OTTINGER. Back on the record. We will take the statements of the remaining panelists. I understand that Ms. Marilyn Romans has appeared as well. If you would like to join this panel, we will proceed now to Mr. Fletcher Byrom.

STATEMENT OF FLETCHER L. BYROM

Mr. BYROM. Thank you, Mr. Chairman. I am Fletcher Byrom, chairman of the Koppers Co. in Pittsburgh. We are a diversified manufacturing corporation including an engineering and construction arm, which, among its other capabilities, has the ability to design and build a medium Btu coal gasification plant. Our process is known as the Koppers-Totzek process, and is based on German brown coal technology, so-called, of the late 1930's and during the war period.

The process is commercially feasible now. There are 16 operations around the world which have been commercial for some period of time, and we are prepared to take a contract tomorrow to build a U.S. plant to produce medium Btu gas.

Its significance is the potential for industrial use.

I am sure in my own mind that at some time synthetic pipeline quality gas will be an important factor in the fuel pattern of the United States. However, what I am concerned about now is that some 60 percent of the gas being consumed is used by industry, and, if the projections are reasonable, there will be a shortfall in natural gas availability in the near term. Most people are agreed that the shortfall will come directly out of industry's availability rather than from home heating use.

I sent a prepared formal testimony which I submitted, and, if I may——

Mr. OTTINGER. It will be included in the record. You may proceed informally.

Mr. BYROM. We are satisfied the medium Btu gas process is feasible for industry today and that the problem facing industry in the very near term—and, by that, I am saying maybe the next 5 or 6 years—is one of substitute supply.

If you couple that with the announced intention, but not policy, of the United States to at least reduce its dependence on imports, it leaves us with very few alternatives—except shutting down industry.

I don't believe the magnitude of the problem is perceived. Just to give you a very quick overview of it: If you were to replace the equivalent of a million barrels of oil per day for use in industry, it would take some 500-plus gasifiers, which I suspect would be in some 25 different plants. Each of the plants would probably have 20 multiple-head gasifiers. It would take about 1,800 journeymen, craftsmen, working for 3 years, to build each one of these plants. It would require to supply them around 150 million tons of additional coal—25 percent more than we now produce. It means a significant number of coal mines would have to be opened. It means that equipment to mine that coal would have to be produced.

When you look at the problem of producing the compressors and structural steel and everything else that is required, time has already

run out on us. It isn't a matter of it running out. It has already run out.

Now, I would like to add a footnote that may sound self-serving, from a guy who heads a company happy to start building these plants tomorrow. If we received contracts for all the plants that we could possibly handle at any given time—and I suspect we could probably not undertake to build more than three or four at one given time—the effect on our earnings per year might be $0.10 to $0.15 a share improved earnings, assuming we were able to build them.

Mr. OTTINGER. How much would each one of these plants cost?

Mr. BYROM. Each of the 500 multiple-head gasifiers would cost from $20 to $25 million. It is not small potatoes, but there is no alternative except shutting down plants.

I am not suggesting that we would get around to building these 500 gasifiers in the foreseeable future. I am saying we had better build some as fast as we can.

I suspect that what I have said is sufficiently provocative that I can leave it for questions.

[Mr. Byrom's prepared statement follows:]

STATEMENT OF FLETCHER L. BYROM, CHAIRMAN OF THE BOARD, KOPPERS CO., INC., PITTSBURGH, PA.

My name is Fletcher L. Byrom. I am chairman of the board of Koppers Co., Inc. in Pittsburgh, Pa. I have been asked to give testimony relating to: (1) the viability of intermediate gas substitution for natural gas; (2) the existing and commercially available technology, and (3) the difficulties involved in high Btu gas generation; as well as the role of coal gasification in solving our immediate and long-term energy problems.

I want to refer you at the beginning to my testimony presented on May 8, 1975 at the Joint Hearings of the Sub-Committees on Financial Markets and Energy of the Senate Committee on Finance. This testimony explores our position on the vital elements of a natural energy policy including tax incentives for energy related projects, and price equalization measures.

Also, on July 14, 1975 we submitted testimony titled: "Coal Gasification: Neglected Response to America's Energy Needs" to the Senate Committee on Interior and Insular Affairs. In it we documented industry's ability to deliver commercially, environmentally safe coal gasification plants which can use any rank of coal.

BACKGROUND

My company, among other things, is engaged in the engineering and construction field and we are presently capable of engineering, erecting and putting into operation plants which will gasify coal, forming a gas with a heating value of approximately 300 Btu per cubic foot. This medium Btu gas can be used as a synthesis gas to produce certain chemicals for which natural gas is now used, such as ammonia and methanol, and is suitable for consumption by industries requiring heat for their basic processes, or generation of electricity.

VIABILITY OF INTERMEDIATE GAS SUBSTITUTION UTILIZING EXISTING TECHNOLOGY

Historically, heavy industry such as electric power generation, steel, chemicals (particularly ammonia for fertilizers), non-ferrous metals, glass and ceramics have been using between one-half and two-thirds of the natural gas consumed in this country. The remainder of the natural gas is consumed by domestic heating, commercial and light industrial uses.

When heavy industry users had their natural gas supply interrupted, in most cases, they turned to fuel oil or liquified petroleum gas (LPG) which has in turn required vastly expanded importation of foreign crude.

Industry needs a new source of domestic fuel immediately. It can be delivered by existing technology. Economic, ecologically sound processes for coal gasification are presently available, and can aid the nation in reaching a measure of energy self-sufficiency.

Introduction of new sources of intermediate gas would reserve available natural gas for domestic heating and light industrial uses where LPG or fuel oils cannot be readily substituted.

Despite any potential increase in new reserves of oil and natural gas, there still exists the eventual depletion of these reserves. We are currently wasting high Btu gas in industrial situations where intermediate Btu gas could easily be used as a substitute. Specifically:

Proven supplies of readily available coal now exist.

Our own Koppers-Totzek process for converting coal to intermediate Btu gas is proven in commercial, large-scale plants in 16 locations outside the United States. Our process has been favorably evaluated by hundreds of industrial companies favoring the substitution of gas from coal for natural gas, from a technical viewpoint.

Industrial facilities—steel plants, glass plants, chemical processing facilities, etc. can, with minor, proven modifications concert from high to intermediate gas.

In geographic areas of heavy industry, a single coal gasification plant could be constructed with sufficient economies of scale to provide an uninterrupted supply of intermediate Btu gas for industry, thereby insuring a continuance of a healthy economy with its resultant effects on employment and industrial growth. This gas could replace the natural gas now being used as fuel gas, and for the production of ammonia and methanol.

SOME DIFFICULTIES ASSOCIATED WITH HIGH BTU SYNTHETIC NATURAL GAS AND OTHER PROCESSES

Much discussion has centered on the use of coal to produce high Btu gas. In our opinion the technology is not perfected to provide a full scale commercial plant that will produce high Btu gas from coal. The answers to many questions involving methanation, control of catalysts and operating second generation gasifiers at high pressures are not yet at hand. Feasibility has been demonstrated, but experience with continuous operations of commercial prototypes is non-existent. Research and development in this area must continue, but this could take approximately ten years to effect a commercial solution to a problem that is here today. On the other hand, we now have technology available to produce medium Btu gas commercially.

There are numerous small, pilot plant gasification plants being funded by the government and/or by industry, which show promise of being successful and could be competitive with the present known technology; but if successful they will not be available to industry on a commercial basis for at least ten to fifteen years. They are not a solution to today's energy problems.

SUMMARY AND RECOMMENDATIONS

Commercial coal gasification processes can solve a part of today's energy dilemma, but they must be fitted into a long-term total energy plan.

Government and industry must move immediately to provide intermediate Btu gas as a substitute for natural gas which is currently being used for heavy industry. This would release natural gas which could be used in homes and commercial installations. We can greatly stretch out our natural gas supplies with this concept and insure industrial and economic growth.

It is imperative that the country have a definitive energy policy which will permit early initiation of plant construction. Under present conditions, the construction of a major coal gasification plant will take in the neighborhood of three years. Even with prompt action, we will be several years behind schedule at a time when actual needs will arise.

H.R. 12112 will provide a part of the solution. Loan guarantees are an important first step but, they are only a preliminary measure. Other funding measures are vitally needed; other government support will be needed.

Mr. DINGELL. I guess our next witness is Ms. Kathy Shreve? Ms. Shreve?

STATEMENT OF KATHY C. SHREVE

Ms. SHREVE. I am Kathy Shreve. I am the acting project director for the city of Seattle's proposed solid waste ammonia project that

would convert municipal solid waste into anhydrous ammonia, which would in turn largely be used in the manufacture of fertilizers.

I have been asked to make a few general statements, addressing not just our project in particular, but some of the opportunities for energy recovery from solid waste.

I understand that the solid waste component is a small part of the total package of biomass products and resources that we have. It would make a small contribution to energy recovery in the United States.

Similarly, there are a number of ways to recover energy from solid waste, and, because solid waste is a local problem, I would propose that all solutions to solid waste disposal and energy recovery are localized solutions.

Any jurisdiction, municipality, or county government pursuing the possibility of energy recovery from solid waste will have to address the same basic issues, however. One of those is the definition of the alternatives, what processes are available, which are technically feasible.

From that point, they must assess the availability of markets. If markets do exist in the area, what are the economic opportunities in those markets. Finally, if there are economic advantages to particular alternatives, how do you assign the risk, both the risk of process, technology, and marketing risk.

I would like to go through the alternatives that the city pursued and mention why they were or were not attractive to us and why they may be attractive to other areas.

One opportunity for energy recovery from solid waste is to produce steam by burning processed or unprocessed solid waste. This was not attractive in our particular situation. We have only one steam plant in our city. It is not located at a site that would be advantageous. However, Nashville, Tenn., found that they could burn solid waste to create steam for heating in winter and chilling of water in summer. It was an economically attractive opportunity for them.

Another alternative is to produce electricity from the steam. Again, this was not economically attractive to the city of Seattle because we are a hydropower-based energy economy and we have very cheap electrical rates.

It is attractive to other parts of the country, like Saugus, Mass., where General Electric is buying steam to generate power.

Other alternatives—In fact, one that might be interesting to Washington, D.C., since, when I flew in, I saw a coal plant used to generate electricity—is to dispose of solid waste concurrently with coal, generating steam and, hence, electricity.

For the city of Seattle, all of these alternatives were turned down because markets did not exist for us. They do for other cities, other jurisdictions.

One opportunity we seriously investigated was the pyrolysis of solid waste, using that pyrolysis gas to drive gas turbine generators for electricity production. There is a market in our area for electricity, which is one of the alternatives we would have chosen if our power rates had been a bit higher. We pay 47 mills per kilowatt-hour of power, and it wasn't attractive. This alternative is attractive to

other cities, such as Honolulu, where power now costs 40 mills per kilowatt-hour. You can produce power from 30 to 32 mills with this particular kind of process.

Solid waste can also be sold as a marketable fuel, hard feeding into boilers. Again it was not an alternative acceptable to us. It will be one acceptable to areas that have large industrial facilities with large boilers.

The solution accepted by the city of Seattle was to pyrolyze solid waste, to use that pyrolysis gas for the production of ammonia, a high-value product, and to sell ammonia.

Everyonewill have to go through this same basic process to determine which alternative is best suited to them. Once that alternative is selected, however, you enter into the problem of risk assignment. All projects for the conversion—the generation of energy from solid waste will be funded by borrowed moneys. In order to assure itself that it can return these moneys, a number of guarantees will be sought out by municipalities.

Local government is not in the business of taking risk. It is in the business of providing services at the best price to its constituents.

The city of Seattle and all other jurisdictions with whom we have come in contact have therefore looked at two of the major risks. One is technological risk. We have in our own instance attempted to cover that risk by acquiring adequate process warranties from the equipment supplier.

The other risk that we have been less successful in covering ourselves against is the risk of the marketplace. What we are proposing to do is offer a standard product in an uncommon way. All of the potential purchasers we have talked to, whether the product be ammonia, methanol, or methane, have said, yes, they are interested, that they will buy the product if the facility indeed exists. They will not, however, commit to the purchase of a product until it has been demonstrated that this is a reliable source.

I propose then that for municipalities seeking to cover the risk in a responsible way, recovering energy from solid waste, the proposed bill before you has some application. We believe that each particular undertaking must be justified beforehand. It must be justified that prospective markets exist, that the technology is available, that it has been demonstrated at least on paper to be feasible, and that it has sound overall project economics.

We would then hope to secure the financing for the project through long-term contracts for product sale. As I mentioned, the source of supply is unproven, and we have found that companies who would purchase ammonia, methane, methanol, whatever the product, are therefore reluctant to enter into long-term contracts.

We believe that, at least in our case and in many other cases, where municipalities are getting into the business of energy recovery, that this kind of demonstration can be asserted through Federal support.

Once demonstrated, the fact that ammonia, methanol, electricity, or whatever can be provided through solid waste, we believe that this kind of contingency would not be required for future projects.

I think with that I will conclude my comments.

Mr. DINGELL. The Chair understands that some of our witnesses

must leave to catch an early plane, and we will therefore recognize members of the committee or the staff for purposes of asking questions of our first three panelists.

The Chair recognizes Mr. Hunt at this time.

Mr. HUNT. Mr. Byron, could you give us a brief description of the composition of the gas that is put out by the Koppers-Totzek method?

Mr. BYROM. Well, it is about a 300 Btu gas, a fundamentally clean gas, and has been produced from any carbon source.

Mr. HUNT. It is not then restricted to a specific type of coal?

Mr. BYROM. It will use any coal, and it produces environmentally clean gas and provides for easy removal of the sulfur. Actually, the process has no by-products except the removal of sulfur from the gas and slag, which is disposed of as aggregate with a number of potential uses.

Mr. HUNT. Fine. Could you give us some feeling as to what, within the plant more or less, the thermal efficiency of your process is?

Mr. BYROM. 75 percent.

Mr. HUNT. In the neighborhood of 75 percent, sir? Does the piping of this product, because of its composition, pose any problems, such as metal embrittlement?

Mr. BYROM. There is no problem there, but the problem in piping it is the low Btu gas is not economic to transport very far. Fundamentally, we are talking about a plant which can service an area that may have, at the most, a 100-mile radius.

You wouldn't want to go into extensive piping, but Columbia Gas, who are certainly people who ought to know something about it, have looked very carefully at the various approaches to the problem. They have decided that the best immediate approach is to proceed right now with the installation of medium Btu operations. We have a couple of proposals jointly with them at the present time.

What is significant about our process is that it is commercially feasible and we can start tomorrow.

Now, it is not the long-term answer to the energy problem of the United States.

Mr. HUNT. Since you would be replacing the natural gas at the 1,000 Btu level that's now coming out of the soil, it would extend what reserves we have, to more critical uses, such as home heating, where the conversion is somewhat involved.

Mr. BYROM. Absolutely, and our process produces a gas which is perfectly useful for the production of ammonia, fertilizer, for example. In fact, most of the plants around the world are producing ammonia.

It could be used to produce methanol. It could be used in a combined cycle process to produce electrical energy, where probably the best thing would be to go to methanol for transport and storage in liquid form. This could be used as jet engine fuel for gas turbines which could then be used for peak shaving in the production of electrical energy.

Mr. HUNT. Tell me, sir: Of the 14 or 15 Koppers-Totzek plants that are now operating around the world, which has the largest Btu output per day?

Mr. BYROM. Just looking at the list, the largest I see is 80 million standard cubic feet.

Mr. HUNT. 80 million standard cubic feet, which would be roughly 300 Btu's——

Mr. BYROM. This is actually producing ammonia. It is not used as energy.

Mr. HUNT. Is it a modular construction? Is there sort of a standard unit that is added onto for the purpose of increasing the capacity of the plant?

Mr. BYROM. To build multiple units, you would do it in four-head gasifiers. You can build a two-headed gasifier, which uses about 400 tons of coal a day, but for multiples, you would want four-headed gasifiers, using about 800 tons of coal a day.

You can just build those alongside each other, and the plant becomes expandable in any way you want to go.

Mr. HUNT. All right. Is there an optimal size for your plant, or a specific module, at this point?

Mr. BYROM. I don't know that we have reached an optimum. Anywhere from 6 to 25 four-headed gasifiers would be reasonable.

Mr. HUNT. From the standpoint of, say, the price per million Btu's, do you feel that you have a significant advantage? 9nd I know this may appear to be a loaded question, but do you have a significant price advantage relative to high Btu?

Mr. BYROM. The question—and I don't in any way want to impugn my colleague—is not one of economics, but of immediate availability. There are still things to be determined in terms of catalysts and in the pipeline quality gas. This is not a question of relative economics, sir.

Actually, if you were to build a plant today, such as I am proposing, the cost of that gas would probably be on an oil equivalent basis about the same as $30 per barrel of oil. It is not cheap.

The question is: If you, for example, need gas to make engine blocks in your foundry and you can't get gas——

Mr. HUNT. The trade-off then is a matter of reliability of supply, as you see it?

Mr. BYROM. That is exactly it. It is not an economic alternative.

Mr. HUNT. Is the composition of the output of your plant similar to that of the Lurgi plant, so that your output also could be subject to methanation or catalytic methanation?

Mr. BYROM. We would hope so. The Lurgi process operates at a higher pressure. It has a higher Btu. I would suspect that the methanation shift would be possible, but it would be less economic unless we could operate at higher pressures.

Mr. PERCIVAL. You need pressure?

Mr. BYROM. We need pressure in order to make it an economic shift.

Mr. HUNT. From the standpoint of an industrial conversion, would problems result from shifting over from high Btu gas to a medium Btu gas?

Mr. BYROM. No problem.

Mr. HUNT. No problem? We were told yesterday by, I believe, a Mr. Wheeler from the Fertilizer Institute that the major ammonia fertilizer plants in this country were so designed that they didn't feel they could accept a medium Btu gas for the production of anhydrous ammonia, and that they were basically locked in by the current capital plant at this point. Would you care to comment on that?

Mr. BYROM. That could be. If he said it is so, I am not going to dispute it. It is his business. It conceivably would require some modification to it. Again, I would like to ask him what he is going to do when he runs out of natural gas?

Mr. HUNT. This is exactly the question he was addressing to us, and there was some concern about the availability of high Btu gas for the ammonia process.

Mr. BYROM. I have done a sort of scenario where in fact the availability of natural gas is down 30 percent from what it is today. With 60 percent of the natural gas today consumed by industry, we aren't going to take that natural gas away from homes. So the 30-percent shortfall has to come out of the 60 percent in industry, which means a 50-percent shortfall in industry.

Then I suspect you start looking at where you put it, and you are probably going to be guided by employment considerations. That organization with the highest employment is probably going to have a priority on getting the natural gas. Ammonia plants don't use a whole lot of people; and, furthermore, you won't run out of nitrogen fertilizer for corn fields for 2 or 3 years. So it is a very easy thing to defer.

I would not want to be producing ammonia gas based on natural gas in the United States today.

Mr. HUNT. But yet, throughout the remainder of the world, if I have read the report from the GAO correctly, the majority of the plants that you do have in operation at this point, the 16——

Mr. BYROM. They are producing ammonia.

Mr. HUNT. It is just in the United States that it has not come to that point yet?

Mr. BYROM. That is right, and, if these people have a major modification problem, so be it. That is better than not producing the ammonia at all. But our gas can be used to produce ammonia and is so doing in 16 plants around the world.

Mr. HUNT. Tell me, Mr. Byrom: Have any of the local gas distribution companies approached you with the possibility of building such an industrial gas or medium Btu gas plant?

Mr. BYROM. We have a proposal with Columbia Gas right now for an ERDA demonstration unit. It is specifically aimed at supplying the Pittsburgh Wheeling Steel Corp. initially for gas at their Steubenville works, and with the idea that it could be expanded to provide industry in that whole area—in the tri-State region of West Virginia, Ohio, and Pennsylvania, with medium-low to medium Btu gas.

Mr. HUNT. I see.

Mr. BYROM. In recent years, we must have had hundreds of study projects, most paid for, where people looked at gasification, but economics and risks are such that it is a very difficult thing to expect private industry to make the decision to move forward.

Mr. HUNT. Even with 16 of your plants operating around the world at this point, there is a level of technological uncertainty?

Mr. BYROM. There's no question about the technology. Nobody is worried about the technology. The risk is in those things which you cannot defend against. For example, if you are going to build a plant to make ammonia economic at present world ammonia prices, and the countries in the Near East were to take their flared gas and make ammonia out of that, they start off with a zero raw material cost——

Mr. HUNT. They can undercut the world market.

Mr. BYROM. These are things which normal business practice has no means of protecting against, and I think that is the principal deterrent. Everybody feels that somehow or other he is going to be the guy who gets whatever natural gas is left.

Frankly, there will be a rush to this sort of thing at the point where we start shutting plants down 2 or 3 years from now. But then, I might add, it will be too late.

Mr. HUNT. With the 75-percent thermal efficiency of the output in this plant, it occurs to me that there is 25 percent of the heat value under current designs that is being lost. Are there other uses for that, which is now thermally dumped?

Mr. BYROM. I think not, but you should recognize that you are comparing this with less than 50 percent efficiency in the production of electricity now, and in many cases that has been by using natural gas.

Mr. DINGELL. Could we ask specifically whether this waste heat could be used for electrical generation?

Mr. BYROM. It isn't heat in that sense.

Mr. DINGELL. It is heat that is going somewhere.

Mr. BYROM. You can use a waste heat boiler. Yes. There is the possibility of using a waste heat boiler, but basically I think all that does is generate the steam needed for the process, so you just turn it around. That is how you get 75 percent efficiency instead of 50.

Mr. DINGELL. The chair recognizes the gentleman from New York.

Mr. OTTINGER. I thank the gentleman. I am going to have to leave shortly and I have a question for Mr. Percival, Mr. Byrom, and Ms. Shreve.

Mr. Percival, these studies that were conducted at your Westfield Development Center—did those studies include the environmental problems involved in the production of high Btu gas?

Mr. PERCIVAL. Not directly concerned with the production of high Btu gas, Mr. Chairman, but indeed, when the orginal plan was laid down, there was an extensive environmental survey done to establish for the benefit of the local population and for the Government that the impact of the plant as a low Btu gas producer—and in that respect there is virtually no difference—was not having an adverse effect on the environment.

I might add at this point, if I may, that the complete historical background of both of these low Btu gas Lurgi plants of British Gas is the subject of a proposal to ERDA in order to supplement their basic knowledge of some of the pitfalls possibly and some of the exercises that probably need to be done in the conception philosophy, design, operation, maintenance costs, and economics of such a plant.

Mr. OTTINGER. In terms of, let us say, the water that would be used, the carcinogens that might be produced in the course of production of this, and so forth, would there be substantial differences between this plant and the plant that was built in the United States for production of the same product?

Mr. PERCIVAL. No, Mr. Chairman. In fact, I imagine that, in the advancing years, with technology and with concern for the environment, that a plant built in the United States now would probably be a better machine for converting coal to product gas without disturbing

the environment than those that were built in Britain, although I might add there were very careful studies carried out at the time.

Mr. OTTINGER. And you say the plant in Britain did use United States coal as a part of its——

Mr. PERCIVAL. Just to recapitulate there, Mr. Chairman, there are three programs which have been completed or are ongoing. The first was the testing of certain American coals in a standard type Lurgi gasifier. The second was the demonstration of the catalytic methanation stage to demonstrate that a product gas which was interchangeable with pipeline gas could be produced for a considerable period of time, in excess of 2 months, could be distributed to the local population and would perform equally well in comparison with natural gas.

This second demonstration involving the methanation stage was not using American coal, but was using a coal which was available in Westfield. As you may know, the plant is built alongside a strip mine and operates in a mode which I think would be used over here. But looking at the results of the American coals and looking at the results of the methanation test, it would be possible reasonably to predict that, one, American coals could be gasified, and two, the product gas could be converted to pipeline quality gas.

Mr. OTTINGER. That was the problem. Why isn't this carried through? Was the cost too high?

Mr. PERCIVAL. Well, they were programs of work which had to be costed and which were observed by Office of Coal Research and the American Gas Association, and the work was completed and published and it is in the public record for the benefit of an operator.

Mr. OTTINGER. Why isn't it being used in Britain? Because you have adequate supplies of natural gas?

Mr. PERCIVAL. Yes, although we pursued coal gasification development until the mid-1960's. At that point, all R. & D. work in Britain as far as British Gas was concerned on the gasification of coal was shut down because of the knowledge that there were supplies of natural gas which, at that time, were thought to be capable of providing Britain with natural gas for at least 25 years.

Mr. OTTINGER. Can you give us any idea of the cost of the gas that was produced during this phase 2 in terms of dollars?

Mr. PERCIVAL. It wouldn't be meaningful, Mr. Chairman, because it was a relatively small-scale demonstration, but, based on, for example, the Lurgi pressure gasification process, because it is a proven process, then, in my view, the projections of gas cost are realistic in the sense that the performance of the plant and the thermal efficiency of the various stages to produce pipeline gas are sufficiently well known to make the projections technically sound and economically sound.

Mr. OTTINGER. Can you give us what those projections are?

Mr. PERCIVAL. It is not possible for me to do this at any particular time. They have to be put together with a knowledge of the cost of the coal that is being supplied to the plant and the projected capital cost of the plant.

What it is possible to do is to predict what the percentage of these items in the gas cost will be. For example, the coal cost will probably constitute about 50 percent of the gas cost and the capital costs about 50 percent of the gas cost.

You can see the balance of the costs in the final gas cost and, therefore, you can direct your investigation and your improvement to those particular areas. Improvements in thermal efficiency naturally reduce the coal costs and improvements in gas thruput reduce the capital costs. Together, they have an impact on the gas cost.

Mr. OTTINGER. If we can give you—I mean, if it could be supplied to you what the cost of the coal will be, could you then project the probable cost of methanized high Btu gas?

Mr. PERCIVAL. A person skilled in the art could give you an accurate cost, given the basic information. I couldn't produce this cost here and now this afternoon, but it is possible.

Mr. OTTINGER. With reasonable accuracy?

Mr. PERCIVAL. With reasonable accuracy. The inaccuracy would stem from the need to predict the capital cost of the plant at the time when the plant went into production and, of course, the impact on coal prices of the discovery that coal has yet another economic outlet in the marketplace, that is for the production of fuel gas.

Mr. OTTINGER. Does this phase 3 study you did on slagging—is the slagging process something which reduces the overall cost of the process?

Mr. PERCIVAL. Yes. I did mention that the slagging mode complemented the standard dry ash mode. In other words, the benefits of slagging are more pronounced with certain types of coal than they are with others, and, therefore, it would be good practice to select the types of coal which the slagging mode of operations should specifically be directed toward.

But looking at an average difference and taking into account that slagging has an impact both on thermal efficiency and on capital cost, it is reasonable to predict, subject to the stisfactory development of this technology, that slagging could reduce the cost of gas, of high Btu gas, by as much as 10 percent compared with the dry ash process.

Mr. OTTINGER. Thank you very much. Mr. Byrom, you said that your process is now commercially feasible, meaning medium Btu gas.

Mr. BYROM. Give me a contract, and I will build it tomorrow.

Mr. OTTINGER. If that is so, why do you want and support a variety of government subsidies provided in H.R. 12112?

Mr. BYROM. I think we are lost in semantics here, sir. I am sorry. By "commercially feasible," I don't mean that it competes with adequate returns on investment on present costs of energy. What I meant—and you are absolutely right in picking me up on it—basically, "commercially feasible," means that a commercial-sized plant is demonstrably, technically feasible and there are no operating——

Mr. OTTINGER. Technically, but not commercially feasible.

Mr. BYROM. Well, yes.

Mr. OTTINGER. In other words——

Mr. BYROM. It is not economic, but it is technically feasible at commercial scales.

Mr. OTTINGER. How much of a subsidy is required—how far off are you?

Mr. BYROM. With an average Btu content of the coal in a plant which we could build today using utility accounting methods at coal priced $26 a ton, the cost of the gas would probably be about $5 a million Btu.

Mr. OTTINGER. So that——

Mr. BYROM. And nobody is going be real happy about paying that for gas, sir.

Mr. OTTINGER. In terms of the help that you need in order to be able to supply this, what you really need is a price support in order to be able to sell this at a competitive price?

Mr. BYROM. I am really——

Mr. OTTINGER. Do you need help in capitalization?

Mr. BYROM. I am the wrong one to ask because all I do is design and build them for somebody else who wants to buy them from me. I think you really have to talk to the people that would have to concern themselves with whether they buy it or not. This loan guarantee proposal is a very positive proposal. There isn't any question about it in my mind.

Mr. OTTINGER. It directs itself to supplying the capital needed to build this rather than to the end pricing. They may be related, of course. If the price is wholly uneconomical, you are going to find it hard to get enough money.

One quick question. Then I will end my questioning. Of Ms. Shreve. There is a subsection (s) of this legislation which amends the tax laws or requires that interest on tax-exempt bonds be taxable to the holder, and I wonder whether this would be something that would—that the city of Seattle would favor or disfavor.

Ms. SHREVE. Would you mind repeating again what the section is? The taxable——

Mr. OTTINGER. Subsection (s) of the bill. Unfortunately, I don't have a copy of the bill here.

Mr. BYROM. Does anybody know the page number?

Mr. OTTINGER. I can probably find it if I had a copy of the bill. Here we are. Page 58. "With respect to any obligation which is issued after the enactment of this section by or on behalf of any State or political subdivision or Indian tribe which is either guaranteed under or supported by taxes levied by said issuer, which are guaranteed under this section, the interest paid on such obligation received by the purchaser thereof shall be included in the gross income for the purposes of chapter 1 of Internal Revenue Code, 1954, as amended," et cetera, "such portion of the interest on such obligation as determined by the Secretary of the Treasury to be appropriate, after taking into account marketing yields and obligation of said issuer and so forth."

Ms. SHREVE. It sounds like it is a mechanism by which, if municipal bonds receive a loan guarantee, then they lose that tax-exempt status which makes funding more expensive. It sounds like this is a mechanism by which the issuer—and I think that would be very acceptable to municipalities.

Mr. OTTINGER. Thank you, Mr. Chairman.

Mr. DINGELL. The Chair thanks the gentleman. The Chair recognizes Mr. Hunt for questions.

Mr. HUNT. Mr. Byrom, one final question. Your testimony indicates that you can construct a plant in a period of about 3 years.

Mr. BYROM. Yes, sir.

Mr. HUNT. Would that include the basic shakedown in addition to the actual physical construction, to truly have it online?

Mr. BYROM. No; that would be completion of bringing it online. We

would anticipate very little difficulty in bringing it onto line. There is fundamentally no unknown technology here, and it would be the normal start-up of a process that we are very familiar with.

Mr. HUNT. Fine. Thank you very much. Mr. Percival, can you give us some idea of what the capacity on a daily basis of your methanation stage is at your Westfield facility, as far as output in, say, standard cubic feet per day?

Mr. PERCIVAL. Certainly. It was 2.5 million cubic feet of substitute natural gas per day.

Mr. HUNT. 2.5.

Mr. PERCIVAL. Million cubic feet per day.

Mr. HUNT. Is there significant economy in scaling that out to a larger size, or is that more or less designed as a working module?

Mr. PERCIVAL. That was a working module which was intended to raise the scale of the work which British Gas has carried out in the early 1950's to such a reasonable scale that the technology was then demonstrated satisfactorily for the benefit of potential clients, technologists, and, of course, bankers.

At that time, there was considerable doubt that production of high Btu gas, methane, supplemental pipeline gas, was a technical feasibility, because, although the basic reactions, of course, were well known, the method of dealing with the chemical engineering problems had not been demonstrated at a sufficiently large scale to impress those sectors of the community which needed to be impressed.

Mr. HUNT. Fine. From an engineering standpoint though, supposing you wanted to raise the output by a factor of 10. Would the engineers anticipate building two units five times as large? One unit 10 times as large? Just basically putting in 10 modules according to your present sizes?

Mr. PERCIVAL. That is classified information, Mr. Chairman. As I pointed out, the methanation demonstration of Westfield was conducted by private enterprise. What I can say is that it was sufficiently demonstrated to the benefit of engineers that the design at 60 million cubic feet per day is part of the proposal which has been submitted in the competition for a demonstration plant for pipeline gas which ERDA has published and which is actually being evaluated at this time.

Mr. HUNT. Thank you very much. I understand the problem of confidentiality. From the standpoint of the Lurgi output, can you give us an idea of the composition and Btu characteristics?

Mr. PERCIVAL. Of standard Lurgi product gas? Yes, it is approximately 300 Btu per cubic foot. It contains on the order of 25 percent carbon dioxide, about 8 to 10 percent methane, and the balance is carbon monoxide on the order of 24 percent and hydrogen on the order of 40 percent; 45 percent or thereabouts. It is about 2 to 1 hydrogen to carbon monoxide, with 9 to 10 percent of methane and about 25 percent of carbon dioxide. That is the standard Lurgi.

Mr. HUNT. Before that is put into a pipeline even for a medium Btu, is it technologically possible or economically feasible to scrub out the carbon dioxide, which has no thermal value?

Mr. PERCIVAL. It is indeed. Of course, this was part of the operation which British Gas conducted during the 14 years of operation of the standard Lurgi process in Westfield in order to adjust the com-

bustion characteristics and the heating value to be compatible with town gas, as it is so referred to, which is produced by the carbonization of coal.

The removal of carbon dioxide and the substitution of nitrogen from the oxygen plant was one way of adjusting what are known as the combustion characteristics in order that the gas is compatible with the family of appliances that it is feeding.

Mr. HUNT. And that medium Btu gas of the composition you described—is there any problem putting it to household use?

Mr. PERCIVAL. None whatever, Mr. Chairman. The practice of odorization is a very well developed technology now, both for natural gas and for fuel gases.

Mr. HUNT. Thank you very much. The increases in capacity that you realized by the slagging process—now, those applied only to the Lurgi stage?

Mr. PERCIVAL. They do indeed. It is, of course, the vital stage because it is the gas producer. There is more difficulty in increasing the specific output of the gasifier than there is in dealing with increasing volumes of product gas for gas treatment.

Mr. HUNT. Or the methanization stage.

Mr. PERCIVAL. Such as the methanization stage or the conversion of carbon monoxide to hydrogen and to carbon dioxide which may be precursory stages to methanation. These are stages which are capable of being scaled more readily.

The essential increase in output really requires developemnt of the gasifier.

Mr. HUNT. Well, it was reported to me at one time, I think through the press, that you have achieved through this continuous slagging process an increase in productivity per unit in the neighborhood of three times. Am I correct in that?

Mr. PERCIVAL. Yes. That is a very conservative number, Mr. Chairman. It is probably more on the order of 4 to 5 times.

Mr. HUNT. And such an increase, of course, would, on a per unit base, reduce the amount of capital that ended up—or the capital costs that ended up in the final product by a significant amount, would it not?

Mr. PERCIVAL. This is the objective of this particular piece of development work, Mr. Chairman, in that there will be a reduction in the capital cost of the gasifier section of the plant.

Mr. HUNT. And, in balancing the capital cost of, say, a balanced unit where you have both the methanation process and the gasifier, how does the capital break down? Is it 60 percent for the methanation process and 40 percent for the gasifier? I am trying to find out how sensitive it is to this increase in production that you have realized by the continuous slagging process.

Mr. PERCIVAL. Yes; it isn't quite so marked as you are suggesting. I think that at the time, when British Gas was "selling" the idea of development to the potential users in the United States, who became eventual sponsors of the project, you realize that many of them had already done very detailed engineering work on the basic Lurgi proc-

ess, and they went back to do their sums in order to determine whether indeed it was worthwhile joining our proposed development, and, therefore, they were looking very closely at the effect on capital costs of the overall plant, of the expected increase in output, the specific output of the gasifier, before they agreed that it would be well worthwhile to invest considerable sums of money over a period of 3 years in attempting to demonstrate this particular development aspect at a substantial scale, and that is what the Westfield project is aiming to do.

It had been demonstrated at a relatively small scale, and, by that, I mean using a 3-foot diameter reactor in the days when British Gas was doing the development work, prior to the shutdown of the project.

It was intended at Westfield to double the diameter of the reactor and possibly increase it to three times in order to show the basic development work done by British Gas in the fifties and sixties was capable of being scaled to a commercial size.

Therefore, the so-called demonstration plant at Westfield is almost commercial in itself. It will consume between 400 and 500 tons of coal per day, even at its present restricted size.

Mr. HUNT. Fine; the utilization of this continuous slagging process on the gasification side—Is this sensitive to different types of coal, or are there adjustments that have to be made to accommodate different types of coal?

Mr. PERCIVAL. I think the best way to answer that, Mr. Chairman, is to say that some coals are particularly attractive, if that is the word.

Mr. HUNT. Are these the noncaking coals, so to speak?

Mr. PERCIVAL. It is a question of ash fusion point as well as cakability, but primarily it is the characteristics and quantity of the ash, and this is why slagging really complements the basic process, because you probably already know that the basic Lurgi process is particularly attractive in the usage of certain restricted types of coal.

I think that that will certainly remain, and the benefits of slagging in those cases will be less than in others. So, taken together, I think the two pieces of technology very substantially increase the applicability of the gasification process to a very wide range of coals.

Mr. HUNT. An increase in output of three or four times certainly is a substantial increase. Do you have any idea or any figures concerning the thermal efficiency both of the first stage of the Lurgi process, with the slagging or continuous slagging methodology, and then, as a combined unit, with both the Lurgi process plus the methanation stage?

Mr. PERCIVAL. Here again, these figures are dependent upon the kinds of coal being used, and, of course, one has to be very careful in defining thermal efficiency that the appropriate elements are included, and it is possible for me to recite to you comparative figures with the standard Lurgi process.

Mr. HUNT. Would it be possible for you to submit that for the record?

Mr. PERCIVAL. Yes. Certainly, Mr. Chairman.

Mr. DINGELL. Without objection, that will appear in the record at the appropriate place.

[The following information was received for the record:]

COMPARISON BETWEEN THE EFFICIENCIES OF LOW AND HIGH BTU GAS PRODUCTION FROM A LURGI AND A SLAGGING GASIFIER

Gasification efficiencies	Lurgi	Slagging
Low Btu gas:		
Crude gas plus tar plus oil plus naphtha times 100 over gasification coal	89.0	90.0
Crude gas times 100 over gasification plus steam-raising coal	68.3	76.2
Crude gas times 100 over gasification plus steam plus power-raising coal for O_2 production	62.6	68.3
High Btu gas: Final gas times 100 over gasification plus steam plus power-raising coal for O_2 production	55-56	[1] 65.0

[1] With tar gasification and modified downstream stages.

Mr. HUNT. Thank you very much, Mr. Percival.

Mr. DINGELL. The Chair observes that several of our witnesses have to leave at this time, and those who must may consider themselves excused, with our thanks.

Mr. BYROM. Mr. Chairman, if it is of any help, I think my associate, Mr. Keeling, who is a vice president and director of our corporation could stay and could answer any questions that may come up, if you would so desire.

Mr. DINGELL. I think that would be helpful. We would thank you. We want to respect your time concerns.

Mr. BYROM. Unfortunately, I have a commercial plane to catch, so I have a problem, but he can stay.

Mr. DINGELL. Very fine.

Mr. BYROM. Mr. Thomas Keeling.

Mr. DINGELL. We welcome you. We thank you, Mr. Byrom. We thank you and Ms. Shreve. I guess you must go too. We thank you for being a witness.

We will now recognize Ms. Marilyn Romans. Ms. Romans, you have been very patient. We thank you for your kindness to us. We recognize you at this time.

STATEMENT OF MARILYN ROMANS

Ms. ROMANS. Thank you, Mr. Chairman. I come here today a relative outsider because, as I read this synthetic fuels loan guarantee plan, fusion projects such as the one I represent here today are not explicitly included in your bill. This is what I would like to address myself to today.

Mr. DINGELL. We are pleased to hear your comments.

Ms. ROMANS. I am in the relatively rare position of being a representative of one of the few private, totally nongovernmental fusion research projects in this country. Fusion Energy Corp. of Princeton is a privately held company, born in 1973. Our financial growth and health is an interesting story, but it is our future that I am here today to discuss. As I said, fusion is not explicitly included in your bill, although desirable energy sources and other renewable energy sources are included, and I think, under this category, we might include fusion.

I have been told that the synthetic fuels bill is not a nuclear bill, and, of course, fusion is a nuclear process. But, if I read the intent of the bill correctly, it is to bring new energy technology as quickly as possible to the American people, and, therefore, the bill's language should include all components of the energy economy which may,

within the bill's lifetime, face the problem of slowdown or extinction due to undercapitalization.

The corporate goal of Fusion Energy Corp. at this time is in fact the production within 5 years of a demonstration 10- to 100-kilowatt power reactor, and, within 7 years thereafter, the production of a 100-megawatt standard power cell that could be stocked to produce any size power reactor.

The technical points involved in the migma cell itself I think are well explained in the documentation I have submitted to the committee. This includes our detailed technical and economic plans, and our very current May 1976 economic projection for the capital input required both to get us through our R. & D. stage—which we think will eliminate in 5 years, that is, 1982, with the demonstration powerplant—and also, after 1982, the capital required to bring online the number of fusion power reactors required to replace a substantial amount of power generation in this country. We estimate up to 70 percent by the year 1990. You will find these numbers in detail in the report "Migma Cost Estimate and Cash Flow" submitted to the committee.

New technologies have problems raising capital for two reasons: (1) They are untried and, therefore, high risk; (2) they often require enormous dollar input to reach the turnover point of making a profit for their investor. New energy sources are often dollar sinks.

In recognizing this problem, the bill's drafters have explicitly included synthetic fuels, solar, wind, geothermal, biomass, and ocean thermalgradient systems. Why isn't fusion mentioned explicitly?

On this point I have two ideas: First of all is the feeling that there is some sacred division between nuclear and nonnuclear energy processes. However, it is immediately apparent to me, and I am sure to you, that one of the processes included in your bill—that is, solar energy—is basically a nuclear process.

In fact, some fusion simply tries to reproduce in the lab what is going on in the Sun. Solar energy arrives in the form of radiation. In our fusion process, fusion energy comes from the simple conversion of electrically charged parties directly into electricity.

Neither of these processes should worry anyone because fusion can use nonradioactive fuels, and its products can be totally in the form of charged particles. Fusion therefore, bypasses most of the hazards long associated with nuclear energy.

Therefore, I would urge that, if you are worrying that this bill should not get in the morass of nuclear problems, you don't have the worry for fusion.

Second, and I think that this is the real problem, all fusion seems to be identified with the Government's fusion program. Since it is so identified, it is identified with the Government's time scale for when ERDA will demonstrate a feasible net power out reactor.

However, corporate interests are not bound by this time scale. In fact, I would like to emphasize that we are not looking to the 21st century for demonstration plant. Fusion Energy Corp's fusion is not tokamak fusion, we don't have to worry about the money and the problems involved in that. We are a separate concern, and the committee should address itself to the needs of the private fusion sector as well as to those of the Government fusion sector. I think that our needs are different.

We have not, at Fusion Energy Corp., and we will not in the near future, seek public research and development grants. ERDA's patent and proprietary restrictions, even though they have been liberalized, preclude us from doing so.

We will continue to acquire our R. & D. capital in the time honored way of knocking on venture capital doors. Our 7-year fusion program, now in its second year, is funded entirely by the financial community. We have acquired $3 million to date, with a recent $1.5 million input, and we are presently negotiating for $63 million, to be spent over the next 5 years. We think this will bring us to our 10–100 kilowatt power reactor.

This plan uses only commercially available technology, and does not depend on any break throughs in superconducting techniques, accelerator technology, or collector-converter technology.

We have a hard and fast rule at Fusion Energy Corp. that if you cannot buy it or make it, you cannot put it into the design.

Let me mention to you that the price tag that I mentioned for completing our R. & D. phase, and getting us to a commercial product demonstration plant in 5 years, is $63 million for 5 years. This is in contrast to ERDA's current fiscal 1977 budget which requests $80 million for one plasma-physics lab. We have a relatively low price tag on our R. & D.

We expect to complete negotiations for this amount, and we expect to continue with the experimental progress we have made, and we expect to light a light bulb for you in 5 years with our migma fusion process. In fact, we expect to operate our first 100 megawatt fusion pilot plant in 1988 at a cost projection of 1 to 6 cents per kilowatt hour, which is competitive with present prices.

We expect to do all this. In fact, our scientific consultants who review the project periodically expect us to do the same thing. Our investors are taking the risk that we will do all this.

Fusion Energy Corp.'s request is not that you give a stamp of approval to what we will do, but to recognize the fact we might do it. In a period of only a few years, we may very well need enormous capital input to bring our demonstration powerplant to commercial feasibility.

Our most recent cost estimates, May 1976, come out of a conference held in Princeton, N.J., attended by energy analysts from Argonne National Laboratory, Oak Ridge National Laboratory and a major power technology company, members of our own staff, and various university people, they developed an investment projection for the capital needed to produce a 10–100 kilowatt standard reactor and a 100 megawatt standard power reactor. The projection rises from one-half billion dollars in year 1 of production, to a maximum of $9.7 billion in year 6, averaging about $3 billion per year over the 10-year period required to make a profit on the investment.

A total investment of about $28 billion will be required to make fusion profitable, that is, to have reached a substantial part of the power generation market.

After this point, if the investor can wait, the return will be enormous. We project a $4.5 billion profit per year in year 7. Averaging over a period of 15 years thereafter, we take $1.9 billion to be the average yearly profit.

What I would like to suggest to the committee is that, if the U.S. Government is willing to take the risk and put up or back some of the capital needed to produce the standard migma cell fusion power reactor, it should, in return, benefit by the profits that will accrue when the profit turnover point is reached.

I would, therefore, urge you to reconsider the language in the section of the bill dealing with renewable energy sources, and explicitly to include fusion projects. This does not guarantee that any project will be funded, it merely sets up the mechanisms by which certain projects might be assisted.

We at Fusion Energy Corp. think we will have a prototype fusion power reactor ready for commercialization soon. We should be included in this bill.

[Ms. Romans' prepared statement follows:]

STATEMENT OF MARILYN ROMANS, DIRECTOR OF CORPORATE PLANNING, FUSION ENERGY CORP., PRINCETON, N.J.

INCLUSION OF FUSION PROJECTS IN THE SYNTHETIC FUEL LOAN GUARANTEE BILL—H.R. 12112

Ladies and gentlemen, I am in the relatively rare position today of representing the views of a private, totally non-government, fusion research organization. Fusion Energy Corporation of Princeton, N.J., is a privately held company, born in 1973. Our financial growth and health to date is an interesting story but it is our future that I am here today to discuss. Fusion projects are not yet included in H.R. 12112. I think this is a mistake.

The Synthetic Fuels Loan Guarantee Plan is, I am told, "not a nuclear bill." And, of course, fusion is a nuclear process. But what is the intent of this bill? If the intent of H.R. 12112 is to bring new energy technology as quickly as possible to the American people, particularly in those areas where private capital sources are reluctant or unable to meet total construction or production needs, then the bill's language should include all components of the energy future which may, within the bill's lifetime, face the problem of problem of project slowdown or extinction due to undercapitalization. Nuclear or non-nuclear, private energy companies face capital problems. This committee wants the fruits of energy invention and technology to find useful implementation as quickly as possible. This is ERDA's mission. It is also Fusion Energy's corporate goal.

New technologies have problems raising capital for two reasons: (1) They are untried and so "high risk." (2) They often require enormous dollar input to reach the turn-over point of making a profit for their investors. New energy sources are often dollar sinks.

In recognizing these problems, the bill's drafters have explicitly included synthetic fuels, solar, wind, geothermal, biomass, and ocean thermal gradient. Why is fusion not mentioned? I have several speculations:

(1) This is a non-nuclear bill, as if this were a sacred division. May I remind the committee that solar energy is basically a nuclear energy source. Solar radiation is broad-band spectral radiation, not just the friendly warm infared spectral slice. Migma Fusion, burning non-radioactive advanced fuels such as deuterium, helium 3, or boron, produces energetic charged particles, collectable as electricity. The sun radiates its energy; Migma Fusion releases its energy to simple electricity.

(2) All fusion is identified as government fusion and, therefore, identified with ERDA's feasibility and prototype time-scale. All fusion is thought to be 21st Century business. As one small private corporate voice, let me emphasize to the committee that all fusion is not ERDA fusion. The small, select community of private fusion research in this country deserves attention to its own needs, apart from ERDA's needs.

Let me remind the panel that almost all major American inventions were made outside large government labs; and with the exception of TV and the transistor, all major American inventions were made outside large corporate labs. Discovery and invention, by definition, take place randomly, often unexpectedly. Discovery

has been on our side at Fusion Energy Corporation to date. We have not, and we will not in the near future, seek ERDA research and development grants. ERDA's patent and proprietary data restrictions, liberalized though they have been, preclude us from doing so. We will continue to acquire our R & D capital the time-honored, painful way of knocking on venture capital doors. The 7-year migma fusion program, now in its 2nd year, is funded entirely by the financial community. The goal of the program is an operational prototype fusion power plant using He_3 as fuel, generating 10–100 KW of continuous electric power, a percentage of which will be converted directly to electricity by deceleration in the prototype. This plan uses only commercially available technology, no wild extrapolations. Cost of this migma fusion program is very small compared to that of government-funded fusion projects. FEC's present 5-year plan to develop a 100 KW power source carries a $63 million price tag, including allowance for inflation. This is in contrast to the new fiscal 1977 ERDA budget requesting $80 million for one year for one plasma physics lab alone.

FEC is presently negotiating this $63 million, 5-year investment through a large Wall Street firm. We expect to complete negotiations. We expect to continue our rapid experimental progress. We expect to light a light bulb via fusion within 5 years. We expect to operate the first 100 MW fusion pilot plant in 1988 at 1¢–6¢/KWH, competitive with present prices. We expect to do all this. Our scientific consultants, some of the most eminent physicists and engineers of the country, see no reason we cannot do this. Our financial backers are taking the start-up risk that we can do this. But from the point of view of this committee, it does not matter whether we will do it; it matters that we might. And, if the day comes that we are ready to try electric power generation by advanced fuel migma fusion, let me give you an idea of what our capital needs will be and why this bill is important to us:

Our most recent cost estimates, May 1976, show that investments to produce 100 MW standard power plants will rise from ½ billion in Year 1 of production to a maximum of $9.7 billion in Year 6, averaging about $3 billion per year over the 10-year period required to make a profit on the 500–600 units produced per year. A total investment of $28 billion will be required to make migma fusion profitable. By that time, if the investors can wait, projected net return will be enormous: $4.5 billion per year in Year 7. Averaging over a 15-year period we project a yearly net profit of $1.9 billion or 20 percent on the maximum investment. A good return for any investor. There is no reason why the U.S. Government, if it participates in the risk through this loan guarantee plan, should not also participate in the return.

I, therefore, urge the committee to reconsider its exclusion of fusion from H.R. 12112. In company with the other environmentally desirable energy sources already mentioned in the bill, Fusion should be explicitly included.

This plan does not guarantee any project will be assisted; it merely sets up mechanisms by which certain projects might be assisted. We at Fusion Energy Corporation think we will have a first product, ready for commercialization in 1982. We think we will need this bill. I hope you will include us.

Mr. DINGELL. Thank you for your most helpful testimony. The committee thanks you.

The Chair recognizes Mr. Nordhaus for questions.

Mr. NORDHAUS. Are you of the opinion that financing of this type of project is included or excluded from the bill as it is presently drafted?

Ms. ROMANS. I would like to have the more hopeful view that fusion is included since the language is so very expansive and inclusive, and refers to desirable energy sources—and fusion certainly is a desirable energy source.

However, I have had a bad experience. I think that Mr. Dingell may remember, last year in the amendment offered to the ERDA authorization bill by Senator Jackson, providing for a $6 billion loan guarantee plan, mainly for synthetic fuels again, very similar language was offered. Fusion Energy Corp. went along supporting that bill, assuming that we were included.

Of course, when the crunch came, it turned out that just about every member we contacted interpreted us out. Therefore, I think that I would be irresponsible if I did not come to you today, and say: Unless that word "fusion" is in there. I just don't know how to interpret it.

Mr. NORDHAUS. The word "fusion" is in there. The clause B does refer to demonstration facilities to generate desirable forms of energy. I would assume that electricity would qualify, direct solar, wind, ocean, thermo radiant, or other renewable energy resources.

I assume that the resource that you use would be hydrogen, which is more or less renewable.

Ms. ROMANS. We can use a variety of fuels, all "more or less renewable." One of them would be deuterium, isotope of hydrogen. Another desirable model would burn helium 3, bred from hydrogen, from deuterium.

Mr. NORDHAUS. I have two very quick questions. One is, have you attempted to receive any financing from ERDA heretofore, or haven't you asked?

Ms. ROMANS. As Fusion Energy Corp., the private entity, we have never solicited public funds. We have at length tried to explore this, all the way to speaking to Dr. Seamans. ERDA's patent policy is what precludes our shareholders from giving us the go-ahead on that.

We were visited just 2 weeks ago by Mr. Kintner and Dr. Bennett Miller of ERDA, who had a chance to inspect our whole project, and our 5-year plan. They, at that time, asked us what was our funding situation. We said we continued to use private financing and reiterated: "We cannot ask you for funds at this time."

Now, if this committee were able to do something about the patent policies that ERDA works under, we would, of course, reconsider that, but we are pushing our R. & D. program purely under private financing. We assume that we will continue to do so.

Mr. NORDHAUS. The bill, as I understand it, incorporates the ERDA patent policy. It does not change the patent policy that is generally available to ERDA's projects.

Does the situation change too much, once you go to commercialization, so that ERDA's patent policy will not give you any problem; or would you need a change in ERDA's patent policy even if you got financing to go ahead to commercialization?

Ms. ROMANS. I believe that there is a distinction. Of course, clarification would be required from ERDA as to how the waiver provisions, background rights provisions, and licensing provisions would affect the commercial phase.

But I think that when we do have a prototype demonstration plant on line, ready to go, and the money is input explicitly for commercialization of that demonstration plant, or the refinement of that demonstration plant, we would no longer worry about the background right provisions.

Mr. NORDHAUS. One further question. There is no reason why the Government, if it participates in the risk, should not participate in the return. Would you explain what you mean by that for our benefit?

Ms. ROMANS. I would be happy to.

We enter into long, detailed negotiations with private investors who become partners in our corporation. I would not mind entering into

long, detailed negotiations with, let us say, ERDA, or another agency of the U.S. Government, as long as we knew that eventually we were all going to be partners in the thing on an equitable basis, according to the proportion of our investments.

I think that there is no reason in my mind why we could not enter into a joint venture with an agency of the Federal Government, being a copartner in venture, absorbing the losses and participating in whatever profit. There is nothing wrong with taking your share of the profit when the risks have been allocated from the beginning.

Mr. NORDHAUS. This is a loan guarantee program, which would not involve, except in the event of default, any capital contribution by the Federal Government, but only an extension of credit in the form of a guarantee.

Would that be sufficient basis for giving the Federal Government a profit share in the enterprise?

Ms. ROMANS. I think, again, that this would be in what we would consider the terms of a contract. For example, if it made it more attractive to the Government to guarantee a higher dollar number, items could be put into the contract, such as shares of one nature or another in the corporation.

This method, I think, has not been taken advantage of enough. I understand that there is a coal gasification project in which ERDA participates more or less as a partner. Now, that is a straight capital investment on ERDA's part, not a loan guarantee. For ERDA's investment, they have a certain share in the project.

Mr. NORDHAUS. Could you submit for the record, hopefully in the next couple of days, any suggestions you might have for how the Federal Government might attain a profit share; and how you would structure such a project, giving the Federal Government the profit share, when the Federal Government is only the guarantor.

Ms. ROMANS. I would be happy to do that.

Mr. NORDHAUS. If you know of this elsewhere in any Federal assistance program, we would like to know about it.

This is all I have.

Mr. DINGELL. Ladies and gentlemen, I would like to thank you all.

I wanted to mention, Ms. Romans, that I was particularly impressed with your comment about the Federal Government participating through some equity ownership in this as a result of its guarantee.

It has been a matter of some concern, how we can protect the public interest in this matter. I want you to know that I am particularly grateful for that comment.

Ms. ROMANS. This is an off-the-cuff comment, but I think that there seems to be a prevailing feeling that either the Federal Government funds a project, or the private capital market funds the project, and that the motives in those two types of investments must be radically different.

The private capital market wants a return on its investment, and the Government wants some more abstract thing, that is, the welfare of the people receiving the effects of the project.

I think that more attention should be given to a straight money return. The Energy Independence Authority, for instance, which would be a Government corporation, has some provision for this, in

that profits would return to liquidate some of the debt that was originally set up by the Treasury for the plan.

I think that this is a reasonable approach to take. I will accept Mr. Nordhaus' suggestion to submit some concrete examples of how we thing this might be done. I think that in general a public/private partnership can be a very fruitful thing. I see it as stimulating more private investment in the project. With seed money coming from public funds, we might be able to attract more private funds.

Mr. DINGELL. Are there any other panel members who would like to comment on this colloquy?

The British do it quite often, and it seems to work quite well for them.

Mr. PERCIVAL. I am not well informed on the performance of such combined activities, but I suppose that it is relevant to consider the position of British Gas and its sponsors in relation to the possible involvement with ERDA in connection with the high Btu demonstration plants.

There will be public and private concern. A public corporation of Britain will be involved with the Federal Government of the United States, and indeed there will be the involvement of the private sponsors who have continued the development of the technology to this point.

I am assuming, for example, that such a proposal can, indeed, go forward within the boundaries of the current ERDA patent and proprietary data guidelines, in which the whole of the shared enterprise will have to function.

In other words, we may be touching new ground here, but it does seem to have benefits, because not only does it bring the public and the private sector together, but can involve an international cooperative enterprise in this respect, and bring the subject of energy conversion into that field.

Mr. KEELING. I don't believe that joint partnership, or participation by the Federal Government applies so much to our company. However, it might well apply to some of our customers.

I know that one of our customers proposed to ERDA that if they built, or had us build a coal gasification plant, and if the resulting gas were more expensive than the equivalent value of imported oil, that the Government would subsidize the difference.

On the other hand, if the price of oil climbed to a point where domestic gas produced from domestic coal would be cheaper, ERDA would then participate in the savings. So it is roughly the same concept.

Mr. DINGELL. The committee does thank all of you for your time and your patience. We will pay careful consideration to the comments that you have made.

Our next witnesses are a panel on environmental and consumer matters consisting of Mr. John McCormick, Washington representative of the Environmental Policy Center; Ms. Carolyn Ruth Johnson, Colorado Open Space Council; Mr. Thomas B. Neville, director of the Stanford Western Energy Policy Center; Mr. Milton R. Beychok, 17709 Oak Tree Lane, Irvine, Calif.; and Mr. Garry DeLoss, staff attorney, Public Interest Research Group, Washington, D.C.

If the panel would please come forward, and take a seat at the table. The Chair would like to inquire if the members of the panel have a plane to catch, or if any of you are under any time constraint?

STATEMENTS OF A PANEL CONSISTING OF THOMAS B. NEVILLE, DIRECTOR, STANFORD WESTERN ENERGY POLICY CENTER; MILTON R. BEYCHOK, CONSULTING ENGINEER, IRVINE, CALIF.; JOHN L. McCORMICK, WASHINGTON REPRESENTATIVE, ENVIRONMENTAL POLICY CENTER, WASHINGTON, D.C.; CAROLYN RUTH JOHNSON, CHAIRMAN, MINING WORKSHOP, COLORADO OPEN SPACE COUNCIL; AND GARY DeLOSS, ATTORNEY, PUBLIC INTEREST RESEARCH GROUP

Mr. NEVILLE. I have to take the plane back to Stanford, and I will have to leave here by 6 o'clock.

Mr. DINGELL. I hope that we will all be out of here by 6 o'clock.

Mr. Neville, I suspect that in light of the time constraint that you are under, we should recognize you first.

STATEMENT OF THOMAS B. NEVILLE

Mr. NEVILLE. Mr. Chairman and members of the committee, I am deeply troubled by the tremendous misallocation of resources that is a result of wrong price signals in the energy market. I would prefer to see the system changed so that energy prices reflect the economic and environmental costs of new supplies. However, if changes are not made soon, and if gas transmission and distribution companies cannot finance gasification plants, then a loan guarantee program may have merit.

The desirability of gasification plants depends on the alternatives to which they are compared. The selection of appropriate alternatives in turn depends on the way the energy market operates. High Btu coal gasification plants appear favorable considering the way the market operates today, but may be less desirable when we compare them with alternatives that are not economic to consumers or producers at current prices.

Today, the energy market is operating very badly because it has separated the suppliers and consumers of energy and because institutional arrangements created by Government prevent the appropriate price signals necessary to inform consumers that new energy is very expensive. Consequently, the Nation's resources are not being used wisely. For example, some consumers are choosing natural gas heating rather than home insulation because the price of gas is so low; others cannot get gas and are choosing electricity because it is clean and convenient.

At the same time, electric utilities on the west coast are trying to site coal-fired plants in the Mountain States in part to move the pollution away from the load centers. If no major changes are made in the system and the situation does not improve dramatically, then one of the choices consumers will make is between gas and electricity.

During the next decade this choice may boil down to coal gasification plants if other supplies are not forthcoming or coal-fired electric

generating plants. If this is the choice, then gasification plants appear more desirable because on a delivered energy basis they are cleaner in terms of conventional pollutants, and cheaper.

If the energy market worked perfectly, it would be appropriate to carry out an analysis based on all the costs including damage to the environment. In this case, the alternatives to gasification plants include increased production of natural gas at market prices, solar water and space heating, and measures to increase energy efficiency such as more insulation.

Clearly, solar heating pollutes less than a gasification plant and, therefore, if the economic costs are about equal, then solar heating may be a better use of our resources. The problem is that some consumers are paying too low a price and others are forced to choose electricity over gas. An analysis based on the full cost of alternatives may produce a misleading conclusion for a single decision in a very imperfect world. If the problems of the energy market are not improved and consumers are making the gas-electricity choice, then Government decisions based on a solar versus gasification analysis, for example, may hurt the situation.

There are a number of arguments made for the loan guarantee program proposed in H.R. 12112. Valuable knowledge about commercial operation will be obtained, import dependence will be decreased and gas transmission and distribution companies will find it possible to raise the enormous amounts of capital needed to finance the plants. I find the latter argument most convincing, but these are issues the committee must weigh. I will focus on the economic and environmental aspects of some of the alternatives.

Conventional emissions from coal gasification plants are less than one-eighth of those from a coal-fired electric plant with a scrubber delivering the same amount of energy. In addition, gasification plants use only one-fifth as much water and produce one-fourth as much solid waste. I have attached to my statement two summaries on environmental impact.

Gasification plants produce some toxic and carcinogenic compounds which I understand are similar to those handled in the refining business and, though dangerous, are manageable. On an environmental basis, coal gasification plants appear to be much less offensive than coal-fired electric plants. Yet, gasification plants do pollute and solar space and water heating and increased efficiency measures like insulation do not. Despite their importance, knowledge of environment impacts alone is not enough to make a decision—all costs must be balanced.

Gasification plants cost less than coal-fired electric plants on an energy equivalent basis. Plants burning Northern Great Plains coal at the mine mouth can generate electricity for about 3 cents per kilowatt-hour, or approximately $9 per million Btu. Estimates for gas from a gasification plant range from $2.61 to $5 per million Btu or more depending in part on the amount of debt and the return on equity. If the choice is between coal gasification plants and coal generating plants, gasification plants appear to be more favorable. They are about eight times cleaner and two or three times cheaper.

The comparison between gasification plants and increased efficiency and solar is less clear cut. We know that consumers would use less gas

if they were faced with the price of gas from a gasification plant, how much less is unclear. Estimates of the cost of solar water heating have been made by several California utilities, and they suggest that the break-even price of gas is about $5 delivered to homes, or about $4.30 at a mine-mouth gasification plant.

Solar water heating is more expensive than the low cost estimates for a gasification plant, however, if gasification plants experience cost overruns, or if expensive financing is required, then solar looks competitive on an economic basis alone. If you add in the environmental impacts, solar water heating may look desirable on a total cost basis.

When you think about these questions, it is important to ask how the system will work in practice. It would be difficult to design a system which works so strongly against insulation or solar heating as our present one. Water heating and space heating are major components of a residential demand. Yet solar cannot compete in this market because low-priced natural gas is allocated to high priority residential consumers. In addition, California utilities are continuing to hook up new customers.

In contract, threatened cutoffs of Canadian gas have induced new residential customers in the Pacific Northwest to install electrical heating. The price of electricity in the Northwest is low compared to the cost of electricity from new plants because of the large amount of hydroelectric power. Consequently, the price consumers pay does not reflect the cost of electricity from the new plants because all the costs are averaged together. As a result, about 90 percent of new homes in representative Northwest service areas are electrically heated, and this is compared to only 32 percent of existing homes in the Northwest that are electrically heated today. A major shift in the demand for electricity is just beginning.

The demand for electric power raises serious questions of regional equity. In 1974, 29 percent of the electric energy for the 11 Western States was generated in 8 Mountain States. As of 2 years ago, utility plans for the following decade placed about 58 percent, or double that amount, of the new generation in the eight Mountain States. Almost all of these proposed plants were to be minemouth coal plants.

In the last 2 years, many of the States and environmentalists have resisted this trend, and I might say, successfully. It is reasonable to expect the same resistance to gasification plants.

These trends toward extensive coal development in the Mountain States are disturbing because they are driven by wrong price signals in a very imperfect energy market. Major improvements in the use of our Nation's resources can be made by sending out better price signals.

I recognize that there are serious equity problems with many of the needed steps, such as natural gas deregulation or taxation of energy and that many of these changes may not be politically possible in the near future.

Nevertheless, I believe it is important to try to make the changes. However, if changes are not made, and if gas transmission and distribution companies cannot finance gasification plants, then a loan guarantee program may have merit in the next few years.

Thank you.

[The attachments to Mr. Neville's statement follow:]

Summary of environmental impact—SNG from western coal

[Basis: Production of 10^{12} Btu/day of SNG]

Air (pounds per hour):	
Particulates	727
SO_2	1,800
NO_x	7,110
CO	377
HC	115
NH_3	34.7
Water (pounds per hour):	
Suspended solids	0
Dissolved solids	0
Organic material	0
Thermal (British thermal units per hour)	(1)
Solid wastes (tons per day)	5,560
Land use (acres)	(2)
Water requirements (gallons per day)	25×10^6
Occupational health (per year):	
Deaths	1.8
Injuries	61
Man-days lost	16,000
Efficiency (percent)	
Primary product efficiency	68.2
Total products efficiency	68.2
Overall efficiency	68.2

[1] Negligible.
[2] See sec. 3.6.

Source: Radian Corporation, "A Western Regional Energy Development Study: Primary Environmental Impacts," Prepared for the Council on Environmental Quality and the Federal Energy Administration, EQ4AC037, August 1975.

Summary of environmental impacts—powerplant with limestone scrubber

[Fuel western coal; location, west. Module basis: Production of 10^{12} Btu/day equivalent of electrical energy]

Air (pounds per hour):	
Particulates	6,490
SO_2	13,100
NO_x	89,500
CO	4,970
HC	1,510
Water (pounds per hour):	
Suspended solids	0
Dissolved solids	0
Organic material	0
Thermal (British thermal units per hour)	(1)
Solid wastes (tons per day)	20,600
Land use (acres)	15,900
Water requirements (gallons per day)	131×10^6
Occupational health (per year):	
Deaths	0.35
Injuries	14.6
Man-days lost	5,500
Efficiency (percent)	35
Ancillary energy (British thermal units per day)	0

[1] Negligible.

Source: Radian Corporation, "A Western Regional Energy Development Study: Primary Environmental Impacts," Prepared for the Council on Environmental Quality and the Federal Energy Administration, EQ4AC037, August 1975.

Mr. DINGELL. Thank you very much, Mr. Neville.

The Chair will now recognize Mr. Beychok.

STATEMENT OF MILTON R. BEYCHOK

Mr. BEYCHOK. As we all know, the world faces a very serious shortage of petroleum crude oil, and I am sure that you have heard that a number of times during your meetings. The Middle Eastern countries have compounded that oil shortage for the industrialized nations of the world by tripling the price of crude oil in the last 2 or 3 years. In the United States, the shortage of domestic crude oil, and the high price of the imported crude oil is compounded by an equally serious dwindling of natural gas supplies.

As a result of this, the U.S. energy supply industry has undertaken a wide range of programs to develop clean burning gas and liquid fuels by the gasification of coal.

Now, why coal? Because the United States has vast reserves of readily available energy in the form of coal. Our total, proven recoverable coal reserves contain over 30 times as many Btu's as all of Saudi Arabia's oil reserves, and the coal reserves which are recoverable with today's mining techniques contain 4 times as much energy as all of Saudi Arabia.

I would ask the chairman to look at my exhibit 1, to see how those coal reserves compare not only with all of the oil in Saudi Arabia, but with all of the oil in Kuwait, and all the oil in Africa, and all of the oil in North and South combined.

Our coal reserves can make us independent from the imported energy, yet we continue to spend $20 billion a year on importing oil from the Middle East, and other nations.

At this time, there are at least six full-scale coal gasification commercial projects under serious design and study in the United States. They include two in New Mexico, one by Wesco and one by El Paso Natural Gas; two in North Dakota; and two in Wyoming.

All of these plan to use the Lurgi coal gasification technology, and all of them looked at all of the other available technologies seriously first.

Most of them plan to construct plants and modules producing 250 million standard cubic feet a day of pipeline quality gas. Four of those projects have already filed applications with the Federal Power Commission for approval of their product gas pricing structure.

The Wesco project is the only one that has thus far obtained complete and favorable FPC approval, and also has operating and construction permit approvals from the New Mexico Improvement Agency, and the New Mexico Surface Mine Commission, and the Department of the Interior has completed and filed a final environmental impact statement with the Council on Environmental Quality.

The plant is designed, and major equipment specifications are ready to purchase. The Wesco project is the most advanced of all the projects listed earlier. Having been a consulting engineer associated with the Wesco project for almost 5 years, most of my further comments will be based upon that advance design.

As an engineer who has spent a lifetime, 20 years, not in reading about, but designing and operating refineries, petrochemical plants, gas treatment plants all over the world, it is my opinion that the Wesco environmental controls represent the utilization of the very latest and very best available technology.

In terms of 1976 dollars, one Wesco plant is going to cost $1.1 billion of which $163 million will be earmarked solely for environmental controls.

Perhaps the most important of the potential emissions from the coal gasification is that of sulfur compounds. Coal gasification is the chemical conversion of coal carbon to methane, which is the prime constituent of natural gas. Most of the sulfur is chemically converted to gaseous hydrogen sulfide during the process.

That is very much different, very much different from the burning of coal which produces gaseous sulfur dioxide. Why is it different? Because we can readily achieve 99-percent control of hydrogen sulfide, whereas 90 percent is probably the best sulfur dioxide control that we can expect.

Exhibit No. 2 is a schematic diagram of a sulfur emission control in the Wesco design. As shown, the Wesco gasification plant is designed for 99.3-percent control of sulfur emissions. This will be done through a combination of hydrogen sulfide removal, and conversion to by-products, soluble sulfur, and the incineration of any residual sulfur compound to sulfur dioxide followed by stack-gas scrubbing to remove that sulfur dioxide.

Since the gasification process itself requires steam, an auxiliary boiler plant is required, and that boiler plant will burn coal to generate steam. It will be equipped with electrostatic precipitator for the removal of fly ash as well as 90-percent control of the sulfur dioxide.

I agree with the gentleman who spoke a while ago that electric power and combustion fuel comprise the major end-use demands for energy in our Nation. Coal can supply either of those demands.

It may be burned to produce electric power, or it may be gasified to supply fuel. Since these are alternative uses of the same resource, it can make us independent of imported oil.

It is valid to compare the environmental aspects of burning coal in powerplants with the gasification of coal. Exhibit No. 3, and again I would ask the chairman to look at exhibit No. 3, very clearly demonstrates what words cannot demonstrate.

A powerplant of the equivalent size of the Wesco gasification plant, and that would be 4,000 megawatts, with no stack-gas scrubber would emit 100 times the sulfur dioxide that a gasification plant will. Unfortunately, most of the powerplants in the country are in that situation, they have no stack-gas scrubber control. If that equivalent powerplant met the Federal EPA's new source performance standard limits, it would still emit some 50 times as much as the gasification plant.

Finally, if that powerplant were, in fact, controlled with stack-gas scrubbers, which very few companies are willing to admit the viability of yet, it would still put out 10 times the sulfur dioxide emissions that the Wesco coal gasification plant will.

This fact is inherent in the fact that gasification converts sulfur to gaseous hydrogen sulfide which can be removed and controlled at 99-plus percent, whereas the burning of coal produces sulfur dioxide which can only be controlled to 90 percent at best.

New Mexico is the only State which has yet promulgated point source emission limits specifically for coal gasification plants, and their limits are quite stringent. The Federal EPA standards for coal gasifica-

tion plants have been in development for 2 or 3 years, and are not expected to be promulgated until 1977.

Exhibit No. 4 demonstrates that the Wesco design will comply with the New Mexico limits for SO_2 emissions from gasification, and there is something like one-thirtieth of the EPA standards for the burning of coal.

Exhibit No. 4 also demonstrates that the Wesco coal fire boilers will comply with the New Mexico limits for burning coal, which in themselves are four times more stringent than the Federal EPA limits.

While they are not included in exhibit No. 4 for purposes of simplicity, the Wesco design also complies with the New Mexico limits on nitrogen oxide and particulates, which, again are more stringent than the Federal EPA limits.

What about our impact on ambient air quality? The environmental impact statement for the Wesco project, written by the Department of the Interior, included a comprehensive air dispersion study of the entire Four Corners area, based upon the industrial projects which could, or might be present in 1986. They considered four coal gasification by Wesco, three by El Paso, four units of the San Juan powerplant, and five units for the Four Corners powerplant, all have a cumulative impact.

Exhibit No. 5 summarizes the results of that study, which was performed by independent consultants under subcontract to the Department of the Interior.

I think that the results, if you will look at Exhibit No. 5, are quite obvious. The study concluded that no compliance problems with the New Mexico ambient air quality standards would result.

As you will see on Exhibit No. 5, the results of that air dispersion model predicted ambient air levels 50 percent or more below the New Mexico standards, many of which are more stringent than the EPA ambient air standards.

It is also worth noting, and again I quote from the EIS, that the results were based on the worst possible case and the meteorological situation which produced the maximum impact can be expected only about 1 day per decade.

So the results were 50-percent below the New Mexico standards, which themselves are below the EPA standards, and this might occur 1 day per decade.

Let us talk about resource utilization efficiency. Exhibit No. 6 shows that coal gasification converts about 66 percent of the thermo energy in the coal into product energy in the form of pipeline gas and byproduct liquid fuels.

As I sat here today, I heard a number of questions about thermo efficiency, and I only heard one correct answer by the gentleman from British Gas who said that you cannot answer that that simply. I will ask you all to look at this, so that we can understand.

If I look at this upper portion, and if I look at the coal input in the pipeline gas, the efficiency of the Lurgi plant can be 85 percent, including the byproduct liquid fuels. If I leave the byproduct liquid fuels out, and only look at the gas in the coal——

But if I look at what must be looked at to complete inputs, the coal, the electric power for the gasification plant as well as the coal and liquid fuel for the boilers, and I look at the complete outputs, and

not only the gas, but the liquid products and the fuel oil that the plant purchases, the overall efficiency will be about 66 percent.

This excludes producing oil and oxygen, and not purchasing oxygen from somewhere else, which is another way of confusing the thermo picture by some people.

If we look at the equivalent 4,000 megawatt plant again, on the same input-output basis, the best of powerplants today, and fuel burning plants, are about 35 percent efficient. So the coal gasification, on an overall basis, versus the powerplant, is twice as efficient.

As a consequence of the comparative low thermo energy efficiency for a coal burning powerplant, it consumes more coal to produce the same amount of energy. Since the coal fired powerplant rejects 50 percent of this input energy to its cooling water system, it consumes more water than a coal gasification plant.

In fact, as shown on exhibit No. 7, the equivalent coal burning power plant uses twice as much coal and eight times as much water to produce the same amount of energy as a coal gasification plant.

Many other environmental control features of the Wesco project, not the least of which is that there will be no discharge of waste water into any surface water body. No discharge of waste water. All waste water will be thoroughly renovated and reused within the plant and the mining operations, and dry air cooling, rather than conventional water cooling is used to minimize the consumption of water.

As far as other environmental aspects of the Wesco project, such as mining area, reclamation and revegetation, solid waste disposal, noise control, and so forth, I would be pleased to answer your questions.

Thank you for the opportunity to make this presentation.

[Mr. Beychok's prepared statement follows:]

STATEMENT OF MILTON R. BEYCHOK, CONSULTING ENGINEER, IRVINE, CALIF.

THE ENVIRONMENTAL ASPECTS OF COAL GASIFICATION

As we all know, the world faces a very serious shortage of petroleum crude oil. And the Middle Eastern countries have compounded the oil shortage for the industrialized nations of the world by tripling the price of crude oil in the last four years. In the United States, the shortage of domestic crude oil and the high price of imported oil is further compounded by an equally serious dwindling of natural gas supplies.

As a result of this situation, the U.S. energy supply industry has undertaken a wide range of programs to develop clean-burning gas and liquid fuels by the gasification of coal. Why coal? Because the United States has vast reserves of readily available energy in the form of coal. Our total proven recoverable coal reserves contain over 30 times as much energy as all of Saudi Arabia's oil reserves. And the coal reserves which are recoverable with today's mining techniques contain 4 times as much energy as all of Saudi Arabia's oil (see Exhibit 1)[1]. Or coal reserves can make us independent of imported energy for at least a hundred years * * * and can save us the 20 billion dollars a year we spend on imported oil.

At this time, there are at least six full-scale commercial coal gasification projects under serious design or study in the U.S. They include:

Owner	*Location*
WESCO (Western Gasification Co.)	New Mexico.
EPNG (El Paso Natural Gas)	
American Natural Gas	North Dakota.
Natural Gas Pipeline Co	Do.
Panhandle Eastern Pipeline Co	Wyoming.
Cities Service Co	Do.

All of these plan to use Lurgi coal gasification technology and most of them plan to construct plants in modules producing 250 million standard cubic feet per day (250 MM SCFD) of pipeline quality gas. Four of the projects have filed applications with the Federal Power Commission for approval of their product gas pricing. I have been associated as a consulting environmental engineer with the WESCO project for over three years, and hence most of my comments herein are based upon the WESCO environmental controls. However, I have also provided some consulting services to two of the other projects listed above. To complete this brief background on the status of Lurgi gasification projects, WESCO has obtained a favorable FPC approval and also has operating permit approvals from the New Mexico Environmental Improvement Agency and the New Mexico Surface Mine Commission. The Department of Interior has completed and filed a final Environment Impact Statement [2] with the Council on Environmental Quality. The plant is designed and major equipment specifications are ready for purchase. By all standards, the WESCO project is the most advanced of all the projects listed above.

As an engineer who has spent over 20 years in the design of petroleum refineries, petrochemical plants and gas treating plants in all parts of the world, it is my opinion that the WESCO environmental controls represent the utilization of the very latest and very best available technology. In 1976 dollars, one WESCO plant will cost about 1.1 billion dollars of which 163 million dollars is solely for environmental controls.

Control of air emissions

Perhaps the most important of the potential emissions from coal gasification is that of sulfur compounds. Since coal gasification is a chemical conversion of coal carbon to methane (the prime constituent of natural gas), most of the sulfur in the coal is chemically converted to gaseous hydrogen sulfide during the process. This is very much different than the burning of coal which produces gaseous sulfur dioxide. Why? Because we can readily achieve 99 percent control of hydrogen sulfide, whereas 90 percent is probably the best sulfur dioxide control we can expect.

Exhibit 2 is a schematic diagram of sulfur emission controls in the WESCO design. As shown, the WESCO vasification plant is designed for 99.3 percent control of sulfur emissions by a combination of—

Hydrogen sulfide removal and conversion to byproduct saleable sulfur; and

Incineration of the residual gaseous sulfur compounds to sulfur dioxide, followed by stack gas scrubbing to remove sulfur dioxide.

Since the gasification process requires steam, a utility boiler plant and steam superheater are required. The boiler plant will burn coal to generate steam, and will be equipped with an electrostatic precipitator for removal of fly ash as well as a stack gas scrubber for 90 percent removal of sulfur dioxide.

Electric power and combustion fuel comprise the major end use demand for energy in our nation. Coal may be burned to produce electric power or it may be gasified to supply fuel. Since these are alternative uses of the same resource, it is valid to compare the environmental aspects of burning coal in power plants with the gasification of coal. Exhibit 3 very clearly demonstrates that the SO_2 emission controls in the WESCO gasification plant are 10–100 times better than in an equivalent 4,000 megawatt coal-burning power plant. Very few power plants today are yet equipped with stack gas scrubbers. But even if they were and the scrubbers achieved 90 percent control, the WESCO SO_2 emission controls would be ten times better. This fact is inherent in the fact that gasification converts sulfur to gaseous hydrogen sulfide which can be removed and controlled to 99 percent * * * whereas the burning of coal produces SO_2 which can only be controlled ot 90 percent at best.

New Mexico is the only State which has yet promulgated point source emission limits specifically for coal gasification plants... and their limits are very stringent. (The Federal EPA's standards for coal gasification are not expected to be promulgated until 1977.) Exhibit 4 demonstrates that the WESCO design will comply with the New Mexico limits for SO_2 emissions from gasification. Exhibit 4 also demonstrates that the WESCO coal-fired boilers will comply with the New Mexico limits, which are almost four times as stringent as the Federal EPA's limits.

Although not included in Exhibit 4, the WESCO design also complies with New Mexico's limits on nitrogen oxides and particulates, which are again more stringent than the Federal EPA's limits.

Impact on ambient air quality

The Environmental Impact Statement (EIS) for the WESCO project, written by the Department of Interior, includes a comprehensive air dispersion study of the entire Four Corners Area based upon the industrial projects which could be present in 1986: Four WESCO coal gasification plants; Three EPNG coal gasification plants; Four units of San Juan power plant; and Five units of Four Corners power plant.

Exhibit 5 summarizes the results of the study which was performed by independent consultants under sub-contract to the Department of Interior. The study concluded, and I quote from the EIS, that "no compliance problems with the New Mexico (ambient air quality) standards would result". As you will note on Exhibit 5, the results are 50 percent or more below the New Mexico standards, many of which are more stringent than the Federal EPA standards.

It is also worth noting that these results were based on a 'worst possible case' approach and the EIS states that "the meteorological situation which produced the maximum cumulative impact can be expected only about one day per decade".

Resource utilization efficiency

Exhibit 6 shows that coal gasification converts about 66 percent of the thermal energy in the coal into product energy in the form of pipeline gas and byproduct liquid fuels[3].

By contrast, as also shown in Exhibit 6, an equivalent coal-burning power plant converts only 35 percent of the coal energy into product energy.

As a consequence of the comparatively low thermal energy efficiency of a coal-burning power plant, it consumes more coal to produce the same amount of energy as does a coal gasification plant. And since a coal-burning power plant rejects 50 percent of the input energy[4] to its cooling water system, it consumes more water than does a coal gasification plant. In fact, an equivalent coal-burning power plant uses twice as much coal and five times as much water to produce the same amount of energy as a coal gasification plant (see Exhibit 7).

Other environmental aspects

There are many other environmental control features of the WESCO project ... not the least of which is that there will be no discharge of wastewater to any surface waterbody. All wastewater will be thoroughly renovated and reused within the plant and mining operations[3]. And dry air-cooling will be utilized to a maximum extent (rather than conventional water-cooling) so as to minimize the usage of water.

As for other environmental aspects of the WESCO project such as mining area reclamation and revegetation, solid waste disposal, noise controls, etc., I would be pleased to answer your questions.

Thank you for the opportunity to make this presentation before your subcommittee.

MILTON R. BEYCHOK.

REFERENCES

1. "Review of World Energy Supplies", H.R. Linden (IGT), 12th World Gas Conference, France, June 1973. "Coal Resources of the United States", P. Averitt, USGS Bulletin 1275. "Worldwide Report", Oil and Gas Journal, Dec. 29, 1975. "Forecast-Review", Oil and Gas Journal, Jan. 26, 1976.
2. "WESCO COAL GASIFICATION PROJECT, New Mexico, FINAL ENVIRONMENTAL STATEMENT, Volumes I and II", Bureau of Reclamation, U.S. Dept. of Interior, January 1976.
3. "Process and Environmental Technology for Producing SNG and Liquid Fuels", M.R. Beychok, U.S. EPA Report 660/2-75-011, May 1975.
4. "Steam-Electric Plan Air and Water Quality Control Data", Federal Power Commission Report S-239, June 1974.

MILTON R. BEYCHOK

B.S. in Chemical Engineering, Texas A & M, 1946.

20 years industrial process design experience with Fluor Engineers & Constructors.

Licensed professional engineer in California and Texas.

Member of: American Institute of Chemical Engineers, Water Pollution Control Federation, Air Pollution Control Association, American Academy of Environmental Engineers.

Government appointments: Federal EPA, Research Grant Reviewer, 1972, California Regional Water Quality Board, 1973.

Government clients: Federal EPA, National Commission on Water Quality, National Science Foundation, Federal Energy Administration, State of New Mexico.

EXHIBIT 1

U. S. Coal can help us become energy independent

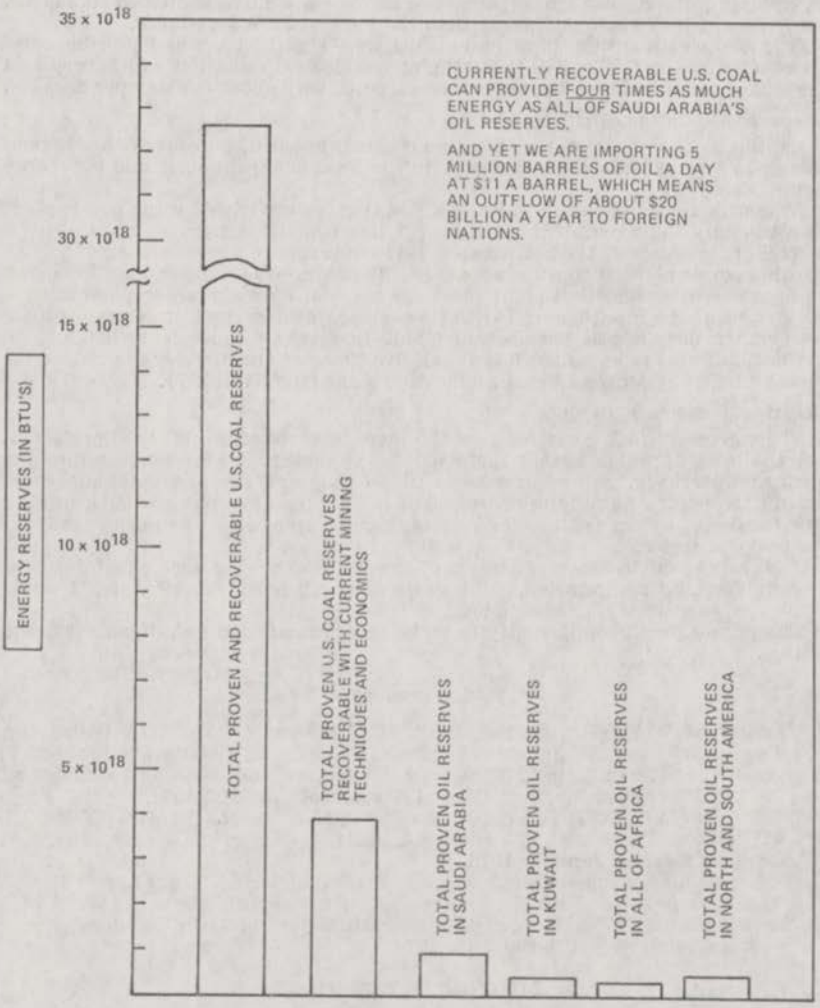


EXHIBIT 2

Coal Gasification Plant designed for 99.3% sulfur control

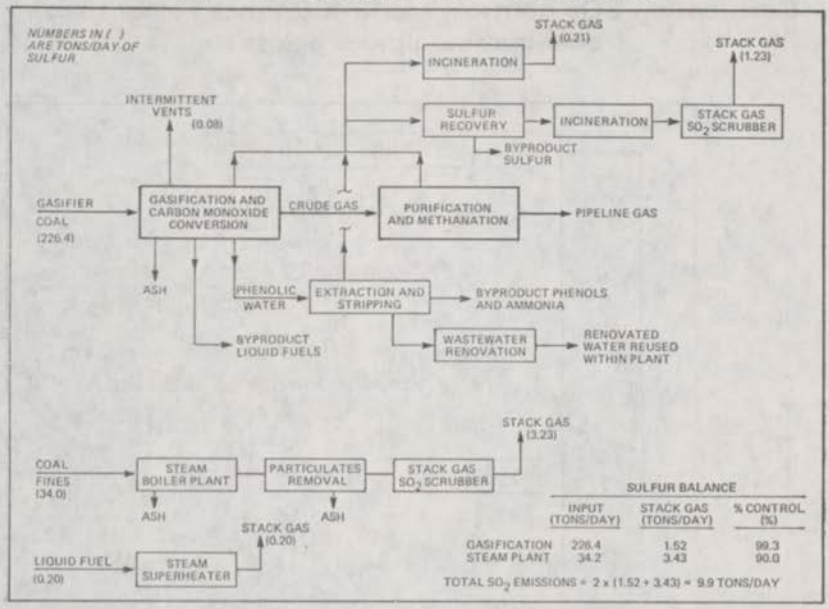


EXHIBIT 3

Gasification SO_2 controls are 10-100 times better than coal-burning power plants

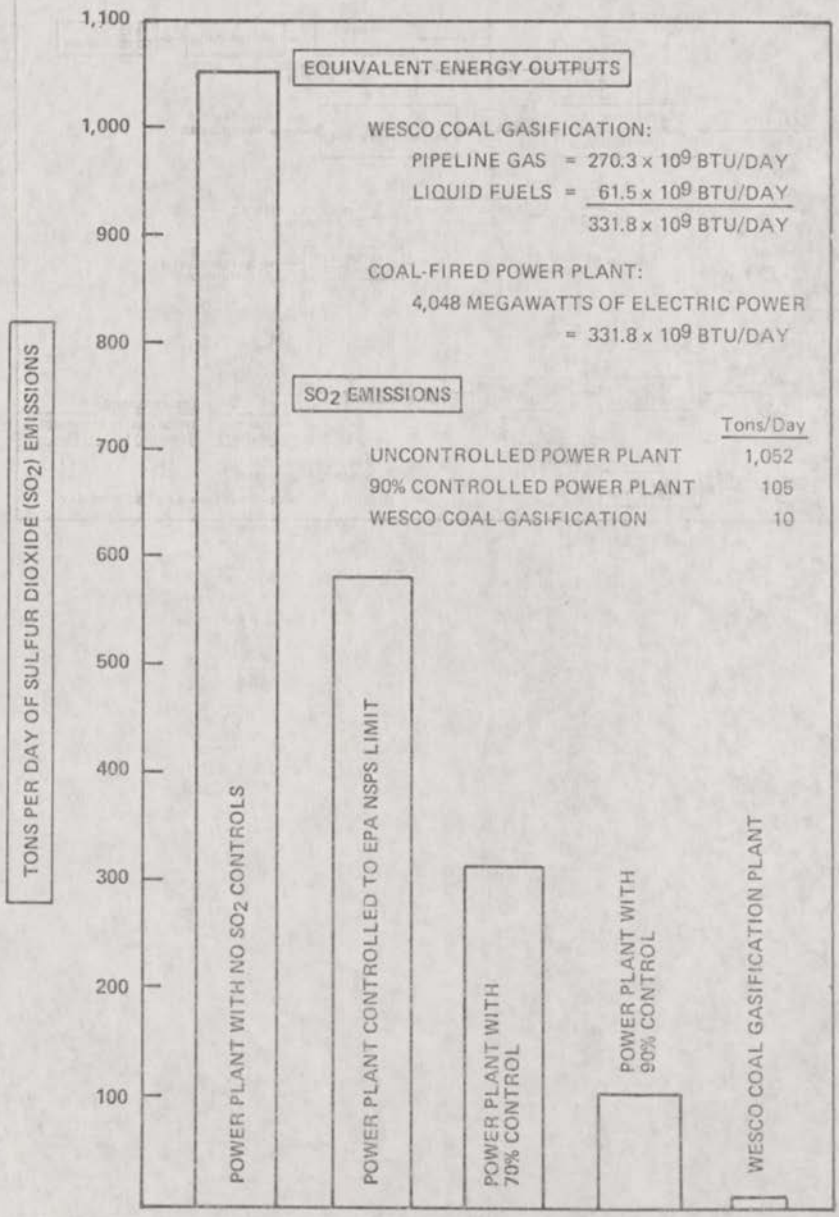


EXHIBIT 4

Wesco Coal Gasification SO_2 emissions will comply with stringent New Mexico regulations

	POINT SOURCE EMISSION LIMITS (POUNDS OF SO_2 PER MILLION BTU'S OF COAL)		
	FEDERAL EPA NSPS LIMIT	NEW MEXICO LIMIT	WESCO'S DESIGN
GASIFICATION	*	0.016	0.015
COAL-FIRED BOILER PLANT	1.20	0.34	0.17
OIL-FIRED STEAM SUPER-HEATER PLANT	0.80	0.34	0.10

* FEDERAL EPA NEW SOURCE PERFORMANCE STANDARD FOR COAL GASIFICATION IS CURRENTLY UNDER DEVELOPMENT. MAY BE PROMULGATED IN 1977.

EXHIBIT 5

Dept. of Interior's Environmental Impact Statement concludes gasification plants will not violate Air Quality Standards in New Mexico

MAXIMUM ANNUAL LIMIT, ug/m^3:	SO_2	NO_x	Partic.
NEW MEXICO STANDARDS	42	77	60
FEDERAL STANDARDS	80	100	60
DISPERSION MODELING:			
WESCO (4 PLANTS)	2-3	4-6	1
EPNG (3 PLANTS)	3-5	3-6	1
POWER PLANTS (9 UNITS)	13-20	21-44	2-3
MAXIMUM 24 - HOUR LIMIT, ug/m^3:			
NEW MEXICO STANDARDS	212	153	150
FEDERAL STANDARDS	365	(NONE)	150
DISPERSION MODELING:			
CUMULATIVE (7 GASIFICATION PLANTS AND 9 POWER PLANT UNITS)	16-39*	3-6*	32-76*
MAXIMUM 3 - HOUR LIMIT, ug/m^3:			
NEW MEXICO STANDARDS	(NONE)	(NONE)	(NONE)
FEDERAL STANDARDS	1300	(NONE)	(NONE)
DISPERSION MODELING:			
CUMULATIVE (7 GASIFICATION PLANTS AND 9 POWER PLANT UNITS)	53-23*	N.A.	N.A.

* BASED ON "WORST CASE" WEATHER CONDITIONS EXPECTED TO OCCUR ONLY 1 DAY PER DECADE, AND RESULTING FROM LINE-UP OF POWER PLANT PLUMES

EXHIBIT 6

Coal Gasification is twice as efficient as Coal-Fired Power Plant

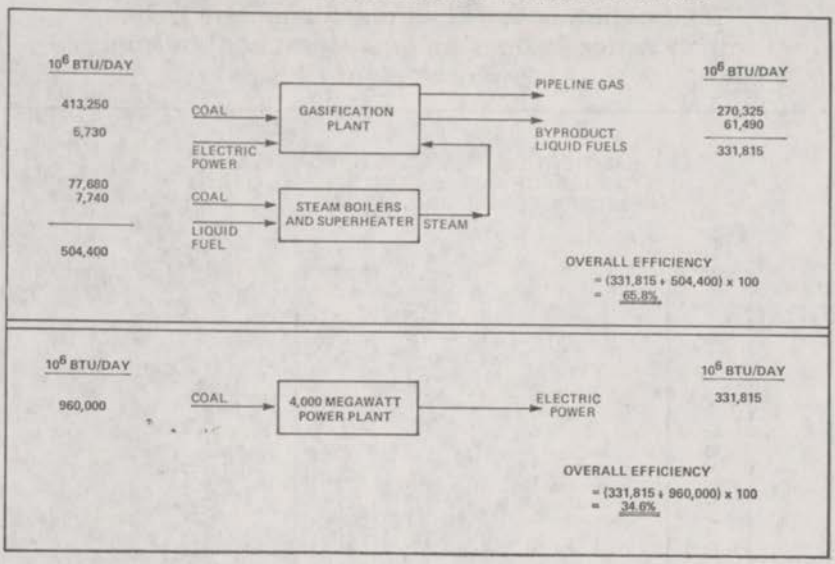
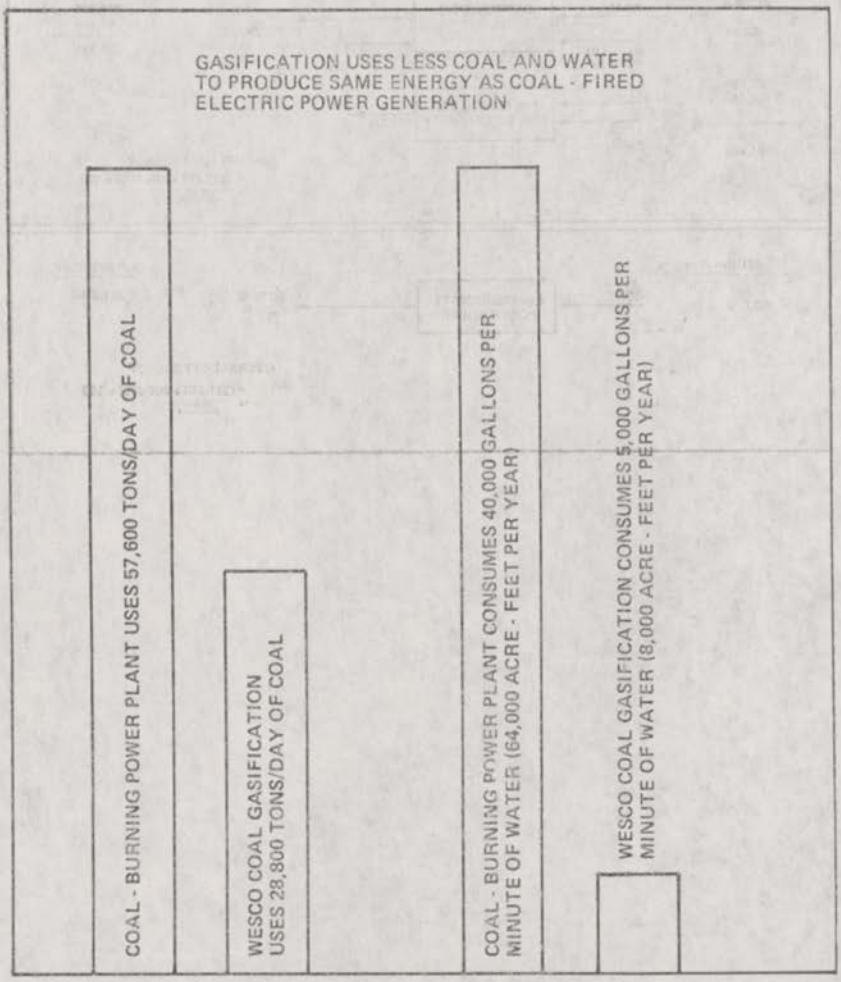


EXHIBIT 7

Gasification uses 1/2 as much coal and 1/5 as much water as does an equivalent coal-burning power plant



Mr. DINGELL. Thank you very much, Mr. Beychok.
The Chair now recognizes Mr. McCormick.

STATEMENT OF JOHN L. McCORMICK

Mr. MCCORMICK. Thank you, Mr. Chairman and members of the committee.

I want to thank you for providing me this opportunity to come before you to discuss this legislation. While H.R. 12112 has come to this committee under a sequential referral motion, it should have been

jointly referred when it was introduced in the Science and Technology Committee, because it most certainly is legislation designed to encourage commercial synthetic fuel ventures using Federal subsidies.

The Science and Technology Committee, under the chairmanship of Representative Olin E. Teague, did a creditable job insofar as providing sufficient time for debate and markup, but its concerns fell short of some of the most important issues related to the bill.

It is my hope that this committee and the House Banking, Currency, and Housing Committee will have the time to now focus on those more fundamental problems of the bill.

Before I begin stating my objections to H.R. 12112, I want to make it clear to this committee that the Environmental Policy Center and many other environmental groups are a strong supporter of coal utilization either by direct combustion or conversion to a synthetic liquid or gaseous fuel.

We realize the great abundance of coal this Nation has, enough to satisfy our needs for centuries. However, we also recognize the serious environmental, social, and worker health and safety problems associated with coal mining, processing, transportation, and utilization. As this Nation increases its reliance upon coal, it will not be done as it was done in the past.

Legislation such as the Federal Strip Mine Reclamation bill and amendments to the Clean Air Act, in particular, the significant deterioration provisions of the act, must be adopted and rigidly enforced. The Coal Mine Health and Safety Act is unworkable and ineffective and must be totally revamped if we are to mine coal without the sickening cost of human tragedy and suffering.

More money must be spent on research and development of safer and more efficient means of mining the coal and, finally, the Federal Government must reorientate its R. & D. priorities and begin channeling the billions of dollars being spent on the Liquid Metal Fast Breeder Reactor Program into solar, conservation, renewable resource, and coal utilization research.

Unless these essential tasks are accomplished first, we are going to be faced with a crisis because we will be forced to convert from an oil and gas energy economy to a coal economy before the turn of the century, and will not have learned how to use that coal safely and efficiently.

The very fact that this legislation is being rushed through the Congress in a few short months, while the Federal coal leasing bill and the coal strip mining bill are still being debated 5 years after their introduction, is evidence that this Congress still does not have an appreciation of an orderly coal development program.

I maintain that, in the absence of a sound coal use policy, we will never have a coal gasification or coal liquefaction industry in this Nation, because those regions of the country, wherein the coal is found, will fight you every step of the way. It is not that they would harbor those resources, they just want assurances that the Federal Government will require development in a manner that offers protection and not colonization.

There are some misconceptions as to the origin of this legislation. Some believe it surfaced from the massive study the President requested when he announced a plan to bring on-line 1 million barrels of synthetic fuels by 1985.

Actually, the guaranteed loan bill was introduced by Senator Jennings Randolph on July 8, 1975, and it was limited exclusively to the advancement of coal utilization. It was during the Senate Interior Committee markup of the ERDA authorization bill that the Randolph bill was used as a Christmas tree to hang new programs such as oil shale, solar, geothermal, wind, solid waste conversion technology, and finally tacked onto the ERDA bill.

It was not Senator Randolph's intention to create a grab-bag program. That was done at the insistence of other interests who smelled the scent of money and came running. He is one voice in this Congress who consistently calls for greater coal utilization in a responsible manner. While we supported his motive in introducing that bill, we could not support his method.

This legislation has been referred to as the most important energy bill of this Congress. The emotionalism surrounding it makes one believe that it would be unpatriotic to vote against it. That is the problem with trying to legislate in a crisis atmosphere.

Clear thinking gives way to a search for quick solutions. But this legislation is not a quick solution. It is a precursor to more legislation of this type. It is the first installment of the President's $100 billion giveaway called the Energy Independence Authority.

H.R. 12112 is not a $4 billion guaranteed loan program. It is the first plateau the Congress must reach to qualify it for an additional $7.1 billion subsidy package when ERDA returns to the Hill with more subsidy legislation to insure that a synthetic fuels industry will get off the ground.

One reason a synfuels industry has not gotten off the ground yet is simply that the market cannot carry it. The technology is too inefficient and capital intensive and, consequently, the cost of the product is too great. But I am not inferring that we abandon all efforts to advance synthetic fuels technology. On the contrary, I strongly support the existing research, development, and demonstration program that ERDA, with the help of legislators such as Chairman Teague, Congressman Hechler, and others, has in place.

The technologies for gasifying coal are varied. Some work most efficiently using bituminous coal, while others can only convert subbituminous coal or lignite. Therefore, the choice of technology may limit its application to only one part of the Nation.

The Lurgi coal gasification process achieves the best results when subbituminous or lignite coals are used as the feedstock. These coals are, essentially, nonagglomorating and can be found in the coal fields of the Northern Great Plains and the Southwest. Those coals are relatively low in sulfur content and low in Btu value. More important, they are found in some of the most arid and undeveloped regions of the country. Setting up a coal gasification industry around those coal deposits will place an unbearable burden on the scarce water supplies and other resources in those regions.

Since the primary purpose of gasifying coal in the first place is to remove the impurities in the coal in order that the energy trapped in the coal can be utilized, it makes good sense to be concentrating on gasifying some of our highest sulfur coal first.

The tremendous coal deposits in the Midwest—Ohio, Indiana, and Illinois—are medium- and high-sulfur coals and require either precombustion cleanup treatment or pollution control devices after com-

bustion in order to comply with the Clean Air Act provisions. These coals are located close to the existing markets and labor force and, from a national interest standpoint, it makes sense to begin with these coals first.

The list of high Btu coal gasification technologies that are candidates for guaranteed loans under this program are exclusively Lurgi technology and all would be located in the West and Southwest. Again, those are areas least likely to sustain a coal gasification industry.

Fortunately, there is another office within ERDA with a better idea. The Fossil Energy Division sent out an RFP for a high Btu coal gasification proposal on October 3, 1975. To date, five companies have responded. The award of the contract is expected in June of this year. The executive summary of the RFP states the following and I quote from that summary:

> The Energy Research and Development Administration is herein soliciting proposals for a pipeline gas demonstration project. This project involves the design, construction, and operation of a coal conversion plant of sufficient size to demonstrate commercial feasibility in the post 1980 time-frame.

It is very important, because it appears that within ERDA we have one program, a research and development program which has an RFP for plant, to demonstrate commercial feasibility, in a very similar time frame that ERDA is talking about in the guaranteed loan program.

The RFP further states that ERDA is interested in reviewing proposals which describe technologies that have applicability to various types of coal including high sulfur coal and agglomerating coals.

This stipulation is to insure that the technology chosen will have the capability of gasifying both eastern bituminous coals and western subbituminous coals. Since the project will be funded on a 50–50 cost-sharing basis, all information derived from the project will become a part of the public domain. Therefore, the public's risk is limited and the benefits returned for that risk are far greater.

Contrasting this arrangement with the provisions of H.R. 12112, we find that the taxpayers' risk of a proposal may be up 75 percent of the cost of the total project. The only information which the public derives is the environmental, social, and economic impacts and the technological feasibility of the process.

The recipient of the loan puts up 25 percent of the cost of the project, perfects the engineering, derives hands-on experience, markets the fuel at a price which insures a return on the investment, and retains all information related to the technology itself. All of this, while assuming 25 percent of the risk. The public, in a sense, bankrolls the venture and gets periodic monitoring reports on the impacts of the project.

ERDA spokesmen refer to preferred proposals as those being in the range of 80 million cubic feet per day, or about one-third the size of anticipated commercial gasification plants. In their estimation, this scale of demonstration plant will provide the necessary information regarding social, environmental, economic, and resource impacts. Most important, the technology must be other than the Lurgi gasification method and the plant must be, again, of a sufficient size to demonstrate commercial feasibility, using a variety of coals.

One contender for a high Btu gasification guaranteed loan is the American Natural Gas proposal to construct such a plant in North Dakota using the Lurgi gasification method. The original design called for construction of a 250 million cubic feet per day plant at a cost of more than $1.5 billion. Recently, American Natural Gas has advised the Wisconsin Public Service Commission of a change in their plants. I would like to quote a paragraph from that memo that was supplied to the Wisconsin Public Service Commission:

> For several reasons, it now appears that the gasification plant would be difficult, if not impossible, to build as initially planned, and as a consequence American Natural Gas has decided to construct the plant in two phases. Phased construction will significantly reduce the immense procurement and construction management and control problems necessarily involved in the construction of a plant of the unprecedented size and the complexity of the full project. Construction of a smaller plant will also significantly reduce the adverse, short-term, socioeconomic impact of the project on the Mercer County school system, for example, will be lessened commensurately with the smaller number of families involved in the construction and operation of a smaller plant. Finally, construction of a full plant the size of that initially proposed appears to present almost unsurmountable financing problems, both from the standpoint of raising the equity capital and of obtaining debt financing with or without Government guarantees.

It is important to note that the size of the plant specified in the new proposal is in the range of the anticipated plant size in the RFP proposal. The logic of the American Natural Gas Co. should be commended and heeded.

This legislation is creating parallel tracks within ERDA which will be competing with each other to accomplish the same end. The justification for H.R. 12112 is that it will provide money to build and operate synthetic fuel plants to determine if they will work and assess the impacts.

The traditional R.D. & D. program within ERDA has a similar mission. In the case of high Btu gasification RFP, and the American Natural Gas proposal to the Wisconsin Commission, the scope of the projects are similar even if the objectives are not.

This bill is redundant and counterproductive to the good effort the Congress has made to giving incentives to new, more efficient synthetic fuels technologies through existing R.D. & D. programs.

This approach will insure that all the costs associated with the conversion technology will be represented in the selling price of the product. Only those processes which can prove themselves in the marketplace will be accepted for commercialization. H.R. 12112 will cater to those technologies that the market has turned down, and will only survive with increasing subsidies.

This Congress will not be acting irresponsibly if it votes down H.R. 12112. That will be a vote against an energy welfare bill that will only provide the Nation with hardware, and not energy.

Thank you.

Mr. DINGELL. Thank you.

The Chair recognizes Ms. Johnson as the next speaker.

STATEMENT OF CAROLYN RUTH JOHNSON

Ms. JOHNSON. Thank you, Mr. Chairman.

My name is Carolyn Ruth Johnson, and I am chairman of the Mining Workshop for the Colorado Open Space Council in Denver. In oppos-

ing the synthetic fuels loan guarantee program provided in H.R. 12112, I am today representing several other groups including the Environmental Defense Fund, Colorado Mountain Club, Citizens for Colorado Wildlife.

Mr. DINGELL. If you wish, those groups will be inserted in the record as part of your complete statement.

Ms. JOHNSON. The one that I would like to mention is the Environmental Defense Fund, which was inadvertently left out.

We all feel that this subsidy program would be a blatant misplacement of money and energy priorities in this country. We believe that sound energy policy must be based on the premise that the true costs of energy production and use should be reflected in the price of that energy.

The subsidies to force capital into energy production schemes which on their own merits do not attract free enterprise capital fly in the face of that policy. We think it would be folly to force upon this country large-scale demonstrations of oil shale, and coal gasification technologies, where not only the people would have to suffer the impacts of boom towns, polluted air, polluted and depleted water, disturbed land, and destruction of the agricultural base, but also they would end up paying the companies to cause this damage.

We see H.R. 12112 as part of a larger subsidy program. It is essentially the same legislation as section 103, and as such our views are essentially the same as they were last fall. Although section 103 would have authorized $6 billion for guaranteed loans for synthetic fuels plants, and this bill provides $4 billion, the administration has stated that they have not changed their view, on the ultimate size and the administration is still intending to obtain a $11.1 billion program of loans, grants, and price supports, as Dr. Seamans testified before the Committee on Science and Technology in March.

We do not feel that creating a synthetic fuels subsidy program piecemeal is any better than the whole thing at once. The Congress owes it to itself and the public to consider the full implications of the legislation at hand, including the inevitable pressures for giving the synthetic fuels interests and the administration what they will "need" to accomplish the program which H.R. 12112 is designed to begin.

Second, these subsidies do not guarantee that any energy will be produced. If the entire $11.1 billion package is approved, ERDA expects production to reach 350,000 barrels of oil equivalent by 1985. This quantity represents only 1.3 percent of our 1974 oil and gas consumption.

Although it may be attractive to view this program as one that will increase the Nation's energy supplies as part of Project Independence, we feel that two important points have been overlooked which should be well understood.

First, not only would this program, if successful, produce very little energy relative to the dollar investment, but there is no guarantee that it will produce any. It would seem to be an elementary rule of money management, and sound legislation, that if Congress is to guarantee financing for major corporations, in turn, Congress and taxpayers must receive a firm guarantee that the project will produce.

Second, this program is billed as a testing program to gain information on the technology and its commercialization prospects. It is most

important that we keep in mind that tests can go either, failure or success.

We feel that it is very misleading to presume that experimental programs will produce any reliable energy supplies and that it is folly to base any Government policies for increasing energy supply on such a tenuous and experimental program.

One of the areas of concern is the environmental impact of synfuels development. The environmental problems with synthetic fuels development are confirmed, not disproven, as planning proceeds. Perhaps this can be best illustrated by recent actions on one of the proposed synfuel projects that is most advanced in terms of planning—the C–b Federal oil shale tract project by the Shell Oil Co. and the Ashland Oil Co.

When the sponsors' detailed mining plan and baseline data, after several years of intensive work, were submitted earlier this year to the Department of the Interior's Oil Shale Environmental Advisory Panel, the panel recommended that the Department not approve the plan because of the predicted violations of the oil shale lease, State and Federal laws in such major areas as water quality and quantity, the leachability of spent shale, air quality, revegetation, and fish and wildlife.

Synfuels present serious problems with water affecting both quantity and quality. In the West, where water is in very short supply, any major new water use or user is a threat to existing users, including farmers, ranchers, municipalities, wildlife and recreation. This program would intensify already serious water problems associated with energy development in the Colorado River Basin.

Just the anticipation and planning, before subsidies were even proposed, of synthetic fuels development has had serious effects in Colorado. If subsidies are approved and the promise of Federal bucks realized, the pressures on and pre-emption of existing water uses, particularly agricultural and wildlife, will increase.

The plans that have ben laid to date for an oil shale prototype program include at least 28 major water development projects for energy under serious consideration by the U.S. Bureau of Reclamation, in addition to many private projects which have not yet been disclosed to the public.

The Department of the Interior has stated that energy projects planned for the upper Colorado River would consume more water than is available to the States under the Colorado River Compact Allocations. Yet, incredibly, the Department has been pushing and accommodating every conceivable energy and water for energy project, in full awareness of the conflicts which will result.

The Bureau of Reclamation's water for energy planning has already substantially preempted and disrupted agriculture. Water development projects which were planned to benefit the agricultural community have been changed to go for energy development.

As just one example, the Yellow Jacket project planned for the White River, which is a major tributary of the Colorado River in the northwest Colorado-northeast Utah oil shale region, was slated originally to have all of its 126,400 acre feet for agricultural irrigation. Today, agriculture has been preempted by oil shale and coal developers and cut to one-sixth of the planned water. This has also happened on

many other large projects such as, for example, West Divide and Dallas Creek.

In the case of water for coal development in the Northern Plains, the Bureau of Reclamation has gone even further in this pattern of disruption and preemption of agriculture. Nearly 700,000 acre feet per year have been sold to the major energy companies, many of whom have expressed interest in coal gasification, from reservoir projects authorized and built to serve agriculture purposes.

In the Southwest, the bureau has sold water to Utah International, Inc., for use in the proposed WESCO coal gasification facility on the Navaho Reservation, even though the bureau admits that water shortages in low-flow years will be worsened.

In addition, a Library of Congress study has concluded that even the Interior Department's calculation of water for coal gasification is based on a gross over-estimation of water in the San Juan River drainage, a major tributary, again, to the Colorado River.

Often these acquisitions have been far in excess of estimated uses for synfuels development, leaving open the questions of whether they are speculating on a large scale or that synfuel development would require much more water than has been publicly revealed by the companies.

A good example of this is the action of Gulf Oil and Standard of Indiana in anticipation of their joint venture development of the Federal oil shale lease tract in Colorado. They have filed for, optioned and purchased from private sources and the Bureau of Reclamation many times more water than that which is said to be needed for a commercial site facility which they have proposed.

The commercial facility of the scale that they propose, 100,000 barrels per day, was to use 20,000 acre feet of water per year, and the lengthier testimony includes the number of their filings. You can see by the comparison that they far exceeded this.

It appears that the Federal Government has assumed for itself, without congressional directive, an obligation to subsidize massive energy development in the West, with heavy emphasis on synthetic fuels, through providing water. The loan guarantee program would amount to an additional, more blatant subsidy to the energy companies.

One of the areas that has received a great deal of publicity is the phenomenon of boom towns in the West, they have been known both historically and at the present.

The many problems of rapid population growth in undeveloped areas have been documented thoroughly and can be observed first hand in such towns as Rock Springs, Wyo., and Craig, Colo. The Federal Government is well aware of boom town problems, and has described them in numerous reports, including the Project Independence report on oil shale.

In our view, contrary to the views expressed by Dr. Seamans before the House Science and Technology Committee, synthetic fuels development need not be subsidized in order to create the anticipated environmental problems, so that they can be identified and studied in even more detail.

The analysis work done to date predicts enough problems, with enough certainty and expected severity, that it would be irresponsible to make a laboratory out of parts of the West, in order that the experiments can become even more detailed. We are not interested in serving as guinea pigs, knowing rather well what the problems will be, and knowing even better that solutions may not be possible, or forthcoming.

We strongly feel that solutions should be found for the many existing boom-bust communities and regions, not new areas created.

To justify the synfuels program as an experiment in documenting impacts is rather like dropping an atomic bomb on a city merely for the purpose of finding out exactly how many people would be killed or injured.

We would hope that the increased interest in and study of the environment in recent years has taught us to pay attention to the predictions we are able to make, however, inexact they may be.

Coal gasification and oil shale development would both require massive mining operations. Oil shale mines to support 50,000 barrel per day operations would each be larger than any mine in this country at the present time.

Thus, an open pit operation would be of staggering proportions, and the land disturbance due to waste disposal even for an underground mine would be enormous. In the West reclamation of any disturbed area is very problematic because of the severe growing conditions, and the problems of reclaiming spent shale are even more difficult than mining land reclamation.

Rather than going into exhaustive detail in this testimony today on the nature and magnitude of expected impact, I have appended to my statement a complete analysis of the impacts of oil shale development, prepared by the Institute of Ecology.

Mr. DINGELL. Without objection, this will be made part of the record.

Ms. JOHNSON. I will conclude, therefore, and ask that my statement be made part of the record in full.

Mr. DINGELL. Ms. Johnson's complete statement will be made part of the record in the appropriate fashion.

[Ms. Johnson's prepared statement follows:]

STATEMENT OF CAROLYN RUTH JOHNSON

INTRODUCTION

Thank you very much for inviting me here to testify today on proposed legislation to provide $4 billion for guaranteed loans to the energy industry to finance synthetic fuels development. My name is Carolyn Ruth Johnson, and I am chairman of the Mining Workshop for the Colorado Open Space Council in Denver. In opposing the synthetic fuels loan guarantee program provided in HR 12112, I am today representing the Environmental Defense Fund, Colorado Mountain Club, Citizens for Colorado Wildlife, Enos Mills Chapter of the Sierra Club, Environmental Action of Colorado, Greeley Audubon Society (Colorado), Greeley Committee on the Environment (Colorado), League of Women Voters of Colorado, Colorado Chapter of Trout Unlimited, PLAN Boulder, Friends of the Earth, National Audubon Society, Denver Audubon Society, National Taxpayers Union (Colorado Chapter), South Dakota Environmental Coalition, New Mexico Central Clearing House, Wilderness Study Project (New Mexico), Council on Utah Resources (representing the Audubon Society, Izaak Walton League, Utah CLEAR, Western River Guides, ISSUE, Save Our Rivers, The Tiger Lilies, Sierra Club, Save Our Canyons, Wasatch Mountain Club, Wasatch White Water Association, Utah Environment Center, Escalante Wilderness Committee, Environment Center of Ogden, Zero Population Growth, Citizens for a Clean Summit County, Utah Nature Study Society, Salt Lake Grotto/National Speleological Society, Ute Alpine Club, and University of Utah Ecology Club.), the Powder River Basin Resource Council (Wyoming), the United Plainsmen (North Dakota), Northern Plains Resource Council of Montana (representing: Stillwater Protective Association, Tri-County Ranchers Association,

Rosebud Protective Association, Bull Mountain Landowner Association, McCone Agricultural Protective Association, Central Yellowstone Valley Association, Sarpy Protective Association, and Environmental Information Center.)

We all feel that this subsidy program would be a blatant misplacement of money and energy priorities in this country. We believe that sound energy policy must be based on the premise that the true costs of energy production and use should be reflected in the price of that energy. Subsidies to force capital into energy production schemes which on their own merits do not attract free enterprise capital fly in the face of that policy. We think it would be folly to force upon this country large-scale demonstrations of oil shale and coal gasification technologies, where not only would the people have to suffer the impacts of boom towns, polluted air, polluted and depleted water, disturbed land, and destruction of the agricultural base, but also they would end up paying the companies to cause this damage.

It is apparent that the chief goal of this legislation is to assist companies involved in oil shale and synthetics from coal. Although some of the more attractive energy sources are mentioned in the bill, it is unlikely that solar, wind biomass and other renewable energy sources combined will receive more than 20 percent of the funds. In addition, Dr. Seamans of ERDA was very careful to caution Congress not to expect emphasis on the non-fossil fuels which conceivably could be funded by this legislation. It is also worth pointing out that the Administration tried to remove the non-fossil alternatives from Section 103 last fall, and that elsewhere they have stated that they have ample authority in the solar and geothermal areas. In other words, this legislation is neither formulated properly or indeed needed if it is the non-fossil alternatives that Congress is interested in. The Congressional Budget Office stated: ". . . the Administration argues that ERDA already has adequate authority for demonstrating solar and geothermal technologies."[1]

Because the Administration has made its priorities so clear on synthetic fuel development funding, and because it is obvious that the primary lobbying forces behind this bill are the companies would would expect to get guaranteed loan support for coal gasification and oil shale projects, our testimony focuses on the fossil synthetics. Unless the Committee were to rethink and drastically amend this legislation to focus on renewable energy sources, we think it unrealistic to assume that any significant amount of funding would go to anything but oil shale and coal gasification.

HR 12112: Part of a larger subsidy program

Many of our organizations provided information and testimony to the House Science and Technology Committee last fall when Section 103 of the ERDA bill was being discussed. [2] HR 12112 is essentially the same legislation, and as such, our views are essentially the same. Although Section 103 would have authorized $6 billion for guaranteed loans for synthetic fuels plants and this bill provides $4 billion, the Administration has stated that they have not changed their view on the ultimate size of the synthetic fuel subsidy program. The Administration is still intending to obtain a $11.1 billion program of loans, grants, and price supports, as Dr. Seamans testified before the Committee on Science and Technology on March 31:

". . . It should be clearly understood that the $2 billion in loan guarantees provided by HR 12112 would only initiate the program recommended by the Administration. Additional authorizations are included in the President's budget for fiscal year 1977 under the proposed Energy Independence Authority. We remain firmly convinced that in order to achieve the objectives of the full 350,000 barrels per day program, that $6 billion in loan guaranty authority will be required along with about $4.5 billion in price guaranty authority and about $600 million in grants." [3]

We do not feel that creating a synthetic fuels subsidy program piecemeal is any better than the whole thing at once. The Congress owes it to itself and the public to consider the full implications of the legislation at hand, including the inevitable pressures for giving the synthetic fuels interests and the Admistration what they will "need" to accomplish the program which HR 12112 is designed to begin. HR 12112 cannot be separated from the rest of the proposed synfuels program, for the reasoning which would lead the Congress to pass HR 12112 would inevitably lead you to pass the additional legislation necessary for the program to proceed—the price supports and grants and possible government purchase contracts.

SUBSIDIES DON'T GUARANTEE ENERGY

If the entire $11.1 billion package is approved, ERDA expects production to reach 350,000 barrels of oil equivalent by 1985. This quantity represents only 1.3 percent of our 1974 oil and gas consumption. Although it may be attractive to view this program as one that will increase the nation's energy supplies as part of Project Independence, we feel that two important points have been overlooked which should be well understood.

First, not only would this program if successful produce very little energy relative to the dollar investment, but there is no guarantee that it will produce any. It would seem to be an elementary rule of money management—and sound legislation—that if Congress is to guarantee financing for major corporations, in turn, Congress and the taxpayers must receive a firm guarantee that the project will produce. Not only does this bill not include such a guarantee but section 18(g)(3) does not even allow the federal Government to have recourse to the substantial assets of these companies if they default. This would seem to be an invitation to default by making their assets immune.

Second, this program is billed as a testing program to gain information on the technology and its commercialization prospects. It is most important that we keep in mind that tests can go either way—failure or success. We feel that it is very misleading to presume that experimental programs will produce any reliable energy supplies and that it is folly to base any Government policies for increasing energy supply on such a tenuous and experimental program.

BETTER ENERGY BUYS FOR THE MONEY

We strongly believe that, before funding any major programs, Congress should carefully weigh all the possible ways to achieve the described results at the least possible cost, then it should select those that are the most effective programs for the dollar. We do not believe that in pushing this program to Congress, ERDA has made a cost-conscious examination of the alternatives, but Congress has the opportunity to correct this. There are other alternatives, among them are conservation and solar conversion.

ERDA has just released its revised national plan [4] with a great deal of publicity over the fact that its new top priority is conservation of energy and that the budget for conservation is 60 percent above last year's. (However, that is 60 percent of very little—$75 million to $120 million. [5] ERDA selected conservation of energy for all the right reasons: it costs less to save a barrel of oil than it does to produce one through new technology, energy conservation benefits the environment, conservation measures produce continuing benefits, conservation can be implemented faster than new supplies can be brought in, and capital requirements to increase energy efficiency are lower than capital needs to produce an equivalent amount of energy from new sources "since most new supply technologies are highly capital intensive." [6] The Federal Energy Administration's work bears up the cost effectiveness of energy conservation with its finding that energy conservation "would save twice as much energy as comparable investment in new supplies would produce." [7]

Other technologies provide for continuous energy savings, while avoiding the tremendous environmental and socio-economic disruptions from synthetic fuels development. For example, if the $4 billion required by ERDA to fund only initially this synthetic fuel program were invested in solar equipment, it could retrofit about 1,150,000 existing homes and 800,000 new homes, for continuous energy savings. [8]

While ERDA excuses its extremely low level of funding for energy conservation with the undocumented claim that this RD & D function "can better be performed by the private sector" and the bald statement that the "primary responsibility" for energy conservation "rests with the private sector," [9] the ERDA plan details at length the woes of the synfuels developers, to back up its desire to provide massive subsidies for oil shale and coal gasification. [10] Frankly, we can't see why it is the Government's responsibility to bail out a few faltering synthetic fuels projects yet someone else's responsibility to pursue the far more promising and beneficial energy alternative. It looks as if the guiding criterion for ERDA energy policy is that the least cost-effective, most technology-intensive energy alternatives should get the most taxpayer dollars. Their proposed synfuel program, of which HR 12112 is a major part, is a good example of this misguided policy.

ENVIRONMENTAL IMPACTS OF SYNFUELS DEVELOPMENT

The environmental problems with synthetic fuels development are confirmed, not disproven, as planning proceeds. Perhaps this can be best illustrated by recent actions on one of the proposed synfuel projects that is most advanced in terms of planning—the C-b federal oil shale tract projects by the Shell Oil and Ashland Oil companies. When the sponsors' detailed mining plan and baseline data—after several years of intensive work—were submitted early this year to the Department of Interior Oil Shale Environmental Advisory Panel, [11] the Panel recommended that the Department not approve the Plan because of the predicted violations of the oil shale lease, State and federal laws in such major areas as water quality and quantity, the leachability of spent shale, air quality, revegetation, and fish and wildlife. [12]

Water

Synfuels present serious problems with water affecting both quantity and quality. In the West, where water is in very short supply, any major new water use or user is a threat to existing users, including farmers, ranchers, municipalities, wildlife and recreation. This program would intensify already serious water problems associated with energy development in the Colorado River Basin.

Just the anticipation and planning, before subsidies were even proposed, of synthetic fuels development has had serious effects in Colorado; if subsidies are approved and the promise of federal bucks realized, the pressures on and pre-emption of existing water uses, particularly agricultural and wildlife, will increase. The plans that have been laid to date for an oil shale prototype program include at least 28 major water development projects for energy under serious consideration by the U.S. Bureau of Reclamation, in addition to many private projects which have not yet been disclosed to the public. [13] The end result is that a large number of entities are vying for limited water resources with little or no comprehensive planning or regard for the cumulative end results. The Department of Interior has stated that energy projects planned for the upper Colorado River would consume more water than is available to the states under the Colorado River Compact allocations. [14] Yet, incredibly, the Department has been pushing and accommodating every conceivable energy and water for energy projects, in full awareness of the conflicts which will result.

The Bureau of Reclamation's water for energy planning has already substantially pre-empted and disrupted agriculture, which contributes over $2 billion annually and is the second largest component of the State's economy. [15] Water development projects which were planned to benefit the agricultural community have been changed to go for energy development. As just one example, the Yellow Jacket Project planned for the White River, a major tributary of the Colorado River in the northwest Colorado-northeast Utah oil shale region, was slated originally to have all its 126,400 acre feet for agricultural irrigation. Today, agriculture has been pre-empted by oil shale and coal developers and cut to one-sixth of the planned water—26,400 acre feet. This has also happened on many other large projects such as West Divide and Dallas Divide.

In the case of water for coal development in the Northern Plains, the Bureau of Reclamation has gone even further in this pattern of disruption and pre-emption of agriculture. Nearly 700,000 acre feet per year have been sold to the major energy companies, many of whom have expressed interest in coal gasification, from reservoir projects authorized and built to serve agricultural purposes. [17] In the Southwest, the Bureau has sold water to Utah International, Inc. for use in the proposed WESCO coal gasification facility on the Navajo Reservation, even though they admit that water shortages in low-flow years will be worsened. [18] In addition, a Library of Congress Research Service study has concluded that even the Interior Department's calculation of water for coal gasification is based on a gross over-estimation of water in the San Juan River drainage, a major tributary to the Colorado River. [19]

In addition, synthetic fuel interests have already made significant inroads into controlling present agricultural water supplies through purchase of water rights and options and acquisition of farms and ranches. Often these acquisitions are far in excess of estimated uses for synfuels development, leaving open the questions of whether they are speculating on a large scale or that synfuel development would require much more water than has been publicly revealed by the companies.

A good example of this is the actions [20] of Gulf Oil and Standard of Indiana in anticipation of their joint venture development of the Federal oil shale lease tract in Colorado, tract C–a. They have filed for 300 cfs to be impounded in Yellow Creek Dam and Reservoir, with a capacity of 427,000 acre-feet, which the Bureau of Reclamation may sponsor; they have signed an option agreement with the Rocky Mountain Power Co. to obtain a minimum of 45,000 acre-feet of water annually; they have obtained or optioned an unpublicized amount of water from private agricultural rights purchased with ranch and farmlands. In addition, these companies have expressed an interest in obtaining 60,000–70,000 acre-feet of water from the Bureau of Reclamation's proposed Yellow Jacket project, which was discussed earlier.

It appears that the Federal Government has assumed for itself, without congressional directive, an obligation to subsidize massive energy development in the West, with heavy emphasis on synthetic fuels, through providing water. The loan guarantee program would amount to an additional, more blatant subsidy to the energy companies.

Water quality

Mining and processing of coal and oil shale for synthetic coal and oil will adversely affect the quality of the remaining water supplies in the region. Increased sediment loading, chemical and trace element population and increased salinity concentrations all would result from synfuels development.

Of major concern is the potential for increased salinity in the Colorado River, where there already are severe economic and international problems from excessive salt loading. It is estimated that present damage due to salinity in the Colorado River is approximately $16 million per year, and that this may rise to $51 million by 2010. [21] Each increment of 1 ppm total dissolved solids, which would be caused by every 10,000 acre-foot withdrawal, [22] will result in an added damage cost of $230,000 per year. [23] Of course, any increased usage of Colorado River water increases salinity, because less water is available for dilution of salts already present. Energy development in the Colorado Basin will significantly increase salinity because of massive water consumption. In addition, oil shale development poses severe salinity threats which may create problems of a much larger magnitude than water consumption alone. First, the waste shale material is extremely high in soluble salts which could easily end up in surface and ground waters as a result of leaching and erosion, both of which are inevitable given the extremely large quantities of spent shale. Second, oil shale mining in Colorado will require pumping and disposal of large quantities of saline groundwater for the mining to proceed. [24] We have seen no disposal plans which would be certain to avoid salinity hazards from either of these aspects of oil shale development.

Cancer-causing agents and toxic substances

The literature on carcinogenic substances associated with synthetic fuels and their effects on workers has been reviewed by the Scientists Institute for Public Information,[25] both historically and in modern times in this country and others. A high incidence of cancer was noted as early as 1876 in the Scottish oil shale industry.[26] More recently, abnormally high rates of skin cancer have been noted in workers at the Union Carbide coal liquefaction plant in West Virginia, despite the use of protective clothing.[27] The cancer potential is an area which we feel has not received adequate in-depth treatment and study by objective researchers; in fact it is our impression that the companies intimately involved with synthetic fuel technology have been more concerned with poohpoohing the potential dangers to synthetic fuel workers and consumers than with insuring that those dangers are well known and prevented. In fact, TOSCO officials have attempted to explain away the high incidence of cancer in Scottish oil shale workers as due to their not taking baths.[28]

Toxic substances, such as arsenic and fluoride, are also of particular concern because of their effects on humans, livestock and wildlife. Recent information from some of the oil shale studies indicates that arsenic levels resulting from processing need a great deal more investigation before safety can be assured.[29] In addition, fluoride in the waste waters to be discharged from oil shale mining is predicted to be higher than acceptable standards.[30] Part of this water is proposed to be used in reclamation work and suppression of dust—areas to which both humans and animals (livestock and wildlife) would be exposed.

Boomtowns

The phenomenon of boomtowns is extremely well-known in the West—both historically and at the present. The many problems of rapid population growth in undeveloped areas have been documented thoroughly and can be observed first-hand in such towns as Rock Springs, Wyo., and Craig, Colo. The Federal Government is well aware of boomtown problems, and has described them in numerous reports, including the Project Independence report on oil shale.[31]

In our view, contrary to the views of Dr. Seamans expressed before the House Science and Technology Committee,[32] synthetic fuels development need not be subsidized in order to create the anticipated environmental problems so that they can be identified and studied in even more detail. The analysis work done to date predicts enough problems, with enough certainty and expected severity that it would be irresponsible to make a "laboratory" out of parts of the West, in order that the "experiments" can become even more detailed. We are not interested in serving as guinea pigs, knowing rather well what the problems will be, and knowing even better that "solutions" may not be possible or forthcoming. We strongly feel that solutions should be found for the many existing boom-bust communities and regions, not new areas created. To justify the synfuels program as an experiment in documenting impacts is rather like dropping an atomic bomb on a city merely for the purpose of finding out exactly how many people would be killed or injured. We would hope that the increased interest in and study of the environment in recent years has taught us to pay attention to the predictions we are able to make, however inexact they may be.

Land disturbance

Coal gasification and oil shale development would both require massive mining operations. In fact, oil shale mines to support 50,000-barrel-per-day operations would each be larger than any mine in this country at the present time. [33] Thus, an open pit operation would be of staggering proportions, and the land disturbance due to waste disposal even for an underground mine would be enormous. (Because of the small quantity of hydrocarbon in the oil sale ore, most of the mined material, 87 percent, ends up as waste material.) In the West reclamation of any disturbed area is very problematic,[34] because of the severe growing conditions, and the problems of reclaiming spent shale are even more difficult than mined land reclamation.[35]

Wildlife

Impacts on fauna and the flora on which it depends will also be severe. For example, the prime oil shale area of Colorado is also the home of the largest migratory deer herd in the United States. [36] All forms of wildlife will be jeopardized by the significant new intrusions of mining, pollution, noise, people and a depleted water supply.[37] In addition, rare and endangered species, which are supposed to be protected by law, will be affected by the loss of habitat.[38]

Rather than go into exhaustive detail in this testimony today on the nature and magnitude of expected impacts, I have appended to my statement a complete analysis of the impacts of oil shale development, prepared by The Institute of Ecology as a critique of the Department of Interior's environmental impact statement on the oil shale leasing program.[39]

THE "MODULAR" APPROACH

As amended in the House Science and Technology Committee, H.R. 12112 contains a special provision for oil shale development—75 percent grants for initial "module" (6–10,000 barrels per day) construction as well as guaranteed loans for commercial-sized plants. (Grants to oil shale are 75 percent while the Government would provide 50 percent funding for comparable coal R & D gasification demonstration plants which are one-fourth to one-third commercial scale.) This provision, ironically, gives oil shale preferential treatment, yet it is generally agreed that shale is the least attractive of all the synthetic fuel options. Rather than limiting the subsidies available to oil shale, as some "modular approach" advocates originally intended, the current version of H.R. 12112 expands the subsidy commitment. Such a commitment to provide guaranteed loans before the results from the modular test are known and thoroughly evaluated presupposes economic conditions several years away, and would completely remove any incentive for the companies to seek private capital. Without defining criteria for "successful" modular demonstration, the bill offers guaranteed loans to "successful" modular projects—in effect creating "cradle to the grave" subsidies.

The whole discussion of modular development underscores the confusion about the purpose of this legislation: Is it intended to foster additional R. & D.? Is it intended to launch a "commercial" industry? Or is it intended to bail out corporations who have invested in synthetic fuels? We also find it puzzling that the "modular" approach is being discussed only with referenc to oil shale. The same multimodule setup is characteristic of coal gasification technology. We think that the first question which must be answered on a "modular approach" is what purpose are the modules to serve?

Clearly, if the modules are to test process technology, then it is unnecessary to construct new and multiple facilities for mining, ore preparation, upgrading, refining and transportation. The modular approach seems to be predicated on the fact that the component of the process most in doubt is the retort itself. Certainly, both oil shale and coal have been mined for decades and the techniques for mining are very well known. Thus, it would be unnecessary to build modules at many different locations—the modules should be located near an existing mine which could be utilized to serve all the technologies under examination, as stated by the Congressional Budget Office:

"Parts of the commercial production are common to many approaches. Large-scale coal mining and transportation, materials handling at the plant, waste disposal, and social and environmental impacts are found in all processes which gasify or liquefy coal. There are technical similarities in much of the equipment used in all those processes. Stronger commonalities exist among the approaches to oil shale processing. In both cases differences between approaches are largely in basic chemical engineering technology." [40]

Our information indicates that an oil shale module can be constructed operated, and fully tested for on the order of $75 million, using existing mining and associated facilities such as those that exist at Anvil Points near Rifle, Colo. [41] The companies involved have ample resources to bear the cost of that testing and many of them have already made the commitment of sizeable sums to buy into a position in the coal gasification or oil shale field, sums far exceeding the cost of testing. For example, Gulf Oil Co. and Standard of Indiana have made a commitment of $210 million for a Federal oil shale lease. It is also obvious that companies have made large investments in developing and purchasing such technologies as the TOSCO II oil shale process and the Lurgi gasification process.

On the one hand, the assumption behind the modular approach seems to be that the companies' uncertainties about investing in synfuels are based on pure technological grounds. On the other, ERDA contends that the technology is well enough known to proceed to commercial scale, risking taxpayers' dollars. The proposal to combine modules now with the prospect of guaranteed loans later seems to confuse rather than clarify the issue. Underlying the whole debate is a contradictory assumption that what is too risky for private investment is safe for the public's money.

We view the modular provision in the bill as nothing more than an exercise disguised as a developmental control. Any commercial-scale oil shale facility will have to begin with a "module" anyway, so the procedure outlined in the bill simply offers the companies money to do what the original guaranteed loan program was supposed to accomplish. The only meaningful "modular approach" would limit the subsidy to the module and provide sufficient criteria and operating requirements to insure that useful information were developed from the project. Yet it is readily apparent that the thrust of H.R. 12112 is to accomplish commercial-scale production. And, of course, EROA already has the authority under existing legislation—in the Non-Nuclear Energy Research and Development Act passed in December 1974—to fund a modular program.

References

1. Congressional Budget Office, "Commercialization of Synthetic Fuels," Nov. 17, 1975, p. 311.

2. Testimony of the Colorado Open Space Council, Environmental Defense Fund, Friends of the Earth, Northern Plains Resource Council, and Colorado Council of Trout Unlimited, before the Subcommittee on Energy R & D and Demonstration (Fossil Fuels), Oct. 27, 1975.

3. Testimony of Dr. Robert C. Seamans, Jr., U.S. Energy Research and Development Administration, before the House Science and Technology Committee, Mar. 31, 1976.

4. U.S. Energy Research and Development Administration, "A National Plan for Energy Research, Development and Demonstrations: "Creating Energy Choices for the Future," April 1976.

5. *Id.*, p. 37.
6. *Id.*, p. 8.
7. Worldwatch Institute, "Energy: The Case for Conservation," Jan. 1976.
8. Environmental Action of Colorado, calculations by solar staff, 1975–76.
9. ERDA, *Supra.*, p. 1.
10. *Id.*, p. 55–58.
11. Shell Oil and Ashland Oil, "The Detailed Development Plan for Federal Oil Shale Tract C–b," Feb. 1976.
12. U.S. Department of the Interior Oil Shale Environmental Advisory Panel, Minutes, May 18, 1976.
13. Colorado Council of Trout Unlimited, testimony before the Subcommittee on Energy R & D and Demonstration (Fossil Fuels), Oct. 27, 1975.
14. U.S. Department of Interior, "Water for Energy in the Upper Colorado River Basin," 1974.
15. Figures obtained from the U.S. Department of Agriculture and the Colorado Department of Commerce.
16. U.S. Bureau of Reclamation, "Preliminary Report on the Yellow Jacket Project," Mar. 16, 1976.
17. U.S. Department of Interior, "Water for Energy in the Upper Missouri River Basin," 1975.
18. U.S. Department of Interior, "Environmental Impact Statement for the Proposed WESCO Project," Jan. 1976.
19. Brown, Howard A., "Water Supply Contracts from Navajo Reservoir for Proposed Coal Gasification Plants," Library of Congress Research Service, May 17, 1974.
20. Colorado Council of Trout Unlimited, "Memorandum: Water Rights for Oil Shale Tract C–a," July 1975.
21. U.S. Environmental Protection Agency, "The Mineral Quality Problems in the Colorado River Basin," 1971.
22. U.S. Department of Interior, "Colorado River Water Quality Improvement Program," 1972.
23. U.S. Department of Interior, "Water for Energy in the Upper Colorado River Basin," 1974.
24. Shell and Ashland, *Supra.*
25. Sauter, Diane Y., "Synthetic Fuels and Cancer," Scientists Institute for Public Information, Nov. 1975.
26. *Id.*
27. *Id.*
28. *Shale Country*, Feb. 1976. (Published in Denver under sponsorship of the oil shale companies.)
29. U.S. Department of Interior Oil Shale Environmental Advisory Panel, Minutes, April 7–8, 1976.
30. Shell and Ashland, *Supra.*
31. Federal Energy Administration, "Project Independence Blueprint, Final Task Force Report, Potential Future Role of Oil Shale: Prospects and Constraints," Nov. 1974.
32. Seamans, *Supra.*
33. Approximately 70,000 tons per day of oil shale rock would be mined for a 50,000 barrel per day operation.
34. National Academy of Sciences, "Rehabilitation Potential of Western Coal Lands," 1974.
35. The Institute of Ecology, "A Scientific and Policy Review of the Prototype Oil Shale Leasing Program Final Environmental Impact Statement of the U.S. Department of the Interior," Oct. 29, 1973.
36. *Id.*
37. U.S. Department of Interior, "Prototype Oil Shale Leasing Program Final Environmental Impact Statement," Sept. 1973.
38. U.S. Department of Interior Oil Shale Environmental Advisory Panel, Minutes, April 7–8, 1976.
39. The Institute of Ecology, *Supra.*
40. Congressional Budget Office, *Supra.*, p. 33.
41. Estimates for Paraho proposed module.

Mr. DINGELL. Mr. DeLoss.

STATEMENT OF GARRY DeLOSS

Mr. DeLoss. Mr. Chairman, and members of the committee; I want to thank you for the opportunity to comment on H.R. 12112, which would permit ERDA to provide loan guarantees and direct subsidies for the construction of synthetic fuel plants and other projects.

I have been researching and commenting on energy policy for Ralph Nader's Public Interest Research Group since the 1973 oil embargo. We are particularly interested in energy conservation policies. Although we have objected to the price rationing approach of the Nixon and Ford administrations, whereby proposals to permit artificially high OPEC pricing of domestic oil and natural gas through deregulation were justified partly as conservation measures, we have supported a number of other energy conservation policies.

Earlier this year, for example, we testified in favor of the Energy Conservation Act of 1976, which would provide loan guarantees, interest subsidies, and public education programs to encourage energy efficiency improvements where they would have the most effect—in the vast population of eixsting homes, commercial buildings, and factories.

Last Thursday and Friday, we hosted a national conference on public policies to promote energy efficiency, entitled "Energy Efficiency as a Nationnal Priority." At the conference over 20 expert panelists described their experiences in the field of energy efficiency in residential, commercial, and industrial uses and recommended public policy initiatives which would promote energy efficiency.

The first thing you should do in analyzing this bill is to separate the wheat from the chaff. The bill would assure the provision of environmental safeguards to accompany synthetic fuel development and the provision of community impact assistance in areas where the construction of new energy facilities is aided by the bill.

These are laudable policies but they could and should be adopted regardless of whether synthetic fuels plants are constructed with Federal assistance. In other words, these provisions in the bill are irrelevant to deciding whether synthetic fuels development should proceed solely through private funding or with the aid of Federal subsidies. Another provision in the bill that should be irrelevant to your consideration of its merits is the gesture toward assistance for the development of renewable energy sources, including "direct solar, wind, ocean thermal gradients, biomass grown purposefully for recovery of energy values, and wastes of all types, such as urban, industrial, agricultural, and forestry wastes." You should note that ERDA assistance to the development of renewable energy sources under this bill is completely discretionary. Therefore it is safe to predict that such assistance would be minimal. If you want to assure assistance to the development of renewable energy sources by this administration, which is notoriously unsympathetic to such programs, you must mandate their development in separate legislation.

The topic for discussion, I think, is whether it is desirable for the Federal Government to provide loan guarantees and other subsidies to encourage investment in synthetic fuel plants. This bill is, in short, a program of capital allocation which is intended to help reduce our need for imported oil. It is an intervention of Government in the

capital market to provide capital for energy production investments which, we are told, would not be made without such assistance.

Now, let me say at the outset that the best thing about this bill is its history of shrinkage from the $100 billion Energy Independence Authority version, to the $6 billion amendment to the ERDA authorization, to the present $4 billion version. There is no guarantee that it will not reverse direction. But even the smaller amount of capital allocation must survive a fundamental test. That test is whether this bill would guide investment into the most productive available use in terms of impact on our energy supply and demand.

If we are going to allocate capital in ways that will reduce our need for imported oil, we should create a list of priorities that ranks candidates for investment according to the amount of oil imports that would be displaced per dollar invested.

Any capital allocation program should start at the top of such a list, and exhaust the more productive investment opportunities before it moves on to encourage the less productive investments in terms of oil imports displaced per dollar invested.

If such a list of investment opportunities were constructed, it is clear that investments that effectively produce energy by improving our efficiency of energy we must be included since the formerly wasted energy becomes available for the same productive uses as newly extracted energy.

Unfortunately, but predictably, the Ford administration has avoided the calculation of energy saved per dollar of energy efficiency investments versus energy produced per dollar of energy supply investments. The administration's preference for subsidizing the highly centralized energy supply systems preferred by the energy industry regardless of their capital efficiency is exemplified by its proposed Energy Independence Authority, which gives only lip service to energy conservation investments while promising to bail out nuclear power and finance the development of a synthetic fuels industry. The bill being examined here today is smaller in scale, but it shares the EIA's defective preference for energy supply investments.

Although a complete listing of investment opportunities ranked according to their effect on our energy supply and demand is not available, existing evidence suggests that there are many opportunities for investments in energy efficiency improvements that would effectively produce energy at a much lower cost per barrel of oil equivalency than would be produced by investments in the production of synthetic fuels.

FEA Administrator Frank Zarb cited several such examples in testimony before the Joint Economic Committee on February 3, 1976. In the Washington, D.C., area, for example, he calculated that investments in additional ceiling insulation would save energy at a cost of $5 per barrel of oil equivalency saved. Nationally, investments in storm windows were estimated to save energy at a cost of $8 to $13 per barrel of oil saved, depending upon regional climate differences. Examples of energy saving opportunities in industry at a cost of $11 per barrel of oil saved were also cited by Zarb.

Based on the presentations of panelists at our conference on energy efficiency, I would like to cite a few other opportunities for cost effective investment in energy efficiency improvements:

Harry A. Tschumi, Jr., of Little Rock, Ark., described a super-insulated home design which cuts heat loss and gain by 65 percent over conventional construction with very little additional construction cost.

Robert Socolow of the Center for Environmental Studies at Princeton University is engaged in a 5-year study of energy use in a residentail development in Twin Rivers, N.J. He described a cost effective retrofit project which has reduced natural gas use by 25 perecnt in 16 three-bedroom townhouses. He expects a second round of modifications to cut gas use to only half of the original level.

Fred S. Dubin of Dubin-Mindell-Bloome Associates described low-cost design features for new commercial buildings which can cut energy use to less than half that required by buildings constructed in accordance with standards most commonly followed in the past 10 years. He also mentioned energy savings modifications of an existing office building that have cut energy use by 29 percent and predicted savings of 50 percent when the program is fully implemented.

Dallas Sullivan, Energy Conservation Director for Ohio State University, described how OSU has modified campus buildings to cut electricity use by more than one-third and natural gas use by about two-thirds at a cost which was repaid in only a few months.

I have attached to my statement an appendix which goes into detail on the Ohio State program.

Mr. DINGELL. Without objection, this will appear in the record in the appropriate place.

Mr. DELOSS. Robert H. Williams of the Center for Environmental Studies at Princeton University described how electricity could be generated with half the amount of energy required by central power-plants, when provided, instead, through factory site installations of facilities for cogeneration of industrial process steam and electricity.

I might note that I would like to commend this committee which has already dealt with legislation regarding utility regulation which would encourage the cogeneration of industrial steam and electricity.

Finally, Donald Navarre, vice president for marketing with the Washington Natural Gas Co., in Seattle, described his company's massive success in reducing gas use by promoting energy conservation. Surveys disclosed that the gas company's attic insulation program alone reduced gas use by 23 percent. The cost effectiveness of the attic insulation investment is so good that gas customers who pay the gas company for the reinsulation work through payments on their monthly gas bills often pay smaller net monthly payments to the gas company than they paid prior to insulating. The combined use of attic insulation, a gas furnace without a pilot light, and an automatic night setback thermostat was found to cut gas use for heating by 37 percent. Further savings are available through a conservationist gas water heater which uses 25 percent less energy than alternative water heaters.

I have cited these examples of cost effective investments in improved energy efficiency to emphasize the potential for effectively increasing domestic energy production through investments which would free presently wasted energy for productive uses. As Donald Navarre of Washington Natural Gas Co., observed in regard to the gas savings created by his company's marketing of energy saving goods and services:

We suddenly realized we had been sitting atop a new gas field for years and didn't recognize it. As an example, the now-insulated homeowners are saving about 744 million cubic feet of natural gas each year simply because of proper attic insulation. Putting it another way, we can now supply gas to about another 8,000 insulated homes without the necessity of any increased gas supply.

These and other experiences described by the panelists at our conference add up to a strong argument in favor of the Energy Conservation Act, which would guide investments into energy efficiency improvements, and against H.R. 12112, which would guide investments into synthetic fuel plants.

The energy efficiency investments would not only produce more energy per dollar invested, they would also avoid the environmental disruption of expanding the energy extraction industry, provide more and better distributed job opportunities, and reduce oil imports sooner than possible through investments in synthetic fuel development.

Given these advantages, we should spend the next 15 years drilling and mining new energy supplies in buildings and factories in all 50 States rather than tearing up our mountain States and the Northern Great Plains for a relatively few barrels of synthetic fuel.

Thus, the American Institute of Architects has calculated that nationwide investments in improving the energy efficiency of new and existing buildings sufficient to save 12 million barrels of oil per day by 1990 would be a much more productive use of scarce capital than investments in traditional centralized energy supply systems during the same period.

The administration's policy of favoring energy supply over energy efficiency, as represented by the proposed EIA and by H.R. 12112, is a policy of less bang for the buck. I may please the energy industry, but it is not in the national interest.

In fact, H.R. 12112's diversion of investments into energy supply options such as synthetic fuels would actually increase our need for imported oil rather than decrease it. This would occur because more energy can be produced from guiding the $4 billion of capital into energy efficiency improvements. The loss in capital efficiency represented by investments in synthetic fuels would have to be made up by importing more oil.

The administration's response to this analysis is predictable. They will concede the short term capital inefficiency of investments in synthetic fuel development, but argue that Federal aid is needed to encourage the long-term development of synthetic fuels.

My reply is that there are long-term opportunities for improvements in energy efficiency technology which will very likely continue to maintain the Btu per dollar advantage of energy efficiency investments over investments in marginal energy supply options such as some synthetic fuels and nuclear power.

The American Physical Society's 1974 summer study is a good source of suggestions for energy efficiency research priorities. When you know that the average home heating system has a "second law efficiency" of only five percent, for example, you can see that theoretically there is room for a twentyfold improvement in efficiency. While perfect efficiency is not a viable goal, the efficiency of home heating systems might be increased several fold in the years ahead. Similar improvements are possible for other energy using systems over the long term.

In summary, I recommend that the committee reject H.R. 12112 and instead focus on the Energy Conservation Act of 1976, which I understand will be the subject of joint hearings by this committee and the Banking Committee.

Since those hearings will examine the Energy Conservation Act and the EIA proposal simultaneously, the capital allocation issues which I have raised here today will be relevant at that time as well.

I would like to close with the recommendation that when you hold those hearings, you should solicit the testimony of some of the persons whose work I have mentioned here today.

Thank you.

[The appendix to Mr. DeLoss' statement follows:]

APPENDIX

TABLE 1.—ENERGY CONSUMPTION REDUCTION IN OHIO STATE UNIVERSITY BUILDINGS

Building	Electricity reduction (percent)	Natural gas reduction (percent)	Months monitored
Allied Medical	43	78	12
McCampbell Hall	63	72	12
Health Sciences Library	20	76	6
Electronics Lab	48	31	6
Biological Sciences	19	49	6
Howlett Hall	24	60	6
Average reduction	36	61	

The dollar savings derived from the energy savings are so great that payback periods for the modification costs, displayed in table 2, are exceptionally brief, ranging from 4.5 months to 11.6 months.

TABLE 2.—DOLLAR SAVINGS IN THE OHIO STATE UNIVERSITY ENERGY CONSERVATION PROGRAM

Building	1-time modification cost	Achieved savings of electricity and natural gas [1]	Payback period (months)	Months monitored
Allied Medical	$30,000	$59,221	6.0	12
McCampbell Hall	57,200	53,551	13.0	12
Health Science Library	27,500	42,971	8.0	6
Electronics Lab	25,750	26,385	11.6	6
Biological Sciences	37,156	99,424	4.5	6
Howlett Hall	31,738	57,386	6.5	6
Total	209,344	338,938	7.4	

[1] Based on monitored energy use over the period shown and projected to total yearly saving at current utility rates.

The dollar savings displayed in table 2 would be even greater, and the payback periods much shorter, if the savings were calculated for oil as the heat source rather than natural gas.

Mr. DINGELL. Thank you very much for your helpful statement.

I will recognize counsel, Mr. Nordhaus, for questions.

Mr. NORDHAUS. Mr. DeLoss, and also Mr. Neville, have you attempted to quantify the relative payoffs in terms of—to put it another way, quantify cost per barrel of reduction in import dependence for supply investment versus conservation investments?

We have had some discussion from various witnesses that the conservation investments are much better, and have a much higher payoff, but we have not gotten very much by way of numbers. Do you have anything on that?

Mr. DeLoss. There is a reason for that, and I think it is that energy policy discussion is generally dominated by the interests of the energy industry, and sympathetic parties within government. Hence the issue of energy efficiency has basically been ignored over the years.

Some of the people whose work I have cited are moving in this direction, but we are just approaching some intelligent appraisal of these opportunities.

I just want to point out that here are some energy-saving investment opportunities that are cost effective, that are being ignored every day. Part of it is just ignorance. Some people are really not sure of how much they could save in this kind of investment.

So one of the remedies that we urge is public education. There is another piece of legislation pending in Congress right now, which would create an Energy Extension Service, that would help communicate that kind of information to people. We need more information, but we have some information that should be communicated right away, today.

Mr. NORDHAUS. For purposes of our hearing record, we have a pretty good idea of what the cost of production of a barrel of synthetic crude will be, and the per barrel equivalent for synthetic gas, and I guess that it ranges somewhere between $15 and $25 a barrel.

Can you give us a comparable figure for the cost of saving the barrel of crude oil through conservation investment? Do you have the numbers?

Mr. DeLoss. The Federal Energy Administration has done a little tinkering in this area, and they suggested a price that could apply to putting attic insulation in the Washingon, D.C., area, for example, to install insulation.

The Ohio State University experiment, in modifying campus buildings as it is indicated in the detailed table that I have attached to my testimony, produced some very short payback periods.

If you wanted to, you could go through their work, and you could take the Btu's saved, and you could divide that into some of the other numbers here on dollar savings, and you could come up with an approximatioin.

Mr. NORDHAUS. We have done this already.

Mr. BEYCHOK. If I may, and I agree with a great deal of what Mr. DeLoss has said. Certainly, our Nation is very proliferate in our capital consumption of energy. It is one of the highest in the world.

Certainly, it is very cheap to conserve energy. I will give you a dollar per barrel for turning off the lights in my house, and putting a solar energy unit in my house would cost $5,000. That is not the point. what it costs to conserve, and one cannot be against conservation any more than you could be against motherhood.

The point is, what do we do after we have reached the point of having turned off some lights, and having insulation. Do we turn off industry, or do we continue to be blackmailed for $20 billion a year for importing oil.

Mr. NORDHAUS. One of the questions that some of our witnesses have raised is the question of what investment priorities the Federal Government ought to have in energy financing programs.

One of the points that perhaps is relevant is that the investment priorities ought to be determined by, partly at least, by the area which has the highest payoff.

Mr. DeLoss. Could I respond to you for a second.

Unfortunately, the fact is that you can be against energy conservation, because the administration right now, particularly in the person of the Office of Management and Budget, is opposing the Energy Conservation Act of 1976.

It is interesting, because that act and this proposal, and the Energy Independence Authority are really two sides of the same coin, the coin of capital allocation.

You have one bill that would promote investment of capital in efficiency improvements, particularly in existing buildings and factories, and on the other side of the coin, you have proposals that would promote investment of capital in the area of these energy supply options.

In this bill, it is synthetic fuels, and in the Energy Independence Authority, it is not synthetic fuels, but it is nuclear power plants, and the nuclear fuel cycle.

So it seems to me very relevant that the administration is opposed to energy conservation in that respect. I think that this happens to be due to the fact that the administration listens very carefully to the energy industry, and not very carefully to other interests.

Mr. Neville. May I make a statement?

I think, in listening to this discussion, and listening to the earlier technical panel, and in particular Mr. Byrom of Koppers, it is very important to make the distinction between the analysis Mr. DeLoss is making, and the analysis that Mr. Byrom was making.

Mr. DeLoss just talked about the real resources used by the country, and deciding where the biggest payoff is. As I tried to point out in my statement, I think in the long run that this is the appropriate analysis that ought to be done.

The problem is that in the short-term there are some very serious problems with the system, and you see really crazy things going on where consumers in the Northwest are afraid of a gas cut off, and are using electricity.

To use this "if the world were perfect" analysis does not always lead you to right short term decisions. I think that it is the important analysis, and efficient use of our resources is the goal that we should be moving toward.

In the short run, you can have some really serious problems and that is why I think unless we do something, the situation will get worse. I really urge that we do something in terms of prices. I think that if you don't do that, you will continue to see crazy things like people using electricity in the Northwest to heat their homes because that is the only clean energy they think they can get, and because it is priced so cheaply that things like solar energy don't look very economic.

I suggest that it is important to consider what variables you can control. Can you only control the very small ones like coal gasification plants, or can you control how the economy, much of it the free market, makes its decisions? As long as consumers make low-cost decisions and energy prices are too low we will have problems.

Mr. DeLoss. I have two comments.

In the short term the kind of policies that I was talking about would have the most effect. Not only is there a fantastic potential for saving energy, and you can see that with what is going on in West Germany and Sweden where they use half the energy and they are advanced industrial societies; not only is there that great potential but, in fact, the leadtime in most energy conservation improvements is very short, especially if you get away from this energy industry position of trying to focus exclusively on new buildings and new factories, and new autos, and start looking to the existing stock of buildings and factories as an area where you can save energy.

There is a lot that can be done with those existing buildings and factories, and it could be done soon. It is cost effective, and that is where we could and should be going. There is nothing hypothetical about it, and there is nothing remote about it.

We keep coming back to the fact that this is not only the cleanest and the safest, and the least risk route, but it is also the one that has the most immediate payoff. I think, maybe, that it is the one that has the most substantial payoff in terms of quantity.

We could spend the next 20 years trying to achieve the efficiency that is achieved right now in other countries. In the meantime, we would have more efficiency coming into being. There are plenty of opportunities in this area.

Mr. BEYCHOK. My argument with Mr. Nordhaus' question is that it is an unfair one. You must compare apples with apples.

You quoted a figure of $20 per barrel for the price of synthetic gas, and then you asked the gentleman what did it cost to turn off the lights and save the first increment.

What he should be asked is, what would it cost to go to cogeneration, or whatever, to improve electric plant generation, to provide 800,000 homes in southern California with gas as this one plant will.

We should compare the same increments, if we are going to look at relative costs.

Mr. NORDHAUS. If we compare what it would cost to freeup the same quantity of natural gas to either provide for expansion of supply, or through conservation, the same quantity of natural gas for new uses, I think that you would have a legitimate comparison.

Mr. BEYCHOK. I think that this is the type of comparison we need.

Mr. NORDHAUS. Insulation investment, for instance, is a way of freeing up a quantity of natural gas. I am not sure that there is anything illegitimate in that question.

Mr. DELOSS. I believe that there has been a Federal report that suggested that at least 40 million existing homes are underinsulated. You have a stock of 40 million homes there that you might go back and reinsulate, and save a considerable amount of natural gas and electricity used, just for starters.

I think that a study that has tried to quantify what some of the potential here is, is a study on cogeneration of industrial steam and electricity that was done by Dow Chemical Co., and some coauthors. They suggested that something like 70,000 megawatts of electric generating capacity in this country could be provided by cogeneration in the next 10 years. The leadtime in constructing cogeneration facilities in a plant is about 6 months to a year.

The real problem in the area of cogeneration, as was indicated in the testimony before this subcommittee by Professor Owens, from the University of California at Davis, I believe, is institutional and not technical nor economic.

The fact is that the social interest is in cogeneration because it is much more energy efficient and much more capital efficient, but the two primary agents in this area are the electric utility industry and the industrial user who has a potential site for the cogeneration facility. They both have certain other interests that might not be served by a policy of promoting cogeneration.

So here is a case where the economics and the technology are incontestable, yet there are some institutional problems, precisely the type of problem that can be solved with public policy initiatives.

So here is an area where energy saving is awaiting public policy initiative. It is not awaiting new technology, breakthrough, and it is not awaiting higher energy prices to make it economically attractive.

I forgot to respond to that point, but many of the energy saving opportunities that I have talked about here today were actually cost effective at preembargo prices. The Ohio State energy saving program was started in 1970, when they realized that their utility use was going up 15 percent a year for a variety of reasons. They wanted to deal with that.

What has happened since the embargo and the postembargo price increases is that the projected paybook periods have diminished drastically, but Ohio State still saw a profitable investment opportunity in this area at preembargo prices.

Now we have to find out why the so-called invisible hand of the free market mechanism has not been working in this area. We have suggested, in some testimony on the other side of the Hill, some areas for investigation. Basically the Energy Conservation Act is aimed in that direction, and this is why we support it so enthusiastically.

Mr. HUNT. Mr. McCormick, on page 5 of your statement, you make reference to an RFP No. E(49-18)—2012. Do you know if the budget is established for this particular RFP?

Mr. MCCORMICK. According to the House-passed version of the ERDA Authorization Act, on page 4, project 77-1-B for a high Btu pipeline gas demonstration plant, which is estimated to cost a total of $500 million, including the non-Federal share of such costs, is authorized. The amount authorized for such plant is $10 billion in fiscal year 1977.

Mr. HUNT. Is that continued on out?

Mr. MCCORMICK. The seed money is for phase 1, that would be the engineering phase.

Mr. HUNT. On that same issue, do you know who any of the applicants are at this point?

Mr. MCCORMICK. I am afraid that I cannot remember the name of the five applicants. There was a press release issued by ERDA, and perhaps I could supply that for the record.

Mr. HUNT. Thank you very much.

Mr. DINGELL. The committee wants to express its appreciation, and we are going to adjourn forthwith.

Mr. BEYCHOK. May I ask the chairman to respond to one question?

Mr. DINGELL. The Chair does not answer questions. The Chair asks them, and will also receive other comments and documents in the record, as might be appropriate. The record will remain open for that purpose.

The committee thanks the witnesses for their presence, and we will recess. The subcommittee will stand adjourned until the call of the Chair.

[Whereupon, at 5:45 p.m., the hearing was adjourned, subject to call of the Chair.]

SYNTHETIC FUEL LOAN GUARANTEES

TUESDAY, JUNE 8, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D.C.

The subcommittee met at 1 p.m., pursuant to notice, in room 2123, Rayburn House Office Building, Hon. John D. Dingell, chairman, presiding.

Mr. DINGELL. The subcommittee will come to order.

The subcommittee continues its consideration of H.R. 12112, legislation to provide loan guarantees for the production of synthetic fuels.

We are very pleased Mr. Robert W. Fri, Deputy Administrator, Energy Research and Development Administration, is here with us today. Mr. Fri, the Chair would like to express my particular thanks to you and to your associates for being here with us today, in view of the shortness of notice to you by the Chair, for which I do apologize.

As you will recall from our discussion of last night, I became aware of the fact that there is a strong probability that there will be second generation technology as provided for in the regular ERDA authorization on-line about the same time or even prior to that which would be funded under the provisions of H.R. 12112. This raises a number, I think, of unfortunate questions in the mind of the Chair that I think require that the answers be discussed before the full committee or rather before the subcommittee on the public record in order that we might have an appreciation of all of the facts and circumstances and the Members might be permitted to achieve a full understanding of any questions that might relate to this matter.

The Chair has considerable problem with the idea that we might on the one hand be financing first generation technology which would come on-line after the second generation technology at higher cost and at lesser reliability. This would essentially create a group of highly expensive possible "white elephants" which might require subsequent public assistance for retrofitting or replacement or might compel consumers to purchase gas at far higher cost than would have been required had we acted more prudently and providently in establishing the framework of Federal assistance for advanced technology.

With those comments, the Chair will recognize you for such statements as you wish, recognizing that you have indicated to the Chair that your presence will be briefly required elsewhere and the understanding you will leave us your assistants for the purpose of assisting the Chair and members of the subcommittee procuring the answers to the questions they might have on this matter.

STATEMENT OF ROBERT W. FRI, DEPUTY ADMINISTRATOR, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, ACCOMPANIED BY PHILIP C. WHITE, PH. D., ASSISTANT ADMINISTRATOR FOR FOSSIL ENERGY; WILLIAM T. McCORMICK, PH. D., DIRECTOR, OFFICE OF COMMERCIALIZATION; RAYMOND ZAHRADNIK, PH. D., DIRECTOR, DIVISION OF COAL CONVERSION; HARRY JOHNSON, PH. D., DIRECTOR, PLANNING STAFF; GEORGE RIAL, DIRECTOR, DIVISION OF DEMONSTRATION PROJECTS; LEONARD TOPPER, PH. D., OFFICE OF COMMERCIALIZATION; AND LEONARD RAWICZ, DEPUTY GENERAL COUNSEL

Mr. FRI. Thank you. Since you called me about 6 o'clock last night we have been trying to get our group together to come up here and I hope we are able to respond to your questions.

First of all, I should introduce for the record the individuals accompanying me today. On my left, is Dr. Philip C. White, Assistant Administrator for Fossil Energy in EDRA.

Mr. DINGELL. We are pleased you are with us.

Mr. FRI. Dr. White runs, among other things, the coal conservation program, the technology development aspects, and notably the demonstration activities for advanced technology in a variety of areas including coal gasification, which seems to be the primary issue here today.

On my right is Dr. William T. McCormick, Director of our Office of Commercialization, who has been working on the program that is proposed here and is intimately familiar with what the program involved in H.R. 12112 is trying to accomplish.

We have also with us members of Dr. White's staff and Dr. McCormick's staff who deal day to day with demonstration projects, the technologies and what not.

Mr. DINGELL. Maybe you could assist us by identifying and introducing all your associates here because I think that would assist us all.

Mr. FRI. From Dr. White's staff, Dr. Zahradnik, who is Director of the Division of Coal Conversion; Harry Johnson, who runs the planning staff under Dr. White; and Mr. George Rial, who is the Director of our Division of Demonstration Projects in Dr. White's organization, which is the division that actually constructs the demonstration projects, runs those projects, as such.

Accompanying Dr. McCormick is Len Topper from his staff, who is the individual who has been most familiar with some of the technical aspects of the plants that have been proposed, and Leonard Rawicz, who is our Deputy General Counsel. Mr. Rawicz has been the attorney who has spent a good part of his life these last several months working with what is now H.R. 12112 reported by the House Committee on Science and Technology.

Mr. Chairman, I have no prepared statement and would be happy to proceed as you wish.

Mr. DINGELL. Well, perhaps it would be appropriate then if the Chair would lay out some of the questions I find troublesome.

As I understand the regular ERDA authorization bill, there is provision in that bill at page 2 for high-Btu gasification in the amount

of $53,054 million, is that correct, under (B) line 25, page 2, and low-Btu gasification in the amount of $47 million?

Mr. FRI. That is correct.

Mr. DINGELL. And the report as I read it indicates as follows: "The objective of the high–Btu gasification subprogram is the investigation and advancement of technology required in the development of improved second generation processes for the production of high-Btu gas from coal by the early 1980's. These new processes are designed to improve efficiency and according to ERDA, could decrease the cost of the product gas by 20 percent compared with current state of the art processes.

"ERDA states that the overall goal of the subprogram is to provide the technology for construction of full scale plants in the early 1980's."

Can you begin by giving us an indication of what is the date for the beginning of the construction and the date for the beginning of the completion of plants referred to there?

Mr. FRI. The nominal schedule from which we have been operating to initiate the procurement process for the first high-Btu gas demonstration plant, as I recall, calls for construction beginning some time in fiscal year 1978 and completion some time mid to late fiscal year 1981.

There is a second high-Btu gas plant which is not in the procurement yet because the authorization hasn't passed, so it would obviously be later than that. We are already a little behind schedule.

Mr. DINGELL. How many plants does this authorization contemplate.

Mr. FRI. As I recall there is one authorized in the 1976 authorization bill and one——

Mr. DINGELL. Six?

Mr. FRI. One demonstration plant for high-Btu gasification in the fiscal year 1976 authorization.

Mr. WHITE. That is correct.

Mr. FRI. And an additional one passed by the House in the fiscal year 1977 authorization bill.

Mr. DINGELL. So that is one in fiscal year 1976 and one in fiscal year 1977?

Mr. FRI. That is right.

Mr. DINGELL. A total of two?

Mr. FRI. Right.

Mr. DINGELL. Are there others which are contemplated in this construction program? In other words, would there be subsequent construction of other plants which would be authorized in subsequent years, according to the budget of ERDA?

Mr. FRI. Dr. White?

Mr. WHITE. No, we have no plans for requesting an authorization for a third high-Btu gas plant. We do, however, plan, in order to make the most intelligent selection of which of the proposed technologies we might best pursue, to award what we refer to as conceptional design phase, phase 1 of the procurement for perhaps more than two. This was covered by operating funds, that is money that is spent for paper studies really to do a little more definitive work on what a commercial plant will look like and work from that back to the demonstration plant for the final design.

We might authorize three of these and pick two if we are authorized to build two plants for the actual construction. If we do build two plants, demo plants, we would not anticipate, not certainly within the next 5 years forecast to have any further demonstrations.

Mr. DINGELL. No further?

Mr. WHITE. Not for high-Btu gas.

Mr. DINGELL. What would the description of the technologies be you would be utilizing in the construction of these two plants? What would be the name of the high-Btu technology you would be using in these two plants?

Mr. WHITE. Well, as part of this program we went out earlier, actually last year, with an RFP requesting proposals. Five proposals were submitted. One of these is based on what we referred to as the synthane process, a process developed by the bureau of mines, which has not actually yet been piloted. A pilot plant has been built, but not yet operated.

One is based on the so-called Hygas process, which has been piloted by the institute of gas technology and cofunded by the American gas association. A pilot plant has been run for some time in Chicago.

Another one is the Cogas process piloted by the Cogas Development Corp. in a pilot plant in Princeton, N.J.

Another one is based on the Lurgi technology which, of course, is the commercial German technology, but an advanced version of that with an advanced methanation step. It does not make high-Btu gas currently.

The fifth one is based on the technology pioneered by Texaco, with their own funding and now offered as a possibility for use with coal. The technology was originally developed for residual oil rather than coal.

Mr. DINGELL. Would you see to it that you submit to us detailed descriptions of those? The staff will work with you on that.

Mr. FRI. Be happy to.

Mr. DINGELL. As I recall in your testimony before the committee at a time earlier, you did not indicate that in connection with consideration of H.R. 12112, gentlemen, there was any other program in Government which related to those matters. Am I correct on that appreciation?

Mr. FRI. Well, I guess I would have to look at the record. We may not have actually said it. Certainly in our testimony before the House Science and Technology Committee it came up.

Mr. DINGELL. It would be fair to infer that that is an important part of the consideration of this committee with regard to the authorization of additional obligations by the Federal Government, would it not?

Mr. FRI. Absolutely. It is indeed in the fact book which has been provided to the committee under tab E which contains a discussion of the relationship between ERDA's R. & D. program and this program. We can provide it to you, again.

Mr. DINGELL. In order to have a more orderly record, the Chair at this time will recognize Mr. Hunt for the purpose of asking questions.

Mr. HUNT. Dr. Fri, from the standpoint of the two, at this point one prospective and one funded, high-Btu coal gasification plants,

what are the expected outputs of those plants as far as their dimensions are concerned? How many standard cubic feet per day?

Mr. FRI. Let me defer to Dr. White.

Mr. WHITE. This was with respect to the demonstration plants?

Mr. HUNT. With respect to the demonstration plants.

Mr. WHITE. I can give it to you in terms of the coal-feeding capacity and I will have to refer to Dr. Zahradnik to translate that. Coal-feeding is in the order of 2,000 to 5,000 tons a day.

Mr. HUNT. Would I be correct——

Mr. WHITE. Eighty million standard cubic feet a day. Eighty million cubic feet a day.

Mr. HUNT. Eighty million standard cubic feet a day?

Mr. WHITE. Yes, sir.

Mr. HUNT. That would be——

Mr. WHITE. That would be 45,000, the largest of those.

Mr. HUNT. Eighty thousand?

Mr. WHITE. 40 to 80 million standard cubic feet a day.

Mr. HUNT. What were the all inclusive prospective costs on these projects, including both the contribution from private enterprise as well as the contributions from the Federal standpoint?

Mr. WHITE. I would like to defer that question to Mr. Rial who I believe has those figures.

Mr. HUNT. The range would be perfectly adequate.

Mr. RIAL. Two million to 500 million.

Mr. HUNT. Two million to 500 million? Was it ever looked at at a range of 2 million to 400 million, or is that 500 million a new figure or one that has been——

Mr. RIAL. That is on overall range and the problem is that we are not in a position to publish these figures right now because this is still in the procurement and evaluation period so I have to generalize.

Mr. HUNT. Well, the range is perfectly acceptable, then, from the standpoint of giving us some order of magnitude as to how much money these plants are expected to cost. Obviously they will be subject to competitive bidding, I suspect.

Mr. RIAL. They have been.

Mr. HUNT. Thank you. In line with this, when are those demonstration facilities expected to be completed? On your current time line, admittedly, there is some level of uncertainly, I am sure.

Mr. WHITE. The present schedule calls for an award of these conceptional designs I described, which would be presumably two or three. The decision is Dr. Seaman's to be made before the end of—presumably before the end of this month and I expect that will take place.

The conceptional design period is generally expected to run about 18 months, which brings us to the end of calendar 1977, at which time we would be in a position to award final contract for the construction of one or two depending on how many are authorized and appear to be justified.

Mr. HUNT. Well——

Mr. WHITE. We would then be looking at a 2½ to 3 years construction period.

Mr. HUNT. 2½- to 3-year construction period?

Mr. WHITE. After the beginning of 1978.

Mr. HUNT. So, this statement that is attributed to ERDA in the committee report of Science and Technology that the overall goal of this program is to provide a technology for the construction of full-scale plants in the early 1980's, prior to that one in 81–82, you would expect these demonstration programs to have basically given us the technological verification necessary to move ahead with the construction of full-scale plants?

Mr. WHITE. Yes. Mr. Rial just provided me with our milestone chart and this shows the construction being finished in mid-calendar 1981. Start operating, presumably operate for 6 months or a year at the least, then we would be ready to proceed to commercialization.

Mr. HUNT. Let us take, for example, the Americal Gas proposal for gasification of coal through existing technology as far as Lurgi is concerned. I am under the impression they are in a 250 standard cubic-foot-per-day plant that will have roughly 36 to 28 gasifiers. Am I correct in that?

Mr. MCCORMICK. Regarding the Americal Natural Gas project, the most recent description of that is not at 250 million cubic feet per day, it is half size. Mr. Hunt, the proposal Americal Natural has most recently made is for a "half-scale plant," that is 125 million cubic feet per day. The other applications and proposals for "first generation technology" are for 250 million cubic feet per day, and, for example, in the case of Wesco this would involve a total of 26 gasifiers.

Mr. HUNT. In the case of Wesco it will be 26 gasifiers?

Mr. MCCORMICK. Yes, 23 normally operating and three backups put into the four major operational trains feeding four methane manifolds.

Mr. HUNT. Could we return then to the ANG proposal which is apparently being broken into two stages now, as I understand it. The first would be the construction setup, shakedown and operation of 125 million standard cubic feet per day plant, and following the successful shakedown on that, or perhaps even lacking to some degree the start of construction on a second train, we would duplicate that 125,000 standard cubic foot per day first strain. Am I correct in that?

Mr. MCCORMICK. That is correct.

Mr. HUNT. What is the construction time line now on the proposal of ANG for the completion, shakedown and basically startup, say, of high confidence of a 90-percent capacity level for that first 125 million standard cubic feet per day line?

Mr. MCCORMICK. Mr. Hunt, that would depend, of course, in their view on whether they could go forward and have the necessary financing. If they were to begin within the next year or so they could complete that plant in approximately 1980, roughly.

Mr. HUNT. All right.

Mr. MCCORMICK. That is the first module.

Mr. DINGELL. When would the second go on?

Mr. MCCORMICK. That again would depend when they started. I am not sure exactly what their plans are. They have only recently come forward with this proposal for the "half-scale plant." Up until 4 or 5 months ago, they were still proceeding with a full-scale plant and they only recently decided to make this change in their application.

Mr. HUNT. All right, fine, then——

Mr. McCormick. The simple answer to the question could be anywhere from 2½ to 3 years, depending on whether they initiated the construction prior to getting the first unit on line or whether they initiated totally sequentially.

Mr. Hunt. Sir, if the bill was to pass this summer what would you set as a realistic target date for ANG's being capable of initiating its construction?

Mr. McCormick. Of course, if they were the successful applicant.

Mr. Hunt. Under the assumption the bill passed this summer and indeed they were the successful applicant.

Mr. McCormick. The earliest they could possibly begin is probably a year to 15 months from today.

Mr. Hunt. Under those circumstances it occurs to me that the demonstration program for 80 million standard cubic feet a day will be on line at about the same time as the first module of the ANG proposal. Am I correct?

Mr. McCormick. That is correct.

Mr. Hunt. So, fundamentally one putting out and in a comparative sense roughly two-thirds, somewhat above that, as far as gas per day of the other, the larger being 125 and the smaller being 80?

Mr. McCormick. If, as Dr. White says, it is an 80 million—he gave you a range of 40 to 80, as I recall—I don't know; perhaps he could comment on what he expects the first one to look like.

Mr. Fri. Dr. White is not able to discuss that.

Mr. White. That's right, I think you have to recognize that there are five competitive bids and the choice is going to be made between them and I don't imagine the choice is going to be particularly influenced by size, either to go to the high range or the low end of the range. It could easily be 40.

Mr. Fri. I don't mean to be flip. I should say this afternoon Dr. Seamans and I are meeting with the Source Evaluation Board on these high-Btu gas plants; the whole thing is legally locked in the cloak of the procurement process at this point and we are just unable to comment very definitely on the character of the individual proposals or how the selections are going to come out. In fact, Dr. Seamans and I do not know how the selections are going to come out.

Mr. Hunt. The question is under consideration at this time?

Mr. Fri. Very actively.

Mr. Dingell. We do respect that. We are not asking you to prejudge these things but we do want to get as much of the comparison of the second generation, its availability and its cost per Btu and what you propose to get from it as from the first proposal; that is the function of the questions of Mr. Hunt and it is not to predispose you toward the selection of any process.

Mr. Fri. I understand that.

Mr. Hunt. If I may return to the ANG process again, I suggested or asked whether indeed the 250 million standard cubic feet plant did involve some 36 or 39 gasifiers. Am I correct in that—at least their initial application?

Mr. Topper. I think the number is 26 gasifiers, something more of that order than 36. I think the plan is initially 26 gasifiers, of which 23 are on stream, three are treated as spares.

Mr. HUNT. Is that the gasifying units from the standpoint of size of those units similar in both the Wesco proposal as well as the ANG?

Mr. TOPPER. Yes.

Mr. HUNT. Are they standardized basically——

Mr. TOPPER. I think in the design for this generation of plants that the gasifiers are all essentially identical.

Mr. FRI. There is not a conventional number of gasifiers. I think we will give you that. I think probably Wesco or ANG is in better position to give you details of their technology. It is like 26 or 36; it is divisible down to a smaller number if that is what you are driving at.

Mr. HUNT. That is basically what I was driving at. There is a large number of these units to be operated in parallel, I suspect—please correct me if I am wrong—for each one of the trains where indeed the output of the gasifiers would flow into a common or perhaps two methanation trains.

Mr. MCCORMICK. For a full-scale plant it would probably be four——

Mr. HUNT. Four methanators?

Mr. MCCORMICK [continuing]. For 250 million cubic feet per day.

Mr. DINGELL. Essentially both Wesco and ANG are the Lurgi process are they not?

Mr. MCCORMICK. Yes, sir; that is correct.

Mr. DINGELL. And that was the process essentially that was used in Germany during World War II?

Mr. MCCORMICK. Yes.

Mr. HUNT. And the one now being used in SASOL in South Africa?

Mr. MCCORMICK. Yes; this is not a situation where the technology for Lurgi is perfectly static. There have been evolutions in the technology since that time, the basic technology improvements. It is not a case that the technology that is being considered is identical in all respects to the technology used in World War II. The SASOL plant is a more advanced version of the basic Lurgi technology.

Mr. HUNT. In line with the utilization of the large number of parallel gasifiers, is this expected to create some problems or could it be reasonably expected to create some problems in the shakedown process; the tuning of this large number of individual modular gasifiers with the trains, the identifying aspect of the process, the oxygen generation and so forth—will this create some complexity?

Mr. MCCORMICK. I am not sure I understand the distinction you are making. There will be a shakedown period for any large plant like this, which would probably be 6 months to a year. Perhaps Dr. White would like to comment further on that.

Mr. WHITE. I would expect the shakedown of a Lurgi gasifier and its associated plants would be significantly less than a second generation plant. I think that can be illustrated by the fact that one of these new generation processing pilot plants which we dedicated last October in Bruceton is just a pilot plant and is still to run. We haven't been able to shake it down in 8 months.

Mr. HUNT. Is not one of the objectives of the second generation technology basically to design a simpler system with a higher level of reliability?

Mr. WHITE. Certainly to design a system that has a higher level of reliability is very clearly one objective. It is not necessarily going to be a simpler system; it may well be, in the case of Hygas, substantially more complex.

Mr. HUNT. What are the other objectives of the demonstration project?

Mr. WHITE. Particularly a higher efficiency in converting coal to combustible gas, a lower investment cost per unit of gas produced, which is likely to be one of the major differences. We see a commercial plant being perhaps 2 reactors instead of 36—two gasifiers—and the large savings, of course, in the cost of both construction and operation in that case.

Mr. HUNT. Would also the utilization of a wider range of coals be one of the objectives?

Mr. WHITE. Yes; one of the characteristics of Lurgi is that it is very good on noncaking European coals, but it has been operated with only indifferent success, over short times, on the characteristic caking coals of Pennsylvania or Kentucky. We hope the new generation will be able to operate on all kinds of American coals, the second generation processes.

Mr. HUNT. Fine. Thank you very much.

Mr. DINGELL. Could you give us an estimate of the differences in cost per Btu of the two processes—the second generation versus the first?

Mr. WHITE. The figure of 20-percent improvement has often been mentioned, and I think realistically one has to consider that that is going to be a top figure. We have to recognize that the cost of coal production and the cost of capital charges on a large plant like this are significant, a major part of the final cost of the unit cost of the gas.

So even if we improve coal utilization and reduce operating and investment costs, we are still going to have a very, very large plant and the continually escalating coal cost. We expect we will be doing very well to lower the cost of the gas by 20 percent; 10 to 15 may be a more realistic expectation for the first of the second generation.

Mr. OTTINGER. On that particular point, I don't understand why the capital costs and the cost of coal are any different from one technology to the other so it would make any difference as to the difference in costs between the two processes.

Mr. WHITE. Obviously the degree to which we can increase the efficiency and get more gas per unit of coal, coal costs per unit of gas is going to be smaller. The same way with the capital costs; the capital charges per $1 million investment obviously will be the same and the charge for a ton of coal mined will be the same; but, if we can use less capital and less coal, we will obviously make a saving, and it is that saving that is going to contribute to the 20 percent as well as improved operating costs by having perhaps fewer units with more reliability.

Mr. DINGELL. What is the basis of your assumption, then, that the second generation will cost, on a Btu basis, 15 to 20 percent less; that the plant will be constructed at a lower cost, requiring less capital

investment; that it will produce more gas per ton of coal; or that it will use more labor, and construction and maintenance of the facility will be simpler?

Mr. WHITE. All of these things contribute. We have a sufficiently well determined design and estimate of cost of that design today on some of these second generation processes to make a reasonable or what we refer to as a horseback estimate of what that cost will be in today's dollars.

Mr. DINGELL. I solicit your guidance. Why do you make the statement that there is a probability of 15 to 20 percent lower cost per Btu on the second generation process as opposed to the Lurgi process embodied in H.R. 12112?

Mr. WHITE. Because of increased efficiency of coal use, overall efficiency of the process is higher, the number of units and therefore the tons of steel per unit of coal produced and gas produced, coal charge and gas produced—amount of steel is lower, the number of units to maintain and operate are fewer, and each of these tend to reduce cost.

And as we look at this overall—we have had this done by competent architect-engineering contractors under contract to ERDA for some several years studying the gasification processes—this is the kind of difference that they estimate is going to be found when we finally build these plants.

Mr. DINGELL. As I understand it, the Lurgi process uses about 70 percent of the coal because some of it is too fine when you finish the processing of the coal. Would the new process use more of the coal for the production of gas?

Mr. WHITE. If we are successful, we think we will be processing run-of-mine coal.

Mr. DINGELL. One hundered percent of the coal as opposed to the coarser and finer grades being lost to the Lurgi process?

Mr. WHITE. Some of the coal has to be used to generate oxygen or pumping the air; there are other things that go into the gasifier, and that is what we mean by overall efficiency. Ray, could you give us perhaps an efficiency number for those two differences we are looking at?

Mr. ZAHRADNIK. Mr. Chairman, we feel that some of the advanced technologies that are being developed could be as much as 10 to 15 percent more efficient on an absolute basis than the first generation Lurgi technology.

Mr. WHITE. Just coal efficiency?

Mr. ZAHRADNIK. That is Btu in the gas versus Btu in the coal.

Mr. DINGELL. How about capital investment, how about operating costs and how about reliability? Could you address yourself to those three points, please?

Mr. WHITE. Let me take reliability first. Perhaps it is the most subjective. To the extent that we are able to minimize the number of units involved, the number of steps and the number of units, the direction is to improve reliability. To the extent that it is a new process and has not yet been demonstrated on the full commercial scale, there is uncertainty with regard to the reliability we are going to achieve.

But experience shows us that, as we build the second and third and fourth of these new units, we get more and more experienced and we get more and more reliability; so the basic simplicities in the design

should begin to come through and we will get more reliability. As to what number to put on it, it would be difficult to make any meaningful estimate at this time.

The construction and operating costs, clearly for operating two gasifiers, even those very large and complex, instead of 36, the operating costs will be significantly less; but it is important to recognize that the gasification is just one part; you have coal feeding, coal preparation, gas cleanup, water-shift reaction and methanation, all of which take place in preparing high-Btu gas, and these steps we are also trying to improve but the improvement is not likely to be quite so major as it is in the gasification step.

But each of these is going to contribute, and I think the point that Ray made of a 10 to 15 percent increase in efficiency right there means that much less coal, although it does not apply to the operating and capital cost, but the other does, and those additional factors will make up the 20 percent if we do manage to achieve that 20 percent. These estimates are the best we can provide.

Mr. DINGELL. The Chair will recognize members for questions in the order they arrived. I first recognize the gentleman from New York, Mr. Ottinger, for 5 minutes.

Mr. OTTINGER. You said under the ERDA program for new high-Btu coal research and development demonstration that there were two plants that you were going to be financing—one in fiscal 1977, starting—is that correct?

Mr. WHITE. One has already been authorized by both Houses, approved. The second has, I believe, been authorized by the House but not by the Senate yet and it is still a matter of further deliberation by the Congress in the next few weeks.

Mr. OTTINGER. And the one that is already authorized is one you anticipate output of 40 to 80 million?

Mr. WHITE. On the basis of single authorization, we went out for a request for proposals. I was quoting the range of the proposals that we received in response to that one authorized plant.

Mr. OTTINGER. Is that the ANG?

Mr. WHITE. No; they are different groups entirely.

Mr. OTTINGER. Right. Is that Coalcon?

Mr. WHITE. Coalcon is a liquid boiler fuel plant. There were other groups. They have been announced publicly. I can't recall. There are various consortia that are involved. We will be glad to supply for the record the names of the proposers.

Mr. OTTINGER. The information that I had was that the Coalcon contract—that is why I wanted to identify it—would demonstrate a module scale conversion of high-sulfur coal to clean-burning liquid and gaseous hydrocarbons to be jointly funded with a consortium of private industry at a total level of $237 million; when completed, the plant will convert 2,600 tons of high-sulfur coal a day to 3,900 barrels of clean liquid fuel and 22 million cubic feet of high-Btu pipeline quality gas per day. Is that inaccurate?

Mr. WHITE. That is entirely correct.

Mr. OTTINGER. So this is an additional demonstration?

Mr. WHITE. Yes. Of course, in terms of the products from the coal, the primary product is the clean boiler fuel. There is a very significant amount of high, pipeline-quality gas but it is not a process aimed primarily at pipeline-quality gas.

Mr. OTTINGER. And has this been contracted for?

Mr. WHITE. Yes, it has.

Mr. OTTINGER. And when is that expected to come on line?

Mr. WHITE. The design is now in final stages. I believe the schedule calls for completion sometime this fall. Conceptual design is to be finished in the third quarter of this calendar year; construction is to start at the beginning of fiscal year 1978. There is a period of final engineering design, which will take another year.

Mr. OTTINGER. And when is that expected to go into operation?

Mr. WHITE. Middle of fiscal year 1980.

Mr. OTTINGER. Middle of fiscal 1980. Do you have an estimate of the cost of the gas that will be produced in connection with that process?

Mr. WHITE. I don't think we do. Do you have any figure on the cost of this gas?

Mr. RIAL. I don't have it for this process but for the commerce plans which would be typical of the process it would be around $3 a million Btu.

Mr. WHITE. Not for the demonstration plant, which would be quite expensive as a small plant, but for a commercial plant built on this process it will be $3 per million Btu.

Mr. OTTINGER. You don't have an estimate for the demonstration plant itself?

Mr. WHITE. No; we haven't tried to cost that out. I don't think we have it available here today.

Mr. OTTINGER. Do you also have a low-Btu gasification plant on a demonstration module in your present program?

Mr. WHITE. Yes, we have; just as we have one pipeline high-Btu gas plant, we have one low-Btu gas plant authorized and a second one under consideration by the Congress currently.

Mr. OTTINGER. And what is the status of those two? You say one has not been authorized yet?

Mr. WHITE. Only one has been authorized. The same schedule—one in 1976; one possibly in 1977. We again went out with a request for proposal here; we solicited proposals for three different possible approaches to this plant, the single plant; one would be for power generation for a utility, one for industrial use, and a possibility a very small plant for industrial or commercial use. We have had the proposals in just the last few weeks; the closing date was the middle of May on those.

Mr. OTTINGER. And what volume do you expect out of that first one? Have you arrived at the point where you can give us any idea what the volume of gas production is that is expected from those demonstrations?

Mr. WHITE. There has been no announcement, and this again is an earlier stage of the procurement process. Generally it is going from—since we did ask for small units, some of them are going to be quite small that will be considered. What we will finally award I don't know.

Mr. SHARP [presiding]. Time has expired.

Mr. OTTINGER. If you would allow me a couple seconds more. Is the estimated cost of this plant—the information I have is between $400 million and $500 million. Is that correct?

Mr. WHITE. I don't know where any such number came from. I do not think that could be correct.

Mr. OTTINGER. What is the estimated cost of the low-Btu plant?

Mr. WHITE. The small plant may run $10 million, $20 million, $50 million, the big ones probably up in the same range as the other one.

Mr. OTTINGER. What did you go to the committee for authorization on?

Mr. WHITE. Do you remember the authorization on the low-Btu?

Mr. RIAL. We have an authorization; it is in the range that he is talking about.

Mr. WHITE. A range of 400 to 500?

Mr. RIAL. Yes.

Mr. WHITE. I stand corrected; apparently the authorization is in the range of $400 million to $500 million.

Mr. OTTINGER. You are talking about a fairly good size plant if you go ahead on that basis?

Mr. WHITE. That is right, if we do.

Mr. OTTINGER. And in the range of production of what size?

Mr. WHITE. I think it will be comparable size, coal rate.

Mr. RIAL. We got these just 2 weeks ago; I don't think we can talk about them.

Mr. WHITE. It is not likely it is going to be any smaller with that amount of money.

Mr. OTTINGER. Thank you, Mr. Chairman.

Mr. SHARP. The gentleman from Texas, Mr. Krueger, is recognized for 5 minutes.

Mr. KRUEGER. Thank you, Mr. Chairman. Earlier, as we were discussing the estimated costs per million Btu for gas that might result, I heard one figure of $3 per million Btu as the likely cost. What that——

Mr. FRI. That was $3 per million Btu for the gas that comes out of the Coalcon project, which is basically a liquid boiler fuel project which produces pipeline-quality gas as a kind of byproduct.

Mr. KRUEGER. I see. Could you give us some sort of range of estimates of the cost for high-Btu gas from the various projects that might be undertaken with these guarantees?

Mr. FRI. The demonstration, the advanced-technology type?

Mr. KRUEGER. Yes. I am sorry; under H.R. 12112.

Mr. MCCORMICK. Mr. Krueger, the gas we estimate for a full-scale, 250 million cubic-feet-per-day plant would be in the range of about $3.50 a million. It would be $3 to $3.50. There are different estimates.

Mr. KRUEGER. Between $3 and $3.50. Is that the more or less direct cost or is that a cost with amortization of the plant? If it includes amortization, at what rate is it being amortized?

Mr. MCCORMICK. Yes, it does, and that was done with the assumption of 25 years. I don't know whether you have ERDA's fact book in front of you that discusses this subject.

Mr. KRUEGER. No, I don't have it before me.

Mr. MCCORMICK. Let me check. In here the case that we use was $3.28 per million and it was amortized 25 years.

Mr. KRUEGER. Twenty-five years. Would you say that 25 years is a very reasonable period for amortization?

Mr. MCCORMICK. Yes, sir; it is normally associated with some value on the order of 75 percent of the useful life of the plant. A plant like this would have a useful life of 30 to 40 years. So that is a reasonable period for amortization.

Mr. KRUEGER. And does that kind of amortization figure also reckon in any additional amounts for repairs or changes to technology or things of that sort or would that be an additional expense?

Mr. MCCORMICK. It includes normal operation and maintenance; it does not include any additional cost for backfitting, if you will, retrofitting a piece of advanced or more advanced technology to the plant.

Mr. KRUEGER. In the technology that we have in mind, what, in your judgment, Mr. McCormick, would be the things that a person out to consider with regard to the use of water—that is, I know that you have undoubtedly looked into this and I am interested in what kind of effects—in other words, how high is the use of water for these various technologies? Is it going to be very substantial use and could you give me some sort of pegs that I could set for relative values on that?

Mr. MCCORMICK. This has been a fairly misunderstood subject, which I am glad to have the opportunity to comment on because we have prepared a table, which I would be happy to submit for the record, which compares the water usage of high-Btu gasification plants, oil shale plants and other large synthetic fuel plants with the water requirements of a comparable size powerplant producing electricity using coal, for example; and, in general, the water requirements are a third to a half on a useful Btu basis—that is, in favor of the synthetic fuel plant. That is, the water requirement is less for synthetic fuel. I have the table here.

Mr. KRUEGER. I would ask unanimous consent that be included.

Mr. MCCORMICK. They are not insignificant, to answer your question; but in comparison with energy generating for generation from alternatives, they are less; and there is a general perception they are much higher and that is incorrect.

Mr. SHARP. Without objection, that material will be made a part of the record at this point.

[The table referred to follows:]

SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS

Plant/option	Usable energy produced (10^9 Btu/d)	Air emissions (pounds per hour)					Water requirements (acre-feet per year)	Solid wastes (tons per day)	Resource requirement (million tons per year)
		Par	SO^2	NO_x	CO	HC			
High-Btu coal gasification (250 mmscfd)	250	180	450	1,780	90	30	6,300	1,400	8.3
Coal-fired power plant with electrostatic precipitator (1,000 MW)	80	500	10,200	6,900	400	120	9,700	750	3.0
Same as above, with limestone scrubber	80	530	1,100	7,300	400	120	11,100	1,700	3.0
Kaiparowitz powerplant (3,000 MW, with scrubbers)	240	1,070	4,300	20,830	NA	NA	54,300	NA	9.0
Shape oil plant:									
50,000 bbl/d	290	130	1,500	600	50	800	6,200	47,700	23.0
10,000 bbl/d	60	30	310	100	10	150	1,200	9,500	4.6

Sources: Radian Corp., A Western Regional Energy Development Study: Primary Environmental Impacts, vol. II, prepared for the Council on Environmental Quality and the Federal Energy Administration under contract No. EQ4AC037, August 1975. Final Environmental Impact Statement on Proposed Kaiparowits Project, U.S. Department of the Interior, March 1976. All figures rounded.

All "water requirements" figures in the Summary Comparison Table are estimates of water consumption; that is, waters removed from the region's watercourses and not returned. While additional water would normally be removed and

returned by power plants over and above the data shown, zero return of waters is incorporated into the design of all proposed standard-size high-Btu coal gasification plants of which we are aware. From the final Kaiparowits EIS, for example, water consumption compares to coal gasification as follows:

CONSUMPTION OF WATER, ACRE-FEET PER YEAR

	Standard-size high-Btu coal gasification plant (250 mmscfd)	Proposed Kaiparowits plant (3,000 MW)
Usable energy output (10^9 Btu/d)	250	240
Water loss from cooling systems	3,500	41,400
All other plant-related water consumption	2,800	12,900
Total water consumption	6,300	54,300

It is emphasized that these figures are estimates provided for the purpose of general information as to the substantial inherent differences in water use.

Mr. KRUEGER. Can you give me some idea of how in situ coal gasification projects differ perhaps in their use of water compared with other kinds of coal gasification projects?

Mr. WHITE. This is a very new and emerging technology, at least in this country. We do have experiments going but, generally speaking, the water use will be significantly less. In order to gasify coal, one does have to put in water with the air to provide the hydrogen to go into the gas, so there is a direct consumption but it all goes into the final product and there is no water for process cooling, this sort of thing, the way there would be in an aboveground plant.

Exactly what the ratio is I don't have any figures at the tip of my tongue but I would guess it would be 25 to 40 percent, no more than that, of what would be required in a conventional aboveground processing coal conversion plant.

Mr. KRUEGER. Thank you. I see my judge with his arm and hammer raised. Thank you, Mr. Chairman.

Mr. FRI. Mr. Chairman, this may be somewhat irregular; inasmuch as I have to leave in about 5 minutes, I was wondering if I could make a couple of comments on some of the information that has been elicited to date before you go on.

Mr. SHARP. If there are no objections from the members of the committee, that will be fine.

Mr. FRI. Let me say, Mr. Chairman, I am delighted at the opportunity that Dr. White and Dr. McCormick have had to go through the features of our demonstration program and its comparison to the plants that will be built under H.R. 12112. This is a subject obviously that we discussed rather extensively with the House Science and Technology Committee and I remember that it came up certainly in the Banking and Currency Committee hearings with followed by a day our first hearing before this subcommittee.

I am glad we have the opportunity to explore this relationship today. I think it is particularly important because what hopefully is coming out of this is the observation that the strategy ERDA believes needs to be followed, ultimately, to have commercially viable synthetic fuel plants in this country requires two basic thrusts. One

is the development of the technology itself, primarily the gasifier, although some of the other aspects of the technology.

Observing that that constitutes by no means all the capital costs of the plant and can make 10- to 15-percent efficiency improvements which, taken together, will result at the outside—and Dr. White's estimates are probably as authoritative as anybody's on this subject—at the outside a 20-percent difference in the cost of gas, which is significant but perhaps less than some people would anticipate from advanced technology development.

Technology development concerns the development of the 20 or 25 percent of the plant that actually gasifies the coal. It is clearly important. And that is the thrust of the technology demonstration program conducted by Dr. White, and we do believe that it is important to have the technology available, operated, so it can be picked up by the private sector in the early 1980's, and that is the schedule the program is on.

However, I would point out that the other thrust one needs if we expect to have the private sector pick all of this up without a lot of Government guarantees when we are really going commercial on this subject in the 1980's—the other kind of information one needs goes beyond technology to the question of the environmental effects, the socioeconomic effects, the data one needs on a full-scale operating plant to convince a banker that he ought to invest somebody else's money into it.

I have discovered, in dealing with the geothermal loan guarantee program which is underway, that it takes a lot to convince a banker. They are not liberal about other people's money, I am happy to say.

There is a range of operating, financial, environmental, socioeconomic and water and other kinds of data that are required.

Now, to get this kind of information, H.R. 12112 intentionally puts this technology through a lot of hurdles that involve something other than the development of new technology. It may be that one could argue that those hurdles ought not to be perceived as important because, after all, one could build a smaller demonstration plant and go look at it and everybody is happy.

The fact is, in my judgment, whether it is objectively correct, sitting here in Washington or not, that the people who have to live with these plants are not prepared to extrapolate upwards—I am talking about the Governors and the local counties as well as the investors and engineers—are not prepared to extrapolate upwards from a quarter-scale demonstration plant and say everything is okay. They want to take a few plants under very carefully controlled conditions and run them through all of the hurdles that a commercial plant would have to go through when that full-scale commercial plant comes into being under private auspices.

I submit that unless we have gone through that gauntlet—which is a nontechnological gauntlet in the sense of developing advanced technology—that when we arrive in the early 1980's, when, I think, we will want to start to build up the synthetic fuel industry that our options will be to either engage in a very complicated and unrewarding controversy with other political jurisdictions and others or to undertake a crash program which will delay the whole thing and override all of their concerns—I think neither condition is in the public interest.

I can't stress how happy I am we are really able to talk about the whole program taken together—I think the whole program taken together tries to address both the technology development about which we talked a great deal today but also the development of our institutions, our feelings about these things, so that when we arrive at a point when this country really needs to develop the industry—and I think we will arrive at that point in the early 1980's in a big way—that we can proceed responsibly. And so there are twin thrusts to the program.

It may be that sitting here in Washington, as I say, one could conceive of a different kind of a program which would be cheaper if Governors and bankers and county managers thought differently. They don't, and I have spent a fair amount of my time over the last 6 months throwing myself in the way of Governors and holding regional meetings to learn that fact.

So I guess the only point I want to make; yes, we do have two thrusts to this program; both thrusts are, in my judgment, essential to a responsible development of this industry, and that is why we actively support the Federal involvement at this early stage in both thrusts so that we can at a later time have a sound basis built so the private sector can responsibly go it alone without Government guarantees.

End of comment, Mr. Chairman. I appreciate your taking me out of order to say that, since I do have to leave here in just a couple of minutes.

Mr. DINGELL. I fully appreciate that. Let me ask you just two questions very quickly. One, can you submit for the record, so as to save time for my colleagues, what different socioeconomic and environmental conditions are to be expected from the second as opposed to the first generation plants? What different information in these areas would we get in the one instance than we would get in the others?

Mr. FRI. I think we owe you a detailed rundown of that. I would indicate, though, there are not only differences in fact but also differences in the way people respond to a demonstration facility which is built for one purpose and then very often closed down as opposed to the first-of-a-kind commercial-scale plant, more of which they may have to live with over the next 20 years.

Mr. DINGELL. All right, but you have indicated to the committee the technology which will be picked up by the private sector in the 1980's is not the technology for which the loan guarantees will be issued under H.R. 12112; that is, it is not the Lurgi process that would be involved in these but rather it is the second generation technology which will be generated under the ERDA authorization bill?

Mr. FRI. I guess that is true. I guess the thrust of my 8-minute monologue was that we have to have two thrusts to the program; in order to establish the nontechnological aspects of the program, we have to go ahead with the technology that we are comfortable will work on a commercial scale. That is why we are using the so-called first generation technology to do it.

Mr. DINGELL. Having established that, we are going to get socioeconomic information which, you advise me, is different on plants which will not be used in the 1980's, which will be either obsolescent or obsolete?

Mr. FRI. Well, the Governor doesn't much care how the gasifier works; what he cares about is how many people come in to construct

the plant, what it does to his local scene, how much coal you dig out of the ground and that kind of thing.

Mr. DINGELL. You are going to get that under either the first or second generation technology. Then, either the technology and either the socioeconomic impact and environmental impact is the same under both the first and second generations or it is not.

Mr. FRI. Well, it is not quantitatively the same, but the real difference is that the program proposed in H.R. 12112 brings in the Governors, brings in the regulatory agencies and goes through the whole process that a commercial plant would have to go through without Government involvement.

Only to help it through, there is a Government involvement in the form of loan guarantees, not only the industry but also to the communities affected, and it may well be, Mr. Chairman, that it would be nice if people thought differently but they don't.

Mr. DINGELL. You are doing this on obsolete technology, or technology that will not be used in the 1980's, and you tell me the information on socioeconomic information on the first generation and the environmental information is different than it is on the second generation. I get the feeling that there is a conflict in your testimony. I would appreciate it if you would resolve it.

Mr. FRI. Well, Mr. Chairman, I guess I have some difficulties going much further than I have. It isn't a question of the particular piece of data; it is a question of what people do with it and how it is reacted to, a process it goes through, and what you are trying to accomplish. What we are trying to accomplish in H.R. 12112 is to get that whole group of people out there, whether they are Governors or county officials or bankers or environmental groups or whatever, to help us go through the whole process to see if we have got something that is institutionally, as opposed to technologically, viable.

Mr. DINGELL. The Chair is going to recognize the gentleman from Colorado and then the Chair will recognize the gentleman from Ohio next.

Mr. WIRTH. While you were out, Mr. Fri got us down to the clearest explanation as to what we are embarked upon, and let me see, Mr. Fri, if I might walk back through that once again.

Mr. FRI. Surely.

Mr. WIRTH. For the purpose of explaining as carefully as possible the relationship between Mr. McCormick's program and Mr. White's program, which is where we may have gotten balled up: Mr. McCormick's program has as its purpose to tie together all of the pieces that would have to go into a commercial project—the gasifier, coal handling, the feeding, the environmental impact, the regulatory problems you are going to have, other technological problems, which have never on the face of this globe been done before, is that correct?

Mr. FRI. That is correct.

Mr. WIRTH. And there is much to be learned if you make the assumption that it is important that we move ahead as quickly as possible on a coal gasification project in the United States. It is important that all of these be tied together and that there are significant technological lessons to be learned from a program tying them all together, is that not correct?

Mr. FRI. Technological and others.

Mr. WIRTH. And that by attempting to put these all together under Mr. McCormick's operation, attempting to put them all together in one large commercial project, you are going to learn and accelerate the learning process. Almost all of the testimony I remember we heard on the Science Committee and, I believe, that has been reflected here, is that it is not obsolete technology, that we are doing something for the first time and, second, that the acceleration of the learning process is going to be achieved by the commercial scale plant; isn't that correct?

Mr. FRI. That is correct, yes.

I think I would add only that there is a lot to be learned and there are a lot of people who want to learn it, who really haven't before had to deal with this problem in the kind of depth we have debated over the last 6 months.

Mr. WIRTH. So, assuming then we were to go ahead with Mr. McCormick's project, we would have learned a lot about a lot of the pieces and how they fit together, which does not have to be learned again. The coal handling, the feeding, the regulatory impact, the environmental impact, only have to be learned one time for the most part.

Mr. FRI. The whole premise of the programing.

Mr. WIRTH. So when we learn all of these, they can then be applied to any future coal gasification project we may want to embark on, which gets us to Dr. White's operation?

Mr. FRI. Right.

Mr. WIRTH. The part you are responsible for in ERDA is the gasifier. The gasifiers will require significant technological changes, is that not correct?

Mr. WHITE. Yes.

Mr. WIRTH. By changing the gasifiers in the basic McCormick operation we then significantly change the technology of coal gasification. Almost everything else remains relatively consistent except for the gasifiers which are being tested under your program; is that not correct?

Mr. WHITE. That is correct. The only thing that would be likely to change at all might be the effect on air pollution by virtue of what comes out the stack.

Mr. WIRTH. But that has much to——

Mr. WHITE. Socioeconomic impact, financial, everything else will be the same.

Mr. WIRTH. The purpose of Mr. McCormick's program is to put all the pieces together, isn't that true? By the time your program, Mr. McCormick, is through—it is the first phase—your program, Mr. White, then fits very neatly into that by being able to take the gasifier component out of the coal gasification project and relate that to the other basic package that is going to, from what anybody knows at this point, remain relatively constant, except the interchangeable piece that comes out of your program, Dr. White, is that not correct?

Mr. FRI. That is correct, and the two are designed to come together roughly at the same point in time to be available for future use together.

Mr. WIRTH. In the early 1980's, is that correct?

Mr. FRI. Yes.

Mr. WIRTH. So we have the relationship which I think you well explained, Mr. Fri, between Mr. McCormick's project, which, for the first time, takes all of the components and puts them together in one reasonably accelerated package, from which a great deal has to be learned, then the interchangeable parts will be developed by Dr. White's operation to be interchanged with the basic package and put together under Mr. McCormick's.

It seems to me that the basic assumption remaining is, yes or no, do we believe that we ought to embark upon an aggressive coal gasification project in this country. That, as I believe you underlined, is the basic issue facing this committee, not the relationship between these two operations in first or second generation technology.

Mr. FRI. I think that is correct. I think, if you believe as I do, there is a significant, I think, very high probability that we will need something on the order of 10 million barrels equivalent of synthetic fuel by the end of this century, then a little simple arithmetic tells you you have to be able to start building plants in a pretty routine way very fast starting in the early 1980's.

Mr. WIRTH. That is routine.

Mr. FRI. That isn't going to happen without having this base of information.

Mr. WIRTH. That routine is built out of what we learned from Mr. McCormick's operation, the basic commercial routine package we might call it, and out of which are the new gasifiers, which is where the technology is going to change?

Mr. FRI. That is correct.

Mr. WIRTH. Thank you, Mr. Chairman.

Mr. FRI. I thank you for permitting me to leave.

Dr. McCormick and Dr. White will stay behind.

Mr. DINGELL. I would love to let you go and I will excuse you as soon as Mr. Brown is done. He has not had a chance to ask questions, and I am sure he is very concerned that you respond.

Mr. BROWN. I want to ask you two brief questions. If the technology for second generation is available before the first generation's technology social and economic feasibility has been established, why not go immediately to the second generation technology to establish socio and economic feasibility? Do you understand my question?

Mr. FRI. Yes, I think so.

Mr. BROWN. I am going to try very hard to understand your answer.

Mr. FRI. Well——

Mr. BROWN. I tried to understand Mr. White's——

Mr. FRI. To be able to say the so-called second generation technology is available requires us to build a demonstration plant incorporating that technology, shake it down and operate it for a sufficient period of time to get the engineering data so that the people who would have to build that plant at commercial scale will say "it works, we understand how it works, we are confident we can scale it up to full-scale commercial size."

Now, the process of building and operating those demonstration plants will take us into the neighborhood of 1983.

Mr. BROWN. The second generation technology has not been done that far?

Mr. FRI. Some of it has been done at a much smaller pilot scale. This is the next step in size between pilot-scale and full-scale commercial, which we need to take in order to verify the technology works, get the data, and so forth.

Mr. BROWN. So, what you are saying is we would delay the establishment of socio and economic feasibility by several years if we waited for the use of second generation technology to establish socio and economic feasibility?

Mr. FRI. Yes. Together sequentially. First, to develop the technology, then to undertake the full-scale plant to determine socio and economic feasibility. That would take another 5 or 6 years.

Mr. BROWN. Let me ask the question again. We would then be delaying the time frame in which we would establish socio and economic feasibility of any kind of a plant let alone the second generation plant, is that correct?

Mr. FRI. I believe so, yes.

Mr. BROWN. All right, and you won't take the first generation technology, which is available now, and go ahead with the establishment of socio and economic feasibility because that socio and economic feasibility may well be transferable to the second generation plant when it is finished by 1983, is that correct?

Mr. FRI. That is correct.

Mr. BROWN. I won't ask you to get into this now. Can you give us a rather precise definition of the difference between commercial and sociologic or socioeconomic feasibility demonstrations and technological development and feasibility demonstration?

We seem to be using the words technology and socioeconomic feasibility interchangeably sometimes, and I want to get the precise clarification of what those two differences are.

Mr. FRI. Let us provide as precise a clarification as we can.

Let me tell you just briefly, though, it stems in large part from the difference between a way an engineer looks at a piece of hardware and the way a banker looks at a piece of hardware or an environmentalist or a Governor. The engineer is very often looking to see if he feels he can build one that will work. The banker is looking to see whether he is willing to invest other people's money in it.

A Governor is looking to see if it is something his people can get along with, and much of the difference comes from the viewpoint of the people who are looking at the same operation.

Mr. BROWN. The difference between the production department and the marketing department?

Mr. FRI. Yes.

Mr. BROWN. Well, Mr. Chairman, I don't want to delay him any further. Those two questions have gone to the heart of the points I want to pursue, but I may want to pursue them with further questions with others. I don't want to lose my time.

Mr. DINGELL. The gentleman will be protected. He has about 1 minute remaining and Dr. Fri does have to go. The gentleman is free to use that 1 minute in any way he wants.

Mr. FRI. Thank you. I am very sorry.

Mr. DINGELL. We appreciate your problem.

Mr. Brown?

Mr. BROWN. I am willing to let Dr. Fri go. I do want to use my time on the other gentlemen and more time later.

Chairman DINGELL. We thank you for your presence and assistance. We will have other questions for your associates and there will be questions we will be asking for the record.

We thank you.

Mr. FRI. Thank you.

Mr. BROWN. What I really want to know is precisely what, to the degree you can give it with any precision, will be learned in the socioeconomic area by the first generation demonstration plant as opposed to what you anticipate will be learned by the second generation demonstration plant?

In other words, what socioeconomic information is transferable and what would be anticipated would not be transferable from one plant to the other. Do you understand my question?

Mr. WHITE. Yes, I think so.

Mr. BROWN. Do you?

Mr. MCCORMICK. Yes.

Mr. BROWN. Help yourself.

Mr. MCCORMICK. Mr. Brown, let me just comment directly on your question, then I would like to expand on it a bit.

Socioeconomic information is only one of the major categories of information that the proposed loan guarantee program would provide. If you build a full-scale commercial, say, gasification plant, you would have to have an influx of workers, construction workers, you would have operating personnel, and you would have an effect on the local community.

The effect on the local community would be in direct proportion to the size of the plant you build. If you are talking about building a first generation, full-scale plant, which is what we are talking about, the magnitude of the effect would be roughly four times that which you would see in a demonstration program.

Mr. BROWN. That is a socioeconomic impact, however, isn't it?

Mr. MCCORMICK. Yes.

Mr. BROWN. OK, go ahead.

Mr. MCCORMICK. What I would like to point out is there are several other major categories of information of a purely nontechnical nature which were interested in gaining from the program under H.R. 12112.

Mr. DINGELL. Could you tell us what that is?

Mr. MCCORMICK. Yes. These are outlined, Mr. Chairman, in the ERDA fact book at tab C. There are nine major categories of information, I can run through them briefly for the committee, if you desire.

The first major category deals with engineering plant operations data. We are talking here about operating fullscale commercial plants on a continuous basis with normal operating personnel which in all likelihood would not be identical with a demonstration plant which is a first of a kind plant at a certain technology which undoubtedly will be highly instrumented and would be interested mainly in the technological features.

You would be able to get operational occupational health and safety data. I said, you would be operating with normal personnel.

Mr. BROWN. This would be different from one generation to another or would it be all the same?

Mr. McCormick. Not if you had a full-scale second generation plant. I believe the question was, how would we get additional information from building first-generation full-scale plants?

Mr. Brown. The question was what is transferable from the first generation plant to the second generation plant? What would be unchanged in the second generation plant and what would be the different impacts between the first and second generation plant?

Mr. McCormick. Most of the major categories of information of a nontechnological nature associated with the first generation plant would be transferred, directly transferable to a second generation plant.

Mr. Brown. Which ones?

Mr. McCormick. OK.

Mr. Brown. Is that the list that you are giving me here?

Mr. McCormick. Yes.

Mr. Brown. Which ones would not? If it is easier, could you just go through them and say system reliability and operability?

Mr. McCormick. On engineering plant operations data, you would get some information that would be applicable to the second generation. The difference is there would be in the technical areas of the gasifier and the differences in the plant that would be.

On environment and socioeconomic information, you would get significant information from the first generation technologies that would be carried over. This would be on reclamation, mining, data, plant effluents, water requirements, and so forth; also, land disturbance and the State and local socioeconomic impact.

All this information would be directly transferable from the first to the second generation technology. The facilities associated with mining, the coal of course would be transferable, they wouldn't change. You would be able to get some data on the economies of scale, operation and maintenance costs, and overall economies of the venture because you would be able to scale, as Dr. White pointed out earlier, the essential differences between the first and second generation technology which are primarily in the gasifier area.

You would obtain a lot of information on project financing of the first generation technologies which would be direct applicable to second generation technologies. These are in the areas of private sector financing experience, which you would get from the first generation technologies as well as giving the financing community more information on the investment uncertainties involved. Since you would be operating a first generation commercial scale plant, you would have to gain information on product distribution and marketing, how you would use the synthetic fuels and how effectively do they work. What is their quality and so forth.

Mr. Brown. Would these be common? Would that be common with the second generation plant?

Mr. McCormick. Yes, it would be information on product substitution and product quality.

In addition, you would gain a significant amount of information on the regulatory barriers which both first generation plants and second generation plants would have to meet. That is bringing a first generation plant through the some 16 Federal regulators, State regulators, the Federal Power Commission, and so forth. That information

base which you would develop would be directly applicable to the commercialization of second generation technologies and, in fact, if you had it in hand would facilitate a more rapid commercialization of second generation.

There would be information you would gain on water requirements. If you build and operate a commercial plant you would collect data on exactly how much water is used and have a firmer basis for knowing what the water requirement for advanced technology would be.

You would have a considerable experience on questions of public acceptance, which as you know are considerable barriers in some cases to the early commercialization of technology.

We are now having some difficulties in the nuclear area and the only way to really know what the real questions of public acceptance will be and separating the facts from fiction is to build and operate a plant, carefully monitor it and see what the real public acceptance is.

Lastly, you will get harder data on manpower and equipment needs which are common to either the first or second generation technologies.

So, in summary there is a gerat deal of information which, if gained from the first generation experience, can be used to facilitate the acceleration of the second generation technology. However, if we wait until we demonstrate the second generation technology, that, as you pointed out earlier in your questioning, will shove the whole schedule for introducing synthetic fuels back 5 or 6 years.

Mr. BROWN. Thank you.

Mr. DINGELL. Time has expired.

The Chair recognizes the gentleman from Texas, Mr. Krueger.

Mr. KRUEGER. Thank you, Mr. Chairman.

Mr. Chairman, I was recognized, I believe, while you were out. I would like to make a 1-minute observation.

Since you have been so courteous, and that is not only Mr. Fri who discovered that bankers have problems with judging whether or not they wish to provide funds for synthetic fuels, there are other people who provide natural fuels who also have problems with their bankers, and I would like to put in this little caveat that those people who are concerned about the price of oil and who are forcing the price of oil down in many cases also are causing difficulties for getting appropriate capitalization.

With that, thank you very much.

Mr. DINGELL. The Chair observes that we have a vote on the floor on the suspensions now pending, and for that reason I suspect it will be necessary and prudent for the committee to recess until these matters have been disposed of.

I assume we would be back in 15 or 20 minutes, perhaps more like a half hour. In any event, we will be in recess for that long. We apologize to you.

The committee stands in recess.

[Brief recess.]

Mr. DINGELL. The subcommittee will come to order.

Gentlemen, we express our apologies to you for the delay. There were three votes on the House floor which necessitated our presence over there.

The Chair has some questions here. We have been referring back to the factsheet. Under No. 1, you refer to engineering plant operation data and you say the main difference is expected in terms of information obtained from commercial scale operations as opposed to demonstration, pilot program levels include—and then you set out a series of things.

Now, is it not a fact that second generation plants will require different operation data from first generation plants?

Mr. McCormick. Mr. Chairman, I am not certain what you mean by different operational data. I am sorry, I do not understand the question.

Mr. Dingell. Well, is operational data necessary?

Mr. McCormick. Well, in order for a potential investor, Mr. Chairman, to be confident that he can invest in a project or process, he would need some experience base, including operational data on the plant and the fact that it is operating successfully over some period of time.

I am not sure what kind of operational data you are talking about.

Mr. Dingell. Well, will not the operational data from a first generation plant be different from that which would be derived from a second generation plant, or will they be the same?

Mr. McCormick. To the extent that the data applies to those parts of the plant which are different it would be, but as we indicated before, there are many features of a first generation and a second generation coal gasification plant that are very similar that the major differences are only in the gasification part of the plant which represents about 20 percent of the overall plant.

Mr. Dingell. Well, is the methanator the same?

Mr. McCormick. It could be.

Mr. Dingell. It could not be?

Mr. McCormick. It could not be; it depends.

Mr. Dingell. How about the gasifiers, are they the same?

Mr. McCormick. The gasifiers would not be the same.

Mr. Dingell. Pardon?

Mr. McCormick. The gasifiers would not be the same.

Mr. Dingell. They will not be.

Well, then will you not have to go out and duplicate your same tests for your second generation plants on the parts and the major constituents which are different.

Mr. McCormick. With respect to the gasifier, the answer is yes, but there are a number of other parts of the plant, including coal feeding, handling equipment, waste disposal, environmental control technology and a number of other aspects of the plant that will be very similar, so what we are saying is that there is some part of the first-generation plant which will be different from a second-generation plant.

Mr. Dingell. Well, then, to resolve the operating uncertainties, you are going to have to do the same work on the second generation plant as you have to do on the first.

Mr. McCormick. To resolve the uncertainties on the second generation, you would only have to resolve them in the areas which are not the same, and as I indicated, that is a relatively small part of the plant.

Mr. DINGELL. Are you indicating a transferability, then, between the two?

Mr. MCCORMICK. Well, absolutely. Mr. Chairman, if there were not any utility in collecting the data in the first generation plants, then, of course, there would be no reason to go forward with this parallel thrust, as Mr. Fri described it.

What we are trying to do is gain a body of information which will be transferable to the second generation technology so we can allow those to proceed in a more expeditious fashion when the technology for second generation becomes available.

Mr. DINGELL. Well, you are saying, then, that you can transfer this data back and forth?

Mr. MCCORMICK. To a large extent, there is much data that can be transferred.

Mr. DINGELL. This is environmental data?

Mr. MCCORMICK. A large amount of this information, yes.

Mr. DINGELL. Is this socioeconomic data?

Mr. MCCORMICK. Certainly in the socioeconomic area——

Mr. DINGELL. That you can transfer back and forth between these plants, between the first generation and the second generation plant.

Mr. MCCORMICK. Yes.

Mr. DINGELL. You can transfer that? There is no difficulty in it?

Mr. MCCORMICK. Yes.

Mr. DINGELL. There is no difficulty in it?

Mr. MCCORMICK. Only to the extent in the socioeconomic area, the size of the plants are different.

Mr. WHITE. As long as we are talking the same sized plant, say the 250 million cubic feet per day gas plant, whether it is first generation or second generation technology, the socioeconomic impact, the stress on the environment with respect to the production of the resource——

Mr. DINGELL. It does not have to do with the type of the plant, it has to do with the size of the plant?

Mr. WHITE. Much more with the size, yes.

Mr. MCCORMICK. In the case of the socioeconomic impact, that is correct.

Mr. DINGELL. How about environment?

Mr. MCCORMICK. There it depends on the type of the plant, too, but there are many kinds of environmental information which would be esssentially the same between a first and second generation plant.

Mr. DINGELL. Why is it if you can transfer it back and forth between the first and the second generation, you cannot transport data and information in these areas back and forth between the Lurgi process plants in the United States and South Africa or the United States and Scotland?

Mr. MCCORMICK. Well, Mr. Chairman, as we indicated before there is, of course, an experience base in Europe. However, the kinds of information that we need to gather in this country go beyond, in some cases, those which are produced in Europe because of the more stringent environmental and other safeguards which we have.

In addition, our regulatory systems that have to be satisfied to build and operate these plants are different, so although much of the purely technical data is transferable, there are a whole range of other kinds

of information related to the successful commercial operation of these plants that cannot be gained from experience in Europe.

So there is a narrow area of technical information transferability, and even not all of the technical information is transferable, because they may, in fact, be using different feedstocks and operating under different conditions.

Mr. DINGELL. They are burning U.S. coal in Lurgi plants in Europe right now, are they not?

Mr. MCCORMICK. They have tested quantities of coal in Lurgi gasifiers, that is true, but that kind of limited experience under a different regulatory system, with different environmental standards, with different factors that are required to satisfy potential investors, is not going to prove——

Mr. DINGELL. Let us go on, if we may, here.

Specifically, you referred to system reliability and operability. Now, did the earlier testimony today not indicate that second generation coal gasification plants are likely to be considerably more reliable than first generation plants?

Mr. WHITE. I indicated that there were two directions in the way it could go. It is a new technology, and with any new technology, it is apt to be rather unreliable when it first starts up, and it tends also to be somewhat more complex, at least some of the technology we are considering are much more complex than a Lurgi gasifier.

On the other hand, we do expect the unit to be much larger and therefore, in terms of having a number of units, the kind of problems and the multiplicity of problems are going to be less. Admittedly, they will be big ones when they come, if we have them, because there will only be one or two large units——

Mr. DINGELL. Can you advise me how you are going to transfer reliability information from the first generation plants to the second generation plants, in light of what you have just told us?

Mr. WHITE. The input of the total system of mining the coal and converting it to gas and feeding that into a pipeline has got a lot of components that are common to either first or second generation. You have to recognize that——

Mr. DINGELL. You are referring to coal mining, then?

Mr. WHITE. Oh, the mining, the preparation, the grinding and feeding of these are not going to be too different.

Mr. DINGELL. I was of the view that coal mining was something that had been done by strip mining or deep pit mining for generations, for centuries, and I am curious what new information is required on this matter that is not available readily from the Bureau of Mines and from the coal-mining companies.

Mr. MCCORMICK. Mr. Chairman, if I may add to that, I think the specific point to which you are referring on page 2 of Tab C of the ERDA fact book addresses the issue of the reliability and operability of a commercial-scale plant that would be staffed and operated by normal operating personnel, as opposed to a technical demonstration plant that could be instrumented and operated under 100 different conditions.

Mr. DINGELL. Have you not indicated to us already that the reliability under the different technologies is different?

Mr. McCormick. I think, as was pointed out earlier, since second generation technology is not here yet, of course, you cannot talk about its reliability. We have some reliability experience on first generation technology.

What we are saying is that by building a commercial scale unit in this country and operating it under normal commercial conditions, we will get information on the overall system reliability and operability, much of which can be transferred to a second generation plant, because simply many of the major parts of such a plant are the same.

There are some differences, but much of——

Mr. Dingell. You have already done this through pilot plants, have you not?

Mr. McCormick. Dr. White may want to comment more on this, but you do not operate a pilot plant the way you operate a commercial scale plant, because it is basically a test bed.

Mr. White. If we get a 100-hour run out of a pilot plant, we feel that we have done pretty well. They just are always up and down with problems. They are not built to provide reliability. They are just built to provide just proof of certain reactions and basic control approaches, but not to have—we do not put the redundancy into the auxiliary equipment to give them reliability.

Another point I would like to make, Mr. Chairman——

Mr. Dingell. Well, let's stay with this. Are you not going to get us a whole lot of information about plants which will function with obsolete or obsolescent technology?

Mr. White. We are going to get a lot of information on plants which are based on technology that will not be duplicated in new plants, but much of that information is independent of that technology.

The point I would like to make is that——

Mr. Dingell. You are saying that the information you get, then, on the operation of one of these plants is independent from the technology?

Mr. White. I said much of the information is not dependent on the particular technology of the gasifier.

Mr. Dingell. Well, how about Lurgi processes in Scotland and Lurgi processes in South Africa?

Mr. White. What about them?

Mr. Dingell. Well, how does this make transfer of information from them to plants in the United States inadequate?

Mr. White. Well, for one thing, the size of the Lurgi plant in Scotland is a very, very small gasifier by European standards. The size commercial plant we are talking about, of 250 million cubic feet a day, is many times bigger. The scale factors are very significant, even for the first half of it, of 120 million cubic feet. Even that—and I believe I am right, correct me if I am not—the plants that we are talking about, even at 125 million cubic feet a day are larger than any coal conversion plants that we have, on which there is operating experience anywhere in the world.

Mr. Ottinger. Would the gentleman yield?

Mr. Dingell. Yes; I will yield to the gentleman.

Mr. Ottinger. The person who actually ran the plant in Scotland was here and testified and he said that with respect to the environmental effects of a methanator operation, the amount of water it would

use, the socioeconomic impacts on the communities and so forth, that he thought you could get all of the information from the plant that has been in operation in Scotland using various kinds of American coals as you could from building a larger plant here in the United States, and I mean, he was right on the spot in doing this with the cooperation of American companies.

Mr. WHITE. Well, he is certainly entitled to his opinion. I think I would have to point out that Mr. Fri spoke earlier on the standpoint of the attitudes and conceptions of the people that he has been dealing with, with the Governors and local communities in the West where these plants are—surely some of them are going to be built, and I do not think, frankly, from what he has seen that they are particularly impressed with running a small plant in Scotland, in terms of its socioeconomic impact, or even its environmental impact.

It is true, you get some useful data out of it. There is useful data on the methanator. There is useful data on some operations of the gasifier, but it is a very small gasifier.

Mr. DINGELL. Let us come around to this. You have two things going on in ERDA with regard to this coal gasification. First of all, you have your demonstration plant that is going to produce 30,000 million cubic feet per day, second generation. It is going to be on line about the same time that these other plants are going to be on line, producing 125,000 million cubic feet per day.

Mr. WHITE. Let's take the other extreme——

Mr. DINGELL. Let me finish my question, here, then you will know what you want to answer.

Which are you going to get a better information transfer on, a demonstration, second generation plant producing 80,000 million cubic feet or a half-scale, first generation plant producing 125,000 million cubic feet.

Mr. WHITE. I think it is obvious that if those were the plant sizes, and you picked the extremes in each case, bring them close together—they might well be the other way, of course, 250 million and 40 million—the——

Mr. DINGELL. Yes; but according to the testimony that we have, it is more likely going to be 125,000 million cubic feet, as opposed to 80,000.

Mr. MCCORMICK. Mr. Chairman, in terms of the projects that have been proposed by the industry, it is less likely that it is going to be 125,000, because there is only one proposal of which we are aware that is that small. The other——

Mr. DINGELL. Which one is that?

Mr. MCCORMICK. That is the American Natural project.

Mr. DINGELL. 125,000?

That is about a third larger, half larger——

Mr. MCCORMICK. The other major four or five projects have all indicated a preference to go to what they view as the most economical size of 250 million cubic feet per day.

Mr. DINGELL. I think my time has expired. The Chair is going to recognize my colleagues.

The Chair recognizes first the gentleman from Indiana, Mr. Sharp.

Mr. SHARP. I have no questions.

Mr. DINGELL. The Chair recognizes the gentleman from Ohio, Mr. Brown.

Mr. BROWN. It seems to me that there are three possibilities that financing might be done in any kind of a demonstration plant to determine commercial and sociological feasibility.

First, you could just put out Government grants to help build the plant, or have the Government build it directly in some way, which seems to me to be the worst way, because the Government does not always do things in the most economical, businesslike way, and one would never know whether they had overinvested or underinvested or anything else.

The second way would be to guarantee the loans, as has been proposed so that the Government would share in the capital formation obligations.

Of course, there is the totally private way which could be done without our action at all, so it is not appropriate to our consideration.

Finally, the guarantee of a price for the product produced by the plant.

Now, I would like for you to address all three of those with the idea in mind, for instance on the latter, that if the committee were to decide to substitute price guarantee for the product emanating from the plant in lieu of loan guarantees for commercial sized high Btu coal-gas facilities, would the price guarantee by itself, in your opinion, be sufficient to insure the construction and operation of such a facility?

Now I happen to feel that is an area of consideration and preference which is not necessarily appropriate to this committee, nor is it appropriate to the Science & Technology Committee, nor even to ERDA. It rather is the specialty of those people in the various economic markets.

I wonder if you might address yourself to the question.

Mr. MCCORMICK. Yes, Mr. Brown. We have considered in some depth the various financial incentives that might be appropriate for high Btu coal gasification, and I might add that, in doing this, we sought the advice of the financial community, and what I am going to say——

Mr. BROWN. In what way? I am curious. If you don't know the answer to it, advise us to what extent you sought it, will you?

Mr. MCCORMICK. We have met individually and collectively with at least 10 of the major investment banking firms on Wall Street. We have extensive day to day discussions with them. In addition, their testimony on this particular issue, both in the Science & Technology Committee hearings both last year and this year, as well as, I believe, on the record of this committee and on the Banking and Currency Committee, and the consensus of their views, as well as the views of the project sponsors, is that a price guarantee would do nothing to facilitate the early initiation of a commercial high Btu coal gasification plant.

Mr. BROWN. For what reasons?

Mr. MCCORMICK. The reason is relatively straightforward, and it simply is that those regulated utilities—and I emphasize the words "regulated utilities"—have limited net worths, all on the order of, or less than a billion dollars. The size of these plants are approximately $1 billion each.

In going to the capital markets—and they normally finance their projects through highly debt leveraged financing—in going to the

capital markets, they are unable to obtain financing, front-end financing, for projects which approximate the net worths of their companies.

These are not small companies by absolute standards, at all, but, on the other hand, the projects are quite large.

The price guarantee mechanism, although it would provide a certain market, does not satisfy an investor that the plant can be completed and successfully operated, and the investor is concerned not so much about the technological test, but all the regulatory, environmental and political uncertainties that face a first-of-a-kind demonstration plant. So, in order to provide the financing for these plants, price guarantees just simply won't do it, and I might add that in the case of the regulated utilities, they do provide a mechanism for recovering costs, and as pointed out earlier in testimony before this committee, in effect, that represents a contract price at the outset which is approved by the regulatory commission, in this case, the Federal Power Commission and the local rate commission.

So to put it very simply, these projects which you have heard about in high Btu gasification already have assured customers, they have people who are willing to pay the price for that gas. The thing that they are unable to get is the financing because of the large size of these projects and the inexperience that the financial community has with them.

Mr. BROWN. What is the prospect that we would have modifications of rates, do you think, that could affect that also? In other words, the plant established in such a way, I suppose, could be economic at the outset, but if the rate is a fixed rate, not economic in the future, is that correct?

Mr. MCCORMICK. I am not sure I exactly understand your question, but——

Mr. BROWN. Well, if you had a contract with the Government to take the supply of the product at a certain level, the price, it seems to me that if initial construction costs or production costs were somewhat higher than you anticipated, that that might still be a commercially and sociologically viable project, that is, it could prove something and be attractive, but the fixed price that you had contracted for just might not work out.

Mr. MCCORMICK. I am sure we could construct a situation where if the Government decided to completely take the open end and guarantee completion of the plant as well—and I emphasize that additional requirement, because even though the Government might guarantee $4 or $5 a million Btu for the gas and say we will insure that you can sell your gas, you still have the risks of noncompletion and the problem there is simply that the plant could get hung up in some regulatory proceedings or run into some unforeseen delay that could cause the plant not to come online anywhere near the time period that the plant would be built.

These risks would not be insured by a price guarantee, and that does not provide much protection, if you will, for the lender during the period during which the plant is not being completed.

So basically I think what we are saying, Mr. Brown, is that the price guarantee is not the right financial tool to build Btu gasification plants. The loan guarantee addresses the central issue of capital acquisition of regulated utility companies that have difficulty in raising large amounts of money with limited net worths.

Mr. OTTINGER. Would the gentleman yield on this point, the gentleman from Ohio?

Mr. BROWN. Happily.

Mr. OTTINGER. I do not think the testimony you have given is at all accurate, Mr. McCormick. In point of fact, the Treasury Department testified on this very question, and its conclusion was that Treasury believes the least objectionable financial incentives would be price supports, and the Science and Technology Committee—I did not hold any hearings with respect to the price support alternative, and I am informed that the only evidence that we had on this subject was a Tosco witness, Mr. Charles Brown, who testified that price supports would not be necessary with a 75 percent loan guarantee.

Mr. MCCORMICK. That is for oil shale, I believe. Mr. Charles Brown represents the oil shale information.

Mr. BROWN. Well, I get the impression from what the witness has said that the testimony was taken in the Banking and Currency Committee and the Science and Technology Committee and that you are also drawing from information you gathered in your conversations with 10 or so investment bankers about what would assure private investment in this area, is that correct?

Mr. MCCORMICK. Yes, sir, and I would just point out that Mr. Neihuss testified for the Treasury Department before the Banking and Currency Committee and expressed strong support for H.R. 12112 and also indicated that he felt in the area of high Btu gasification that a loan guarantee was appropriate.

What he did say was that he felt that ERDA should have a flexible package of incentives to apply the incentives to the proper technological and regulatory situation, and I am sure he would confirm that, if asked.

Mr. DINGELL. If the gentleman from Ohio would yield, I am curious if the banker here was speaking pro bono publico or whether he was talking out of his own self-interest?

Mr. BROWN. And the same thing might apply to the Treasury Department, was the Treasury Department speaking for what the Treasury Department would like to see done, or what the real world is likely to do in an economic sense?

Mr. MCCORMICK. Well, Mr. Brown, all I can say is that I think the collective testimony of perhaps 10 financial witnesses have all drawn the same conclusion as to the appropriateness of the loan guarantee incentive in the case of the high-Btu gas, and so the financial community, the project sponsors and everybody that we are aware of that has an opinion that professionally bears on this issue, seems to be in agreement.

Mr. BROWN. Can I switch to another part of the same problem—another similar problem unrelated to economics in a direct way, but only in an indirect way, and that is the question of patent rights and proprietary information.

Do you have a feeling about what you might get in the way of response from the private sector if patent rights of a process would be jeopardized by whatever we might do legislatively based on either 25-percent participation by the Federal Government, or just the simple act of guaranteeing a loan?

Similarly, proprietary rights, as they are currently protected by the Freedom of Information Act, what is your feeling about what ought to be done in that area in the legislation that might flow from this committee?

Mr. McCormick. Mr. Brown, this issue is, as you know, a very volatile one and one in which people have wildly different opinions on.

Mr. Brown. Well, they have wildly different opinions, and I might say once again that I am asking you about areas which I think are not properly under the jurisdiction of this committee, if one is a strict constructionist with reference to the Rules of the House of Representatives, because obviously patent rights are something that the Judiciary Committee has struggled over for some years with more or less success and not an area of our jurisdiction, and the same thing is true of the Freedom of Information Act.

Mr. McCormick. If I can just briefly respond, H.R. 12112 deals with patents insofar as it applies under subsection R the patent position or patent policies in the Federal Nonnuclear Energy R. & D. Act which is ERDA's main organic authority for the nonnuclear technology areas, and in the basic patent provisions of that act, provide that under normal situations, the Government would take title to any invention conceived of in the course of assistance under that act.

Mr. Brown. You mean developing the particular technology?

Mr. McCormick. Yes; developing the particular technology, although the Administrator would have the authority under certain circumstances to waive the right of taking title in the event that he felt that that was in the national interest. So the basic patent language of the Nonnuclear Act provides for taking title with the ability to grant waivers, and since H.R. 12112 would be an amendment to the Federal Nonnuclear Act, it would be under the same provisions that now govern ERDA in other nonnuclear areas.

Mr. Brown. Unless we fiddle with it in some ways in the legislation. Now, that raises the question, then, do you think it would be sufficiently discouraging to private entrepreneurs if we said that because you have a Federal loan guarantee, any technology that would be applied in this as a result of a social and economic demonstration project, undertaken under this act providing for loan guarantees, would result in that technology becoming a matter of the public domain?

Mr. White. Yes; I could not answer too strongly on that point, Mr. Brown, I think it would stop the program dead in its tracks.

If you have ever had any experience dealing with the Lurgi Corp., you know they are concerned about background technology—not the new stuff that comes out of the program——

Mr. Brown. It is the background technology that I am asking for.

Mr. White. It is very carefully guarded, and they are not about to enter into an operation that puts it into the public domain.

Mr. Brown. So they just say nuts to you, we are not interested?

Mr. White. I think they would. They have said that in the private sector pretty bluntly a number of times. They simply will not deal with such a situation and I think many American companies are the same way with respect to background patents in a situation where what they are getting is a loan guarantee.

I don't know where it would finally end up if you had an impasse or it was a national crisis, but I don't think it would be a constructive effort in trying to bring forth the technology for the use of the American public.

Mr. McCormick. It should be reemphasized here, Mr. Brown, that this does not deal with any technology developed in the course of a demonstration project that would be assisted under the bill. That new technology developed in connection with the project would become the right of the Federal Government unless the Administrator chose to give that right up.

Mr. Brown. The means of encouraging the development?

Mr. McCormick. Yes; if he viewed that that were in the national interest.

I would also like to make sure that I did not mean that they should not be forced to license. The requirement of making the technology available to all responsible parties under reasonable license, I think, is provided for now and is something we should certainly insist on, and we are doing so in our present contracts.

Mr. Dingell. The time of the gentleman has expired.

The gentleman from New York, Mr. Ottinger.

Mr. Ottinger. Thank you, Mr. Chairman.

Dr. Zahradnik, do I understand correctly that you have been most closely associated with the development of the second generation technology efforts in the synthetic fuels?

Mr. Zahradnik. Yes.

Mr. Ottinger. Do I understand correctly that from the point of view of socioeconomic effects, and environmental effects, that you learn just about as much from a high Btu as a low Btu plant?

Mr. Zahradnik. Well, my colleagues have an advantage on me, Congressman. I am not sure that I understand completely what socioeconomic effects mean.

We do, in the pilot plants we construct them and operate them for developing the advanced generation technology comply to a number of regulations. We comply to the zoning laws of the area in which we build the plants. We make sure that the roads are built properly, electrical wiring codes are adhered to, mechanical structure codes for the vessel are adhered to, and the environmental protection laws which apply are adhered to.

We cooperate with our own Assistant Administrator for Environment and Safety in ERDA. We cooperate with——

Mr. Ottinger. Well, what I am trying to get at is you can get this information from both the high and the low Btu work——

Mr. Zahradnik. We get information from all of our projects. Much of it is transferable from one technology to another, much of it is not. The end use of high Btu gas is different from the end use of low Btu gas, and in that ultimate end use, there are differences.

Mr. Ottinger. How many, and can you give us an idea of the scope and the size of the demonstrations that are presently going on in the high and low Btu——

Mr. Zahradnik. Well, I will let George Rial answer on the demonstrations, but we have four pilot plants in the high Btu area. These

pilot plants range in size from 30 tons a day of coal to 120 tons of coal a day. We have a liquification plant operating at 50 tons of coal a day.

We have a small low Btu gasifier operating at 10 tons a day. We have plants on schedule which will operate from 100 to 600 tons per day of coal. That is the size of the pilot plants.

Mr. OTTINGER. You are not involved directly with the demonstration plants?

Mr. ZAHRADNIK. That is correct, sir. Mr. George Rial is.

Mr. OTTINGER. Well, Mr. Rial, can we hear from you with respect to the demonstration plants?

Mr. RIAL. Dr. White has already indicated that the high Btu runs there in the range of 40 to 80 billion cubic feet a day.

The problem I have in answering your second question is that we have just received these proposals about 2 weeks ago from about 14 proposers, and we are going through the evaluation stage at this point. We still may get some late proposals coming in, and for me to try to answer that reasonably is that I am in an unethical position——

Mr. OTTINGER. I hope I can ask some questions that are generic. I do not want to get into which company you are going to have to do what.

Can you give us an idea of how long a life you could ordinarily expect from a second generation demonstration plant?

Mr. RIAL. From these plants, we are trying to evaluate them on the basis of continuing on in commercial operations. This is one of the evaluation criteria that we use, both in the high Btu and the low Btu.

The only thing that would not permit them to be carried on in the commercial field is that if the technology itself was unsuccessful or the economics of it turned out to be too high priced in the end evaluation, but the plants will be built in such a way that they cannot continue running, assuming these two evaluation criteria are met.

Mr. OTTINGER. Are they built so that they can be expanded into commercial sized plants if these criteria are met?

Mr. RIAL. Yes; they are one module, and if you put together several of those modules of a similar kind, you would have a commercial sized operation.

Mr. OTTINGER. We are paying particular attention to that, and they can be expanded, assuming they are successful.

What is contemplated will happen to the product of the demonstration plants.

Mr. RIAL. The pilot plants?

Mr. OTTINGER. The demonstration plants.

Mr. RIAL. The original demonstration plants?

Mr. OTTINGER. No; your second generation demonstration plants.

Mr. RIAL. The second generation demonstration plant, which was the nucleus, and to which the others were added to, will continue to be a part of the eventual commercial installation. That is our objective.

Mr. OTTINGER. Out of the demonstration plant, what do you do with the gas that is produced?

Mr. RIAL. What do you do with the gas?

Mr. OTTINGER. Yes.

Mr. RIAL. Part of the responsibility of those proposing this RFP was to dispose of the gas, so these people have all lined up markets for utilization, some of them into industry, others into gas systems.

Mr. OTTINGER. Assuming that you get the 15-percent to 20-percent increase in efficiency in the second generation technology as has been testified you hope to be able to achieve, how would that translate itself into price?

You say under the first generation technology, under the best possible conditions, Mr. McCormick testified that you might get gas at $3.50 per million cubic feet.

Mr. RIAL. The answer to your question of the 15 percent to 20 percent was really the answer to what was the cost to the consumer. It really was a 15-percent to 20-percent reduction in the end price.

Mr. OTTINGER. A 15- to 20-percent reduction in the end price is what you anticipate?

Mr. RIAL. Yes.

Mr. ZAHRADNIK. Mr. Ottinger, maybe I can amplify a little bit on the comments of Mr. Rial. I think it is an important point.

If you take a commercial plant that produces 250 standard cubic foot a day, let me make arithmetic simple and with some concessions, assume that the gas produced would cost $4.

That means the daily revenue of this plant is $1 million. The yearly revenue is $300 million, $350 million, assuming it has a pretty good on-stream factor.

If one can improve the efficiency of a plant whose revenues is $350 million a year by 10 percent, assuming everything else is about the same, one saves $35 million a year per plant. That is a significant saving.

Mr. OTTINGER. That is a very significant saving.

Mr. ZAHRADNIK. Over a 20-year lifetime, that is a lot of money. Over an industry giving birth to a synthetic fuels industry, it is highly significant.

Mr. OTTINGER. So that would indicate that there would be certainly great financial advantages, if you are going to have the Government participate in financing anything, finance the second generation technology rather than the first.

Mr. ZAHRADNIK. We have been saying that for a number of——

Mr. MCCORMICK. Mr. Ottinger, if I may comment on that, as you know, what we are talking about in the loan guarantee program is building a rather limited number of these first generation plants, so at the most, we would be talking about building two or three of each kind for the purpose of gaining this other body of information that would complement the technological information gained on the second generation technology.

So we do not mean to imply that we would be promoting the future commercialization, necessarily, of the first generation technology which we have indicated is 20 percent more costly, so what we may, in fact, have in the end is a couple of plants, a few plants that have a product which might be——

Mr. OTTINGER. A couple of multibillion dollar white elephants?

Let me get back into the——

Mr. MCCORMICK. There is one other point on that, and some people—if you look at when you could build them, we could build a first generation full-scale plant today. We could not build a second generation full-scale plant today, and it should be pointed out that the cost comparison——

Mr. OTTINGER. If the two are coming on at the same time——

Mr. MCCORMICK. In one case, that is a modular plant, and in the other case we are talking about a full-scale plant, and the point I was about to make was simply——

Mr. OTTINGER. From the point of view of technology, it does not really make that much difference, because if the second stage technology does, in fact, work, you put these things together and you are going to have a commercial scale plant, and you are going to have it at a level that is sufficiently more efficient so it is very likely you are going to get private financing for it.

Mr. MCCORMICK. What we are saying simply is the body of information which we have described that can be gained from building a full-scale demonstration project using first generation technology is transferable, so that we can have, in the middle 1980's both technical information and this other body of information that will allow us to proceed with the accelerated commercialization of second generation and advanced technology.

Mr. OTTINGER. I guess really the question we have to decide is is that worth $11.5 billion to get that information to the extent that you can get it more reliably than you can from demonstration sized plans?

Mr. MCCORMICK. Well, first of all, the legislation which the committee is considering is $4 billion.

Mr. OTTINGER. Well, we all know that is not so. I mean, you testified yourself that this was part of the original program, that you anticipate the 350,000 barrels per day—which indeed, you have used here, that will take $6 billion loan guarantees, $4.5 billion in price supports, and $600 million in construction grants.

I mean, you are going to go back on the testimony which was given in the Science Committee with respect to that?

Mr. MCCORMICK. As you well know, we came forward with a comprehensive set of proposals that envisioned a 350,000 barrels per day program.

The Science and Technology Committee has determined that, in their view, that large a program is not warranted. They have provided a bill, I should say, a proposal that cuts the program down to about $4 billion in loan guarantees.

Mr. OTTINGER. You don't mean to say that Dr. Seamans misrepresented to us, because he said to us that this was just the $4-billion installment on what he fully intended to complete the original program.

Mr. MCCORMICK. The difference, Mr. Ottinger, is simply between what ERDA and the administration has proposed and what the Science and Technology Committee has come up with in its deliberations.

Dr. Seamans has indicated, and we do not imply that we are backing off the position that we still feel a 350,000-barrels-per-day program is the right first step. The Congress, however, may decide that a smaller program is the first right step, so the fact that the Science and Technology Committee came out with a $4 billion loan guarantee as opposed to our original proposal does not mean that we are——

Mr. OTTINGER. I understand that exactly the same plants were to be started on exactly the same scale, and that indeed the anticipation of ERDA was that it was going to take the full commitment that they had indicated.

Mr. McCormick. No, sir. We provided the Science and Technology Committee, at their request, with a revised program based on a $4 billion loan guarantee program. Their report, as you know, states that they do not view this as necessarily an installment on a larger program, and they view it as self-contained, and they requested from ERDA——

Mr. Ottinger. Vis-a-vis the $100 billion program they did so state, but not vis-a-vis this program.

Mr. McCormick. Well, the committee report states specifically—I dont' have it in front of me—that it is no endorsement of a larger program or a program involving any other forms of financial assistance other than those contained in H.R. 12112.

Mr. Ottinger. But you testified on this thing that you did not anticipate that you would be able to sell this stuff without price supports. We specifically asked you, you know, could you supply the percentage to that?

Dr. Seamans said you could not just take a percentage of this thing, what was going to be involved eventually was, as far as he could tell and accurately represent to our committee, the Science and Technology Committee, that——

Mr. McCormick. Mr. Ottinger, we indicated that in certain fuel areas as we originally saw the program, we may perhaps need price guarantees, for example, in the oil shale area. However, the Science and Technology Committee chose to limit initial development of oil shale to commercial modules rather than full-scale plants, and therefore we believe the utility of price guarantees for modular development of shale is limited.

Mr. Ottinger. Can I ask your technical people one more question, Mr. Chairman? I see you were beginning to wave your gavel there.

Mr. Dingell. The Chair is, but the gentleman may ask the question.

Mr. Ottinger. I wonder if you can advise us what kind of problems there might be in hooking up 26 to 32 Lurgi gasifiers to run together.

Mr. McCormick. That is a problem recognized by the designers of these first generation plants, Mr. Ottinger. The Lurgi machines are notoriously hard to run, and they do have a lot of downtime, so that detailed design of these plants involve a lot of redundancy, a lot of modularity, developing ways in which the gas can be processed, such that one part of the plant is down, another part of the plant can continue operating and continue making product.

It is a little unfair to separate the concepts of operability and reliability from maintainability, and I think you have to look at this as a complete package. By building a lot of redundancy into the system, one can keep it operating, but the redundancy costs money, it makes a high maintenance item, a lot of cost to operate, and so forth, and it is partially these kinds of considerations—in fact, it is a large measure these kinds of considerations—which makes the advanced technology more attractive, the high-capacity, high throughput gasifiers, the far fewer number, means that you will have far less materials and reliability problems, the thing should operate more onstream time, and you will have a process you can count on.

So I think it is a combination of mechanical problems associated with the inner connections of these 26 or 36 gasifiers, plus the modularity and redundancy which create high maintenance cost as well as lower the onstream factors of these first-generation plants.

Mr. Ottinger. Thank you very much, Mr. Chairman.

Mr. DINGELL. The Chair now recognizes Mr. Nordhaus for questions.

Mr. NORDHAUS. Mr. McCormick, could we continue going through in some detail the information you expect to obtain from the loan guarantee, from the projects that would be constructed with the loan guarantee program under H.R. 12112?

Going back to the first of your points, Engineering Plant Operations Data, Mr. Dingell had asked you whether reliability information on the first generation technology would be useful in insuring investors that second generation technology was reliable, and your answer was, well, the information was to the gasifiers, and certain other aspects of the process would not be particularly relevant to the second generation reliability, but certain other aspects of the process would be common to both first and second generation, and the information would be transferable.

Now, I gather from the testimony we have just had that the greatest area of uncertainty as to reliability is with the gasifiers, is that true?

Mr. MCCORMICK. I wouldn't necessarily say. I mean, I think——

Mr. NORDHAUS. Well, where is the greatest area of uncertainty, as far as reliability and maintainability?

Mr. MCCORMICK. There are a number of areas that are critical points in the chain, you might say.

Mr. NORDHAUS. Why don't you spell it out, in decreasing order of uncertainty what the greatest areas are.

Mr. MCCORMICK. Mr. Nordhaus, I wish we knew, and it is difficult to know until, in fact, you build one of these plants, and that is what we are proposing to do.

Mr. NORDHAUS. From the point of view of investors who need reassurance to the operational reliability of this plant, where are the greatest questions raised.

Are they with the direct gasifiers, the methanation process?

Mr. MCCORMICK. As Mr. Zahradnik pointed out, in the gasifier area, there are questions of reliability and we will get data, some of which will not be transferable, as he pointed out, to the more advanced technologies, where we expect the reliability to be better.

However, if you look at the other aspects of the plant, that is the oxygen plant, the coal feeding systems, the crushing systems and so forth, we never handle coal——

Mr. NORDHAUS. Does not a large fossil fuels electric plant have coal needs of almost the same scale as what we are talking about here?

Mr. MCCORMICK. Yes, but, you know, there are aspects of a plant that are different, in terms of a feeding system into the gasifiers and so forth.

Mr. NORDHAUS. Let me rephrase the question.

Mr. MCCORMICK. There are a number of substantial differences between a conventional coal-powered power plant and a gasification plant, and certainly——

Mr. NORDHAUS. But as far as coal feed, coal handling, crushing, and that kind of thing, are those—do those involve such a giant technological leap that they are areas of great uncertainty?

Mr. MCCORMICK. There are some uncertainties. The problem, basically, is—and what I think you are suggesting is that there are other places where one can get this data to satisfy a potential investor. Now if an investor is going to back a billion dollar project without any kind

of guarantees or assistance, they tell us at least in discussions with them, that they would like to see a couple of these full-scale plants.

Mr. NORDHAUS. Could I follow this up with another question, then, and that is, if there, as you can see, if there is the possibility that even if you complete and operate a first generation plant that there are going to be further uncertainties as to reliability of certain components which will be considerably different in second generation plants, is there going to be a similar need for demonstrating through a loan guarantee mechanism the second generation plants.

Mr. MCCORMICK. That, Mr. Nordhaus, depends on the success which we encounter in demonstrating the second generation technologies at the modular scale. Certainly, in all the areas of the plant which are similar, first and second generation, the financial community investors will be reasonably satisfied that you can put together a 250-million-cubic-foot-per-day plant and make it run. Now, as Dr. Zahradnik pointed out, in the area of the gasifier, we expect the reliability and the efficiency of the second generation gasifiers to be higher, so if we were to successfully build and operate a full-scale first generation plant and convince the financial community regulators and others that you can make this thing work within environmental constraints and within other constraints, then we expect that when the second generation technology is successfully demonstrated at the modular scale, then the uncertainties in proceeding to full commercial scale there will be less because the part of the plant which is least efficient in the first generation and least reliable will be more efficient and more reliable.

Mr. NORDHAUS. So essentially, what you are saying is that as far as the ability of the gasifier to do the job, that that is not even going to be demonstrated by the program for the first generation plant.

Let me go on to some of the other uncertainties that you mentioned in your fact book, if I may, in particular the environmental and socio-economic information.

Now, your fact book indicated that it was only through the construction of commercial-sized facilities that reliable information can be obtained about environmental impact. One of the questions that this assertion would raise it, can we really be assured that air quality information and water quality information with respect to the current Lurgi technology is going to provide the information necessary to resolve environmental uncertainties about the second generation technology, which acocrding to the earlier testimony would be the basis for our commercial synthetic fuels industry.

Are there not going to be unresolved environmental questions about the second generation technology which can only be resolved through building a full-scale second generation plant?

Mr. MCCORMICK. I think the environmental problems which are associated with second generation technology will be less.

As I believe was pointed out earlier, we expect, for example, the efficiency of the second generation gasifier to be higher, and that means, for example, there would be less waste to dispose of in a second generation plant.

Mr. NORDHAUS. We are talking particularly about air quality and water quality. Is there less——

Mr. MCCORMICK. Others may want to comment on this, but in the case of——

Mr. NORDHAUS. Mr. Zahradnik, would you like to——

Mr. MCCORMICK [continuing]. Air quality, I do not think there is any——

Mr. NORDHAUS. Are there going to be uncertainties that are going to be resolved only through demonstration of a first generation plant which will not have to be resolved again through a full-scale second generation plant?

Mr. WHITE. I would like to answer that, if I may, Mr. Nordhaus. I think the way to look at this is that the first generation plant, built full-size, is going to answer a great deal on the environmental impact, as well as socioeconomic.

The second generation, having gone through the demonstration plant, is going to have the improvement in environmental control, the extent we are able to achieve it, demonstrated at that smaller scale, and the only little piece of uncertainty you are going to have left is you are going to need to answer it by building the large, second generation plant, is to what degree is there any scale-up question in extending a demonstration to really extrapolate that improved result to the full-scale plant that you have already built to the first generation.

There is a small increment of uncertainty, granted, but it is really quite small, at that point.

Mr. NORDHAUS. Mr. Zahradnik, do you——

Mr. ZAHRADNIK. I will amplify on what Dr. White said. I think it must be stated for the record very clearly that the Lurgi machine is a machine that produces a lot of tars, a lot of soot in the gas, and that the clean-up systems peculiar to Lurgi must face and deal with this problem, and consequently a large part of the gas clean-up system is a gas clean-up system specifically tailored to the Lurgi gas product.

One of the advantages of second generation technology is that the amount of tars and dust produced is lessened, and in some cases eliminated. The gas clean-up problem then becomes simpler. The machinery that would affect this gas clean-up would become simpler, and indeed different, qualitatively, than the machinery that has been tested on the Lurgi plant, and consequently some of the experience in Lurgi technology would not translate one to one.

Mr. NORDHAUS. So would it be fair to sum up what you said, that you have some uncertainty as to whether the full-sized first generation plant would be either necessary or sufficient to resolve environmental uncertainties about a second generation?

Mr. ZAHRADNIK. I think there are qualitative differences between the gas compositions coming off second generation gasifiers as opposed to Lurgis, and these qualitative differences will necessitate different equipment to be installed in the system.

Mr. NORDHAUS. We could find ourself——

Mr. BROWN. Would you yield to let me clarify?

Does this therefore mean that the first generation plant is unproductive in terms of what it establishes in that particular point?

Mr. ZAHRADNIK. Mr. Brown, it is not unproductive, in that it tells us how to deal with that particular technology. If the technology is going to change, many of the principles would remain the same, but the specifics could be different.

Tars and phenyls and materials of this sort are going to be carried over in Lurgi gases and need to be washed out and these are going to create attendant air pollution and water pollution problems. They just have to be looked at.

In advanced gasifiers, these will not occur, but that does not mean that some other phenomenon will not be there that will have to be looked at from an air pollution and water pollution point of view. But the specifics may not be transferable. You may need not transfer them.

Mr. BROWN. My question really is whether—some will and some won't. Is this what you are answering?

Mr. ZAHRADNIK. That is correct. The second generation technology is a generic term referring to a number of concepts.

Mr. Rial, for example, has five proposals of second generation technology for his demonstration program. These differ among themselves, just as they differ from Lurgi.

Mr. NORDHAUS. Could I go on to the question of land disturbance, particularly as it relates to the coal gasification plant? Now, could you explain to the subcommittee why information about land disturbance could not be obtained from any large strip mining operation, why you have to build a coal gasification plant in addition to your strip mine?

Mr. MCCORMICK. In that particular case, there is a lot of information you could obtain from a large strip mine, and I don't think we—we certainly do not mean to imply in this particular narrow area is the only way to get that kind of information. There are, of course, certain wastes that are particular to coal gasification plants that you would not get from a mine.

Mr. NORDHAUS. For instance, the coal fines, as they are called?

Mr. MCCORMICK. Yes, the pitch and tar that comes out.

Mr. NORDHAUS. Which, in all likelihood, would not have to be disposed of with the second generation technology anyway, was that not the earlier testimony today?

Mr. MCCORMICK. In the case of the second generation technology, it could either be drastically reduced or perhaps even——

Mr. NORDHAUS. So, in all likelihood, the information on how to dispose of these byproducts would be of no value, since you would not have to dispose of them once you went into commercial production with the second generation technology?

Mr. MCCORMICK. I had better turn this over to somebody else on this particular point. I do not know what we are expecting, exactly, in terms of our second generation technology, in terms of waste exactly.

Mr. WHITE. It is too early to say, but as Zahradnik pointed out, surely it is clear that they are going to be better than Lurgi, which is a very unsatisfactory process in terms of its byproducts.

So, from that standpoint, it is true that that particular part of the first generation plant will not be translatable directly.

The coal mining, the coal transportation and handling all will be transportable——

Mr. NORDHAUS. But all of that you can get elsewhere, so—from any large strip mining operation.

Is there any peculiarity about coal mining for coal gasification that would need to be resolved here that justifies a program of this magnitude?

Mr. WHITE. To some degree, yes. In other words, in general today that strip-mined coal in the West is, as I understand it, transported by rail to a power station and burned.

Mr. NORDHAUS. A lot of the stations are mine mouth stations, are they not?

Mr. WHITE. Well, then there is not much, but usually there is some transportation, but maybe it is just by truck, but here we are going to do quite a different job in preparation of that coal. It may be even washing it. We have not decided on that, yet. That may be required in second or third generation.

Mr. NORDHAUS. From the point of view of land disturbance, there is no real difference, is there?

Mr. WHITE. If by land disturbance, you just mean the mine, that is certainly true.

Mr. NORDHAUS. Whatever it is that you are describing in your fact book.

Mr. MCCORMICK. Mr. Nordhaus, if I may interject here and make a couple of general comments, I think it is clear exactly what your line of questioning——

Mr. NORDHAUS. What we would like to do is go through your points in some detail——

Mr. MCCORMICK. Let me make a general comment——

Mr. NORDHAUS [continuing]. To make sure the committee understands.

Mr. MCCORMICK. Let me make a general comment, if I may, about those points.

There are certain points in here in which we can generally get more or less unique information from a commercial scale plant. There are a number of other points where the information you could get from a second generation plant is the same, and then there are some other points where there is little or no translatability, that is, because something in the plant is different.

There are also some points where you can get useful information from other sources, as you pointed out, a mine or something else.

Mr. DINGELL. The Chair regretfully has to advise you that we are glad to get a response, but in fairness, we have a great deal to cover today, and it would be appreciated, I think, by the committee if you would make your response to the questions as short as you can.

Mr. NORDHAUS. Mr. Dingell, could I go on to the next point in the fact book?

Mr. DINGELL. You certainly may.

Mr. NORDHAUS. The next point is the State and local social and economic impact.

Is there any information of this nature that could not be derived from observation of any large construction project that suddenly hits a small town? I mean, is this something that is so peculiarly unique for coal gasification that you need the program recommended by H.R. 12112 in order to get that information?

Mr. MCCORMICK. Well, Mr. Nordhaus, as Dr. White just mentioned to me, you know, how many billion dollar plants do we have. The point that I think he is correctly making is that what we are talking about are rather large and abnormal impacts on local communities, building these facilities in remote areas.

Mr. NORDHAUS. There are a number—for instance, the West is dotted with large dams, for instance, with large powerplants. Are these projects so different in quality that observation of these projects would not at least give you some indication of what the social and economic impacts on State and local communities would be?

Mr. MCCORMICK. Well, the experts in that field, including the Governors that might be affected and the Governor's conference people and many people that have concerns in this particular area and who have testified on it are such that they believe that the impacts that we would get from these plants are significant, and are significantly different, that they have great concern about them, and that is why——

Mr. NORDHAUS. Well, one can understand their concern, in other words, they know they are going to be impacted and they want to have the impacts alleviated. I am not sure that that—I mean, that seems to argue that they already have the knowledge, not that they need to go into the program in order to obtain it.

Mr. MCCORMICK. Well, I can only repeat that there is, as you point out, a great deal of concern, and there is also a number of features about these plants, such as their size, the fact that they would be located in remote areas, the nature of the construction and the influx of people that make them rather unique, and there is a lot of very hard information that could be obtained from these plants that would be directly applicable to future commercialization if that should take place, particularly in the Western States where you have remote regions of the country that could be affected by these plants.

Mr. NORDHAUS. Let me go on to the next point. The next point is the economic data that could be—the plant and mine facility economic data.

We had testimony earlier today that capital investment, operating and maintenance cost, and overall economics of first and second generation coal gasification technology was significantly different.

Mr. MCCORMICK. Twenty percent, I believe, was the figure.

Mr. NORDHAUS. Yes.

I guess the question that it raises is, Will the information on plant and mining facilities economics which you obtain with respect to first generation technology really give us the information that is necessary on the second generation technology, or are we more likely to get more reliable information from extrapolation of the results that we obtain from the one-third scale—one-third commercial scale second generation plants that ERDA is already proposing to fund.

Mr. MCCORMICK. Well, there are two aspects to that. One involves the scale-up of the gasification step, and the other involves the balance of the plant and we have indicated that about 80 percent of the plant is not the gasifier, and much of that will be the same, or very similar, for the advanced technology plant.

Mr. NORDHAUS. But as far as the overall economics is concerned——

Mr. MCCORMICK. Well, the overall economics are dictated by the capital and the operating costs, primarily, and what we are saying is the component of capital costs, which is the gasifier, is approximately 25 percent of the plant, that you have the crushers, the handling system, the oxygen plant, the clean-up systems and other aspects of the plant that will be similar, and the kind of data that you can get from the—not only the capital costs, but the operation of these plants with

normal crews of working personnel working under normal commercial operations will be very useful in extrapolating from the demonstration to the full-scale plants for second generation technologies, where the major difference is in the gasifier.

Mr. NORDHAUS. Are not the investors going to have the same questions about full-scale generation technology in 10 years that they have about full-scale first generation technology?

In other words, they are not going to know what the economics of a complete plant using components, some of which have never been tested at full scale, will be.

Mr. MCCORMICK. Since 80 percent of the economics, as Dr. White pointed out earlier, are dictated by the nongasification part of the plant, the gasifier part of the plant, and, as Dr. White put it, the maximum expected decrease in product prices is roughly 20 percent, then if the investors can see the full-scale commercial plant using first generation technology operate in all of those other parts of the plant, operate successfully, then that would go a long way toward convincing them, especially with the demonstration of second generation technology at the modular level, that they can go to full-scale second generation with great confidence.

That, in fact, is what the essence is of these two parallel approaches. We can put together the technical information from the advanced technologies from the other information from the first generation and combine it to allow investors to have the total passage of information to permit accelerated development of synthetic fuels when we believe it is needed.

Mr. NORDHAUS. Can we go on to the question of regulatory information?

Could you spell out how you feel that information obtained in dealing with regulatory agencies for a plant, the construction of which is going to commence in the next year or so, will be useful in dealing with regulatory obstacles that the commercial synthetic fuels industry is going to face, 10 or 15 years from now?

Mr. MCCORMICK. Well, just to deal—there are several levels, as you know, of regulation and one is at the Federal level, and then you have, of course, your State levels, and so forth.

There are 16 major Federal laws and regulations which have to be complied with for one of these plants, and the regulatory area is perhaps the most fertile one in terms of getting early information, because building novel energy projects, we have had a lot of experience with regulatory delays in other areas, and we can frankly expect that we can have some delays in this area.

Mr. NORDHAUS. Well, why—what kind of information do you think you will get; namely, that there will be regulatory delays, or is it something more specific than that?

Mr. MCCORMICK. I can go through the various categories of Federal regulation, if you wish. I think—and I will mention a few of them—but what potential investors are really faced with before they will make an investment in a full-scale commercial plant is, they want to know whether the plant they are investing in will be able successfully to get through the various regulatory hurdles that it must go through, and these include such things as the Clean Air Act, the NEPA, the Occupational Safety and Health Act, the various antitrust statutes——

Mr. NORDHAUS. Let me interrupt you with a question, and that is, Had you had a demonstration program 10 years ago and had you gone through the then-existing regulatory hurdles, would that information have been of any use today? That would have been in 1966, before the Federal Water Pollution Control Act was amended in 1972, before the Clean Air Act amendments in 1970, before the Occupational Safety and Health Act was enacted?

Is there any reason to believe that information about dealing with regulatory agencies and regulatory statutes today is going to be particularly useful 10 or 15 years from now?

Mr. MCCORMICK. Well, retrospectively, the answer to your question is, It would not have been terribly useful 10 or 15 years from now, but I think prospectively, looking into the future, we have accumulated a fair body of law in the environmental and regulatory areas, some of which we can expect to change, but I think to a large degree, although there have been some amendments, for example, to the Clean Air Act, and so forth—or there may be—the Clean Air Act is a substantial body of information and regulation——

Mr. NORDHAUS. You may be aware that this committee reported out an amendment to the Clean Air Act recently which ran 180 pages, and they seemed to go through this exercise every 3 or 4 years.

Mr. MCCORMICK. I think the experience base which you would develop in connection with these first generation projects, in any case, would be extremely useful for second generation technologies regardless of what regulatory requirements are in force at that time.

Mr. NORDHAUS. Even though they are different from the ones that you dealt with originally?

Mr. MCCORMICK. A lot of people bemoan the fact that regulations change——

Mr. NORDHAUS. This completes my series of questions on this subject, and I think Congressman Wirth would like to direct a few questions to you.

Mr. WIRTH [presiding]. Mr. McCormick, in the last exchange with Mr. Nordhaus, you talked about first generation projects. At this stage, how many of the first generation projects are you considering?

Mr. MCCORMICK. We are aware of a total, perhaps, of 20, 25, different kinds of projects. For example, in the high Btu coal gasification area, there are about six serious projects that various companies have indicated have spent money on and have plans together. In the case of oil shale, there are perhaps——

Mr. WIRTH. Stay with coal gasification, high Btu, if we might. How many is ERDA currently considering they might fund under the authorization of this bill?

Mr. MCCORMICK. At the maximum, we would only be able to fund a maximum of two plants, or two high Btu coal gasification plants.

Mr. WIRTH. OK, now, going back to what Mr. Fri was saying this morning, if as he stated, the rationale is to tie all of the pieces—the regulations, the environmental and social impacts, and so on—together in one package, and if it is true that we will learn a great deal from doing that, why is it necessary to build more than one of these?

Mr. MCCORMICK. In the case of high Btu gasification, there are several different major sources of feedstock, that is, coal. There are——

Mr. WIRTH. Does the feed stock not go more to the second generation plants? How do you deal with the second generation plants? The rationale, as I understood Mr. Fri to state it, had nothing to do with feedstock, but had to do with linking together all of these pieces that heretofore have not been put together, and Dr. White's program is the one that, in the second generation, deals with different coals and different technologies for coping with those coals. And it would seem to me that——

Mr. MCCORMICK. I do not think that Mr. Fri was trying to exclude the fact that there is some technical information, or ignore the fact that there is some technical information that would be obtained from the first generation plants. The reason we suggest building more than one high Btu coal gasification plant is because the lignite coal, for example, in North Dakota and the subbituminous coal, either in Powder River or Four Corners, and the Illinois coal, are different, and the problems associated with those are different, and even though the second generation technologies that we have developed we hope will work on different kinds of coals, there still will be some problems particular to lignite in terms of coal handling, in terms of waste——

Mr. WIRTH. But it seems to me that is exactly what Mr. White's program does, is to focus on different coals. Is that not true, Dr. White—among other things?

Mr. WHITE. Yes. Different coals, and of course, different technologies, but——

Mr. WIRTH. Sure, but that can be done on a smaller scale. We do not have to build the whole—all of the other pieces of this for the purpose of the 20 percent which relates to your program, the different gasification processes.

As I understood Mr. Fri, he said the purposes of doing this first generation is to link all of these pieces together and to see if all of them work, and work the bugs out of that, while your program is coming along. Then, by the early 1980's, the two programs have been worked out, we have that "on the shelf" ready to go, if it works.

Mr. WHITE. That is correct, and I think I would answer your question with the point that the building of one first generation plant is certainly going to answer many, many questions, and I think we have a real challenge to decide whether having a second one in a different part of the country with different coal, and different environmental problems, different water problems and so forth, justifies the additional expenditure.

Now, this is not a lost expenditure, by any means. These plants may need a little bit of support, but they are also going to produce a lot of gas, especially if they are 250-million-cubic-foot plants, and I would like to point out to the committee to keep in mind the arithmetic of this gas supply situation.

Seventy billion cubic feet a day are now used, roughly, and that is dropping at 6 percent a year——

Mr. WIRTH. I think, Dr. White, this committee, of all committees, is very aware of the problem that you are talking about.

Mr. WHITE. Sixteen plants lost every year in supply and we have to make that up some way, and we had better be ready to move pretty fast when we move.

Mr. WIRTH. And the issue again, going back to what Mr. Fri was saying had nothing to do with more than one commercial-sized first generation plant, because the rationale was to see if you could put all of the pieces together. There was no reference in his summary to different kinds of coal.

That is your baby. That is what you should be doing down the line in your four, five, or six projects in order to be ready at the same time that the big commercial scale is ready.

Does the gentleman from Ohio have anything he would like to add to this?

Mr. BROWN. Yes; I want to ask the same question if I may, in a different way.

I can see the problem of the different kinds of coal, but as Mr. Wirth points out, I think that has a tendency to be a technical problem which perhaps, once resolved, then does not necessarily require a commercially feasible-sized demonstration. If you can resolve it, it seems to me, with some modifications, you can build your other plants, or somebody could build the plants without the Federal loan guarantees, because they will know if it works.

Why is there a necessity to build the two phases of 125-million-cubic-foot-per-day plant side by side? Why would not the 125-million-cubic-foot-per-day plant be sufficient to demonstrate commercial feasibility?

Mr. MCCORMICK. Well, on the last question there is very little question that you could get much, maybe even 90 percent of the information from a 125-million-cubic-foot-per-day, or half-sized plant.

The practical problem I think we are faced with is most of the proposals that people have come forward with are for plants of twice that size. Some of these projects have already filed with the Federal Power Commission, have filed environmental impact statements, and have gone through a lot of trouble putting together proposals for a 250-million-cubic-foot-per-day plant.

If you were to limit the scale of the plant in the legislation, say, to 125 million cubic feet per day, you would effectively eliminate either one or two things. You would either reduce the competition for the award to one company, that company which has proposed a half-sized plant, or you would put in a 2- to 3-year delay in the entire program while all of the other companies resubmit their filings to the Federal Power Commission, redo their environmental work, and a number of other things.

So the question on a half-sized plant really relates to whether you want to limit the competition to one project, or you want to put a 2- to 3-year delay on the whole program, because most of the other companies are proposing plants of twice that scale.

Mr. BROWN. Why?

Mr. MCCORMICK. Well, the calculations that were done some time ago on the most economical scale plant concluded that a plant on the order of 250 million cubic feet per day was economically optimal, if I could use that term, plant. In other words, that was a proper size to get the gas for the least amount of money.

Mr. BROWN. But is it true that a 250-million-cubic-foot-per-day plant is really two 125-million-cubic-feet-per-day plants side by side?

Mr. MCCORMICK. Yes.

But I should point out that the 125-million-cubic-foot-per-day plant would entail a gas cost that would be higher than the 250 million cubic feet per day——

Mr. BROWN. To what extent?

Mr. MCCORMICK. Well, it is estimated, I believe, by the American Natural Gas Co., which is the sponsor of that particular project, that the gas would be about 40 cents per million Btu's higher, or approximately 12 to 15 percent higher.

Mr. BROWN. Because of the volume of production and the writing off the fixed cost of the plant over what is produced out of that plant?

Mr. MCCORMICK. That is correct. It is a less than economically scaled plant, so it would be about 40 cents per million Btu.

Mr. BROWN. What do you get out of the 250-million-cubic-foot-per-day plant?

Mr. MCCORMICK. In the way of cost of the gas?

Mr. BROWN. Yes.

Mr. MCCORMICK. The estimates range between $3 and $4 a million Btu. The American Natural Co., I believe, is using a figure around $3.10—excuse me, $3.50 for the half-sized plant. It would have been $3.10, I believe, for the full-scale plant.

Mr. OTTINGER. Would the gentleman yield on that? That assumes full operation and full capacity?

Mr. MCCORMICK. Yes, that is operating at normal capacity, 90 percent.

Mr. OTTINGER. And how long do you expect to get up to full capacity?

Mr. MCCORMICK. I think they estimate between 6 months and a year. That would be the initial start-up period.

Mr. OTTINGER. I mean, it would seem to me that this was the bottom estimate that we saw, and there were estimates all the way up to $6 million or $7 million.

Mr. MCCORMICK. No, of all the filings to the FPC that have gone in, to my knowledge, they range between two and a half——

Mr. OTTINGER. Are we talking about the same thing?

Mr. MCCORMICK. Yes, $2.50 and $3.50 a million Btu.

Mr. OTTINGER. Are you talking about Btu gas?

Mr. MCCORMICK. High Btu gas.

Let me point out, Mr. Ottinger, that there are some uncertainties in this, because nobody has built the full-scale plants, everybody is talking about different-year-dollars, because nobody knows quite when they get started, so they range, as I said, between $3 and $4 in the current estimates of most of the project sponsors, four or five projects—five projects that——

Mr. BROWN. Wait a minute, before you take over the time here, I would like to finish my line of thought on this question, if I may, and then just complete, and let you ask on your own time.

My question relates to whether or not the other three or four bidders—because I have no desire to reduce it to one bidder by what we do—could not perhaps come up with their bids in less than 3 years, if, in fact, the 250 million cubic foot plant is two 125 million cubic foot plants?

Mr. MCCORMICK. Mr. Brown, in the case of the Wesco project, which is furthest along in the Federal Power Commission proceeding because, in fact, they have a ruling, they have been in that regulatory process now for over 3 years.

Even though it may sound simple to decide to cut the plant in half, they would have to go through a refiling to the Federal Power Commission, go through hearings, go through another tortuous process, to get a regulatory ruling. They would have to go back and redo their environmental work to some extent, and it would unavoidably entail a number of delays.

So for them, and for several of the other projects, it would entail a significant amount of time to go back.

Mr. BROWN. But are all of these other plants, in effect, two 125 million cubic foot per day plants side by side?

Mr. MCCORMICK. Yes, in effect they are.

Mr. BROWN. So they all have the same problems?

Mr. MCCORMICK. They all have the same problems.

Mr. BROWN. What is the difference in cost between the 125 million cubic foot per day plant and the 250 million cubic foor per day plant?

Mr. MCCORMICK. American National estimated that the cost of a 250 million cubic foot per day plan is in the neighborhood of, I believe, $1.1 billion, and the half-sized plant is in the neighborhood of about $700 million and $750 million, so it is not half price, it is more than half the price because of the economies of scale to which you were referring earlier, the fixed costs and so forth.

Mr. BROWN. Well, that does not help me much with what I consider to be a fairly difficult call on which way that ought to go.

Mr. MCCORMICK. Well, I think the major point, Mr. Brown, that I am trying to make is that what you have, if you were considering limiting it to a single 125 million cubic foot per day is the choice between putting what I would estimate as a minimum delay of in the neighborhood of 2 years into the program or seriously reducing the competition to the one company that has been preparing over the last several months, some months, their particular application.

Of course, they were not the furthest along in the process, as I indicated.

Mr. BROWN. Except that has a price tag on it of $300 million and a loss of only 10 percent, whatever figure that was you gave, of additional information. That is where I think we are all agonizing, and I would be glad now to yield to the gentleman from New York.

Mr. DINGELL. I will accept the gentleman's offer to yield the floor, and the Chair will now recognize Mr. Hunt.

Mr. HUNT. Mr. McCormick, if I understand your fact book correctly, by far the largest part of the cost of the gas coming out of the high Btu plant will be fixed costs, basically, or period costs as opposed to the variable costs of feedstock? Am I correct in that?

I think the figure is 29 percent under an assumed $9 per ton of coal cost.

Mr. MCCORMICK. We estimate that it will be 29 percent feedstock, 32 percent operating maintenance, and then there is amortization, capital, tax, profit and interest.

Mr. HUNT. So, during this shakedown period in which it is going to its target onstream factor of 90 percent, if it was running at, say, 50 percent of that 90 percent level, say 45 percent, you would basically figure that the gas would not cost the target amount, but roughly 71 percent more. Am I correct?

Mr. McCormick. Yes; but I would point out that that is only over the rather short period in which it is going through an initial start-up, which is, as you know, less than 1 year out of the total useful life of 35 to 40 years.

Mr. Hunt. Agreed, but that point of reliability causes us some great concern.

Mr. McCormick. Mr. Hunt, I do not believe that is really a question of reliability. That is an issue of the startup of any new plant, regardless of whether you are talking about first generation or second generation technology.

Mr. Hunt. Well, in a first generation plant we have heard testimony this afternoon that the reliability is considered to be somewhat lower than perhaps the second generation plant. In fact, this is one of the objectives that they are aiming at.

Now, let me go on from this, if I may. If indeed, because of the complexity of this plant with its highly redundant gasifier system, that if it only could be brought up because of the problems that we have heard discussed relative to the reliability of Lurgi and it on-time period, if indeed, it only ran at 50-percent design capacity, we would have gas coming out of that plant that if we took a $3.50 figure would be basically $6 gas.

Mr. McCormick. If it ran over its full life of operation at 50 percent, that is true.

Mr. Hunt. Well, even during this period—this is, I guess, something that is of concern to the committee—if indeed, during that period of shakedown—and say supposing it expanded because of the complexity, the redundancy of the system itself, into a 2 or 3 year period, indeed, the high cost of that gas, rather than encouraging the market might very well prejudice the financial community against further investment in even secondary technologies.

I pose this as a hypothetical, pointing out the presence of this very large and very complex, with a multiplicity of gasifiers, might very well work, if it did not work properly, to your exact schedule, to prejudice the market against future investments in coal gasification.

Mr. McCormick. I think that is unlikely, but first of all the point on high degree of redundancy with respect to the gasifiers, I think we indicated earlier in the day that in the case of the Wesco plant, there are 26 gasifiers, 23 of which would be normally operating and three of which would be backups or spares, so I do not see that as a high degree of redundancy.

Mr. Hunt. With respect to the cost of the product, I think naturally we are going to expect that any first of a kind of plant is going to have costs that are higher than we would expect of future plants, regardless of whether it is a first generation or a second generation plant. We have had the experience, which I think has been rather dramatic, in the nuclear power industry where the first few plants on a dollar per kilowatt basis are very high and over the years they have come down considerably as we gained experience with them.

Mr. Hunt. Well, I really cannot argue that with you, since I do not know the subject, apparently, clearly enough to find out whether that is a parallel argument.

Mr. McCormick. They come down by a factor of three or four on a kilowatt basis, so it has been very dramatic. And you can expect that, really, to be a trend in any new development project.

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Mr. HUNT. Well, do you know the on-line experience that say, being at the same time in the Sasolburg patent, which I believe also has a number of parallel gasifiers associated with it?

Mr. MCCORMICK. I do not have that on the tip of my tongue. Ray may be able to answer that.

Mr. ZAHRADNIK. I do not have that data available. It did take Sasolburg a long time to come online. The first 10 years of operation were erratic, at best, but I think that once they solved the problems peculiar to their coals and peculiar to their operating characteristics, they were able to run reasonably satisfactorily.

I think it is certainly a question, Mr. Hunt, that needs to be examined further.

Mr. HUNT. Well, indeed, if it took the Sasolburg plant which is somewhat smaller, and I guess by that reason somewhat easier to control, admittedly we apparently do not wish to gain from their experience in this area—but if it took them 10 years to shake that down and get it to its current level, which I presume is roughly onstream 90 percent or above——

Mr. ZAHRADNIK. Yes.

Mr. Hunt [continuing].—and we are working with different types of coal, in a larger unit which is more complex with the possibilities of failure, at least within the first 3 or 4 years, I would suspect, somewhat higher than Sasolburg had between its eighth and ninth years of shakedown, I raise the question that indeed we may be, by the presence of these first generation high Btu plants prejudicing the market against the second generations, and indeed, perhaps leading ourselves into a position where loan guarantees would be required for the second generation, since they would be under construction while this is in, if it follows the Sasolburg experience, shaking down.

Mr. MCCORMICK. Mr. Hunt, I don't think that the experience that we have gained in other areas, such as the nuclear power area—I do not think the rather unusual high costs of the first plant, which some companies frankly lost a lot of money on, for example, Westinghouse and General Electric, was a significant deterrent to utilities for purchasing future plants as the costs come down, so I am not aware of any experience which would bear out the trends you are suggesting.

Mr. ZAHRADNIK. Mr. Hunt, if I could just interject—and I think Bill McCormick would agree—that these are complex technologies, whether indeed the marketplace will be prejudiced or not, I do not know, by failure of the plant to start up, but I would certainly feel that a 6-month start-up period would be optimistic.

Our experience in pilot plants is that it takes quite a while to come onstream. By the same token, you know, it is arguments like these, we have to get that operating experience under our belt somehow in this country with complex machinery that turns coal into gas, and whether we deal with first or second generation technology, whether we do it today, or tomorrow, or sometime in the future, we are going to have to face those problems. They are not going to go away by postponing the decisions.

Mr. HUNT. Well, if, indeed, we had an infinite amount of time, this might not be a problem. But due to the fact that we will be overlapping the construction for the full size commercialization effort, on-line second generation technology, and presumably under those circumstances seeking financing in the free capital markets, for those

second generation efforts to go commercial it might be a very inopportune time for high Btu gasification.

Mr. WHITE. It is a choice between bad experience or no experience in terms of its impact on the financial market. Either one produces some uncertainty or discouragement, I think.

Mr. HUNT. Well, this comes down, really, to the value of what information we are expected to gain from the first generation technology, which brings me to the point of questioning really the benefit as far as information that is in this fact book relative to project financing information. I find in there in the final, closing statements, the sentence:

> The essential difference, however, is that the valuable experience in financing these new projects will be gained, both by the lenders involved and by the project sponsors.

Under a loan guarantee, the presence of a loan guarantee itself would seem to me to basically disqualify any financing experience associated with this, under the presumption that the follow-on plants would not require a loan guarantee. It so biases the market, that——

Mr. MCCORMICK. Mr. Hunt, in terms of the financing experience, I would not agree with that, simply because the borrowers or the project sponsors would be required to go to the debt markets and obtain capital for future plants that would be unassisted by loan guarantees in the same manner that——

Mr. DINGELL. Now, where is that in the legislation?

Mr. MCCORMICK. Excuse me?

Mr. DINGELL. Where is that requirement in the legislation, or in the regulations?

Mr. MCCORMICK. Which requirement, Mr. Chairman?

Mr. DINGELL. That they would have to go to the capital market for future projects, unassisted by the loan guarantee?

Mr. MCCORMICK. There is nothing in the legislation which requires them to go to capital markets, but since these regulated utility companies in the case of high Btu gas, finance all of their projects with debt financing, the only way they could finance these projects would be to go to the capital markets. There is no other way——

Mr. DINGELL. But they are not really going to the capital market. A lender in the capital market is not lending in reliance on the credit or the repayment ability of the borrower here at all. He is borrowing on the reliability, on the guarantee that is given by the U.S. Government.

Now, am I in error on that?

Mr. MCCORMICK. No; that is correct.

Mr. DINGELL. That is correct.

Mr. MCCORMICK. He still has to go——

Mr. DINGELL. So how, then, is experience with a Government loan where the lender loans in reliance on the Federal Government in any way going to indicate to you the financing capability of that individual with regard to some unguaranteed loan?

Mr. MCCORMICK. Well, in the following way, Mr. Chairman, that the borrower——

Mr. DINGELL. I must say, this boggles my mind.

Mr. McCormick. The borrower and the project sponsors would have to go, in any case, to the financial institution. These financial institutions even with loan guarantees, are going to examine the projects, get involved in it——

Mr. Dingell. They are going to look at it and they are going to to say you have a Government guarantee, here is your money.

Mr. McCormick. That is certainly not what they testified to before the Banking Committee and the Science Committee. They have taken a very deep interest in the project and——

Mr. Dingell. They are going to look and they are going to say, What are our chances of getting repaid? We are going to get repaid and we are loaning on the full faith and credit of the U.S. Government.

Mr. McCormick. Well, even——

Mr. Dingell. What else are they going to look at?

Mr. McCormick. Well, even with the full faith and credit of the U.S. Government, they would not want to get involved with a project that is going to wind up failing in a year or two. Consequently, they have gone into great detail in these projects, and some of the investment banking firms that have testified have really shown and demonstrated how knowledgeable they are about the details of these projects. They have not used these guarantees——

Mr. Dingell. Now, they are going to be fussy about the 25 percent that the Federal Government is not financing, but they are not going to be fussy about that other 75 percent, because they know the Federal Government is good for it.

Mr. McCormick. Mr. Chairman, they simply do not regard these obligations as blank checks from the Federal Government. They do not want——

Mr. Dingell. Well, what is it, if it is not a blank check? If it is not repaid, the Federal Government is going to back up a truck full of money and pay off the debt. That is what it says. And if you interpret it any other way, you do not understand loan guarantees.

Mr. McCormick. Mr. Chairman, I think I understand the legislation.

Mr. Dingell. I understand loan guarantees. I have been voting on them for 20 years and I have great reservations every time, and the reason people want loan guarantees is because they don't trust the credit of the borrower, but they do trust the credit of the Federal Government. Now, if I am in error, tell me?

Mr. McCormick. That is certainly correct, but——

Mr. Dingell. Well, all right.

Mr. McCormick [continuing]. But the statement——

Mr. Dingell. So how are you going to interpret that kind of experience as being reliable experience with regard to somebody who does not have the credit of the Federal Government behind him?

Mr. McCormick. I would simply state again that even with the Federal role guarantee, it requires that the investment community, the potential investors and the investment banking community, become initimately familiar with the details of these projects. That experience, which they gain——

Mr. Digell. All they are going to need to do is be familiar with the fact that some bureaucrat in the Federal Government was silly enough to give 100-percent guarantee on 75 percent of the project. That is all they have got to do, and when there is a default, all they have to do is walk in and collect that money.

Mr. McCormick. They certainly would disagree with you on that point, Mr. Chairman.

Mr. Ottinger. Would you gentleman yield, Mr. Chairman?

Mr. Dingell. I would be glad to yield.

Mr. Ottinger. I would just like to point out that they testified they would not put up money for these projects where they are not on loan guarantee. Dillon Read testified before the Science Committee on that.

Mr. McCormick. Yes, sir, that is correct.

Mr. Dingell. If they were going to rush out and borrow money on reliance—on their own credit, they would not need a Federal loan guarantee, now would they?

Mr. McCormick. That is correct.

Mr. Dingell. All right.

Mr. Hunt. If I may return to the question of financing, you said that it really took some time for the financial markets to become intimately familiar with the operations and potential of these programs. Dillon Read, I presume, is reasonably familiar with it due to the fact that they are the investment bankers for American Natural Gas.

Mr. McCormick. Yes, sir, that is correct.

Mr. Hunt. I would then say, and I only look backward for experience on this, but that which was financeable in 1966 may very well not be financeable in 1976.

Mr. McCormick. It is possible.

Mr. Hunt. And indeed, there is this transfer of time between when the second generation, or indeed, the follow-on financing would take place, which would be again, in rough terms, 8 to 10 years away.

So the experience gleaned from the financial market in today's situation may be of really no value as far as the future situations, even if they both had, you know, the same level of credit worthiness.

Mr. McCormick. I certainly, Mr. Hunt, would not subscribe to that statement at all, because the base of information which the financial community would gain in dealing with novel synthetic fuel ventures, regardless of whether they were guaranteed by the Government or not——

Mr. Hunt. Well, this is not novel, is it?

Mr. McCormick. Well, it is novel——

Mr. Hunt. The state of the art technology——

Mr. McCormick. It is novel in the sense that the investment community has not had any experience in financing this project with or without guarantees, so what I am simply saying is that the potential investors in the investment community, even with the Federal loan guarantee, will be required to become involved in these projects, to understand them and to become familiar with them.

Until we have investor confidence and the confidence of the financial institutions in this country, there is no way in which a commercial synthetic fuel industry, or any other——

Mr. Hunt. Well, this goes back to my earlier point, that a failure because of, say, a number of reasons, be they environmental, be they technical, be they reliability, just even the question of mean time to repair a given plant, the MTB or whatever it is, I have forgotten, may indeed close down this plant during this early cycle, which is exactly

the period of time in which one would be going to the market to seek money for the second generation plants.

Mr. McCormick. If you are suggesting that there is a possibility for failure of these plants, I would agree with you, and that is simply why there is investor uncertainty about them.

Mr. Hunt. Well, whether they fail with or without the Federal loan guarantee, they would still be a failure in the eyes of the market.

Mr. McCormick. They will never get financed, at least within a few years, without a loan guarantee.

Mr. Hunt. Then, indeed, with the new technology, or the second generation technology, we have a large black eye in the area, or indeed, we have to reeducate the entire market as to the superior advantages of the commercial value of the second generation.

Mr. McCormick. Mr. Hunt, if we are going to be afraid to move forward because we are afraid of failure, then I suggest we will never get anywhere.

Mr. Hunt. Well, there is some question as to whether a loan guarantee is the proper technique for basically backing something with that high a risk associated with it.

Mr. McCormick. OK, if you decide—and there are two parts to this issue, one is should you go forward with the plant, and the second is, if you do, how do you finance it, and I think the question of how you would finance these, or how you would provide some assistance to get them going, as we have talked about, there we think the loan guarantee is the proper financial vehicle.

We do believe it is necessary to move forward on them.

Mr. Dingell. Let me ask you a question. Under the Securities Act of 1933, are Government-guaranteed loans covered?

Mr. McCormick. Mr. Chairman, I do not believe that they—I would have to defer to counsel on that.

Counsel says he does not believe that they are. We have answered a question, Mr. Chairman, I believe for the Banking Committee on this issue, and indicated that we would have no objection in providing that they would be covered.

Mr. Dingell. Well, would you want to enlighten us as to what the impact of that is, and what they get out from under, under this now? This is one of the things that caused me some great distress when we had the prior legislation before us.

Maybe counsel would want to come up and give us his name and identify himself and we will get him to help us with it.

What do they get out from under, under the Securities Act of 1933, by not being covered where Government-guaranteed loans are involved?

Mr. Rawicz. My name is Leonard Rawicz, Deputy General Counsel. I am afraid I cannot enlighten you on that point. We have not specifically looked at that.

Mr. Dingell. You haven't? You mean you are going to guarantee $2 billion worth of loans here under this with the potential for going to $4 billion, and you do not know the answer to that question?

Mr. McCormick. Mr. Chairman, we have answered a question for a committee on this very point. I do not have the answer with me. We can certainly supply it for the record.

Mr. Dingell. Which committee did you answer the question on.

Mr. McCormick. I believe it was the Banking and Currency Committee.

Mr. Dingell. You answered it there but you don't have the answer today?

Mr. Rawicz. Mr. Chairman, the individual who worked on that particular item is not with us today. He was out of town today and unfortunately——

Mr. Dingell. Fortunately?

Mr. Rawicz. I said—no, I am sure he would be happy to address the issue, and——

Mr. Dingell. Well, it strikes me as curious that there would be such dark ignorance about this down there.

Mr. Rawicz. We can't know everything, Mr. Chairman.

Mr. Dingell. I would not want to glean from this that it is your view that this is an unimportant subject.

Mr. Rawicz. Mr. Chairman, as I said, the expert on this is out of town. Had we known about the hearing before last evening, we could have had him in town.

Mr. Dingell. Well, was this ever discussed by anybody at ERDA besides the expert who is out of town?

Mr. Rawicz. I am sure he discussed this with one of the members of the General Counsel's staff.

Mr. Dingell. You are the General Counsel, are you not, sir?

Mr. McCormick. He is the Deputy General Counsel.

Mr. Rawicz. Not with me, no.

Mr. Dingell. And you are in the dark on this subject?

Mr. Rawicz. Yes; I am. This never came up in the other hearings, in Science and Technology.

Mr. Dingell. Never?

Mr. Rawicz. It did not.

Mr. Dingell. They did not look into it?

Mr. Rawicz. They did not.

Mr. Dingell. They were not curious about it?

Mr. Rawicz. No, they never——

Mr. Dingell. You did not inform them?

Mr. Rawicz. The question was never raised.

Mr. Dingell. Never raised.

Am I to gather then that this is regarded as not being of merit, or that the research of your agency was not thorough?

Mr. Rawicz. Mr. Chairman, I do not know what their feelings or thoughts on this issue are.

Mr. Dingell. Well, if they are exempt from the Securities Act of 1933, it would tend to indicate that it was the view of the drafters of that statute that they figured that the persons who were going to make loans would make loans in reliance on the credit and the faith and credit of the United States and not that of the lender. Am I in error on that?

Mr. McCormick. Mr. Chairman, my best recollection on that issue is that when ERDA was asked its opinion on whether it should be covered under the act, and as I recall, we responded that we did not see any reason why it should not be.

Mr. Dingell. Why it should not be?

Mr. McCormick. Yes; why it should not be. We are not opposed to that, and——

Mr. DINGELL. Was there ever any consultation with the SEC on this matter?

Mr. MCCORMICK. I am sure there was, but I do not know. I did not look into it personally. As I said, if you wish, we can provide the details of that for the record.

Mr. DINGELL. Very good.

Mr. Ottinger?

Mr. OTTINGER. The question occurred to me during Mr. Hunt's questions on the financing, that all these European plants, do you have any idea how these European plants were financed?

Mr. MCCORMICK. I do not have any information on the details, but I do know that the cost of fuel in Europe is considerably higher than the cost of fuel in the United States.

Mr. OTTINGER. But you have not, in terms of gaining financial information, looked into seeing how that was done with respect to European and South African plants?

Mr. MCCORMICK. I personally do not have any specific information on that. I am sure that some of our people who have looked into financing are aware of the details of how those are——

Mr. OTTINGER. You do not know whether there were any of the American finance companies, any of these 20 or so that you said you approached that participated in the financing of the European plants?

Mr. OTTINGER. Can you supply that to us for the record?

Mr. MCCORMICK. I simply do not have the answer to that question.

Mr. MCCORMICK. We certainly can.

[At the time the hearings were printed the material referred to had not been received.]

Mr. OTTINGER. I would be particularly curious if Dillon Read got involved in any of those financing of the plants in Europe or elsewhere in the world, South Africa.

Mr. MCCORMICK. It is possible. I do not know whether Dillon Read is involved in that.

Mr. OTTINGER. To your knowledge, there were no loan guarantees with respect to——

Mr. MCCORMICK. No; I am not aware of any.

Mr. OTTINGER. Let me ask you a couple of questions about water. You provided this chart which is entitled "Summary Comparison of Environmental Impacts" and it lists high Btu coal gasification, 250—I guess that is million cubic feet——

Mr. MCCORMICK. Billion Btu's per day.

Mr. OTTINGER. Coal-fired plant with scrubbers. Kaiparowits powerplant, 300,000 megawatts with scrubbers and shale oil plants.

Then you have the water requirements for each one, and I assume that these water requirements are the amount of the water that is drawn into the plant. Can you tell us, or supply for the record, how much water is consumed in each one of these processes?

Mr. MCCORMICK. No; this is the water consumption.

Mr. OTTINGER. Is the water consumed, and not returned?

Mr. MCCORMICK. Yes.

Mr. OTTINGER. That was not my understanding. I was not aware that in the coal-fired powerplant—maybe your technical experts can help—that there was actually water consumed. It seemed the water was just used for cooling in those plants.

Mr. WHITE. Certainly with a coal-fired plant, there is substantial consumption, just with the evaporation and the cooling. The water is lost and not returned to the system.

Mr. OTTINGER. But these are not those figures, are they?

Mr. MCCORMICK. I believe they are.

Mr. OTTINGER. That just does not seem right. We were told from materials that Wesco supplied that in the four plants that they were planning to put up that there would be 33,000 cubic feet of water per year actually consumed.

Is that a figure that you are familiar with?

Mr. MCCORMICK. Cubic feet, or acre-feet?

Mr. OTTINGER. Acre-feet.

Mr. MCCORMICK. Well, the number is essentially the same. What is shown on this table for one high Btu commercial scale plant is 6,300 acre-feet per year. If you multiply that by 4, you get 25,000, so it is in the neighborhood.

Mr. OTTINGER. Well, the figure you have for a high Btu coal gasification plant is 6,300.

Mr. MCCORMICK. That is correct.

Mr. OTTINGER. If the Wesco figures are accurate, it would be closer to 8,250.

Mr. MCCORMICK. Mr. Ottinger, these are not our figures. They are the figures produced by the Council on Environmental Quality, and in all cases except Kaiparowits, which there we have used the figures out of the final environmental impact statement produced by the Department of Interior, these are not ERDA figures.

Mr. OTTINGER. I cannot believe, particularly with respect to that, that that is water consumed by the project. But you said you were going to check on that.

Now, with respect to the shale oil figures——

Mr. MCCORMICK. Dr. Zahradnik assures me that these figures are, in fact, correct, and that is the total consumption, and not——

Mr. OTTINGER. What are consumed and not returned, in each case?

Mr. MCCORMICK. Consumed and not returned.

Mr. ZAHRADNIK. Mr. Congressman, in order to make natural gas substitute from coal, you have to add hydrogen is present in the water, and so this is actually a raw material, a chemical that is transformed to natural gas in the process, and consequently disappears.

Mr. OTTINGER. I was aware of that with respect to your coal gasification process. But with respect to the water that is used in the regular electric powerplant, it is my understanding that the water is not consumed in that way, that the water is simply used for cooling and is substantially returned, and you would have a relatively small amount that might disappear by means of evaporation, because it is hot, but it would not be anything on this order.

Mr. WHITE. What you say sounds reasonable. I find it hard to reconcile those figures.

Mr. OTTINGER. Now, with respect to your shale oil figures, I see among the studies that you are financing, is a study of the water that would be consumed in the shale oil process, and I wondered if you are doing a study and paying a substantial amount of money for that study, how did you get these figures?

Mr. McCormick. This figure came from the western regional energy development study which was financed by the Council on Environmental Quality and is an estimate of shale oil water requirements.

Mr. Ottinger. What are you doing a study for, then? How much did you pay for it?

If my recollection is right—I am taking this off the top of my head—the study is due on July 1.

Mr. McCormick. I am not sure which study you are referring to, Mr. Ottinger.

Mr. Ottinger. Well, let's see if I can get some help. The title of the study is "Comparative Analysis of the Water Requirement for Technologies being considered for Oil Shale Retorting."

Mr. McCormick. Right. What that study is, Mr. Ottinger, is a comparison of the various different surface-retorting technologies and their comparative water requirements. This is simply an estimate and an approximation of what a surface shale plant would require in the way of water.

The different technological approaches each have a different water requirement. and that is what we are looking into.

Mr. Ottinger. Thank you, Mr. Chairman.

Mr. Dingell. The Chair recognizes Mr. Hunt.

Mr. Hunt. Mr. McCormick, in some of the research studies summaries that you gave to me. I noted that there was a project title called Information as a Function of Plant Size which is due on August 1, and the first sentence in the background statement says, "Prior to a determination of the optimum technology/plant size for the synthetic fuels program, further examination is required of the relationship between the plant size and the information gained for each technology."

In the fact that you have a due date of August 1 on this. I wonder, has a similar study been done for the Wesco and the ANG plants on the part of ERDA?

Have you determined what the optimal plant size would be——

Mr. McCormick. No.

Mr. Hunt [continuing]. Or are you just basically accepting the proposals as far as the applicants are concerned?

Mr. McCormick. Mr. Hunt, that study is intended to address the question of exactly how much information you get from different-sized plants in each category That was intended to include ANG and Wesco

For example, if we had authority to proceed with a competitive procurement for a first-generation coal gasification plant, we would expect to get proposals from Wesco and ANG and others, and in that particular case, we know that the proposals we would receive from ANG would be from a plant that is half the size of the Wesco proposal.

What we would like to examine in detail is precisely what kind of information w get and how much——

Mr. Hunt. Well, would you consider—and I leave this as an open question, but would you consider basically rejecting either the ANG or the Wesco proposals at this point for loan guarantees on the basis that they have oversized their plants as opposed to sized them for what appears to be the purpose here and the information gained for each technology. Basically size those two plants and say, 250 is really too

large. What we really need is a 50-million-cubic-foot-per-day plant or something, because what we are after is information and that is the optimal-sized plant from the standpoint of Government exposure relative to the acquisition of said information.

Mr. McCormick. Well, we are fairly convinced that a plant at the 50-million-cubic-foot-per-day level is not a sufficient size to demonstrate commercial viability of technology.

Now, the question you are asking and the one which we are also very interested in, is what is the comparison of information that you get from a 250 and a 125? There you are——

Mr. Hunt. Well, this is of great concern to us, because this is basically what the payout of this proposed loan guarantee program, as far as high Btu gases, is supposed to be. Information. And we are just wondering whether there might be a cheaper way of obtaining that information.

Mr. McCormick. Well, basically——

Mr. Hunt But we share your concern.

Mr. McCormick. Well, basically to get the information that we are talking about today, you would have to build something approaching a commercial scale plant, we believe.

Now, the question as to whether you need a 125, a 200, a 250 or whatever, we are not sure what the optimal point for Federal investment is there. However, we are fairly confident that anything below 125 million cubic feet per day is not going to be a demonstration of full commercial viability in the sense of including factors other than purely technological ones.

In other words, we feel that you have to build a plant on the order of magnitude of an economically optimal plant, the ones that people would be investing in later on.

Mr. Hunt. Well, if I may return to this information aspect, Congressman Ottinger raised the issue of your study with the due date, I believe of June 1, or July 1, I am not sure, on the water requirements associated with the modular oil——

Mr. McCormick. Yes.

Mr. Hunt [continuing]. Oil shale plant, my question is, have you conducted a similar study with either the USGS's help—and I believe they do have good expertise in their natural water survey—as to what the availability of water is, and in addition to that, what the water requirements would be for these high Btu first generation plants?

Mr. McCormick. Well, as I say, from this information that we just discussed, we have a rough idea of what the water requirements would be for these plants. In addition, we have undertaken a joint study with the Water Resources Council to estimate what the water requirements for the total program would be, and their impact on various regions of the country.

Mr. Hunt. Well, I guess my question follows from that, then, what incremental value would you gain from basically going through the full scale, if indeed this is subject to analysis. The improvement in accuracy I doubt would be more than what, 5- or 10-percent swing in either direction.

Mr. Zahradnik. I will give Dr. McCormick a moment to think about that question, Mr. Hunt, but I would like to point out that some years ago, the American Gas Corporation was concerned with very pre-

cisely the same question and did do a survey of the sites available in the country for high Btu gasification plants about the size we are talking about, and looked at the issue, not merely from water availability, but availability of coal as well as the entire transportation infrastructure to get water and raw materials to the plant and the project gas out, and observed that there were, I think, by actual count some 138 sites available.

One might take exception with the numerics, but certainly it suggests that the country has adequate sites for a number of these facilities with regard to water, with regard to coal, and with regard to access.

Now, the study did not look at what the impacts and tradeoffs were and one would suspect that this would have to be done in time, but certainly just without looking at the tradeoffs, there are sites available.

Mr. HUNT. There are sites available and the information, as I understand it, can be gleaned without going through this loan guarantee exercise.

Admittedly, it may be somewhat——

Mr. ZAHRADNIK. They were, you know, just the availability of sites was all the study addressed. Just, you know, whether the impact of the plant itself would have some adverse effect, I do not know. Bill might want to talk about that. But certainly the availability of the sites, I do not think there is any question but that that is true.

Mr. DINGELL. Mr. Nordhaus?

Mr. NORDHAUS. Mr. McCormick, a concluding request, and that is, of course, the materials for the record, and if at all possible we would like to have that tomorrow morning, if the materials could be gotten together quickly, and that is some comparisons of the costs, the economics of the various projects that have been discussed in the course of the hearings this afternoon, in particular the Coalcon project, the two demonstration—second generation demonstration projects, one that has already been authorized by information available, we would like to have it as soon as you can get it.

Mr. MCCORMICK. It might come in two pieces, that which we have available immediately and that which we have to produce.

Mr. NORDHAUS. OK. That is all I have.

[The material requested had not been received at the time the hearings were printed.]

Mr. DINGELL. Gentlemen, we thank you. The committee stands adjourned.

[Whereupon, at 5:20 p.m., the subcommittee adjourned, to reconvene subject to the call of the Chair.]

SYNTHETIC FUEL LOAN GUARANTEES

MONDAY, AUGUST 30, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D.C.

The subcommittee met at 10 a.m. pursuant to notice, in room 2359, Rayburn House Office Building, Hon. John D. Dingell, chairman, presiding.

Mr. DINGELL. The subcommittee will come to order.

This last week, the General Accounting Office issued a report entitled, "An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies." This report, which was developed as a followup response to a request from the Committee on Science and Technology, is most timely. The GAO is to be complimented for the approach it has taken to a most complex subject.

GAO did not limit its analysis to the issue of financing emerging technology; instead, it asked and addressed a broader and more fundamental set of questions.

Specifically, are there more cost-effective alternatives for the intermediate future which would relieve the symptoms of an apparent current domestic energy shortage and lay a substantial foundation for future domestic supply development?

The GAO's analysis outlines two critical constraints. First, just as our domestic reserves of fossil fuels are finite, so are this Nation's fiscal resources. And second, just as energy that is consumed today will not be available for following generations, Federal moneys to support private energy development will reduce either the public's purchasing power or funds available for other governmental services.

This report raises serious questions as to the wisdom of committing massive portions of the Federal budget and credit to the private development of synthetic fuels at this time. This is particularly significant since it appears far more cost effective to emphasize conservation and the development of renewable resources today, while at the same time we encourage more promising second generation synthetic fuel technologies.

The conservation alternative emphasized by this report has been an integral part of this subcommittee's thinking since it was formed at the beginning of this Congress and is reflected in bills already on the books. The Energy Policy and Conservation Act that was passed and signed into law last December included conservation initiatives in the field of automotive and industrial efficiency. Our most recent legisla-

tion, the Energy Conservation and Production Act, which was signed 2 weeks ago, incorporated much of the Omnibus Energy Conservation Act and directly addressed energy conservation in the industrial, commercial, and residential areas.

Further, it provides a clear framework of incentives for encouraging tertiary oil recovery, as recommended in this GAO report. In concert with the thrust of this report, the subcommittee has also recognized and has drafted and held hearings on legislation that deals with increasing the efficiency of electrical generation through load management techniques.

Today's hearings have been called to examine the conclusions reached in the GAO report, and to allow the Energy Research and Development Administration an opportunity to respond to these conclusions. Representatives of both agencies are present for this purpose.

Only through the kind of cross lighting of views which this hearing allows can the facts of the matter be established—facts which should be of great interest to the House in the event that it considers legislation on this subject this year.

The Chair is pleased to welcome the Honorable Phillip S. Hughes, Assistant Comptroller General, accompanied by Mr. Monte Canfield, Director, Energy and Minerals Division, for the General Accounting Office; and for ERDA, Dr. William T. McCormick, Director, Office of Commercialization and Dr. Roger W. A. LeGassie, Assistant Administrator for Planning and Analysis.

Gentlemen, we will first recognize GAO for comments, as appropriate, and then we will recognize our friends from ERDA. The Chair observes that, without objection, we will insert the full text of the GAO analysis into the record so it will appear in the appropriate place, as a part of a single document.

[Testimony resumes on p. 544.]

[The report referred to follows:]

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

An Evaluation Of Proposed Federal Assistance For Financing Commercialization Of Emerging Energy Technologies

Multiagency

In March 1976 GAO said that the Congress needed better information before approving the administration's proposed multibillion dollar Federal loan guarantee program for synthetic fuel plants.

This report analyzes the pros and cons for commercializing synthetic fuels and other emerging energy technologies by responding to the following questions:

- What can Government do to accelerate development of synthetic fuels?
- Can more energy be produced at less cost by stimulating the development of other new energy technologies?
- Is conservation a more cost-effective alternative to Federal incentives?
- Which types of Federal financial incentives are best in specific situations?

EMD-76-19

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-178205

To the President of the Senate and the
Speaker of the House of Representatives

On March 19, 1976, in response to his request, we reported to the Chairman of the Subcommittee on Energy Research, Development, and Demonstration (Fossil Fuels), House Committee on Science and Technology, our comments on the Administration's proposed synthetic fuels commercialization program (RED-76-82).

Subsequently, we testified before the House Committee on Science and Technology; Subcommittees of the Senate Committee on Banking, Housing and Urban Affairs, House Committee on Banking, Currency and Housing; and House Committee on Interstate and Foreign Commerce, on developing and commercializing energy technologies. In that testimony, we indicated that we were doing further work on the status of feasible technologies which appear to have impediments to full commercialization.

In addition, we indicated that this work would include an assessment of the priorities attached to the various technological options, and our assessment of the most appropriate incentives or other actions for encouraging their development. As our study of the matter progressed, it became evident that pursuit of alternative technologies is extricably intertwined in overall national energy strategies, including strategies for implementing energy conservation actions.

This report is the result of our analysis. It is intended to aid the Congress by providing a framework and perspective for making decisions on the many energy options before it.

Copies of this report are being sent to the Director, Office of Management and Budget, and the Administrators of the Federal Energy Administration and the Energy Research and Development Administration.

Comptroller General
of the United States

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ABBREVIATIONS

EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
FPC	Federal Power Commission
GAO	General Accounting Office

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

AN EVALUATION OF PROPOSED FEDERAL ASSISTANCE FOR FINANCING COMMERCIALIZATION OF EMERGING ENERGY TECHNOLOGIES

D I G E S T

GAO seeks to provide a framework and perspective for considering actions by the Federal Government which could contribute to solving energy problems confronting the United States over the next 10 to 25 years.

Unless choices of technology and financing methods are considered in perspective, the risk of piecemeal decisionmaking increases substantially.

Making the right choices among energy technologies, in GAO's view, requires consideration of three factors.

--The contribution that each technology can make in meeting the Nation's energy needs within a specified time frame either through reducing demand or increasing energy supply.

--The total cost of making the technology commercial including costs of plant construction, costs of alleviating adverse socio-economic impacts caused by the energy development, and the costs of price supports or further subsidies which may be required.

--The price at which energy produced by the technology would have to be sold and the means by which the price would be assimilated by our economic system. (See p. 45.)

Making the right choice among financing mechanisms requires, in GAO's view, interrelated analysis of at least three factors.

--The technology's state of development. Is the technology developed to the extent that it can be deployed on a broad basis?

Tear Sheet. Upon removal, the report cover date should be noted hereon.

--The technology's economic feasibility. Will the energy produced as a result of deploying the technology be economically competitive with competing energy sources?

--The target group whose actions will be influenced. Are they large industrial firms or diverse and widely dispersed groups of homeowners? (See p. 46.)

The recent slowdown in the rate of growth in demand for energy is a sharp reminder of the importance of the demand side of the energy equation and of conservation in particular. This fact, and the wide differences of opinion on the sources of energy supplies to meet that demand, suggest that the Nation should carefully explore all supply sources as well as conservation alternatives before embarking on a program to commercialize synthetic fuels. (See p. 5.)

CONCLUSIONS

GAO concluded that certain conservation measures are by far the most cost effective way to "produce" energy and therefore should have the top priority for Government financial assistance.

Among the energy supply-increasing technologies considered, GAO found several that are cost effective throughout the country or in particular geographical areas. These technologies are hydrothermal energy, municipal waste combustion systems, solar hot water and space heating, and tertiary oil recovery. The ultimate supply of energy to be captured from these sources may be smaller than the ultimate potential of other supply technologies such as synthetic fuels, but they appear more cost effective.

The cost effective technologies should be given priority in Government assistance for commercial development in GAO's judgment. This assistance will ensure their maximum

contribution between now and 2000 and give the Nation time to consider the potentially larger supply sources and develop them as appropriate. These latter sources include synthetic fuels as well as fusion, solar photovoltaic cells, thermal gradients, and breeder reactors. (See p. 47 and 48.)

Synthetic fuels production is not cost effective in that the total cost of output is not price competitive with foreign oil. Nor does it look attractive on the basis of present knowledge when compared to other technologies on an actual, or incremental, price basis.

Serious questions exist regarding any national commitment at the present time to uneconomic, high-cost supply technologies which substantially exceed the cost of imported oil. Mainly, larger commitments to building capital intensive energy sources could result in less incentive in future years to develop alternative lower cost energy sources. In addition, technologies producing energy that costs more than energy from imported oil would put exporting countries in a position to increase energy prices. (See p. 51.)

The pricing yardstick used in evaluating emerging technologies needs to be considered very carefully. An incremental cost standard is the only realistic one for making sound economic judgments which treat all emerging technologies equally. The alternative is average, or "rolled-in" pricing. This means that the real cost of new supply sources is averaged with a far larger volume of lower priced energy.

The rolled-in yardstick favors synthetic and other fuels susceptible to rolling in treatment. Incremental cost, on the other hand, would apply the same test to all energy options, including conservation. Decisions made on this basis would allow a consistent and rational process of choice on a cost effective basis. (See p. 49.)

Conservation

Areas offering the greatest opportunity for conservation include

--insulation and other measures that conserve energy in all buildings,

--less wasteful uses of energy by industry, and

--improved management of electrical demand.

A variety of financial mechanisms can be used to stimulate conservation. (See page 51.) Many of the actions GAO believes are desirable to encourage conservation and are authorized by the recently passed legislative extension of the Federal Energy Administration (FEA).

Synthetic fuels

The Energy Research and Development Administration's (ERDA's) most optimistic projections show synthetic fuels production reaching the equivalent of 2.4 quads and 22 quads in 1985 and 2000, respectively. (See p. 8.) However, ERDA is in the process of revising these estimates downward. Moreover, the projected prices are not competitive with existing or other emerging energy sources.

The large investments required to build synthetic fuel plants would direct Federal incentives primarily to the large industries which have access to capital. Two basic concerns underlie the stated need for Federal loan guarantees to finance synthetic fuels technology:

--concern that the product produced will not be economically competitive, particularly since the existing world market price for oil could always be manipulated to substantially undercut the price of synthetic fuels; and

--concern that technological advances in other energy areas or within synthetic fuels technology will make "first generation" synthetic fuels plants obsolete before they ever operate.

Research and development on "second generation" synthetic gas technology is expected to reduce costs by about 15 percent.

In the present circumstances, Government financial assistance for commercial development of synthetic fuels should not be provided at this time. Full priority should be directed to development of improved synthetic fuels technologies, however, it appears possible to gain adequate information of an environmental and regulatory nature from smaller plants under Government control. When commercialization of the technology becomes a prime objective, consideration also should be given to approaches other than loan guarantees for gaining private industry interest.

AGENCY ACTIONS AND UNRESOLVED ISSUES

In commenting on a draft of this report (see Appendices III and IV) the ERDA Administrator expressed deep concerns with GAO's analysis, presentation, conclusions, and recommendations, particularly as they related to actions on synthetic fuels. The Administrator pointed to what he regarded as five serious deficiencies.

In some of the items pointed out by the ERDA Administrator, GAO made revisions to its final report. Basic differences remain over what steps the Government should take today to maintain the option of developing a synthetic fuels industry in the 1990s. (See p. 60.)

MATTERS FOR CONSIDERATION
BY THE CONGRESS

GAO recommends that the Congress:

--Continue to place the highest priority on energy conservation actions, including obtaining better cost/benefit data on the whole range of conservation opportunities. This will provide the basis for further developing and funding specific programs.

--Maintain close oversight of the new conservation programs. As these programs prove effective or ineffective, shift emphasis accordingly.

--Continue to encourage the installation of units for solar hot water and space heating.

--Maintain close oversight of the Federal Energy Administration's actions to increase incentive for tertiary recovery of oil and authorize further incentives if the need and possibility to increase tertiary oil recovery becomes apparent in light of other energy developments.

--Consider whether it is advisable to enact legislation which would at this time authorize Federal loan guarantees to builders of synthetic fuel plants and consider instead directing ERDA to continue research and development to improve the technology and; in addition construct and operate smaller plants of a size sufficient to meet its stated goal of obtaining socio-economic, environmental, and regulatory information in a timely fashion.

--Consider further actions, including the provision of loan guarantee authority to encourage municipal waste combustion systems.

CHAPTER 1

INTRODUCTION

In recent months considerable legislation has been introduced in the Congress which would provide various forms of Federal assistance to encourage private sector use, or implementation of, a variety of energy technologies. One such bill, H.R. 12112, is currently the subject of intense congressional deliberations. It would provide Federal loan guarantees to accelerate the commercialization of synthetic fuels--gas from coal, oil from coal, and/or oil from shale.

The President, in his 1975 State-of-the-Union-Message, called for Government financial incentives to stimulate industry interest in developing and demonstrating the commercial viability of synthetic fuels. In February 1975, an Interagency Task Force on Synthetic Fuels Commercialization was established to study the various factors associated with commercializing synthetic fuels.

Because the price of synthetic fuels is almost certain to be higher than the price of energy produced from traditional energy sources, the Task Force recommended that loan guarantees, construction grants, and price supports would be needed to encourage industry participation. A GAO report entitled "Comments on the Administration's Proposed Synthetic Fuels Commercialization Program" (March 19, 1976) evaluated that proposal.

This report goes beyond the earlier effort, addressing the following questions bearing on whether Federal financial incentives should be used to accelerate commercialization of alternative energy sources and conservation actions.

--How could the Government accelerate the development of synthetic fuels to meet the Nation's future energy needs?

--Can more energy be produced at less cost if Federal incentives are used to stimulate the development of other new energy supply technologies such as solar energy, geothermal power, and enhanced oil recovery?

--Is conservation a more cost effective alternative for use of Federal incentives?

--Which types of Federal financial incentives--loans, loan guarantees, tax actions, purchase agreements, price regulation, Government ownership--are most appropriate in specific situations?

In considering these issues, the report attempts to avoid the risk of piecemeal decisionmaking by directing attention to some of the implications of certain choices for our national energy situation.

Our report examines a number of emerging energy supply technologies and conservation actions which are technically feasible and estimated to have a significant supply impact by 1985 and 2000, but are not being actively commercialized by the private sector. A major consideration in choosing among energy technologies obviously is the total time and cost to make the technology commercial. The report does not include a discussion of more uncertain technologies not ready for commercialization such as fusion, solar photovoltaic, thermal gradients, or breeder reactors.

No single mechanism for providing financial incentives appears appropriate to all circumstances. In determining the incentive which would best stimulate a particular energy or conservation technology, we believe the following three factors are important:

--The technology's state of development. Is it developed sufficiently so that it can be scaled up and deployed on a broad basis?

--The technology's economic feasibility. To determine this, we compared the incremental cost of the appropriate competing sources of supply. For example, synthetic oil was compared with imported oil, synthetic gas with imported liquified natural gas and with imported oil, solar heating with electricity, and retrofitting actions with imported oil.

--The target group who would be influenced by the incentives. Are we trying to influence the actions of a few large industrial firms or of many small businesses or of a large number of homeowners? What kind of resources does the target group normally have at its disposal?

Individual bills before the Congress cover a wide range of objectives and financing techniques. However,

no one bill focuses on all emerging energy technologies, considers all costs associated with development, or more importantly, attempts to focus on targets of proposed actions on some consistent priority basis.

In the remaining chapters of this report, we

--Provide perspective on the role of new energy technologies and energy conservation. (Chapter 2, pages 4 to 11.)

--Analyze the potential energy savings associated with various energy conservation actions, the cost of such actions, and the impediments to their widespread implementation. (Chapter 3, pages 12 to 23.)

--Discuss the status of emerging energy supply technologies, the potential supply impact and cost of these technologies, and the obstacles to their commercial implementation. (Chapter 4, pages 24 to 37.)

--Review the actions available to the Government to accelerate development of emerging energy supply technologies or conservation actions, including the advantages and disadvantages of each. (Chapter 5, pages 38 to 43.)

--Present our conclusions as to the Government actions we believe are desirable to accelerate energy conservation and supply, focusing on the relative priority of various conservation and supply choices. (Chapter 6, pages 44 to 56.)

CHAPTER 2

PERSPECTIVE

Before the Arab oil embargo in the fall of 1973, the United States was importing about 6 million barrels of oil a day, principally from the Arab oil producing countries. This oil accounted for about 35 percent of domestic oil consumption. The embargo made the American public aware that energy consumption was exceeding domestic production and that the Nation was becoming increasingly dependent on imported oil. In response to the embargo, the President established the goal of "Energy Independence."

Progress toward achieving this goal is, as yet, not apparent as oil imports have risen to about 6.8 million barrels per day and now represent about 42 percent of the oil being consumed in this country. This growing dependence on imports has increased the United States' vulnerability to supply disruptions and oil price rises.

What can be done to lessen U.S. dependence on imported oil as well as to what extent that dependence should be lessened have been the subject of considerable debate on the part of the Administration, the Congress, and the Nation. One of the issues in this debate is how we will assure our energy supplies in case of future embargos. The major action which has been legislated so far to respond directly to the embargo problem is the authorization of a strategic petroleum reserve in the Energy Policy and Conservation Act (Public Law 94-163). In addition, debate on the issue also centers around uncertainties over (1) our future energy needs, (2) the probability of further domestic discoveries of oil and natural gas, and (3) the ability to properly balance social, environmental, economic, and technological concerns associated with the future development of existing and new energy sources and conservation technologies.

Numerous studies 1/ have been made using various scenarios to attempt to understand the nature, extent, and timing of

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1/ These studies include FEA's "1976 National Energy Outlook;" ERDA-48, "A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future;" "A Time to Choose" by the Ford Foundation; "Achieving Energy Independence" by the Research and Policy Committee of the Committee for Economic Development; and the Bureau of Mine's "United States Energy Through the Year 2000 (Revised)."

actions required to balance future energy supply and demand. The conclusions reached by these studies differ widely on the mix and relative emphasis that should be given to developing new and existing energy sources primarily because different sets of assumptions are made. The assumptions in turn reflect differing levels of optimism about the feasibility of obtaining slower growth through conservation. The energy growth rates and the level of imports are the two most crucial components of most of these studies because they have a direct bearing on how urgent the need is to develop domestic energy sources, i.e., the higher the growth rate, the greater the need to aggressively develop all possible energy supplies.

The highest energy growth studies are generally based on the 4.3 percent rate of growth in energy consumption experienced in this country from 1965 to 1973. However, most studies now question whether historical trends are the best indication of future energy growth. For example, the lowest of the scenarios (zero energy growth scenario) presented in the Ford Foundation study is predicated on redirecting economic growth away from energy intensive industries toward economic activities that require less energy. This assumption results in very limited increases in energy demand until the late 1980s and then zero growth after that.

In a recent speech, the Administrator of the Federal Energy Administration (FEA) stated that the United States must set up a goal of limiting the growth in energy demand to 2 percent per year if it is to escape the political and economic consequences of energy dependence. Different scenarios show energy growth rates ranging from 0 to 4.5 percent annually, however, recent studies appear to cluster around 2-1/2 to 3 percent annual growth in energy demand. This consensus on reduction in historical growth rates is based largely on increased conservation measures--both price induced and as a result of explicit Government actions. This rate of growth suggests that although the United States must step up its work on developing emerging energy technologies to meet long-term needs, conservation actions may buy time to fully consider trade-offs and make choices that will result in the most energy at the least cost to society. This is not to say that conservation and improved efficiency in energy use are not also long-term options and that energy conservation in particular could not be a cornerstone of any national energy policy.

The uncertainty over the mix of energy sources that will best meet future energy growth rates is caused by the lack of systematic methods of computing, comparing, and projecting the costs and benefits associated with implementing energy conservation measures, new energy supply technologies, and

the future development of existing energy sources. However, to some extent the costs and to a larger extent the benefits are not always clear and, in many cases, may be subjective. Another important factor, but one which can only be roughly estimated, is the time frame required for perfecting new technologies still in the research and planning stages.

Even though uncertainties exist, based on the energy supply and demand scenarios, the following are available courses of action which can be taken individually or in some combination to help lessen U.S. reliance on imported oil.

1. Adoption of conservation measures to reduce the growth rate in energy demand.

2. Increase (or slow the decline of) domestic production of oil and natural gas through new exploration and greater use of enhanced recovery techniques.

3. Expanded use of coal.

4. Expanded use of nuclear power.

5. Encouraging the use of emerging energy technologies such as synthetic fuel, solar power, and geothermal power.

Both the appropriate mix and the possible contribution of these opportunities are still hotly debated. To illustrate the possible role of different energy sources, we use in this perspective two scenarios from the Energy Research and Development Administration report entitled "A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future,"--one emphasizing the energy savings potentially available through conservation measures and the other emphasizing the additional energy supplies available from emerging technologies.

ERDA's Scenario I--Improved Efficiencies in End-Use--shows that an intensive energy conservation program directed at improving end-use efficiencies has the potential of making a substantial impact on total energy consumption. Much of the energy savings are not dependent on technological development but on educational programs and other policies that will assist end-users in making decisions necessary to implement energy efficient technologies. Beyond the initial phases, however, substantial new technology is seen to be needed to continue the drive toward efficiency in energy production and use to achieve the full set of benefits which are indicated by the scenario.

ERDA's Scenario V shows simultaneous commercialization of all new technologies. The scenario assumes continuation of historical demand trends modified to reflect recent price increases. ERDA points out that this scenario is idealistic and that it is highly unlikely that all new technologies can be developed with complete success. However, according to ERDA, based on the assumption that domestic production of oil and gas has peaked, and is declining, only the successful development and implementation of a large number of new technologies in a combination of approaches can make importing fuel a matter of choice.

In this report we concentrate only on those new technologies that have been proven technically feasible and are estimated to be capable of making a significant supply contribution by 2000, not the broad range of new technologies covered by the ERDA study, such as solar photovoltaic. All of the technologies covered in this report could be simultaneously commercialized if the country is willing to pay the price.

The table on page 8 shows for both ERDA scenarios the mix of energy sources and conservation actions to meet demand for 1985 and 2000. The charts are calibrated in terms of quadrillion British thermal units (Btu) 1/ or quads. One quad equals a thousand trillion (10^{15}) or 180 million barrels of oil equivalent.

The table serves to illustrate the range of choices available for the United States energy future depending on the extent to which conservation actions or various new supply technologies are emphasized. There are of course many possible scenarios for the United States energy future presented in a variety of studies all of which illustrate the range of the choices facing our Nation.

In the case of the two ERDA scenarios, the largest differences by the year 2000 are in (1) the amount of energy saved by conservation actions (43 quads in Scenario I versus 28.4 quads in Scenario V); (2) the amount of oil imports required (20.6 quads in Scenario I versus 4.1 quads of exports in Scenario V); and (3) the amount of supply from emerging technologies (19.6 quads in Scenario I versus 48.6 quads in Scenario V). The differences in the two

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1/ The amount of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit.

COMPARISON OF ERDA'S SCENARIO I (EMPHASIS ON CONSERVATION) AND SCENARIO V (EMPHASIS ON NEW ENERGY TECHNOLOGIES) FOR 1985 AND 2000

	1985		2000	
	Scenario I	Scenario V	Scenario I	Scenario V
	(In Quads)		(In Quads)	
Existing Sources:				
Domestic oil	21.1	21.1	12.5	12.5
Natural gas	26.5	26.5	22.8	22.8
Coal a/	18.5	16.7	22.9	25.1
Nuclear	10.9	13.2	20.4	24.4
Hydroelectric	3.4	3.4	3.6	3.6
Imported oil	10.5	7.8	20.6	b/ .0
Subtotal	90.9	88.7	102.8	88.4
Emerging Sources:				
Tertiary oil	3.0	3.0	7.2	7.2
Geothermal	.9	1.6	2.4	6.6
Solar	.2	.3	3.5	4.8
Biomass	2.0	2.0	6.5	8.0
Oil Shale	.0	1.0	.0	8.0
Liquids from coal	.0	.5	.0	10.5
Gas from coal	.0	.9	.0	3.5
Subtotal	6.1	9.3	19.6	48.6
TOTAL - Energy resources	97.0	98.0	122.4	137.0
Impact of energy conservation	10.3	9.2	43.0	28.4
	107.3	c/ 107.2	165.4	165.4

a/ Excludes synthetic fuels from coal.

b/ No imported oil, furthermore 4.1 quads of exports are assumed.

c/ Difference due to rounding.

scenarios indicates to us that while the roles of conservation and emerging supply technologies are uncertain, both have vast potential depending upon the priorities assigned to them.

Also obvious from the scenarios is that extra emphasis on either conservation or energy supply technologies can likewise reduce the need to emphasize the other. Moreover, because emerging energy supply and conservation technologies are potential sources to balance our energy needs, they will involve consideration not only of the aggregate role of each source but also of the individual technologies which make up the aggregate source. Hence, less emphasis on emerging supply technologies could provide more flexibility of choice between, for example, synthetic fuels and solar and biomass. On the other hand, less emphasis on conservation could provide more flexibility, for example, between efficiency measures and so-called "belt tightening" measures.

Energy conservation

Many conservation technologies can provide potentially cost effective alternatives to developing new energy supplies --i.e., in many instances it can cost less to save a barrel of oil through, for example, constructing more energy efficient buildings than it will to supply a new barrel.

ERDA's Scenario V which emphasizes simultaneous commercialization of all new technologies shows conservation contributing 9.2 and 28.4 quads by 1985 and 2000, respectively. In contrast, Scenario I, which emphasizes energy conservation actions, shows conservation contributing 10.3 quads and 43 quads in 1985 and 2000, respectively.

Other studies assume considerably higher estimates of the potential savings from energy conservation actions. For example, the Ford Foundation in its Technical Fix Scenario estimated that using energy saving technologies presently known and economically justified at existing prices, conservation actions could contribute about 24 quads and 64 quads in 1985 and 2000, respectively. That scenario is the "middle case" scenario for that project. Their more optimistic "Zero Energy Growth" Scenario is not used in this report for analytical purposes.

Oil and natural gas production

Domestic Oil production peaked in 1970 at 9.6 million barrels per day and has been declining ever since to the current level of 8.2 million barrels per day. Production of natural gas has fallen from a peak of 22.6 trillion cubic feel (TCF) in 1973 to 20.1 TCF in 1975. The only expected major increases in

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the near future are from the Prudhoe Bay field on the North Slope of Alaska and the Outer Continental Shelf.

Before the embargo, new oil exploration and development was curtailed because of availability of less expensive imported oil. The advent of higher crude oil prices has stimulated greater exploration activities, however, U.S. production continues to decline. The Trans-Alaskan pipeline, when it is completed, will initially deliver about 1.2 million barrels per day 1/, an increase which at most could lift domestic supplies to levels reached in the early 1970s.

Under both Scenarios I and V, ERDA-48 shows domestic oil production (including tertiary oil production) to be 24.1 quads in 1985 and 19.7 quads in 2000. For 1985 this represents an increase of 14 percent over 1974 production and for 2000 a decrease in production from 1974 of 6 percent. These figures include production from the Outer Continental Shelf and Alaska.

ERDA's Scenarios I and V show natural gas production to reach 26.5 quads in 1985 and to decline to 22.8 quads by 2000. However, a January 14, 1976, GAO report entitled "Implications of Deregulating the Price of Natural Gas" (OSP-76-11) pointed out that even with price deregulation, production of natural gas can be expected to deline to 16.8 quads in 1985 primarily because of the inability to sustain the new field discovery rate experienced in the past.

Expanding the use of coal

Coal is the country's most abundant energy resource. The U.S. coal resources are estimated to be about 4 trillion tons. However, over the last 75 years, the use of coal has declined from supplying over 90 percent of the Nation's energy needs to about 17 percent.

The regulated price of natural gas, cheap import prices before the embargo, and continued development of nuclear power have limited the growth of coal use. Additionally, growth in coal production and consumption has been affected by State and Federal laws governing mining health and safety, strip mining and land reclamation, and air quality.

The Arab embargo and the dramatic increase in the price of oil have stimulated interest in direct burn of coal as a primary energy source.

1/ FEA's latest estimate.

Most studies indicate that coal production must rise substantially. The question is by how much? Under its Scenario V which emphasizes commercialization of new technologies ERDA shows coal consumption (including coal for synthetics and exports) to be 18.1 quads or 18 percent of 1985 resource consumption and 39.1 quads or 28 percent of resource consumption in the year 2000.

Under its Scenario I, which emphasizes conservation actions, coal use in 1985 and 2000 is estimated to be 18.5 quads and 22.9 quads, respectively. No coal is used for synthetics under this scenario.

Expanding the use of nuclear power

The use of nuclear power has grown in recent years, but it still only supplies about 2 percent of total energy demand. Nuclear plays a signficant role in both the ERDA scenarios.

In Scenario I it provides 10.9 quads and 20.4 quads in 1985 and 2000, respectively. In Scenario V which emphasizes technological development it supplies 13.2 quads or 14 percent of 1985 resource consumption and 24.4 quads or 18 percent of resource consumption in the year 2000. Other studies have included lower predictions for nuclear power. These predictions reflect certain problems that have yet to be overcome including economic considerations, availability of uranium, efforts to develop new nuclear reactor technologies, and certain safety and safeguard problems.

Development of new energy supply technologies

Some energy technologies appear to be technically feasible and are at the point where they could be demonstrated: tertiary oil recovery, solar hot water heating, solar space heating, biomass conversion, synthetic gas from coal, synthetic liquid from coal and/or shale, and geothermal power. Many of these technologies are not being commercialized because the technology is simply too expensive, resulting in the price of energy produced from projects using these technologies being greater than competing prices from traditional energy sources, like foreign oil. Others, like certain solar technologies, appear to be cost effective on a life cycle basis but are not being widely commercialized because of higher initial costs and perhaps, because of lack of information on the part of the consumer.

ERDA in its most optimistic scenario for new technologies shows new energy sources providing 7 percent of resources consumed in 1985 and 34 percent of resource consumption in the year 2000.

CHAPTER 3

ENERGY CONSERVATION

Energy conservation means using less energy and using it more efficiently. There has been increasing recognition of the major role conservation can play in slowing or even reversing the growth of the gap between energy demand and our domestic energy supplies. The overall potential is prodigious. A recent report by two physicists estimated that available and feasible changes could have reduced 1973 energy consumption in the United States by a full 43 percent 1/. Another report, by the Office of the Chief Engineer of the Federal Power Commission, indicated that a number of common energy-consuming systems use only 2 to 8 percent of the total energy available from the fuels they consume 2/.

ERDA's plan recognizes energy conservation as its highest priority and cited the following characteristics:

--"A barrel of oil saved can result in reduced imports."

--"It typically costs less to save a barrel of oil than to produce one through the development of new technology."

--"Energy conservation generally has a more beneficial effect on the environment than does energy produced and used."

--"Capital requirements to increase energy use efficiency are generally lower than capital needs to produce an equivalent amount of energy from new sources since most new supply technologies are highly capital intensive."

--"Conservation technologies can generally be implemented at a faster rate and with less government involvement in the near term than can supply technologies."

--"Energy efficiency actions can reduce the pressure for accelerated introduction of new supply technologies."

1/ "Assessing the Potential for Fuel Conservation," Marc H. Ross and Robert H. Williams, The Institute for Public Policy Alternatives, State University of New York, July 1, 1975.

2/ "Staff Report - A Technical Basis for Energy Conservation," Office of the Chief Engineer, Federal Power Commission, April 1974.

-- "Since the actions persist over time, the benefits are continuing."

Beside the continuing effects of conservation, measures taken need not be repeated to continue saving energy. For example, as a rule of thumb, one barrel saved in consumption saves an additional barrel used for conversion and delivery of energy.

The physical potential for energy conservation has been estimated in a number of studies. However, the questions of how much of the potential can be realized, in what time frame, at what cost, and with what approaches, requires much more examination. One study planned by a Federal agency to perform such an in-depth assessment was not completed, while another study to assess the capital costs of energy conservation actions, was not funded.

The following section of this chapter presents a review of the conservation programs included in the Energy Policy and Conservation Act, along with FEA's estimates of their potential impact. 1/ The analysis in the latter portions of this chapter is based, in large measure, on the Ford Foundation's Energy Policy Project (hereafter referred to as the Ford Project) project entitled "A Time to Choose." Because the energy situation has been changing, some of the Project's work is dated. Even so, it provides useful estimates of the energy savings possible through conservation.

ENERGY SAVINGS FROM CURRENT POLICY

The Energy Policy and Conservation Act, Title III, requires mandatory fuel economy standards for new autos starting in 1978, provides for voluntary energy efficiency improvement goals for consumer products, includes a voluntary industrial conservation program, continues the Federal conservation program, and supports voluntary state energy conservation programs. By 1985, these efforts will reduce energy requirements about 7 quads per year which represents only a small portion of the potential for conservation. Conservation potentials cited for these activities are FEA estimates.

1/ On August 14, 1976, the President signed legislation extending FEA's life (Public Law 94-385) which included a number of new conservation programs. While many of the programs address conservation opportunities discussed in this chapter, we have not had time to fully analyze their potential impact. Page 51 in our summary chapter contains a brief discussion of these conservation programs.

FEA estimates that the auto fuel economy standards will lead to savings of 2.1 quads a year by 1985. Based on the historical automobile replacement rate, we estimate that the entire auto fleet will reach the maximum efficiency requirement of 27.5 miles per gallon by the mid-1990s. This would result in a further saving of 24.5 percent in automobile fuel use or an additional 1.5 quads a year.

Should consumer products meet the efficiency goals scheduled for 1980, 1.6 quads a year will be saved by 1985. Because this goal is scheduled for 1980, a large proportion of the savings will be realized by 1985, so this saving will not grow as much as the auto saving will in the years beyond 1985. FEA estimates that the State energy conservation programs under the Energy Policy and Conservation Act will result in savings of 1.8 quads a year by 1985. The Federal program is expected to slowly expand on savings previously achieved under the presidentially mandated Federal Energy Management Program. FEA estimated that the savings attributable to this program were 0.6 quads in 1975 and will remain in this range through 1985.

Smaller amounts of energy savings are anticipated from the voluntary industrial energy conservation program. The industrial program, aimed at the ten most energy-intensive industries, is expected to save 0.9 quads in 1980, but only 0.6 quads in 1985. This decline is anticipated because the program is only expected to accelerate actions which companies would have carried out on their own by 1980 because of price increases.

FURTHER POTENTIAL FOR ENERGY CONSERVATION

The major thrust of the programs adopted in the Energy Policy and Conservation Act have aimed at a limited number of fairly significant energy use activities, such as automobiles and home appliances. Additional measures focusing on other energy uses can yield substantial savings beyond those anticipated for the programs now in effect.

Changes in energy use which could result in energy savings can be classed roughly into three types. The first class involves changes in practices which can be implemented immediately (turning down thermostats) or within a few months or years. These changes, such as the mandatory 55 mile per hour speed limit, will usually not have large dollar costs, but the changes of convenience or habits can be important. The second class of changes can be called "retrofitting." Retrofitting involves changes or additions to existing energy

using equipment, such as adding insulation to buildings, or adding an automatic control system for a factory process. Individual retrofitting actions can be carried out relatively quickly, but it will take a number of years, for example, for insulation retrofitting to be completed in the tens of millions of American houses in which it is cost-effective: such a program could begin to yield energy savings very quickly, with little lag period, but the full savings would not be achieved until the program was completed.

Retrofitting changes will involve dollar costs, which can range from being very cost effective to being prohibitively expensive, and thus their extent of accomplishment will be affected greatly by economic factors. For example, expensive storm windows may be cost effective in New England but probably not in most Southern states.

The third class of energy-use changes involves replacing existing equipment, facilities, and processes. These will be the slowest to reach their full potential for energy savings, because many of these changes may be delayed until existing equipment has served its useful lifetime. This lifetime ranges from over a decade for cars to half a century or more for homes and commercial buildings. Increasing energy costs may speed up the retirement of some extremely energy-intensive equipment or structures.

In light of those differences of timing, it will be important to focus on changes of practices and retrofitting to achieve early energy savings from conservation policies, and also to consider ways in which the retirement of inefficient energy-using equipment and structures can be accelerated.

For our estimates of the potential for additional energy savings, we have relied on the Ford Foundation's Energy Policy Project. The project considered several scenarios, one called "Historical Growth" which projects the trend of energy use if energy supplies are emphasized, one called "Technical Fix" which incorporates a number of supply and conservation actions, which the Foundation saw to be both energy and economically efficient, and another named "Zero Energy Growth" which emphasizes energy conservation and even greater efficiency. The conservation estimates we use are based on the "Technical Fix" results and the consumption estimates are based on the "Historical Growth" projection. Though energy consumption is not expected to grow as fast as the 3.4 percent growth rate of the Historical Growth scenario (most projections today are in the 2.5 to 3 percent growth range), the higher consumption estimates still can be used to illustrate the potential impact for conservation actions.

Finally, it should be noted that neither the Ford Project's study nor other studies mention every possible opportunity. In the following discussion, we consider only some of the more important actions which could be taken by the residential, commercial, transportation, and industrial sectors and the utility industry to conserve energy.

The residential sector

The residential sector consumed about 22 percent or 15.3 quads of energy during 1975. Without additional Federal actions, consumption would grow to about 22.9 quads by 1985 and 30.1 quads by 2000. About 21 percent of this energy can be saved each year by 1985 and, by 2000, almost 36 percent. The following table shows the major areas where the savings can be achieved.

	Potential savings in quads	
Savings area	1985	2000
Space heating	2.7	7.0
Air conditioning	.8	1.3
Water heating	.6	1.5
Other	.6	1.0
Total	4.7	10.8

The largest opportunity for saving energy in the residential sector is in space heating and water heating. Weatherproofing both existing buildings and new housing with ceiling and wall insulation, storm windows, weatherstripping, and constructing thermally "tighter" homes are important conservation steps. Using heat pumps in homes with central air conditioning rather than electric resistence heating is another important measure. Other conservation actions in this area include use of more efficient fossil fuel furnaces, and electric igniters rather than pilot lights.

Besides these measures, consumers themselves can reduce consumption by lowering thermostat settings and not heating or cooling unoccupied rooms. A study done for the Environmental Protection Agency (EPA) estimated that a practical thermostat control program could achieve as large a saving in 1985 as an insulation program could. Public education would improve awareness of these opportunities.

The commercial sector

The commercial sector used about 14 percent or 9.8 quads of energy during 1975. By 1985, consumption is expected to grow to 15.1 quads and 21.3 quads by 2000 without additional Federal actions. About 9 percent of this energy can be saved each year by 1985 and, by 2000, about 21 percent. The following table shows the major conservation areas.

Savings area	Potential savings in quads 1985	2000
Space heating and total and energy systems	a/ 0.7	3.2
Air conditioning	0.3	0.5
Other	0.3	0.7
Total	1.3	4.4

a/ Figure based on space heating at 1.3 quads plus total energy systems at a decrease of 0.6 quads.

Many of the savings opportunities for the residential sector apply in this sector as well. For instance, better insulation could save 0.7 quads in 1985. Other opportunities include using heat pumps instead of electric resistence heating and using total energy systems, which would combine electricity generation with waste heat recovery for use in space heating and cooling, say for use in a large building or a shopping mall. Though total energy systems could only make a minor contribution during the next 10 years, they could over the long-run, be almost as important an energy saver as the improved insulation of commercial buildings.

Additional conservation opportunities pertaining more to user practices than installed technology are available in the commercial sector. Examples include reduced lighting levels and reduced ventilation rates. These changes could be implemented quickly, according to an EPA study, and could save as much as 1.6 quads by 1985, but would require changes in building codes.

The transportation sector

The transportation sector of the economy accounted for 26 percent--or 18.6 quads--of the Nation's energy use in 1975.

Without Federal actions, it is expected to grow to 26.0 quads in 1985 and 38.4 quads by 2000. Automobiles consume about 57 percent of the transportation energy and offer the largest potential for saving energy. This was recognized by the setting of fuel economy standards in the Energy Policy and Conservation Act discussed earlier. Additional transportation savings can be obtained from the following areas.

Savings area	Potential savings in quads 1985	2000
Air transportation	1.1	3.4
Trucks	0.3	2.1
Total	1.4	5.5

For air transportation, the conservation opportunities include increasing passenger and freight load factors, slightly reducing flight speeds and reducing the number of short distance flights. Fuel use by trucks can be reduced by shifting from gasoline to diesel engines and increasing the use of trains for intercity freight.

Additional opportunities, such as increased carpooling, vanpooling, and shifts from autos to buses in urban areas will reduce fuel use. Regarding carpooling, a study done for EPA estimated that an increase of average vehicle occupancy of 0.4 persons in commuting trips could be attained and result in energy savings of 1.0 quads a year by 1985.

The industrial sector

Industry is the largest of the Nation's energy consuming sectors accounting for about 38 percent of U.S. energy use, or 27.3 quads in 1975. Without Federal actions, this is expected to grow to 52.1 quads in 1985 and 96.9 quads by 2000. The voluntary industry efficiency program of the Energy Policy and Conservation Act will obtain only a small portion of the potential for industrial conservation.

Overall savings opportunities in the industrial sector constitute about 12.1 quads of the energy projected to be used by industry in 1985. This is more than double the savings potential of the residential sector and about 80 percent of total energy use by the commercial sector. By 2000, about 36 percent of projected industry energy consumption could be saved.

By 1985, roughly 50 percent of all industrial energy use will occur in five industries--paper, aluminum, steel, plastic, and cement. Major savings are possible through the use of more efficient production processes in these five industries. The steel industry has the largest potential but by 2000 the introduction of new processes could make the percentage savings in paper and plastic comparable. Today some Swedish and German industries are using 20 to 43 percent less energy per ton of output than U.S. industry requires. Major conservation opportunities for industry are identified below.

Savings area	Potential savings in quads 1985	2000
Five energy intensive industries	4.0	11.6
Miscellaneous cogeneration of steam and electricity	0.4	2.9
Miscellaneous direct heat	2.9	5.4
Other	4.8	13.9
Total	12.1	33.8

Energy savings pertaining to industry across the board are available for direct heat applications by using heat recuperators and regenerators and if fossil fuels were used instead of electric resistence heating. Another possibility is cogeneration, which is the simutaneous production of steam and electricity. However, cogeneration has a long implementation time associated with it, and is not expected to make its major contribution until after 1985. Yet it is a proven technology--almost 30 percent of electricity generated in West Germany is produced in industrial plants.

Electric utilities

In addition to the four end-use categories, the electric utility industry plays an important role in the energy economy. In 1975, utilities consumed over 28 percent of all U.S. primary energy resources for generating the electricity consumed in other sectors. (Consumption statistics for the sectors previously discussed include the appropriate electricity they consume.)

Because electricity was an inexpensive and flexible source of energy, its use has been promoted for many years. Utility rate structures were designed this way--rewarding power users with lower priced electricity as their consumption grew. Changing utility rate structures to end these promotional features and substituting conservation oriented rate structures will discourage wasteful electricity use, encourage industrial and onsite power generation, and reduce peak load demands.

The major aspect of conservation oriented utility rate structures is called load management. Utilities generally meet base-load and intermediate demands with nuclear and coal-fired plants, and meet short-term (several hours per day) peak demands with oil or gas fired turbines which have substantially lower capital costs but which have much higher energy costs. Pricing structures which increase electricity costs when demands are greatest can reduce the range of daily fluctuations in electricity demand. This will allow utilities to generate a greater share of their output with the more energy-efficient nuclear and coal-fired plants and, thus, save some of the energy wasted due to the inefficiency of peaking turbines. Consideration is also being given to special measures to protect low income persons such as "life line pricing" which would provide a minimum amount of electricity at low rates.

Besides such rate structure revisions, improvements can be made by increasing generating and transmission efficiency, and sharing demands through system interconnections.

Cost effectiveness of conservation

Many of the conservation strategies discussed above are cost effective today. For example, FEA has found that in a climate like Indianapolis, Indiana, a typical homeowner could install ceiling insulation at a cost that would be equivalent to purchasing oil at $5.90 a barrel, or 14 cents per gallon of heating oil. Additional retrofitting might be wall insulation and storm windows, at 28.5 cents and 30.5 cents per gallon of oil equivalent. These savings can be compared to heating oil which is now priced at over 40 cents per gallon and rising with the cost of petroleum.

A study by the National Bureau of Standards found a number of industrial conservation actions to be cost effective. Some of these examples are shown below.

Action	Estimated cost	Estimated annual savings
Schedule use of 12 30KW furnaces to minimize peak demand	None	$3,600
Insulate 420 feet of steam line	Minimal	$1,720
Installing steam traps on phonograph record molding presses	Minimal	$105,000
Recover boiler flue gas heat for space heating and feed-water preheating	a/ $9,040	$5,360
Improved Combustion Control for Dual Feed Systems	$29,000	$40,090

a/ Incremental cost for recovery system.

There are other energy conserving actions which have been proposed that appear to be cost effective because they entail no capital expenditure. Changes in user practices such as turning down thermostats cost nothing and offer immediate savings.

Modifying transportation practices such as increasing airline load factors, reducing the number of short distance air trips, and increasing carpooling and railroad use are all cost effective changes. Changes such as these reduce the passenger or freight costs per mile traveled.

These examples show some conservation actions which are cost effective, however, many more not mentioned here may also be cost effective. Often, specific circumstances will dictate whether an action is economical, and a determination can only be made on a case-by-case basis.

IMPEDIMENTS TO IMPLEMENTATION OF ENERGY CONSERVATION

Although many potential energy conservation actions are now cost effective, there are a number of impediments to accomplishing these actions. These include (1) a need for more accurate and complete information on conservation costs and benefits, (2) a lack of incentive for many users to improve their energy efficiency, (3) preoccupation with

initial costs rather than life-time costs, (4) several Government regulations, and (5) the slow rate at which existing technology is replaced.

Besides the lack of information, access to capital, especially for small borrowers, also may be lacking. Another problem is the lack of incentive, especially in the case of builders, owners, and renters in the residential and commercial sectors who may not pay utilities directly or who may not plan on occupying the building long enough to justify retrofitting it themselves.

An obstacle to more efficient new homes and manufactured goods is the concern of manufacturers and builders regarding the impact that the selling price of their products will have on sales. The problem is that initial cost can determine salability of a product, even though the total life cycle cost of buying and operating an energy efficient house, car, appliance, or other product would be lower.

Industry, as well as consumers overemphasize first cost, or avoid conservation investments for other reasons. Tentative indications in one of our reports now in preparation are that, in parts of the industrial sector, energy-conserving investments are only being made if they offer extremely fast paybacks (1 to 3 years).

Several Federal regulations promote inefficiency. For example, Interstate Commerce Commission regulation of the trucking industry results in inefficient routing and empty backhauls, and Civil Aeronautics Board rules may adversely affect airline load factors. These regulations were written with service and industry competition in mind, but may need to be overhauled to take into consideration the efficient use of energy. Electricity and steam cogeneration by industry is impeded by laws which discourage the sale of electricity by industry.

A final impediment is the slow rate at which equipment and facilities throughout the economy are replaced; for example, there are steel plants in operation today that were built in the first quarter of this century. Often the potential energy savings from a new process or efficient industrial equipment are insufficient to justify replacing the existing ones while retrofit may also be unjustified.

Despite the potential for conservation and recent recognition, Federal funding is only a small portion of total energy expenditures. Excluding the state energy conservation programs, about 8 percent of FEA's fiscal year 1977 budget is devoted to conservation. About 4 percent of ERDA's fiscal

year 1977 budget is devoted to conservation research and development activities. In addition, ERDA's combustion, fuel cell, and magnetohydrodynamics research may begin to contribute to energy efficiency between 1985 and 2000.

Although better data on costs and potential impacts needs to be developed, energy conservation should play a major role in Federal energy activities. Enough is known to place priority on particular conservation actions in each sector. Federal activities can be pursued which would emphasize the major opportunities, provide public information services and, in some cases, financial incentives to stimulate activity.

CHAPTER 4

EMERGING ENERGY SUPPLY TECHNOLOGIES

In addition to improving existing technologies and encouraging and developing energy conservation techniques, energy research and development also involves new energy technologies. This chapter focuses on these new technologies designed to increase the Nation's energy supply, their potential, and the factors constraining their widespread use. Included are those technologies that have been proven technically feasible and are estimated to be capable of making an important supply contribution by 2000.

Although there exists a wide range of projections of the potential of new energy supply technologies, ERDA's most optimistic scenario in their National Plan 1/ shows that no individual new technology which we examined in this report is expected to provide more than 10.5 quads or 8 percent of total domestic supply required by 2000. 2/ Within this perspective, synthetic liquid fuel from coal is expected to produce the largest impact in 2000 (10.5 quads), followed--in descending order--by oil from shale (8 quads), oil recovered using tertiary techniques (7.2 quads), energy from biomass (waste material only--mostly municipal waste) (6.5 quads), electric energy from geothermal (mostly hydrothermal) resources (5.6 quads), solar water and space heating energy (3.5 quads), and synthetic gas from coal (3.5 quads). The combined potential impact from synthetic fuels shown in ERDA's National Plan is higher than the other emerging energy supply technologies. However, synthetic fuels technologies appear to us to be the only ones which could need all three levels of financial assistance --front end money, construction assistance, and product price supports. Essentially, this is because synthetic fuels technologies appear at this time unable to compete economically with conventional energy sources.

1/ Throughout this chapter, we use Scenario V of ERDA's National Plan.

2/ ERDA is in the process of reevaluating and adjusting downward its projections for synthetic fuels.

TECHNOLOGIES WHICH APPEAR TO BE ECONOMICALLY COMPARABLE TO CONVENTIONAL ENERGY SOURCES

Along with their potential impact, any ranking of the relative attractiveness of new energy supply technolcoies should also consider their economic feasibility in comparison to traditional energy sources. The cost of solar space heating, solar hot water heating, energy from municipal waste, tertiary oil recovery, and geothermal energy (hydrothermal) appear favorable in certain applications and locations.

Energy from municipal waste systems

The combustion methods of recovering energy from municipal waste which now appear to be commercially viable are (1) water-wall incinerators which burn municipal waste directly and (2) powerplant boilers which burn municipal waste mixed with a fossil fuel in industrial or utility powerplants.

Estimates in ERDA's National Plan indicate that by 1985 2 quads per year of municipal waste materials could be converted to usable energy. The plan also shows that, by 2000, 6.5 quads per year could be converted.

An EPA official stated that some municipal waste conversion processes appear economically attractive in locations where the alternative cost of waste disposal is over $6 per ton. He further stated that the actual cost of waste disposal ranges between $2 and $25 a ton, however, most cost over $6 per ton.

EPA has a program which provides planning assistance to municipalities for demonstrating the use of municipal wastes as a fuel. ERDA also has a biomass program, however, its program is directed toward developing biomass technologies other than municipal waste combustion.

At least five municipal waste systems are currently operating. Twenty-eight additional plants are planned or under construction and approximately 37 other communities have expressed interest in building plants.

Obstacles to implementing municipal waste systems

Although the municipal waste combustion technologies appear commercially viable and should not be impeded by

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major technical problems, fuel resources and plant planning may affect the growth of this industry. A concern among municipalities is access to a reliable source of sufficient waste material to fuel a plant. ERDA has also cited inadequate information and planning as obstacles to implementation. Lack of information slows planning, system selection, procurement, and project financing. The failure of municipalities to recognize the importance of the planning process, hire appropriate experts to guide them, and carry out the planning properly has, in the past, slowed system implementation.

Tertiary oil recovery techniques

Primary recovery of oil is that produced by drilling and natural forces, such as gas in solution, subsurface pressures, and natural water drives.

The two terms secondary recovery and tertiary recovery are often used synonymously with enhanced recovery. Technically, secondary recovery means a "second crop" of oil after the "first crop" from primary production and tertiary means a "third crop".

For simplicity, we will define secondary recovery to include the already economically and technically proven techniques of pressure maintenance, traditional waterflooding, and cyclic steam injection. Tertiary oil recovery--the subject of this section--will be defined to include the newer, less widely used techniques.

Nearly 106 billion barrels of oil (about 590 quads) --about 24 percent of total identified domestic reserves --have been recovered using largely primary and secondary recovery techniques. Another 34 billion barrels (about 190 quads)--about 8 percent--remain recoverable using primary and secondary techniques. 1/

Tertiary oil recovery techniques may be used after primary and secondary methods no longer yield economic quantities of oil. According to an ERDA official, 20 to 60 billion barrels (about 110 to 330 quads) may be recoverable using tertiary recovery techniques. Others estimate range from less than 20 to over 100 billion barrels.

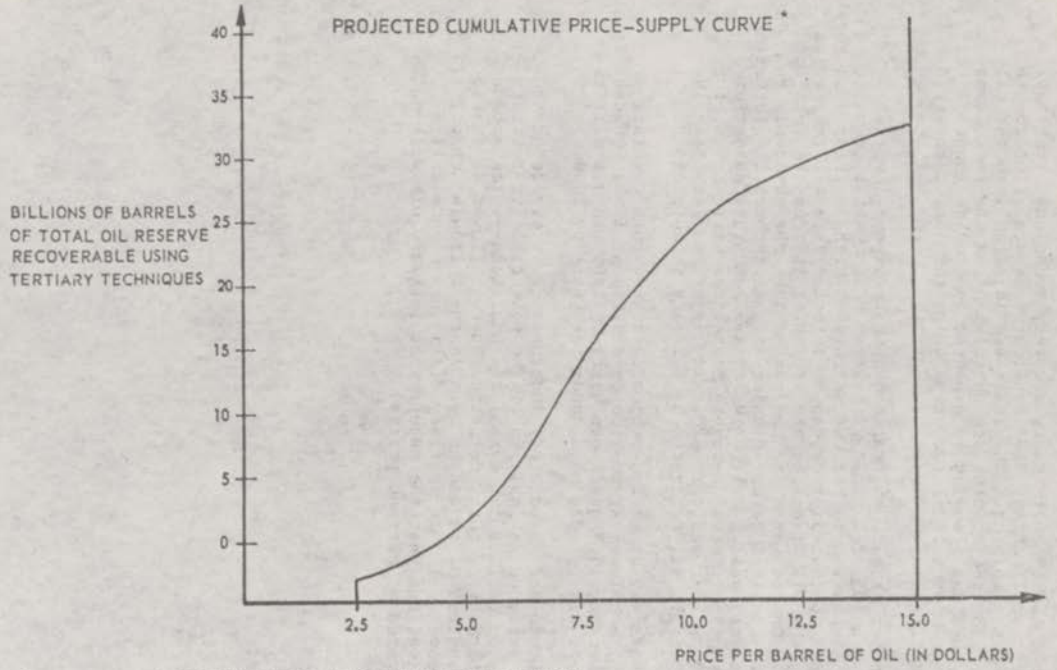
1/ "Analysis of the Potential and Economics of Enchanced Oil Recovery," Preliminary Report, October 31, 1975, Lewin and Associates, Inc.

Among the three tertiary recovery techniques that have the widest application, ERDA considers chemical flooding to be the most promising. Chemicals are injected into the oil reservior to free or displace petroleum from the rock formations. Chemical flooding is expected to provide about 50 to 60 percent of total oil recovered using tertiary recovery techniques.

Another method, thermal enhanced recovery, involves injecting an oil reservoir with steam or hot water or using in-situ combustion to release petroleum which is trapped in rock formation. Carbon dioxide can be injected into oil reservoirs, reducing the oil viscosity and stripping it from the rock formations. Gas or water is then pumped into the reservoir to drive the combined carbon dioxide and oil through the formation to a recovery well. Gulf Universities Research Consortium estimates that thermal recovery techniques will account for about 30 percent and carbon dioxide injection less than 10 percent of all oil recovered by tertiary techniques.

ERDA's National Plan projections show that tertiary recovery technique may provide an additional 1,500,000 barrels of oil per day (3.0 quads per year) by 1985 and 3.6 million barrels of oil per day (7.2 quads per year) by 2000.

A Lewin and Associates, Incorporated, study conducted for FEA included an analysis of the potential for tertiary recovery in California, Texas, and Louisiana--which account for 64 percent of total domestic reserves (lower 48 States only)--indicated, as can be seen in the following chart, that recovery of some tertiary oil is now economically attractive, but that the majority of tertiary oil will not be recovered at current prices.



* ADOPTED FROM "THE POTENTIAL AND ECONOMICS OF ENHANCED OIL RECOVERY – PRELIMINARY REPORT #3," MARCH 19, 1976, BY LEWIN AND ASSOCIATES, INC. WASHINGTOND.C.

Other studies differ widely on the projected cost of oil recovered using tertiary techniques. A variety of estimates indicate that oil recovered using tertiary recovery techniques will cost about $8 to $18 per barrel. Lewin and Associates, Incorporated, attribute the wide variation to the variety of technologies. The Oil and Gas Journal 1/ projects the cost of tertiary oil at $20 to $25 per barrel.

Industry is currently sponsoring over 150 tertiary recovery projects. Tertiary recovery currently provides about 270,000 barrels of oil per day or .54 quads per year in the United States. ERDA is sharing in the cost of 8 projects at a cost of $16.2 million. Project cost sharing (ERDA will provide up to 50 percent of total project costs) and widespread dissemination of data are the methods ERDA intends to use to accelerate commercialization of tertiary recovery techniques. ERDA plans to participate in 111 enhanced oil projects by 1980. Once these projects have been completed, an ERDA official stated that additional incentives should not be required.

Obstacles to implementing tertiary oil recovery 2/

The initial investment and lengthy payback period are major obstacles to widespread commercial use of tertiary technologies. Tertiary projects require two to four times the investment which is required for secondary recovery projects during the first 2 years. The greater investment is required because of the cost of pumps, compressors, redrilling, distribution lines, treating facilities, and injection fluids. After the first 2 years, project costs would be similar for secondary and tertiary projects.

The major problem with carbon dioxide injection is obtaining the required quantities of carbon dioxide at the oil field. Chemical flooding may require chemicals which are in short supply. The industrial capacity to produce enough chemicals to support widespread use of this technology does not

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1/ Oil and Gas Journal, Annual Production Report, Enhanced Recovery Survey, April 5, 1976, Volume 74, Number 14.

2/ To make tertiary oil recovery more attractive, the law to extend FEA's life (P.L. 94-385) allows the petroleum price regulations to be modified to provide additional price incentives for tertiary recovery techniques.

now exist. In addition, the amount or combination of chemicals required may have to be altered to suit each oil field. Chemically saturated water retrieved from wells present a disposal problem. Except for this chemical disposal problem, environment problems are principally the same as those associated with primary recovery.

Solar energy

Numerous systems have been devised to convert sunshine into usable energy. However, only direct thermal systems--solar hot water heating and solar space heating appear to have economic application today and only in some geographic areas. Direct thermal applications involve collecting solar energy for heating water and heating and cooling homes. Industry and agriculture can also use direct thermal technology as a source of low temperature heat. Currently, solar equipped buildings are custom designed and require an energy storage system or a conventionally fueled backup system. A typical system for solar heating consists of a collector exposed to the sun's rays, a heat transfer fluid (usually air or liquid) which carries the collected energy to the points of storage or use, a storage device, and equipment for distributing heat within the building as well as conventional backup equipment.

According to an ERDA official, solar water heating appears to be competitive with electricity in about 90 percent of the country, where electricity costs exceed 5 cents a kilowatt hour in the Northeast or 3 cents a kilowatt hour in other parts of the country, and assuming a 10-year payback. However, solar space heating would only be competitive in about 20 to 30 percent of the country, under these conditions.

The U.S. Department of Labor's data on the cost of electricity for March 1976 shows the cost of electricity in the Northeastern United States to average 4.41, 5.86, and 7.23 cents per kilowatt hour for 500, 250, and 100 kilowatt hours per month respectively. The rest of the country's metropolitan areas average cost was between 3.7 and 6.2 cents per kilowatt hour, depending on quantity consumed.

The Federal Government intends to demonstrate the practical use of this technology by 1977. Systems analysis and overall design of the demonstration program for Federal buildings are underway and proposals have been solicited for installing heating systems in new and existing buildings at selected locations. A variety of Federal incentives--including low interest loans to homeowners and builders, tax credits, and accelerated

amortization of solar energy equipment for commercial buildings--are being considered to remove barriers for widespread use and commercialization. 1/

Already, State Governments have begun to encourage the use of solar equipment. Ten states have passed legislation and two others have proposed legislation which reduces the taxes associated with solar energy systems. In these cases, all or a portion of the solar equipment was exempted from property taxes. Texas has exempted solar systems from sales tax. New Mexico and Arizona have reduced solar's first cost handicap by providing an income tax credit of 25 percent of the cost of the solar equipment (up to $1,000).

Because solar energy systems offer opportunities to reduce life-cycle costs, five states have passed legislation requiring life-cycle cost analyses to be considered for new and remodeled state buildings. Demonstration of solar systems on state buildings are also authorized in four states. Acceptance by the building industry is being encouraged directly in Florida and Minnesota by adding solar provisions to their state building codes. For example, Florida's building code was amended to require home hot water systems which will accept solar heating devices.

Obstacles to implementing
solar hot water and space heating

The solar energy industry is small but expanding rapidly; about 118 manufacturers now produce solar equipment. Most applications require conventional (oil, gas, or electric heating systems) backup systems, however, few integrated solar-conventional heating systems are available. Evaluations of system efficiency and durability, storage subsystems, backup system requirements, aesthetics and mass production costs are not complete.

Life-cycle costs of solar hot water and space heating are less than conventional systems in many areas of the country but high initial costs may be a major problem. A typical hot water unit may cost about $1,000 to $2,000, but units are also available costing up to and above $16,000 for space heating. The homeowner who decides to equip his home with solar hot water or space heating must finance these costs

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1/ As discussed in the summary chapter of this report, the FEA extension legislation recently signed by the President includes a number of incentives of this type (see page 51).

at installation time and builders must include solar costs in their selling prices. However, banks do not uniformly allow inclusion of the solar system costs in their mortgages. The institutional problems associated with heating involve, among other things, sun rights, acceptance by the building industry, zoning laws, and building codes.

Geothermal energy

Geothermal energy is the natural heat of the earth. Where heat is concentrated in areas of the earth's crust similar to oil reservoirs, it is accessible and has potential commercial uses. Geothermal reservoirs have been found primarily in the Western United States; more than half are on Federal land.

Only the hydrothermal technology--which includes dry steam and steam from mineralized water (wet steam)--has progressed to the commercial stage. Dry steam is now being used at an area known as the Geysers to generate power for northern California. This hydrothermal dry steam field, located about 85 miles north of San Francisco, is operated by the Pacific Gas and Electric Company and has an electrical generating capacity of 502 megawatts to help meet the power requirements of San Francisco. The Geysers' ultimate capacity is expected to reach 2,500 megawatts of electric power by the year 1985. The United States Geological Survey has not identified any other major dry-steam fields suitable for commercial production in the United States.

Another hydrothermal field exists in the Imperial Valley in Southern California. Private concerns plan to produce electricity from wet steam in this area in the near future. Hot geothermal fluids are also providing heat to more than 400 buildings in Klamath Falls, Oregon, and to about 200 homes in Boise, Idaho. ERDA's National Plan projections show that this form of energy will provide 1.4 quads per year by 1985 and will increase to about 5.6 quads per year by 2000. It should be noted that this impact is highly regionalized.

ERDA currently estimates that electricity produced from hydrothermal (wet steam) energy resources, when built, will be competitive with any new coal or oil fueled generating plant. ERDA has estimated that electricity generated from the wet steam fields in the Imperial Valley may cost 1.5 cents to 2 cents a kilowatt hour which would be more than 1 cent per kilowatt hour cheaper than current electric costs in any major metropolitan area of the country except Seattle.

Effective June 25, 1976, ERDA implemented a 75 percent loan guarantee program ($30 million for fiscal year 1977 to cover possible defaults) designed to encourage, assist, and accelerate private development of geothermal energy by minimizing the lender's financial risks and to develop normal borrower-lender relationships which will eventually encourage the flow of credit without the need for Federal assistance. ERDA expects to be able to guarantee loans totaling approximately $200 million (assuming 1 in 7 default ratio) with the fiscal year 1977 funds. As of August 12, 1976, ERDA had not received any loan guarantee applications.

ERDA anticipates that additional incentives may eventually be required to further accelerate and enhance the economic attractiveness of geothermal energy. ERDA is considering the impact created by tax incentives, direct project subsidies, cost sharing projects and financial support to local communities for planning grants. Tax incentive possibilities include depletion allowances and deductions for intangible drilling costs.

Obstacles to implementing geothermal energy

Today's only major commercial areas are the hydrothermal steam fields at the Geysers in California. For this area and other geothermal sources, there are uncertainties or a lack of information on exact location, magnitude and longevity of exploitable resources. Technical problems include demonstration of the technology on a commercial scale, corrosion and scaling. Concern has also been expressed over the resource lifetime and ability to sustain a given level of power generation. Hydrothermal, like all geothermal energy, use is highly regionalized; steam cannot be transported without high heat loss. Plants and associated facilities must be constructed onsite.

Effluents from hot water or vapor systems can pollute streams or ground waters, although objectionable fluids and gases could be reinjected into a deep reservoir. Noise, land use, visual impact, potential subsidence of the land surface due to fluid withdrawal, and potential seismic disturbances are other problems faced in geothermal energy development.

TECHNOLOGIES WHICH APPEAR UNABLE TO COMPETE ECONOMICALLY WITH CONVENTIONAL ENERGY SOURCES

The ERDA plan shows that of the total energy demand projected for 2000, synthetic gas from coal could supply about

3 percent, synthetic liquid from coal over 8 percent, and shale oil could contribute about 6 percent. 1/ However, at this point, synthetic fuel technologies are the least economical of all the new energy supply technologies.

Coal liquefaction

Coal liquefaction is the process of converting coal into a liquid fuel. There are several different methods; some processes burn coal, condense the resulting gases, and add hydrogen to form a liquid while other processes chemically dissolve coal with hydrogen to form a liquid.

Technology for converting coal to liquid fuels was developed in Germany over 60 years ago. Commerical operation, which started in Germany in the 1930s, expanded and accelerated with the onset of World War II. However, there appears to be only one commercial coal liquefaction plant in the world. This plant is owned and operated by a South African government-controlled corporation and produces about 5,000 barrels of fuel per day as well as other chemicals, petro-chemicals, and fertilizers.

ERDA's National Plan projects that the coal liquefaction processes will be capable of providing .48 quads per year by 1985 and 10.5 quads per year by 2000.

Oil shale

Two methods are being studied to recover shale oil from rock--surface retorting and in-situ retorting which is not far enough developed to be considered a near-term alternative. In the surface retorting process, oil shale is mined, crushed, and hauled to a surface retort, where it is heated and the oil recovered. Spent shale is dumped on the surface or partially returned to the mine.

Oil shale deposits are found in several areas of the United States. However, the only U.S. deposit having adequate size and availability using present technology is the Green River formation, located in Colorado, Wyoming, and Utah. These deposits are estimated to contain about 600 billion barrels of shale oil (over 3,000 quads). Much larger quantities are believed to be contained in poorly defined and generally lower grade oil shale deposits. The ERDA plan shows that the potential

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1/ ERDA's now reevaluating these estimates and adjusting them downward.

impact of oil recovered from oil shale is 1 quad by 1985 and 8 quads by 2000. Currently, eight firms have announced plans for oil shale projects.

Coal gasification

In this process, coal is fed into a high-temperature vessel, called a gasifier, into which steam and either air or oxygen is injected. Chemical reactions occur and a mixture of gases is produced; usually carbon monoxide, hydrogen, and methane. Methane is the main constituent of natural gas. The gases are then cooled and undesirable components, such as carbon dioxide and sulfur, are removed.

The raw gas produced at this point is referred to as low British thermal unit (Btu) 1/ gas if produced with air, and medium Btu if produced with oxygen. This gas has a low or medium heat value (less than 450 Btu's a cubic foot) and cannot be economically transported over long distance by pipeline. It is valuable, however, as a fuel supply for electrical power generation plants or industrial processes using gas-fired furnaces which are located near the conversion plants. Low- and medium-Btu gas can be upgraded to a high-Btu gas --950 to 1,000 Btu's a cubic foot--through a reaction between hydrogen and carbon monoxide, referred to as methanation. High-Btu synthetic gas is a direct substitute for natural gas and can be transmitted in existing pipeline networks with natural gas.

Coal gasification processes were used in the United States in the late nineteenth century. During the 1920s and 1930s, approximately 12,000 coal gasification units were in operation in the United States. These units produced a low-Btu gaseous fuel generally known as producer, or town gas. With the advent of inexpensive natural gas during the next 2 decades, most of the units were either scrapped or mothballed. Today, low-Btu coal gasification processes are used rarely in the United States. In many foreign countries where domestic natural gas and oil are not as abundant as in the United States gasification processes have been able to survive. All of these (at least 50 plants) processes produce either low- and/or medium-Btu gas.

1/ The amount of energy necessary to raise the temperature of 1 pound of water by 1 degree Fahrenheit. A barrel of crude oil has an energy content of 5.6 million Btu's; a gallon of gasoline, 125,000 Btu's.

Projections in ERDA's National Plan show that by 1985, coal gasification will provide about .92 quads of energy. By 2000, the output is expected to increase to about 3.5 quads--only 2 percent of total projected demand.

At least 16 U.S. companies have announced plans to build high-Btu gasification plants in the United States. Three of these companies have applied to the Federal Power Commission (FPC) for approval of their projects.

ERDA feels that to develop a scale of synthetic fuel industry by the year 2000 which will hold oil imports at current levels, an informational 350,000 barrel-a-day program, must exist by 1985, which could be expanded later as results from the program indicated.

Obstacles to implementing synfuels

The major financial obstacles are the high cost of the output from synfuels plants--projected to be substantially higher than oil and natural gas, and the high capital costs--about $1 billion for a commercial size (about 50,000 barrels of oil a day equivalent) synfuel facility. The Synfuels Interagency Task Force estimated the prices of synfuels which would be required to yield various rates of return (on discounted cash flows after taxes on entire capitalization).

At 15 percent rate of return, the estimated regulated price of high-Btu synthetic gas--$2.61 to $3.02 per thousand cubic feet 1/--is about double the proposed FPC domestic price of new natural gas ($1.42 per thousand cubic feet). Converted to the equivalent price per barrel of oil, the $15 to $18 per barrel price of high-Btu synthetic gas does not favorably compare with the $12 current price of foreign oil. However, the estimated price of synthetic gas compares more favorably with the current price of imported liquified natural gas --approximately $3.00 per thousand cubic feet.

The Synfuel Interagency Task Force's report shows the price of oil from shale to be in the $10 to $18 per barrel range. However, some recent industry estimates of the expected cost of shale oil range up to $18.90 per barrel. The Task Force's report and recent industry estimates project the price for synthetic oil from coal to be about $20 to $30 per barrel.

1/ Projection contained in the report by the Synfuels Interagency Task Force. Most of the recent industry estimates are over $3.00 per thousand cubic feet.

Officials of the three companies which have applied to FPC to build high-Btu coal gasification plants said that lenders are reluctant to finance plants partly because the lenders are skeptical of technical success. However, ERDA officials, as well as other industry officials, told us that the technical risks of the proposed gasification plants using first-generation technology are minimal.

Shale oil technology does not appear as advanced as existing gasification technology. A commercial-size module (approximately 10,000 ton a day) has not been built. To date, in the United States, operation has occurred in experimental 1,000 ton-a-day plants and there are differences of opinion about the technical risk in scaling up to commercial size. Some companies believe a single, commercial-size module should be built, while other companies, believing the technology proven, consider the module approach a waste of time and money and that building a commercial plant with five or six modules is preferable.

Risks associated with coal liquefaction appear to be greater than gasification and oil shale. The only commercial plant in the world today uses coal provided at roughly one-third to one-half the projected costs of eastern U.S. coal. Based on the data resulting from operation of this South African plant, the economics of first-generation liquefaction technology and the product mix appear to constrain application of the process in the United States. We were unable to find anyone who is actively seeking to commercialize this technology in the United States.

Air and water pollution, solid waste disposal and water use problems are expected for the plants and associated coal mines. The extent of the environmental effects would depend on what type of process and equipment is used. Besides the environmental effects of mining, other environmental effects of shale oil production include solid waste disposal --which in some cases are expected to be of an amount larger than the shale used--and effects on wildlife, land, air, and water quality.

There are also social-economic considerations. Coal conversion plants or shale facilities are expected to be built in a rural setting close to the resource. This would increase population and therefore increase demand on schools, stores, roads, waste facilities, water, police and fire protection, and other important community services. These areas often are not well prepared or in a position to finance the front end cost of such rapid change.

CHAPTER 5

PROS AND CONS OF ALTERNATIVE FEDERAL FINANCING INCENTIVES

This chapter discusses the major Federal actions that can be used to stimulate new energy supply technologies and conservation actions. The array of potential Federal actions can be classified as indirect or direct. Indirect actions operate through the market mechanism to affect the price of products, thereby influencing, hopefully, consumer behavior. They are the best suited to new energy supply technologies and conservation actions that are currently economic or nearly so.

In contrast, direct actions bypass ordinary market mechanisms, involving the Government as a commercial agent, allocating resources directly.

The principal types of direct and indirect actions are shown below.

Major Government actions available for stimulating new energy technologies and conservation actions

Type of action		Examples of such action
Indirect:		
1.	Tax action	Excise tax on gasoline/percentage depletion allowance
2.	Price regulation	Price controls on oil
3.	Credit assistance	Direct loan/loan guarantee
4.	Subsidy	Price guarantee
Direct:		
1.	Specific regulation	Tariffs/quotas
2.	Contracts	Purchase agreement
3.	Grants	Construction grants
4.	Government ownership	Tennessee Valley Authority

This report does not take a position on whether market or nonmarket forces work best in the U.S. economy. Rather, it tries

to address various actions from the perspective of what each can be expected to do to "get a particular job done."

INDIRECT ACTIONS

As stated earlier, these actions operate through the market mechanism to affect the price of products and, hopefully, appropriately modify energy supply and use patterns. The steps involved seek to modify the decisions of energy users and energy producers. Since such actions generally result in only moderate shifts in cost-benefit ratios, they are not normally best suited to assist technologies which require large advances to become economically competitive.

Tax actions

Tax actions are some of the most effective and frequently used methods of influencing economic behavior. Tax actions can be used to stimulate conservation actions and accelerate the commercialization of emerging energy supply technologies. Like other indirect actions, tax incentives (tax credits to promote insulation of residences and business structures) and disincentives (excise tax on gasoline to promote conservation) are most effective when applied to conservation actions and energy technologies that are currently economic or nearly so.

The major advantages of tax actions over other types of Federal incentives are that tax actions can be relatively easy to administer, provide for public visibility, and are capable of being precisely tailored to reach the targeted population. Most ordinary tax incentives may not be effective in modifying the behavior of low income individuals. Thus, low interest loans or other incentives may be needed in such cases.

Tax incentives, of course, have the disadvantages of reducing the tax revenue collected by the U.S. Treasury and of assuming permanent status.

Price regulation

Price controls are useful in emergency situations in that they can temporarily prevent hardship to low income consumers. On the other hand, price controls may induce waste, often require a large bureaucracy to administer them, and reduce--or render more costly--the effectiveness of other initiatives such as price supports for synthetic fuels.

As indicated above, price controls may be imposed in the context of regulation, such as setting a "fair rate of return" on utility profits. In that event, price controls on one fuel may be set so as to affect the use of another fuel.

For example, if FPC regulation extended to synthetic gas, the costs of such gas might be "rolled-in" with the costs of natural gas and the consumer charged a price based on average costs. In this case, price controls on natural gas would be used to promote development of a new fuel source, rather than merely to set a ceiling on the price of traditional fuel.

One of the major drawbacks to price controls, which hold prices below market levels 1/, is that they work at cross purposes with national efforts to conserve energy. For example, natural gas consumers have little incentive to upgrade the insulation of their buildings given the continuation of gas price controls.

Conversely, allowing gas prices to rise should tend to encourage installation of insulation in structures. It should be obvious here, that the issue is one of relative prices, not regulation per se.

Credit assistance

Loans and loan guarantees are most effective in making investment decisions in which fixed costs are a major component of total costs and investor choice is sensitive to relatively small variations in the cost of capital. In such a situation, a loan guarantee can eliminate or reduce any risk premium demanded by investors. Loan guarantees also appear attractive because their observable, direct, and immediate impact on the budget is low or even trivial. (See below for the GAO position on this issue. Appendix I also addresses this question in more detail.)

However, loan guarantees have several disadvantages. First, and most importantly, they are unlikely to increase the total supply of investment funds 2/ and hence would likely divert such funds to insured areas and away from others. This affects both the economy as a whole and the energy sector. If loan guarantees were issued for energy

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1/ Whether or not those levels are themselves "controlled" by other forces, such as the Organization of Petroleum Export Countries control of world oil prices.

2/ This issue is not clear cut. Some members of the financial community are now arguing that some money, otherwise not available for venture capital, might be siphoned from nonproductive savings activities (hoarding and gold holding) into these relatively secure areas.

projects, this might divert investment funds away from home mortgages or even State/local bond issues. In addition, any stimulus to investment in certain energy projects may come at the expense of investment in oil or gas or other areas.

Alternatively, loan guarantees may be ineffective. Despite the lower interest rates which loan guarantees would generate, firms may be unwilling to undertake the activity if a higher rate of return on capital is available elsewhere. If the loan guarantee is for a basically unprofitable activity such as the production of synthetic fuels, the reduction in interest rates would not reduce total costs by enough to make the venture look attractive and to warrant participation by firms with alternate investment possibilities.

Thus, to the extent that loan guarantees stimulate investment and result in lower (than otherwise) prices for certain fuels, users of those fuels benefit in proportion to their consumption. However, the stimulus to investment was effected by a transfer of risk from investors to taxpayers. This risk transfer is a form of indirect subsidy, which under currently proposed legislation for synthetic fuels would not completely appear in the budget. The true costs of such subsidies may also be hidden because they are difficult to estimate at the time decisions are made. To exemplify, prospective default rates often cannot be reasonably calculated at the time guarantees are made.

Loan guarantees also frustrate budgetary discipline because they do not compete for Federal tax monies in the same manner as other programs. Since few--if any--immediate outlays are made as the program begins, less attention is paid to the opportunity costs of any guarantee program.

Subsidies

Because the output from synthetic fuel plants is not expected to be competitive with the price of energy from traditional sources, subsidies in the form of price guarantees may be needed.

Price guarantees would involve a commitment by the Federal Government to pay the difference between market prices at the time of production and any costs of production above those prices. For a price guarantee to be of much use for development of synthetic fuels, for example, it would have to be considerably above the equivalent current world price for crude oil.

The cost of price guarantees would depend on expected volume of the fuel whose price was being guaranteed. For

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limited commitments to synthetic fuels, e.g., 350,000 barrels per day or equivalent, the budgetary cost would be over $600 million per year (assuming a $5 per barrel equivalent price differential between the cost of synthetic fuels and the world oil prices).

However, a price guarantee system may eventually lead to large expenditures if there is significant growth in the industry being so subsidized. These expenditures can also present a problem if economies of scale necessitate production of the subsidized product by one or a few firms. In such a situation lack of adequate competition and/or inefficiency could result in excess costs to the Government.

DIRECT ACTIONS

These actions are best suited to situations when (1) some action is required to deal with an emergency or very urgent problem, usually national in scope; (2) effective action of the type desired in a predetermined time frame by private enterprise seems unlikely; (3) the action is deterred principally by cost-ineffectiveness together with uncertainty regarding the future and the size of necessary capital requirements; or (4) the action requires attention to goals, such as developing environmental and socio-economic data, which industry may be unwilling or unable to pursue.

Direct actions would tend to provide more specific visibility and control than some indirect actions. This can be important in (1) assessing performance on projects, and (2) making appropriate comparisons with competing alternatives.

Specific regulation

A tariff on imported oil would stimulate production of and drilling for domestic crude oil and could also be used to provide partial support for development of new energy technology. However, tariffs on imported crude oil are not a precise means of stimulating any given activity, such as synthetic fuels or other new energy technologies. This is because the effect of higher prices caused by the tariffs may not be directed at the activities which the policy seeks to promote. Quotas, on the other hand, may create equity problems by producing large windfall gains to favored domestic producers.

Contracts

Related to price guarantees are actions such as procurement contracts and grants. For example, the Federal Government might choose to promote synthetic fuel development of new energy technologies by guaranteeing to purchase at a stated price a specific amount of output. This would provide producers a minimum demand for their products and hence set a floor for potential profits. Unless a firm price is agreed to beforehand, such contracts tend to be "cost-plus" in nature and share all the advantages and disadvantages of similar Government involvements in the past. Disadvantages common to such contracts include complexity, incentives for inefficiency, and the need for sustained monitoring. However, the Government need not retain the output purchased. It could resell it on the open market were that course of action the least costly one. As stated earlier, advantages of this option include more control of project efficiency and progress and greater visibility of financing as compared to indirect methods.

Grants/Government ownership

Grants could be provided for specific development work or for construction. In the latter case, the required volume and cost of capital to the enterprise would be reduced. In some circumstances, the Federal Government might finance all of the construction costs, in which case it would still have the option of contracting out to private industry operation of the plants as was done during World War II, and as we are doing with uranium enrichment.

If Federal ownership were retained, the operation would not be constrained by a need for profit and such an effort would less likely be deterred by large capital requirements. Again, these options would provide the Government with greater control of project efficiency and progress and greater visibility of funding as compared to indirect methods.

CHAPTER 6

SUMMARY

OVERALL CONCLUSIONS

Our basic purpose in this report has been to provide a framework and perspective for considering (1) energy actions which could contribute to solving energy problems in the next 10 to 25 years and (2) the role of the Federal Government in encouraging activity in each of the areas. Without such a framework and perspective, we run the risk of piecemeal decisionmaking on our energy options without ever focusing on the implications for overall energy policy of the choices we make.

Our report focuses on two things:

--Emerging energy supply and conservation technologies which are technically feasible but for a variety of reasons, are not being actively commercialized by the private sector. For each technology, we have attempted to define and assess its potential role in filling energy needs by both 1985 and 2000.

--The major financial and pricing mechanisms which are available to the Government for stimulating activity with regard to emerging energy supply and conservation technologies.

The recent slowdown in the rate of growth in demand for energy is a sharp reminder of the importance of the demand side of the energy equation and of conservation in particular. This fact and the wide differences of opinion on the sources of energy supplies to meet that demand suggest that the Nation should carefully explore all supply sources as well as conservation alternatives before embarking on a program to commercialize synthetic fuels. Even if an all out effort were undertaken to develop commercially all new supply technologies, such technologies offer little hope for reducing dependence on imported oil prior to 1985. Also their impact beyond 1985 is highly uncertain. The projected output in 2000 of each of the new supply technologies cited throughout much of this report are based on ERDA's most optomistic scenario which ERDA acknowledges is idealistic. Moreover, ERDA believes that it is highly unlikely that all new technologies can be developed with complete success.

Major considerations in choosing among technologies

The three key factors which we believe should be carefully considered in choosing among energy technologies are:

--The contribution that each technology can make in meeting the Nation's energy needs within a specified time frame either through reducing demand or increasing energy supply.

--The total cost of making the technology commercial including costs of plant construction, costs of alleviating adverse socio-economic impacts caused by the energy development, and the costs of price supports or further subsidies which may be required.

--The price at which energy produced by the technology would have to be sold and the means by which the price would be assimilated by our economic system.

Analysis of the potential contribution of energy technologies indicates that some are preferable to others. In particular, conservation technologies and actions seem to offer great potential. Once a conservation investment is made, the energy savings go on year after year. Conversely, failure to make conservation investments will require the production of more and more energy supplies year after year to meet essentially inefficient uses of energy.

With regard to the choices among new supply technologies the various forms of oil and gas production from coal and oil shale are complex and highly capital intensive. Development of the technology on a commercial scale requires creation of a substantial industry infrastructure to sustain it once it is in place even if the product produced cannot compete economically. There are obvious disadvantages in sinking costs in technologies where the economics are uncertain and where improved technology or competing energy sources in years ahead may make the plants obsolete. For example, the costs of constructing an oil shale plant producing 50,000 barrels a day is estimated at $1 billion. If the price of a barrel of oil from shale were to exceed the price of imported oil by $5 a barrel, then an additional price subsidy of $250,000 a day or about $90 million each year could be required for just one small plant.

It is important also to focus on the incremental price of the energy produced or saved by any action. The incremental price of numerous supply increasing actions is often overlooked because the additional supply will initially be only a small part of the total energy used and the price can be "rolled in" with the substantially lower price of existing energy supplies. Any immediate effect on the consumer is thereby mitigated. For example, the price for synthetic gas is expected to be twice the recently announced FPC price for new gas discovered, but because it might be rolled in with the price of existing gas supplies, the incremental price of the new supply can be easily overlooked. Conversely, the cost of implementing certain other technologies or actions including most conservation options and many solar options is usually presented only on an incremental basis. We discuss the importance of this distinction later in this chapter.

In short, in choosing any energy technologies, it is important to keep in mind the full implications of the technology to which we commit ourselves and the incremental costs of the actions we take.

Financing mechanisms

In determining the mechanism which would best stimulate a particular energy technology, we believe at least three factors should be carefully examined.

--The technology's state of development. Is the technology developed to the extent that it can be deployed on a broad basis?

--The technology's economic feasibility. Will the energy produced as a result of deploying the technology be economically competitive with competing energy sources?

--The target group whose actions will be influenced. Are they large industrial firms or diverse and widely dispersed groups such as homeowners?

Interrelated analysis of these three factors should precede the choosing of the most appropriate financing mechanism or other Government activity to stimulate a particular financing technology.

For example, loan guarantees have received much attention as a potential way of encouraging a variety of energy technologies. In general, loan guarantees would seem to best fit those circumstances where the technology has been known to work, is economical, and where the person wanting to make an investment

in the economically attractive energy technology cannot do so primarily because of financial constraints. By transferring some of the risk, loan guarantees tend to marginally reduce the interest costs of a loan and to assure the availability of financing which otherwise may not have been available. This is the basic logic, for example, for making Federal loan guarantees available for housing. Conversely, loan guarantees should be carefully examined and other options considered where there are questions regarding the viability of the technology or the economic competitiveness of the product.

Loan guarantees also may not be appropriate for target groups consisting of large firms with reasonable access to capital markets even if the energy activity in question is technically and economically feasible. Investment capital is normally available to such firms and their basic decision not to invest in a particular energy activity may be influenced primarily by the availability of attractive investment opportunities elsewhere.

CONCLUSIONS REGARDING TECHNOLOGIES

On the basis of our review, in terms of dollars expended on a cost effective basis, we believe that certain conservation measures have by far the greatest potential benefits and should have the top priority for stimulative Government actions.

Among the supply-increasing technologies considered, we found several technologies to be cost effective either in total or in particular geographic areas. These technologies are hydrothermal energy, municipal waste combustion systems, solar hot water and space heating, and tertiary oil recovery. Because they are cost effective, these technologies would be the most efficient to implement in the near future in terms of dollars expended now and in the near future on supplies of energy.

The supply of energy to be captured from these sources may be smaller than the potential of other supply technologies considered in this report such as synthetic fuels, but the economics appear more certain. Thus, we believe these technologies should be given priority for Government assistance in commercialization to (a) insure their maximum contribution between now and 2000 and (b) to provide a source of additional supply to give the Nation additional

time to consider and fully develop efficient means of producing energy from larger supply sources including synthetic fuels and other technologies not considered in this report such as fusion, solar photovoltaic cells, thermal gradients, and breeder reactors.

Synthetic fuels production--while technically feasible with first-generation technologies--is not cost effective in that the total cost of output is not price competitive with foreign oil. Nor does it look as attractive when compared to other technologies, which we examined, on an incremental price basis. We believe synthetic fuels technologies should receive a high priority for Government research, development, and demonstration efforts designed to develop more advanced and efficient production technologies, but we question whether assistance should be given to commercialization of synthetic fuels at the present time.

There are also serious questions regarding any deep national commitment to uneconomic, high-cost supply technologies which substantially exceed the cost of imported oil; certainly, the deeper the commitment to building a broad industry infrastructure of highly capital intensive energy sources, the less the incentive in future years to support development of lower cost energy supply options. Further, for such high cost technologies, imported oil is likely to form a defacto price floor as opposed to its current role as an energy price ceiling. In such circumstances, the exporting countries could be in a better position to exert continued upward pressure on energy prices.

The role of pricing policy as a tool to help stimulate commercialization of emerging technologies also needs to be considered very carefully.

Certainly, careful decisions are needed to provide a stable regulatory framework for oil and gas which clearly recognizes that the Nation is moving into an era of higher priced and relatively scarce energy and that world energy prices are established not in a free market, but by a cartel of producing Nations. The alternative, of course, is orderly deregulation of oil and gas--a process already started with oil.

In any event, we need to remove the current uncertainty as to the duration and intent of Government price regulation. Such uncertainty is at least as much a deterrent to commercializing of emerging energy technologies as the concern that the current average regulated price of oil and gas may not

fully reflect the costs of developing or finding new energy supplies. Further, if future decisions to provide Government assistance to new technologies for commercialization purposes are to be made on an incremental cost basis, then the price of oil and gas, which in effect will be the standard for many years, must be both realistic and certain.

We believe that the incremental cost standard is the only realistic one for making sound economic judgments and treating all emerging technologies equally. The only other measure which can be used is rolled-in pricing which would serve to average the real cost of a new supply source across a far larger volume of lower priced energy.

Among the technologies we have considered, a rolled-in yardstick would clearly favor synthetic fuels; likewise, it would clearly discriminate against such options as conservation and solar hot water and space heating. Using incremental cost to evaluate alternatives on the other hand, would reduce all of these options to the same test --the actual cost of the output from the new technology--and allow a consistent and rational process of choice on a cost effective basis.

1. We favor the use of incremental cost as a yardstick to select cost-effective technologies or actions which receive priority for government financial assistance in the commercialization process.

2. We believe that certain conservation actions and other technologies are cost effective and should receive top priority for Government financial assistance.

3. We believe that emerging and promising technologies which are not cost effective, such as synthetic fuels, should receive high priority for research, development, and demonstration assistance but we question whether commercialization assistance should be given to technologies that are not cost effective.

4. We believe further recognition needs to be given to the role of pricing policy in developing new energy technologies and the related need for the price of domestic oil and gas to reflect clearly the cost of finding and developing new energy supplies. Higher prices can be provided either in a stable, responsive regulatory environment or through deregulation.

Our specific conclusions regarding the areas of technology we examined follow.

Conservation

Conservation should have top priority for Government financial assistance because it has the greatest potential payoff and is most attractive on an incremental cost basis. Areas offering the greatest opportunity include insulation and other measures to conserve energy in new and existing buildings, industrial energy conservation, and improved utility load management. Still, there is a need as discussed in our report for more detailed, reliable, and comprehensive information on a variety of energy conservation opportunities.

The preferable financial mechanism or Government action for stimulating different conservation opportunities varies because different target populations are involved. For example, tax credits would likely be most effective in stimulating middle and upper income homeowners to install energy conserving measures. However, for low income homeowners and others of limited financial capability, low interest loans or grants from the Treasury may be more effective mechanisms. In addition, Federal leadership and action in developing uniform building standards which incorporate desirable energy conservation features would be useful.

Tax credits also could be used to stimulate energy conservation investments by industry. However, because the payback period for such investment may not compare favorably with other investment opportunities--even with added incentives--consideration should be given to establishing Federal standards for energy efficiency, particularly for the more important industrial uses of energy.

Utility load management affects a broad range of consumers and can best be addressed by Federal leadership in establishing and encouraging implementation of utility rate structures which use the price mechanism to encourage reduced use of energy.

Overall, price is an important concept in achieving effective energy conservation. Energy price increases would serve to stimulate the implementation of some conservation technologies without direct Government financial assistance. However, we emphasize that both price induced conservation measures and those resulting from explicit Government actions are needed to insure the desirable and necessary goal of maximum energy conservation implementation.

Many of the incentives and actions which we believe are desirable to encourage conservation are addressed in whole or in part in the recently signed law to extend the Federal Energy Administration. This includes:

--A variety of proposals for improving electric utility rate design including Federal funding of demonstration projects and participation in the proceedings of utility regulatory commissions ($15 million is authorized to be appropriated for these activities during fiscal year 1977).

--Federal development of conservation-oriented performance standards for new residential and commercial buildings ($5 million is authorized to be appropriated for grants to State and local governments to finance the cost of adopting these standards).

--FEA's development of a program to assist low income persons in weatherizing their homes ($200 million is authorized to be appropriated through fiscal year 1979).

--Federal support and assistance to States which develop energy conservation programs ($105 million is authorized to be appropriated through fiscal year 1979).

--A 2-year energy conservation and renewable resource demonstration program to test various forms of Federal financial assistance including grants, low interest loans, and loan guarantees ($200 million is authorized to be appropriated for the demonstration program).

--Federal loan guarantees for installing conservation and renewable resource equipment (obligation authority for loan guarantees up to $2 billion is authorized).

Careful monitoring of the effectiveness of these new programs will be required and adjustments made in the incentives authorized and more stringent measures adopted as needed to achieve conservation savings. In this regard, we are specifically required to monitor the new program to test various forms of financial assistance.

Synthetic fuels

ERDA's most optomistic scenario shows synthetic fuels production reaching the equivalent of 2.4 and 22 quads in 1985 and 2000, respectively. However, ERDA is in the process

of revising these estimates downward. Moreover, the projected prices are not competitive with traditional energy sources and research and development on second-generation technologies is expected to reduce costs by only about 15 percent.

Because of the size and investment required to build synthetic fuel plants, incentives must be targeted at large industry which normally has access to the capital markets. Two basic concerns underlie the stated need for Federal loan guarantees to induce the investment needed to commercialize first-generation synthetic fuels technology: (1) concern that the product produced will not be economically competitive and that the existing world market price for oil could always be manipulated to substantially undercut the price of synthetic fuels, thereby increasing its economic unattractiveness and (2) concern that technological advances in other energy areas or within synthetic fuels technology will make first-generation synthetic fuel plants obsolete before they ever become operational.

Against those concerns, the stated purpose of ERDA's synthetic fuels commercialization program is to identify and resolve potential future socio-economic, environmental, and regulatory impediments associated with constructing large commercial scale synthetic fuels plants before the synthetic fuels are needed to meet our Nation's energy needs.

Given ERDA's basic objective and the present economic unattractiveness of first-generation synthetic fuel technology, we believe that, in lieu of providing Federal loan guarantees for billion dollar size "commercial" plants, efforts should be directed to research and development of improved synthetic fuels technologies and to meeting ERDA's objective of identifing and resolving socio-economic, environmental, and regulatory problems. To meet this latter objective, it appears possible to gain adequate information from smaller plants under Government control. At the point in time that commercialization of the technology becomes the prime objective, we believe consideration also should be given to the "commercial pull" approach of gaining private industry interest in commercialization.

Smaller plants

Because synthetic fuels are not expected to be economic, even if built to commercial size, an alternative approach would be not to emphasize the cost of the output and concentrate on acquiring the socio-economic, environmental,

and regulatory information. We believe this could be done by having the Government construct and operate--either itself or with a contractor--smaller synthetic fuels plants.

Assuming synfuels demonstration plants are successful and prove feasible and capable of regulated, environmentally safe operation, the demonstration plants could be sold to private firms. At that time--when synfuels have been proven viable--if it is considered desirable and inducements are required to stimulate private firms to enter commercial operations of synfuels, consideration could be given to offering some sort of financial assistance to private firms.

In the meantime, the Congress could maintain oversight of the plants through the yearly authorization and appropriation process. This yearly monitoring of plant progress offers enhanced potential for building smaller, less costly plants while still maintaining maximum information capability. Should the plant not prove to be feasible, yearly oversight would enable project termination at the earliest possible date and may allow minimizing the financial loss related to the project.

Commercial pull

The so-called "commercial pull" approach advocated by a number of people 1/ could also be considered as a way of moving the commercialization of technologies such as synthetic fuels where the economic competitiveness of the product produced is in question. Using this approach, the Government could announce that it would purchase a set amount of synthetic oil or gas at some future point in time and request bids from industry. The Government then could select the lowest bid that appeared technically feasible. This method may prove to be a less cumbersome and perhaps less costly way of stimulating the construction and operation of a desired number of synthetic fuel plants.

1/ Dr. R. H. Holloman, Director, Center for Policy Alternatives, Massachusetts Institute of Technology, discusses potential new approaches by Government of this type to encourage commercial implementation of energy technologies in the book Energy Research and Development, prepared for the Ford Foundation's Energy Policy Project, Ballinger Publishing Company, Cambridge, Massachusetts, 1975.

Municipal waste combustion

This is a cost-effective technology, and while it is being implemented to a limited extent, Federal financial assistance could hasten and maximize its use. Because this technology could best be employed by utilities, municipalities, or local government units which, in many instances, may have limited financial capability, loan guarantees would appear to be a preferred mechanism for accelerating this technology.

Solar heating

Solar hot water and solar space heating are currently economic in many parts of the country, but like many conservation measures, are not being widely implemented because of the long payback period and general lack of consumer awareness. We believe that Federal financial incentives should be used to accelerate the commercialization of these technologies. The incentives should be directed to consumers--homeowners and businesses. Again, like certain conservation actions, tax credits seem like the most appropriate mechanism to stimulate middle and upper income homeowners and business to install solar heating units, while low interest loans or grants would best stimulate low income homeowners and small businesses with limited financial capability. In addition, loan guarantees could be a useful mechanism to assist State, municipal, and non-profit institutions obtain the necessary capital to invest in such solar heating for their facilities.

As indicated earlier, the legislation to extend the FEA includes a program designed to test various forms of financial assistance. Under that program, persons installing renewable energy resource devices could receive a grant not to exceed $2,000 or 25 percent of the cost of installing such devices and could have obligations issued to finance installation of such devices guaranteed by the Government. Whether or not the magnitude of incentives offered will be sufficient to encourage wide implementation of solar heating is something we have not analyzed.

Hydrothermal

ERDA recently implemented a loan guarantee program to accelerate the development of geothermal energy, including hydrothermal technology--the only type of geothermal energy currently economic. We believe no further Federal financial assistance to accelerate commercialization of hydrothermal energy is warranted at this time. For other geothermal applications, Federally sponsored research, development, and demonstration of the economic and technical viability

of the concept seems to us to be the appropriate Government role.

Tertiary oil recovery

In general, secondary measures to recover oil are economic and widely used. Tertiary recovery techniques for the most part are not widely used since they are not economic. One quick action which would improve the economics would be to release domestic oil produced by tertiary techniques from price controls. This should increase the use of tertiary techniques on old producing wells. In this regard, the bill to extend FEA recently signed by the President requires that early consideration be given to amending petroleum price regulations to provide additional price incentives for bona fide tertiary recovery techniques.

In addition, ERDA should continue to carry out its program of research, development, and demonstration designed to acquire more information and promote the use of tertiary oil recovery techniques. We have in process a report on ERDA's progress under the program which will include specific recommendations for program improvement.

MATTERS FOR CONSIDERATION BY THE CONGRESS

This report is intended to provide the Congress with a framework and perspective to aid it in making decisions on the plethora of energy options before it. We have analyzed the various options in the light of the key factors which must be carefully considered in choosing (1) among energy technologies and actions and (2) funding mechanisms for encouraging implementation of the technologies and actions. On the basis of our work, we recommend that the Congress:

1. Continue to place the highest priority on energy conservation actions, requiring improved information on major conservation opportunities which will provide the basis for the development and funding of specific programs which can be tailored to take maximum advantage of the opportunities.

2. Maintain close oversight of the several new programs to encourage energy conservation, evaluate the effectiveness of incentives offered, and consider such further actions as may be necessary, including the greater use of mandatory energy

efficiency standards. The GAO will continue its efforts to aid the Congress in this regard.

3. Continue to encourage the installation of solar heating technologies targeting the financial incentives to the users as described in the report.

4. Maintain close oversight of FEA's actions to increase incentives for tertiary recovery of oil and authorize further incentives if the need and possibility to increase tertiary oil recovery becomes apparent in light of other energy developments.

5. Consider whether it is advisable to enact legislation which would at this time authorize Federal loan guarantees to builders of synthetic fuel plants, and consider instead directing ERDA to continue and expand its research and development to improve the technology and; in addition, construct and operate smaller plants of a size sufficient to meet its stated goal of obtaining socio-economic, environmental, and regulatory information in a timely fashion.

6. Consider further actions, including the provision of loan guarantee authority, to encourage municipal waste combustion.

LOAN GUARANTEES SHOULD BE INCLUDED IN THE BUDGET

The Congressional Budget Act of 1974 (Titles I - IX of Public Law No. 93-344, July 12, 1974) is a comprehensive statute which sets forth many of the procedures by which the Federal budgetary process is to operate. Our interpretation of the Act's language and the intent of the Congress in enacting this legislation is that the total amount of loan guarantees including associated contingent liabilities are not required to be included in the Federal budget. Review of S. 2532 and H.R. 12112 indicate that such disclosure is not contemplated.

However, one must look beyond the language of the Act and consider that one of the fundamental objectives of the Congressional Budget Act of 1974 was to establish a process through which the Congress could systematically consider the total Federal budget and determine priorities for the allocation of budget resources. We believe this process achieves its maximum effectiveness when the budget represents as complete as possible a picture of the financial activities of Federal agencies. We further believe it is vital to maximizing the effectiveness of the process that Federal financial resources be measured as accurately as possible because priorities are actually established through decisions on the conferring of the authority to enter into obligations which will result in immediate or future outlays of Government funds. From this standpoint, therefore, the budget should (a) encompass all actions which confer authority to spend money, (b) reflect as accurately as possible the amount of such authority which is conferred, and (c) recognize the point at which control over the spending of the money passes from the Congress to the administering agency. The consequence of excluding loan guarantees and their associated contingent liabilities from the budget is to thwart Congress' achieving the maximum effectiveness of the process it established to review the Federal budget and determine priorities.

In the case of Federal loan guarantees for housing and other programs, historical experience permits the default rate to be estimated with reasonable accuracy and included in the budget. However, if the Congress enacts S. 2532, H.R. 12112, or similar legislation, authorizing a relatively small number of very large loan guarantees, we believe that it will be difficult to accurately predict the extent of default, and therefore, the total amount approved for loan guarantees should be shown in the budget.

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COMMENTS ON THE PROPOSED FINANCIAL RESOURCES FOR THE ENERGY INDEPENDENCE AUTHORITY

The Energy Independence Authority (EIA), as proposed by President Ford on September 22, 1975, would be a quasi-public Federal corporation which would provide financial assistance to energy projects which would make a significant contribution to energy independence and would not otherwise be undertaken by the private sector. The Authority could create wholly owned subsidiaries to carry out its functions with financial resources of $100 billion. Of this amount, $25 billion would comprise capital stock to be purchased by the Treasury and the remainder would comprise debt obligations, requested initially as a once and for all congressional authorization. Any issuance of Authority securities or other assistance would be subject to Treasury Department approval.

EIA financing would be by direct loans, loan guarantees, price guarantees, purchase and leaseback of facilities, and even purchase of equity capital. Assistance to any one project would be limited to $10 billion. Loans would bear interest at a rate determined by the Authority Board and guarantees for loans would be backed by the full faith and credit of the government. EIA would concentrate its efforts in those energy subsectors least likely to attract private capital. Theoretically, EIA's efforts would stimulate investment in these areas from the private sector. The overall effect of EIA would presumably be an increase in the likelihood of energy independence in the foreseeable future.

EIA's success will depend largely on its ability to induce private investment. However, the likelihood of increasing private investment is dependent on other variables such as the price of foreign oil, the demand for energy, the economic attractiveness of investing in the energy sector as opposed to other possible investments, and the size of energy investments planned without inducement from EIA.

A priori arguments can be made that EIA's $100 billion would stimulate large amounts of investments by industry in energy projects, however, because of the many non-quantifiable variables, any assessment of the adequacy of EIA financial resources would be highly speculative and judgmental. If the Congress decides that legislation similar to S. 2532 is required, an attractive modification may be to provide a lesser amount initially, say for example, $10 or $20 billion.

Further funding could then be provided through annual appropriations as needed.

Funding EIA annually would provide the Congress with a mechanism to annually assess the impact Federal funds are having toward stimulating private investment in energy projects. Such assessments could be made through the annual authorization and appropriation hearings. These assessments could provide for not only an evaluation of the extent to which Federal funds have stimulated private investment, but also the impact additional Government funding could have on furthering energy independence. During this annual review, the Congress would assess the progress being made in developing new energy technologies and have greater flexibility in allocating Federal funds to technologies which industry is unlikely to develop independently.

ERDA COMMENTS AND GAO EVALUATION

In commenting on a draft of this report, 1/ the ERDA Administrator expressed his deep concern with our analysis, presentation, conclusions, and recommendations. For the most part, ERDA's concerns related to the position we take on Government loan guarantees for the construction of commercial-size synthetic fuel plants. The Administrato. specifically pointed to five serious deficiencies that he felt were contained in the draft.

Subsequent revisions were made in the body of the report in light of items 1, 4, and 5 listed in the Administrator's letter. Specifically, we

--revised Chapter 2 to use instead two of ERDA's scenarios to set the perspective for our work and to illustrate the wide range of opinions regarding the energy choices our Nation faces.

--recognized that the current estimated price for liquified natural gas imports is similar to the estimates for synthetic gas from coal.

--cited disadvantages for tax incentives in Chapter 5.

Points 2 and 3 in the ERDA Administrator's letter go more to the heart of what we perceive as ERDA's basic concern. In essence, ERDA believes that a financial incentives program which includes loan guarantees is needed immediately if the Nation is to have the option of a major synthetic fuels industry in the 1990s. ERDA believes the plants constructed now must be of commercial size to obtain needed environmental, regulatory, and economic data and provide the commercial operating experience necessary to overcome investor uncertainty by the middle 1980s.

Nowhere in our report have we suggested that the synthetic fuels option be foreclosed. Rather, we concluded from our work (1) that synthetic fuels deserved high priority for

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1/ See Appendix IV for the full text of his comments.

APPENDIX III

Government research, development, and demonstration; and (2) that, given the state of the technology and current economic unattractiveness, Government loan guarantees or other financial incentives for commercial-size plants which could cost upwards of a billion dollars each did not seem appropriate at this time.

In a broader context, our more basic intent was to provide the Congress a framework and perspective for making choices among the many options before it, including not only synthetic fuels but other energy technologies and conservation actions.

APPENDIX IV

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

AUG 19 1976

Honorable Elmer B. Staats
Comptroller General of
the United States
General Accounting Office

Dear Mr. Staats:

ERDA has reviewed the draft GAO report entitled "Are There Better Choices?" which is concerned with Federal proposals to finance the commercialization of advanced energy technologies.

We are deeply concerned about this report because it presents strong conclusions and recommendations to the Congress without a sound underlying basis of analysis supporting them. The draft report represents in our view, a presentation of a point of view rather than any new, independent analyses of alternatives.

This lack of underlying objective examination is particularly important since the opinions expressed in the report have implications not only with respect to important legislative proposals now pending before the Congress for synthetic fuels and other technologies, but also with respect to the broader matter of the overall balance among ERDA's energy R,D&D programs.

In particular, I wish to call your attention to the following major concerns which we regard as serious deficiencies in the draft report:

1. In arguing that it is not necessary to provide now a Federal guaranty program for synthetic fuels, GAO has used for its analysis a very optimistic estimate of the future effects of conservation (i.e., Ford Foundation technical fix case) and coupled this with an equally optimistic high estimate of domestic conventional oil and gas production in the year 2000 (20 million b/d greater than today's domestic production). We believe such unrealistic demand/supply

cases cannot prudently be used as a basis for national energy policy. Nevertheless, even using such optimistic projections, the GAO report still admits to a substantial synthetic fuel production requirement beginning in the 1990's if we are to avoid a further increasing dependence on foreign oil. With this requirement, lack of certainty as to the future price and availability of imported fuels, and with the long lead times associated with the growth of such a large new capital intensive industry, uncertainty facing investment must be resolved by the middle 1980's if we are to maintain a capability to have plants in operation in the early 1990's. This means that we cannot delay taking action now to obtain needed information regarding the environmental, regulatory and overall economic characteristics which can affect the commercial viability of this option.

2. The GAO draft report has numerous assertions about the favorable comparative economics of new and emerging conservation and renewable energy resource technologies vis-a-vis synthetic fuels. Such discussion is hardly germane to an evaluation of synthetic fuels technologies. Indeed, ERDA shares GAO's enthusiasm concerning the attractive features of conservation and renewable resource technologies. However, even if these technologies are very rapidly introduced, they, by themselves, cannot obviate the indicated need in the 1990's for substantial quantities of synthetic fuels, or alternatively, continued imports.

3. The GAO report fails to either present or analyze the underlying rationale for the financial incentive program for synthetic fuels and other technologies embodied in H.R. 12112. Repeatedly, the draft GAO report characterizes this program as one which is aimed at augmenting domestic fuel supplies through subsidized synthetic fuel production. While one effect of the program would be to supplement domestic fuel supplies by some modest amount, the primary purpose of the program is to maintain the option to develop a synthetic fuel industry that can meet a projected demand in the 1990's of several million barrels per day of synthetic liquids and gaseous fuels.

The guaranty program, therefore, is designed to acquire critical information and, to the extent possible, resolve at an early date regulatory, environmental, financial, political and other barriers which may preclude later private sector investment because of the lack of information concerning the commercial viability of these plants. The Nation's experience with commercializing nuclear power has demonstrated that early attention to these matters is essential to preclude later delays. The report continually refers to a production program which "chooses" or "commits" to synthetic fuels. Such choices, as we see it, are to be made by the Nation, not today, but at a later date. The Synthetic Fuels Commercialization Program is designed to provide a needed meaningful basis for that decision, not to preempt it.

4. The draft GAO report compares the costs of synthetic fuels with today's price of imported crude oil and today's regulated price of natural gas. We believe the price of synthetic fuel products should be compared with the price of future alternatives against which they will compete beginning in the late 1980's. They should also be compared with products that will realistically compete in the end use markets which they are likely to serve. For example, synthetically produced gas from coal should be compared with alternatives to natural gas such as Alaskan gas, LNG (now priced at about $3 per million Btu) and gas made from petroleum products, as well as higher priced depleting domestic conventional resources. When these comparisons are made, one finds that these other alternatives to natural gas are projected to be equally expensive and even more expensive in the case of gasification of petroleum products which is already occurring in the U.S. While over the next 20 years some substitution for natural gas will occur among electric utilities and large industrial users, we see no way in which these conversions can be assured to be large enough to offset a steady or rising demand for liquids and gaseous fuels and a steadily declining domestic supply.

5. In Chapter 5, we found the comparisons of alternative Federal financial incentives to lack objectivity and to be without a systematic basis for comparison. For example, the incentive analysis did not contain criteria against which the incentives were compared. Furthermore, although advantages and disadvantages were cited for some incentives, in the case of loan guarantees the disadvantages were cited without noting some of the major advantages. Also in the case of tax incentives which were later recommended in the report for accelerating the introduction of conservation technologies, the report did not cite any major disadvantages, not the least of which is the permanent status tax subsidies generally assume and the general failure of tax incentives to be focused on individual projects. We continue to believe that in many situations where capital availability and project scale relative to the sponsor's net worth are the major financing problems, that loan guarantees are the most effective, efficient, and least costly financial tool available to the Government.

Finally, we believe that the draft GAO report is so substantially lacking in analysis and information supportive to its conclusions, that publication of the report would only serve to confuse and further obfuscate the issues discussed. Furthermore, the publication of the report in anything near its present form will be damaging to the early implementation of our needed energy supply programs.

My staff has transmitted more detailed concerns regarding the report in the nature of factual, editorial and judgmental material.

Sincerely,

R. C. Seamans

Robert C. Seamans, Jr.
Administrator

STATEMENT OF PHILLIP S. HUGHES, ASSISTANT COMPTROLLER GENERAL OF THE UNITED STATES, U.S. GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY MONTE CANFIELD, DIRECTOR, ENERGY AND MINERALS DIVISION, AND WILLIAM F. McGEE, AUDIT MANAGER

Mr. HUGHES. Thank you, Mr. Chairman.

I have a statement that I would judge would take something like 20 minutes to read. It is essentially a summary of the conclusions and the recommendations in our report.

I can read that, if you like. I can try to do some summarizing, if you wish to place that in the record.

Mr. DINGELL. What is your wish, counsel?

Mr. HUGHES. I would suggest that perhaps the thing to do is to discuss the issues here as they exist between us and ERDA. Perhaps it would be better to brief the statement.

Mr. DINGELL. Without objection, your full statement will appear in the record, and we will recognize you for purposes of summarizing.

Mr. HUGHES. Thank you, Mr. Chairman.

I think that I would ike to say what I think the principal issue is, and also perhaps address the question of what it is not.

First of all, the issue is not whether we should have further interest and concern for synthetic fuels, whether they should have a high priority, and whether or not they are somewhere in our future. As a matter of fact, I think we are inclined to agree with ERDA that they are in our future almost inevitably.

The issue before the Congress at the present time is what the Congress should do now about synthetic fuels in the context of a total energy situation. Should it do as ERDA has recommended, authorize construction of a number of plants of commercial size that would be 75 percent guaranteed by the Federal Government, or should it do something different than that?

We think the latter. We think there is a different course of action that the Congress should very seriously consider, and we think that this is so for essentially three reasons.

First, we believe that there is uncertainty as to the volume and timing of any need for synthetic fuels. We also think that there is uncertainty, leaning on the adverse side, as to the economics of those fuels. Finally, we think that there are other more attractice areas for the Federal Government to address at the present time.

Those include conservation in a rather broad sense, the recent Federal Energy Act Extension deals with this problem in authorization terms, and we would encourage the energetic pursuit of the activities authorized in that act. But conservation, we think, is fundamental, and at the moment is the most cost-effective way to "produce" energy.

Second, we think that there are other options that are better than synthetic fuels in the short run and that should be pursued: Solar space heating and water heating, the use of municipal waste to produce energy, and tertiary recovery of oil, among others.

In summary, I reiterate that the issue is not whether synthetic fuels should be the matter for priority Federal attention. The question is, how we should go about the task of lending Federal support to the pursuit of synthetic fuel technology.

I will stop with that, Mr. Chairman.
[Mr. Hughes' prepared statement follows:]

STATEMENT OF PHILLIP S. HUGHES, ASSISTANT COMPTROLLER GENERAL OF THE UNITED STATES

Mr. Chairman and Members of the Committee: Our interest and involvement in the issues surrounding the commercialization of synthetic fuel technologies has been quite extensive over the past year. In a report dated March 19, 1976, we commented on the Administration's proposed synthetic fuels commercialization program and suggested that the Congress await completion of further analyses before considering legislation authorizing a commercial synthetic fuel demonstration program. In another report dated May 5, 1976, we presented our evaluation of the status and obstacles to commercialization of coal liquefaction and gasification. In addition, over the past several months, we have testified before the House Committee on Science and Technology: Subcommittees of the Senate Committee on Banking, Housing, and Urban Affairs, House Committee on Banking, Currency and Housing; and House Committee on Interstate and Foreign Commerce, on developing and commercializing energy technologies.

Before each of these Committees we stated that we were continuing our work on the status of feasible technologies which appear to have impediments to full commercialization, and, that we would complete this work by this summer. In addition, we indicated that this work would include an assessment of the priorities attached to the various technological options, and our views on the most appropriate incentives or other actions for encouraging their development. As our study of the matter progressed, it became evident that pursuit of alternative technologies is inextricably intertwined in overall national energy strategies, including strategies for implementing energy conservation actions.

On August 24, 1976, as you know, we submitted to the Congress a report presenting our evaluation of proposed Federal assistance for financing commercialization of emerging energy technologies. The balance of my statement presents the highlights from our report.

In recent months a number of bills have been introduced in the Congress which would provide various forms of Federal assistance to encourage private sector use, or implementation of, a variety of energy technologies. One such bill, H.R. 12112, would provide Federal loan guarantees to accelerate the commercialization of synthetic fuels—gas from coal, oil from coal, and/or oil from shale.

Individual bills before the Congress cover a wide range of objectives and financing techniques. However, no one bill focuses on all emerging energy technologies, considers all costs associated with development, or more importantly, attempts to focus on targets of proposed actions on some consistent priority basis.

The major thrust of our evaluation is aimed at setting forth a framework and perspective for considering (1) energy actions which could contribute to solving energy problems in the next 10 to 25 years and (2) the role of the Federal Government in encouraging activity in each of the areas. Without such a framework and perspective, we run the risk of piecemeal decisionmaking on our energy options without fully considering the implications for overall energy policy of the choices we make.

Framework for choosing appropriate energy technologies and financing mechanisms

In our judgment, making the right choices among energy technologies, requires consideration of three factors.

The contribution that each technology can make in meeting the Nation's energy needs within a specified time frame either through reducing demand or increasing energy supply.

The total cost of making the technology commercial including costs of plant construction, costs of alleviating adverse socioeconomic impacts caused by the energy development, and the costs of price supports or further subsidies which may be required.

The price at which energy produced by the technology would have to be sold and the means by which the price would be assimilated by our economic system.

Making the right choice among financing mechanisms requires, in our view, interrelated analysis of at least three factors.

The technology's state of development. Is the technology developed to the extent that it can be deployed on a broad basis?

The technology's economic feasibility. Will the energy produced as a result of deploying the technology be economically competitive with competing energy sources?

The target group whose actions will be influenced. Are they large industrial firms or diverse and widely dispersed groups of homeowners?

The recent slowdown in the rate of growth in demand for energy is a sharp reminder of the importance of the demand side of the energy equation and of conservation in particular. This fact, and the wide differences of opinion on the sources of energy supplies to meet that demand, suggest that the Nation should carefully explore all supply sources as well as conservation alternatives before embarking on a program to commercialize synthetic fuels.

Serious questions exist regarding any national commitment at the present time to uneconomic, high-cost supply technologies which substantially exceed the cost of imported oil. Certainly, larger commitments to building complex, highly capital-intensive energy sources will result in less incentive in future years to develop alternative lower cost energy sources. In addition technologies producing energy that costs more than energy from imported oil would put exporting countries in a position to increase energy prices.

The pricing yardstick used in evaluating emerging technologies needs to be considered very carefully. An incremental cost standard is the only realistic one for making sound economic judgments which treat all emerging technologies equally. The alternative is average, or "rolled-in" pricing. This means that the real cost of new supply sources are averaged with far larger volume of lower priced energy.

The rolled-in yardstick favors synthetic and other fuels susceptible to rolling in treatment. Incremental cost, on the other hand, would apply the same test to all energy options, including conservation. Decisions made on this basis would allow a consistent and rational process of choice on a cost effective basis.

CONCLUSIONS

Based on our analysis of the various energy options available to this Nation, we concluded that:

Certain conservation measures are by far the most cost effective way to "produce" energy and, therefore, should have the top priority for Government financial assistance.

Areas offering the greatest opportunity for conservation include insulation and other measures that conserve energy in all buildings; less wasteful uses of energy by industry; and improved management of electrical demand.

Many of the actions we believe are desirable to encourage conservation are authorized by the recently passed legislative extension of the Federal Energy Administration.

Among the energy supply-increasing technologies considered, we found several that are cost effective throughout the country or in particular geographical areas. These technologies are hydrothermal energy, municipal waste combustion systems, solar hot water and space heating, and tertiary oil recovery. The ultimate supply of energy to be captured from these sources may be smaller than the ultimate potential of other supply technologies such as synthetic fuels, but they appear more cost effective.

In our judgment the cost effective technologies should be given priority in Government assistance for commercial development. This assistance will ensure their maximum contribution between now and 2000 and give the Nation time to consider the potentially larger supply sources and develop them as appropriate. These latter sources include synthetic fuels as well as fusion, solar photovoltaic cells, thermal gradients, and breeder reactors.

In our judgment, Government financial assistance for commercial development of synthetic fuels should not be provided at this time. Synthetic fuels production is not cost effective in that the total cost of output is not price competitive with foreign oil. Nor does it look attractive on the basis of present knowledge when compared to other technologies on an actual, or incremental, price basis.

The large investments required to build synthetic fuel plants would direct Federal incentives primarily to the large industries which have access to capital. Two basic concerns underlie the stated need for Federal loan guarantees to finance synthetic fuels technology: (1) concern that the product produced will not be economically competitive, particularly since the existing world market for oil could always be manipulated to substantially undercut the price of synthetic fuels and

(2) concern that technological advances in other energy areas or within synthetic fuels technology will make "first" generation synthetic fuels plants obsolete before they ever operate.

Research and development on "second generation" synthetic gas technologies is expected to reduce costs by about 15 percent.

While we do not favor providing Government assistance for commercial development of synthetic fuels at this time, we do not advocate that this option be foreclosed. We would like to strongly emphasize our conclusion that the Government should place a high priority in furthering this option. Such priority should be in the area of Government research, development, and demonstration.

ERDA has emphasized the need to acquire the socio-economic, environmental and regulatory information associated with the construction of synthetic fuel plants. It appears to us that the Government can acquire much of the necessary information by constructing and operating—either itself or with a contractor—smaller synthetic fuels plants.

Assuming synfuels demonstration plants are successful and prove feasible and capable of regulated, environmentally safe operation, the demonstration plants could be sold to private firms. At that time—when synfuels have been proven viable—if it is considered desirable and inducements are required to stimulate private firms to enter commercial operations of synfuels, consideration could be given to offering some sort of financial assistance to private firms. Options in addition to loan guarantees need to be carefully considered.

In the meantime, the Congress could maintain oversight of the plants through the yearly authorization and appropriation process. This yearly monitoring of plant progress offers enhanced potential for building smaller, less costly plants while still maintaining maximum information capability. Should the plant not prove to be feasible, yearly oversight would enable project termination at the earliest possible date and may allow minimizing the financial loss related to the project.

Another alternative way of commercializing technologies such as synthetic fuels where the economic competitiveness of the product produced is in question is the so-called "commercial pull" approach. Using this approach, the Government could announce that it would purchase a set amount of synthetic oil or gas at some future point in time and request bids from industry. The Government then could select the lowest bid that appeared technically feasible. This method may prove to be a less cumbersome and perhaps less costly way of stimulating the construction and operation of a desired number of synthetic fuel plants.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Mr. Chairman, in closing we hope the Congress will: Continue to place the highest priority on energy conservation actions, requiring improved information on major conservation opportunities which will provide the basis for the development and funding of specific programs which can be tailored to take maximum advantage of the opportunities.

Maintain close oversight of the several new programs to encourage energy conservation, evaluate the effectiveness of incentives offered, and consider such further actions as may be necessary, including the greater use of mandatory energy efficiency standards. The GAO will continued its efforts to aid the Congress in this regard.

Continue to encourage the installation of solar heating technologies, targeting the financial incentives to the users as described in the report.

Maintain close oversight of FEA's actions to increase incentives for tertiary recovery of oil and authorize further incentives if the need and possibility to increase tertiary oil recovery becomes apparent in light of other energy developments.

Consider whether it is advisable to enact legislation which would at this time authorize Federal loan guarantees to builders of synthetic fuel plants, and consider instead directing ERDA to continue and expand its research and development to improve the technology and; in addition, construct and operate smaller plants of a size sufficient to meet its stated goal of obtaining socio-economic, environmental, and regulatory information in a timely fashion.

Consider further actions, including the provision of loan guarantee authority, to encourage municipal waste combustion.

This concludes my prepared statement. We will be glad to respond to questions.

Mr. DINGELL. Mr. Canfield, do you have any comments?
Mr. HUGHES. I would also like to introduce Mr. McGee.
Mr. DINGELL. All right.
Do you have any comments, Mr. Canfield?
Mr. CANFIELD. No, sir. We welcome the opportunity to be here.
Mr. DINGELL. We should hear from ERDA, since your views are of importance to the committee, too, in this matter.

STATEMENT OF WILLIAM T. McCORMICK, JR., PH. D., DIRECTOR, OFFICE OF COMMERCIALIZATION, U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, ACCOMPANIED BY ROGER W. A. LeGASSIE, PH. D., ASSISTANT ADMINISTRATOR FOR PLANNING AND ANALYSIS

Mr. MCCORMICK. Thank you, Mr. Chairman. You introduced Mr. Roger LeGassie, Assistant Administrator for Planning and Analysis and Evaluation in ERDA who has overall responsibility for our forecasting, supply, and demand analysis. He is here specifically to comment on those, as well as other things.

The Chairman has noted—with your permission, I will summarize this statement, rather than read it in the record. I would hope that we could include also in the record the two attachments to the testimony, which is Dr. Seaman's letter to Mr. Staats summarizing ERDA's concerns about the GAO Report and secondly, a detailed analysis of the GAO Report.

Mr. DINGELL. Without objection, your full statement will appear in the record, and you are recognized for such summary that you may wish to give.

Mr. MCCORMICK. Thank you, Mr. Chairman.

Our major concern with the GAO Report is the lack of analysis that we find in the report that underlies the conclusions that are arrived at. Throughout the report, there are numerous assertions and contentions of the relative economic attractiveness, of various energy alternatives.

We have found specifically no mention of those, relative economicness or the cost effectiveness.

We have further found that there is no detailed forecast for an analysis to compare the cost of various energy alternatives during the time periods of interest. We think in general the report does not give adequate emphasis to the growing problem of the oil import tendency.

I would like to emphasize for the committee a fact that you are quite aware of. Our domestic oil and gas supplies have declined in the early 1970's, and are continuing to decline. We are importing 40 percent of our total oil consumption. This has risen from 29 percent, right before the Arab oil embargo.

This is an extremely important point, in our view. All of the major forecasts of domestic supplies of oil and gas project that even with decontrol and deregulation and vigorous exploration and development of the Outer Continental Shelf and Alaska, even with vigorous conservation efforts, that our imports of foreign oil will be required to rise again late in the 1980's and early into the 1990's.

This forecast is true with the Ford Foundation Report, it is true with FEA's estimates, it is true with ERDA's estimates, Banker's Trust, and others. Everybody's forecasts that we have seen, all of the major forecasts, projects a substantial requirement for synthetic fuels in the late 1980's, early 1990's period.

We believe that in order to meet this capacity in the 1990's that we estimated at 5 million barrels a day in the mid-1990's, we will need 100 major synthetic fuels plants. We believe before industry can make the required investment for those 100 or so plants that the major uncertainties facing investors will have to be resolved by the middle or late 1980's.

The only way that we can see resolving those uncertainties is to build and operate a few, a limited number of commercial demonstration plants, so we can gather the environmental, regulatory and other information that we think is so important to have.

We do not believe the GAO report, although it is contended in a later chapter that the information can be gained through other means, the GAO report has not laid out an analysis of the various categories of information that we have outlined in some detail in our report, as well as in our factbook. We do not believe that they have made a case that this information can be gathered in other ways.

There are numerous comparisons of the economics of synthetic fuels, assertions about the comparative economics of synthetic fuels. Throughout the report, synthetic fuels are compared with today's prices of today's imported oil and regulated prices of natural gas. We believe more correctly that the comparison should have been made with the alternatives that are facing the gas distribution suppliers in this country on the margin, that is that although new regulated natural gas will be $1.42 per million Btu, there are many higher priced sources of synthetic and natural gas already being produced in this country.

Today, there are 11 major synthetic gas plants operating in this country producing synthetic gas from imported naphtha and other petroleum products. In the case of all of these plants—and the Federal Power Commission has a list; I would be happy to provide the committee, if you want to insert it in the record, that shows that all of these plants are operating at a range of $4 to $5, $5.50 per million Btu.

There is one producing 250 million cubic feet a day at $1.40 per million cubic feet in this country.

It seems that the comparisons that ought to be made are not the comparisons of synthetic pipeline quality gas or coal with imported oil in today's regulated prices, but the prices at which these new supplies will have to compete on the margin with other alternatives.

In terms of the need for Federal asssistance, we believe that we cannot meet the requirements of the early 1990's and resolve the various uncertainties, as I said, without constructing and operating a limited number of these plants.

The financial community has not had the experience, does not have the knowledge base to make these investments, because there have been no plants operating in this country.

We have done a rather extensive analysis of the various kinds of incentives that are appropriate for various technologies. Frankly, we believe that the 6 pages of discussion that are contained in the

GAO Report hardly stack up against a thousand pages of analysis that the interagency task force completed last year.

We do not think that there is anything in the GAO report which underlines the rationale of the careful analysis carried out by the interagency task force last year.

Mr. Chairman, in summary, we would just like to say that this rather brief report which quotes extensively from other sources and carries out no analysis of its own, even using its own rather optimistic assumptions, comes down with a substantial requirement for synthetics, and we fail to see how this report at all undermines the case for getting on with the kind of program that is embodied in H.R. 12112 and related legislation.

[Mr. McCormick's prepared statement and attachments follow:]

STATEMENT OF Dr. WILLIAM T. MCCORMICK, JR.

Mr. Chairman and Members of the Committee: I am pleased to be with you today to provide ERDA's views on the recently released GAO report entitled, "An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies." Attached to my testimony is a letter from Dr. Robert Seamans to the Comptroller General summarizing ERDA's major concerns about the GAO report. In addition, as attachment two, we are providing the Committee a detailed critique of the GAO report.

Mr. Chairman, in general we are deeply concerned about this report because it presents strong conclusions and recommendations to the Congress without any substantial underlying basis of analysis. The report represents, in our view, a discussion of a particular point of view rather than the result of an objective analysis of real energy alternatives for the Nation.

In our review of the GAO report we have found no analysis which seriously questions the basic rationale for undertaking a limited commercial demonstration program for synthetic fuels and other energy technologies such as is embodied in the legislation considered by this and other committees; i.e., H.R. 12112. There are several major points in this regard. First and most important is the national need for synthetic fuels and the timing of such need. Second, is the question of whether or not Federal financial assistance is needed and last is the issue of the least costly and most efficient form of such assistance. Let me address each of these issues separately.

NEED FOR SYNTHETIC FUELS

With respect to the need for synthetic fuels, several facts should be clearly kept in mind. First, is the fact that domestic production of oil and natural gas peaked in the early 1970's and continues to decline. A second fact is that imports of foreign oil have been steadily rising over the past 15 years. Just before the Arab oil embargo of October 1972, 29 percent of all oil consumed in the U.S. was imported; today, that figure exceeds 40 percent. As pointed out last week in a New York Times editorial, we have as a Nation developed an alarming complacency with respect to our growing oil import dependency.

Now consider the future. All major forecasts of domestic supplies of oil and gas project that even with complete decontrol of oil and gas prices, vigorous exploration and development of our Outer Continental Shelf and Alaskan resources and extensive use of tertiary oil and gas recovery technologies, domestic conventional oil and gas production will resume its decline sometime in the late 1980's or early 1990's. This means that even assuming rather optimistically that conservation efforts can reduce total demand growth for energy from the historical rate of over 3 percent to 2 percent, the requirement for synthetic fuels in the mid-1990's will be on the order of four to five million barrels per day. If this capacity of synthetic fuels is not available then the only other alternative for the Nation is to import more Arab oil at an unknown cost both in economic terms and national security terms. The GAO report fails to make this clear. It also fails to admit that a consensus exists among major forecasters—FEA, ERDA, the Synthetic Fuel Tanks Force, the Ford Foundation's Energy Project and Bankers Trust—that it is less than two decades before this country willl require a new domestic industry to supplement our dwindling conventional oil and gas supplies

if we are to avoid large increases in imported oil. The report does not recognize that even vigorous conservation measures cannot obviate the need for either substantial increases in oil imports or substantial production of domestic synthetic fuels. The choice is clear, it is simple and it is unavoidable.

NEED FOR FEDERAL ASSISTANCE

The second major issue is the question of whether Federal financial assistance is needed to lay the foundation for initiating an industry which might need to grow to a capacity of five million barrels per day by 1995 and ten million barrels per day by the year 2000. Bear in mind that five million barrels per day implies 100 major plants and ten million barrels per day implies 200 plants. If we started today to build this industry, it would have to grow at a compounded annual rate of 17 percent per year to meet these projected capacity requirements. Such a sustained growth rate for a large capital intensive industry is, by all measures, an enormous undertaking. One only needs to consider the present contribution of nuclear power 20 years after the first commercial power reactor in Shippingport, Pennsylvania came on line in the late 1950's. Today, two decades later, nuclear power is providing only 9 percent of our electricity generation although its contribution is projected to grow to 45 percent by year 2000. The point of this comparison is that there are long lead-times in launching a completely new industry.

Questions have been raised concerning the comparative economics of synthetic fuels and industry attitudes towards making the investments in these technologies. We believe that, in general, the prices of synthetic fuels are close to being competitive today with foreign oil and with alternatives to natural gas such as imported LNG and conversion of naphtha into gas. Both are expected to be more expensive than coal gas and less reliable because they must be imported. The GAO report incorrectly compares the estimated prices of synthetic fuels with regulated well-head gas prices and imported crude oil. The report should have compared the price of synthetic fuels with the price of alternatives with which they would compete at the margin. For example, while it is true that regulated interstate gas prices are presently at $1.42 per million Btu's this gas, which is the cheapest of all domestic gas supplies, provides only a fraction of the total domestic gas requirements—a fraction which is continuing to shrink. This means that an increasingly large share of gas consumed must come from higher priced alternatives of which synthetic fuels is one. Failure to recognize this fact is a serious deficiency in the GAO report. A second major deficiency in this connection is the implied assumption of easy substitutability of one fuel type for another. The country has over $100 billion invested in its gas transmission, distribution and end-user equipment systems. In economic terms this means that keeping the gas pipelines full even with higher priced gas alternatives will in many cases be cheaper for the American consumer than retrofitting to accommodate electricity or imported oil. In any case, such substitution would occur only gradually and its extent, effects, and cost have been ignored in the GAO report.

Without Federal assistance, it is clear from numerous witnesses before this and other committees that the environmental, regulatory and political uncertainties are such that potential investors are faced today with major financial risks and will not make commitments to synthetic fuel plants. These risks stem from the absence of any domestic experience with the construction and operation of synthetic fuels plants. Even though in many cases the technology is well in hand and entails minimal risk, a major synthetic fuel project faces serious potential delays and even non-completion simply because the regulatory rules have not yet been agreed upon. So although industry may see the future need for synthetic fuels and view the technology as likely to be competitive in the near future, investors simply will not commit the necessary huge sums without some risk-sharing in the case of the first few plants. The recent announcement last week by the Secretary of Interior of the suspension of development of the two richest oil shale lease tracts in Colorado further illustrates the fragile nature of these initial projects. The companies involved complained of a plethora of environmental, legal and other uncertainties in the development of oil shale leases.

TYPE OF FINANCIAL ASSISTANCE

The last major issue is simply which financial incentives are most effective and least costly to accelerate the construction of these plants. Bear in mind that the proposed synthetic fuels program is not an effort to permanently subsidize the

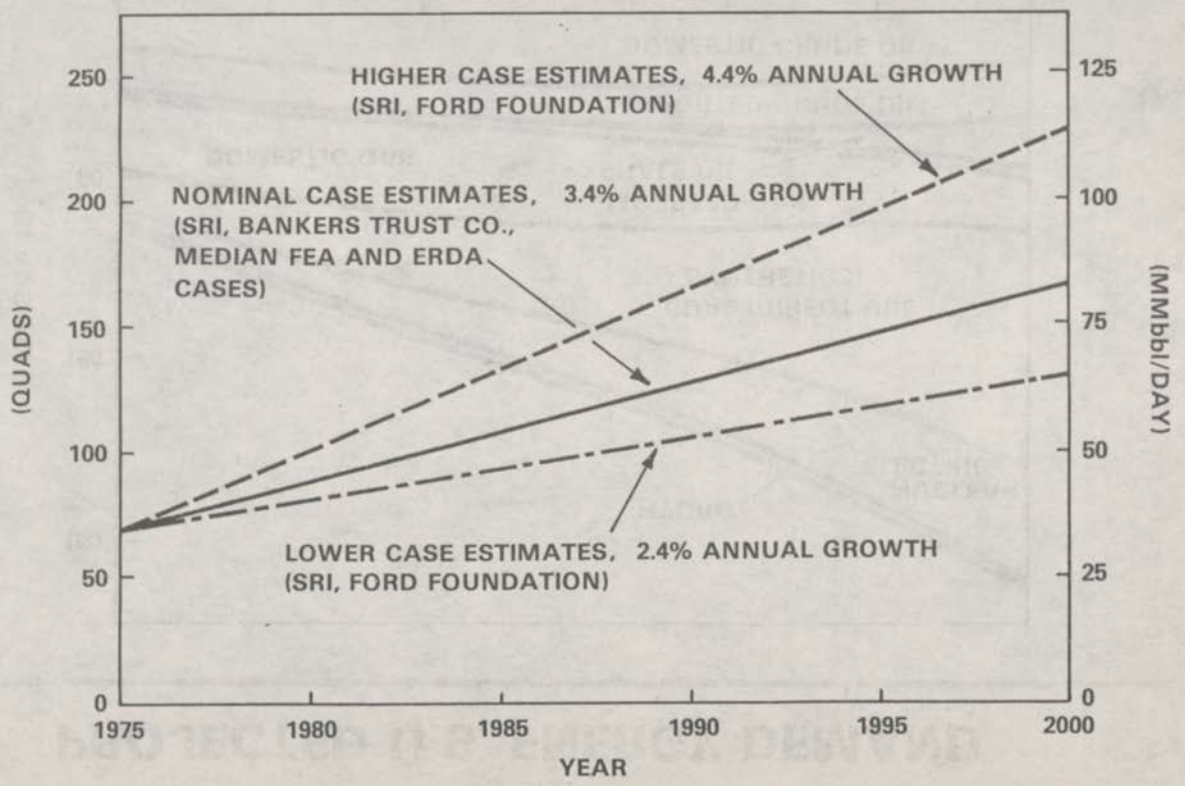
ongoing production of synthetic fuels but rather a carefully limited demonstration of a critical number of "first-of-a-kind" plants.

Last year the Interagency Task Force on Synthetic Fuels under the President's Energy Resources Council analyzed, for each major synthetic fuells technology, the comparative costs and benefits of each major incentive type including loan guarantees, direct loans, price guarantees, purchase agreements, tax incentives, etc. We believe this analysis forms a comprehensive basis for the legislative proposals contained in H.R. 12112 and the Banking Committee amendments. While the GAO suggested that loan guarantees are not an effective or preferred approach, again there is no analysis to dispute the recommendation for loan guaranties made in the Synthetic Fuels Interagency Task Force's extensive analysis.

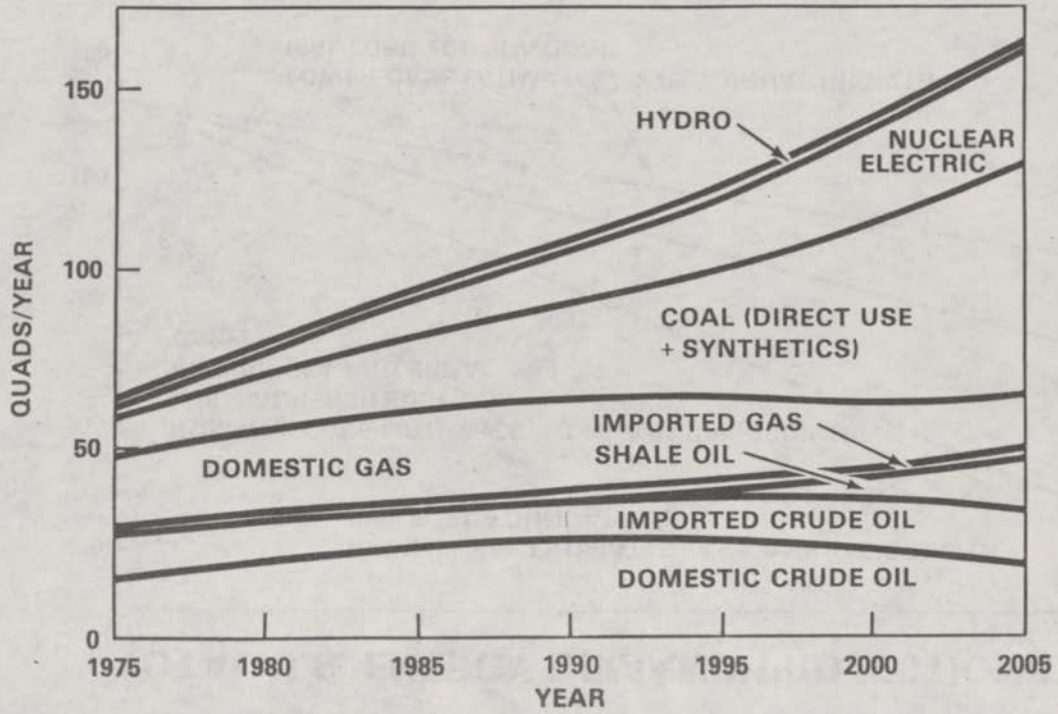
In summary, the GAO report consistently understates the future requirements for synthetic fuels and overstates the degrees to which conservation and renewable energy resources can satisfy this future energy gap. We believe that the GAO assertions regarding relative cost effectiveness of various technologies are without basis and are nowhere supported in the report. We further believe that GAO's assertion that synthetic fuels production is not cost effective is erroneous because it fails to recognize the future sources of supply and likely costs of alternative energy sources. Finally, we strongly urge the Congress to reject GAO's recommendation that "government financial incentives for commercial development of synthetic fuels . . . not be provided at this time." The conclusion is unsupported and clearly not in the best interest of a prudent National energy program.

Mr. Chairman, this completes my prepared remarks. I will be pleased to answer any questions that you or other members of the Committee may have.

TOTAL U.S. ENERGY DEMAND PROJECTIONS



PROJECTED U.S. ENERGY DEMAND



ANNUAL U.S. PRODUCTION AND IMPORTS
(PETROLEUM AND NATURAL GAS)
MILLIONS OF BARRELS PER DAY
(SCALE FOR PETROLEUM)
TRILLIONS OF CUBIC FEET PER YEAR
(SCALE FOR NATURAL GAS)
U.S. PRODUCTION
(PETROLEUM)
U.S. PRODUCTION
(NATURAL GAS)
IMPORTS
(PETROLEUM)
IMPORTS
(NATURAL GAS)
IMPORTS AS A PERCENTAGE
OF TOTAL PETROLEUM
CONSUMPTION
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
24
22
20
18
16
14
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6
4
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1966
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1976
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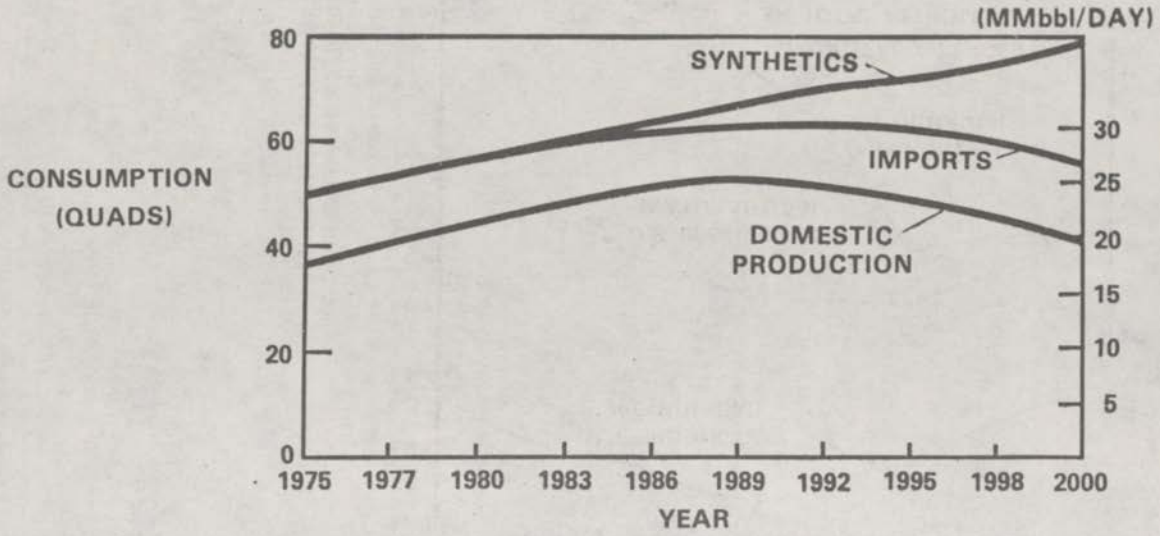
37%
39%

TOTAL CONSUMPTION OF LIQUIDS AND GASES



NEED FOR SYNFUELS

ATTACHMENT I

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION,
Washington, D.C., August 19, 1976.

HON. ELMER B. STAATS,
Comptroller General of the United States,
General Accounting Office.

DEAR MR. STAATS: ERDA has reviewed the draft GAO report entitled "Are There Better Choices?" which is concerned with Federal proposals to finance the commercialization of advance energy technologies.

We are deeply concerned about this report because it presents strong conclusions and recommendations to the Congress without a sound underlying basis of analysis supporting them. The draft report represents in our view, a presentation of a point of view rather than any new, independent analyses of alternatives.

This lack of underlying objective examination is particularly important since the opinions expressed in the report have implications not only with respect to important legislative proposals now pending before the Congress for synthetic fuels and other technologies, but also with respect to the broader matter of the overall balance among ERDA's energy RD & D programs.

In particular, I wish to call your attention to the following major concerns which we regard as serious deficiencies in the draft report:

(1) In arguing that it is not necessary to provide now a Federal guaranty program for synthetic fuels, GAO has used for its analysis a very optimistic estimate of the future effects of conservation (i.e., Ford Foundation technical fix case) and coupled this with an equally optimistic high estimate of domestic conventional oil and gas production in the year 2000 (20 million b/d greater than today's domestic production). We believe such unrealistic demand/supply cases cannot prudently be used as a basis for national energy policy. Nevertheless, even using such optimistic projections, the GAO report still admits to a substantial synthetic fuel production requirement beginning in the 1990's if we are to avoid a further increasing dependence on foreign oil. With this requirement, lack of certainty as to the future price and availability of imported fuels, and with the long lead times associated with the growth of such a large new capital intensive industry, uncertainty facing investment must be resolved by the middle 1980's if we are to maintain a capability to have plants in operation in the early 1990's. This means that we cannot delay taking action now to obtain needed information regarding the environmental, regulatory and overall economic characteristics which can affect the commercial viability of this option.

(2) The GAO draft report has numerous assertions about the favorable comparative economics of new and emerging conservation and renewable energy resource technologies vis-a-vis synthetic fuels. Such discussion is hardly germane to an evaluation of synthetic fuels technologies. Indeed, ERDA shares GAO's enthusiasm concerning the attractive features of conservation and renewable resource technologies. However, even if these technologies are very rapidly introduced, they, by themselves, cannot obviate the indicated need in the 1990's for substantial quantities of synthetic fuels, or alternatively, continued imports.

(3) The GAO report fails to either present or analyze the underlying rationale for the financial incentive program for synthetic fuels and other technologies embodied in H.R. 12112. Repeatedly, the draft GAO report characterizes this program as one which is aimed at augmenting domestic fuel supplies through subsidized synthetic fuel production. While one effect of the program would be to supplement domestic fuel supplies by some modest amount, the primary purpose of the program is to maintain the option to develop a synthetic fuel industry that can meet a projected demand in the 1990's of several million barrels per day of synthetic liquids and gaseous fuels. The guaranty program, therefore, is designed to acquire critical information and, to the extent possible, resolve at an early date regulatory, environmental, financial, political and other barriers which may preclude later private sector investment because of the lack of information concerning the commercial viability of these plants. The Nation's experience with commercializing nuclear power has demonstrated that early attention to these matters is essential to preclude later delays. The report continually refers to a production program which "chooses" or "commits" to synthetic fuels. Such choices, as we see it, are to be made by the Nation, not today, but at a later date. The Synthetic Fuels Commercialization Program is designed to provide a needed meaningful basis for that decision, not to preempt it.

(4) The draft GAO report compares the costs of synthetic fuels with today's price of imported crude oil and today's regulated price of natural gas. We believe the price of synthetic fuel products should be compared with the price of future alternatives against which they will compete beginning in the late 1980's. They should also be compared with products that will realistically compete in the end use markets which they are likely to serve. For example, synthetically produced gas from coal should be compared with alternatives to natural gas such as Alaskan gas, LNG (now priced at about $3 per million Btu) and gas made from petroleum products, as well as higher priced depleting domestic conventional resources. When these comparisons are made, one finds that these other alternatives to natural gas are projected to be equally expensive and even more expensive in the case of gasification of petroleum products which is already occurring in the U.S. While over the next 20 years some substitution for natural gas will occur among electric utilities and large industrial users, we see no way in which these conversions can be assured to be large enough to offset a steady or rising demand for liquids and gaseous fuels and a steadily declining domestic supply.

(5) In Chapter 5, we found the comparisons of alternative Federal financial incentives to lack objectivity and to be without a systematic basis for comparison. For example, the incentive analysis did not contain criteria against which the incentives were compared. Furthermore, although advantages and disadvantages were cited for some incentives, in the case of loan guarantees the disadvantages were cited without noting some of the major advantages. Also in the case of tax incentives which were later recommended in the report for accelerating the introduction of conservation technologies, the report did not cite any major disadvantages, not the least of which is the permanent status tax subsidies generally assume and the general failure of tax incentives to be focused on individual projects. We continue to believe that in many situations where capital availability and project scale relative to the sponsor's net worth are the major financing problems, that loan guarantees are the most effective, efficient, and least costly financial tool available to the Government.

Finally, we believe that the draft GAO report is so substantially lacking in analysis and information supportive to its conclusions, that publication of the report would only serve to confuse and further obfuscate the issues discussed. Furthermore, the publication of the report in anything near its present form will be damaging to the early implementation of our needed energy supply programs.

My staff has transmitted more detailed concerns regarding the report in the nature of factual, editorial and judgmental material.

Sincerely,

ROBERT C. SEAMANS, JR.,
Administrator.

ATTACHMENT II

ERDA PAGE BY PAGE COMMENTS ON GAO REPORT

Page ii, para 3.

In making the "right" choice among financing mechanisms, GAO has ignored as criteria the factors of risk, credit and rate of return. These were carefully evaluated by the President's Task Force last year, but are not even addressed in the GAO report.

Page ii, para 3.

ERDA agrees that the nation should explore all promising supply and conservation alternatives. However, the agency believes that conservation alternatives, even if aggressively pursued cannot obviate the need for substantial quantities of synthetic fuels in the early 1990's. This conclusion is supported by all major supply/demand analyses in recent years.

The reference to the slowdown in the rate of growth in demand for energy is largely due to the post-embargo measures and more recently the national and world recessions. However, this year demand is rising rapidly as evidenced by the Edison Electric Institute figures (see August 16 Wall Street Journal) of a growth of 5.2 percent in electricity demand in the first 3 weeks of this year.

The GAO emphasis on conservation does not take into consideration how much of the potential for price-induced conservation has already been captured.

Page ii, para 4.

The GAO conclusion that certain conservation measures are the most cost-effective and others are more cost-effective than synthetic fuels is based on an "appearance" (last line) rather than on a sound analytic analysis. Neither the measures of cost-effectiveness are discussed in the report nor are the quantitative comparisons shown.

Page iii, para 1.

This is the first of several instances in which all synthetic fuels are asserted to be not cost-effective when the cost of their output is compared to that of foreign oil.

Two points must be made:

(1) The economic comparison of high Btu gas produced from coal with alternatives should, as is later noted in the report, use LNG and synthetic gas from naphtha as the alternatives rather than imported oil. These are the real alternatives that are available.

(2) Where oil is the appropriate competing fuel the economic comparisons should be made as of the time that the synthetic fuel plant come into operation in the early 1980's rather than at the present time. All major forecasts project world oil price to continue to rise.

Page iii, para 3.

The GAO questions the prudence of ". . . any national commitment . . .". H.R. 12112 does not represent a commitment but rather a preservation of the option to proceed in a timely manner with development of a synthetic fuel industry to meet the projected requiremetns of about 5 million barrels per day in 1995.

Page iii, para 4.

This paragraph appears to confuse the economic evaluation of emerging technologies on an incremental (or marginal) basis with the later pricing of the output of such plants on an incremental versus a rolled-in pricing basis. In any event, the administrative analysis showing the desirability of synthetic fuels was not based on rolling in these products.

Page iv, para 6.

The GAO report makes the statement ". . . the projected prices are not competitive with existing or other emerging energy sources.". ERDA believes that high Btu gas is now competitive with existing higher priced alternative sources such as LNG and naphtha conversion. Moreover, at least one potential builder of a shale oil modular plant (Union Oil) indicates that the output of the plant will, with only a government loan guaranty, be competitive with existing world oil prices.

Page v, para 2.

The possible 15 percent cost reduction which the GAO report cites, would be applicable only to that part of the investment which represents process technology. Infrastructure, socioeconomic impact assistance, financing costs, and other elements which are insensitive to the specific coal conversion process used will not be affected.

Page v, para 3.

ERDA does not agree that it is possible to gain the information sought by the H.R. 12112 program from smaller plants under government control. Only commercial-scale plants operating in the private sector will acquire a credible body of information addressing the environmental, regulatory, socio-economic, and other uncertainties which restrain private investments without Federal assistance. GAO has not presented any evidence suggesting that the information desired from the commercial demonstration program can be obtained any other way.

Page vi, para 2.

The GAO report recommends that Congress ". . . place the highest priority on . . . obtaining better cost/benefit data on the whole range of conservation opportunities." This directly contradicts the numerous assertions in the GAO report about the "cost-effectiveness" of conservation opportunities.

Page 1, para 1.

The GAO report does not recognize that the purpose of H.R. 12112 includes commercialization of renewable resources as well as synthetic fuels and demonstration of energy efficient facilities and equipment.

Page 1, para 3.

This paragraph states that "... the price of synthetic fuels is almost certain to be higher than the price of energy produced from traditional energy sources, ...". This assertion is presented without supporting analysis. ERDA believes the assertion to be not true with regard to synthetic high Btu gas which ERDA now believes to be competitive with the alternative sources of LNG and synthetic gas from naphtha. Although it appears, with regard to non-high Btu was synthetic fuels, to be at least partially true now, and may remain so in the near-term, the correct timeframe for this analysis is the post-1985 period when synthetic fuels will begin to be ready for substantial market penetration. Further, this discussion ignores the dimensions of risk, credit, and uncertain world oil pricing, and the part that they play in discouraging private sector investment in synthetic fuel.

Page 2, para 4.

GAO lists three factors which they believe to be important in "... determining the incentive which would 'best' stimulate a particular energy or conservation technology ...". A fourth factor which ERDA believes to rank equally with these in importance is the assessment of the financial barrier to be addressed by the incentive, i.e. is the financial incentive needed because of risk, credit limitation, or a rate of return problem?

Page 3, para 1.

The GAO report states that ". . . no one bill . . . considers all costs associated with development . . .". It fails to note that H.R. 12112 covers a broad range of technologies and requires consideration of all costs associated with development including socioeconomic and environmental costs.

Page 5, para 3.

The GAO report states that the recent and perceived reduction in historical energy growth rates indicates that ". . . conservation actions may buy time to fully consider tradeoffs and make choices . . .". A large part of the observed and perceived reduction is the consequence of conservation resulting from post-embargo and one-time measures, the sharply increased price of energy, and the recent world and national recessions. The reductions have reduced the severity of the problem somewhat, but they have not eliminated it. ERDA is of the opinion that the Nation is not yet in a position to make choices and must maintain the integrity of all of our major options. If synthetic fuels demonstrations are not vigorously pursued now, there is no way we can meet the projected demand of the 1990's.

Page 7, para 4.

The table on page 8 is described in the GAO report as illustrating ". . . the range of choices available for the United States energy future . . .". It should be noted that even in Scenario I which is an optimistic case for the effect of conservation measures, that oil imports would rise in year 2000 to 21 quads. This clearly demonstrates that even with aggressive conservation and renewable resource development, these measures cannot obviate the need for synthetic fuels if we are not to increase our foreign oil dependence. In fact, all of the major supply-demand analyses including FEA's and the Ford Foundation scenarios all project a substantial requirement for synthetic fuels by the end of the century, if we are not to increase imports.

Page 9, para 1.

ERDA agrees with GAO's assertion that both emerging supply and conservation technologies have vast potential, but disagrees with the implication that the requirements for increased imported oil and gas can be made up through conservation and application of renewable resource technologies. These approaches are not focused toward ameliorating the "liquids and gaseous fuels gap." Elsewhere in the report, GAO also fails to address the makeup of demand by energy sector.

Page 9, para 3.

Many conservation technologies are described in this paragraph as being ". . . potentially cost-effective alternatives to developing new energy supplies . . .". On page ii, such technologies are asserted to be cost-effective. Nowhere in the GAO report is this assertion substantiated by analysis.

Page 9, para 5.

This paragraph cites "estimates" of the Ford Foundation Technical Fix scenario. As previously noted, these are not really estimates, but rather boundary conditions. Further, the Ford Foundation Technical Fix scenario is generally regarded as being highly optimistic with regard to the effects of conservation and is conceded by GAO to be "dated" at this time. Finally, even granted that the savings which appear in this scenario could be achieved, there is still a large deficit in liquid and gaseous fuels in the millions of barrels that must be met by either imports or synthetics in the mid-1990's.

Page 10, para 4.

This paragraph compares natural gas production in ERDA Scenarios I and V with a GAO report. The GAO report expects natural gas production to decline to levels well below those of Scenarios I and V. The nation's need for synthetic high Btu gas or imports of LNG will be even greater than ERDA or FEA projects to the extent that GAO's expectation proves correct, or alternatively, will require highly expensive and possibly unmanageable fuel switching by consumers.

Page 11, para 5.

This paragraph states that ". . . certain solar technologies *appear* to be cost-effective on a life cycle basis . . . ". Page ii states that these are cost-effective. Further, since no analysis is presented it is not clear what life cycles are being compared and what fuel prices are being assumed in the comparison. ERDA believes that with the possible exception of solar hot water heating in certain parts of the country.

Page 12, para 2.

This paragraph and those which follow quote ERDA's plan with regard to energy conservation. ERDA believes that the quotations cited are correct. It is important, however, to understand that ERDA's plan still envisions the need for aggressive development of the synthetic fuels options because all energy saved is not in the form of oil or natural gas, and that the focus of the synthetic fuels program is on oil and gas.

Page 13, para 3.

The GAO report states "The physical potential for energy conservation has been estimated in a number of studies. However, the questions of how much of the potential can be realized, in what time frame, at what cost, and with what approaches, requires much more examination." ERDA agrees with this observation.

However, page ii states "GAO concluded that certain conservation measurers are by far the most cost-effective way to 'produce' energy and therefore should have the top priority for government financial assistance." It is hard to reconcile these two statements.

Page 12, para 2.

GAO characterizes the Food Foundation's Energy Policy Project as "dated" and as providing "useful estimates". Despite this, GAO leans heavily on it as a basis for its conclusions.

Page 15, para 1.

GAO states that insulation retrofitting is "cost-effective in 'tens of millions' of American houses". This statement is made without backup or analysis.

Page 15, para 5.

The Ford Foundation Technical Fix and Historical Growth scenarios are described as "projections". As previously noted, the Ford Foundation report disclaims this and calls them only "possible energy futures" and states that ". . . they are illustrative, to help test and compare the consequences of different policy choices . . . and it is not likely that the real energy future will closely resemble any of our scenarios."

Page 16, para 2.

In this paragraph and many which follow that describe conservation savings, a statement is made regarding the level of energy consumption without Federal action. These statements are ascribed by GAO to the Ford Foundation Technical Fix. These statements contain phrases such as "would grow" or "is expected to grow to". It should again be noted that Ford disclaims any claim to prediction.

Page 16, para 4.

The use of the words "can" and "could" are very significant. It does not appear that consumers are implementing the strategies outlined (such as setting back thermostats) to nearly the extent needed to achieve GAO's quoted savings.

Page 19, para 3.

This paragraph and the following one are concerned with savings in the electric utility sector. The fifth paragraph of page 22 notes certain institutional barriers which stand in the way of achieving certain conservation goals. GAO fails to mention the role of state regulation in electric utility conservation as it is a formidable barrier to achieving the conservation goals established.

Page 20, para 4.

The statement is made that "many of the conservation strategies discussed above are cost-effective today." This contradicts previous paragraphs in which uncertainty was expressed regarding the costs and benefits of conservation strategies. Further, here as in other statements of a like nature, the assumptions and analysis underlying the statement are not presented. There are, of course, many conservation strategies such as lowering the thermostat or turning off the lights which would be cost-effective since their cost (to the consumer) is zero. These measures are necessarily voluntary and recent experience suggests that they cannot be sustained over a long period of time. With regard to others of a lasting nature, such as home insulation, we do not feel that most of the analyses properly account for the personal discount rate which consumers, particularly homeowners, apply to a proposed investment.

Page 21, para 4.

GAO states that " . . . many potential energy conservation actions are now cost-effective." Later in this same paragraph GAO states there is a " . . . lack of incentive for many users to improve their energy efficiency." It is difficult to reconcile these two statements.

Page 22, para 3.

GAO asserts without supporting analysis that " . . . the total life cycle cost of buying and operating an energy efficient house, car, appliance, or other product would be lower." This statement, like other similar ones in the report, carries with it embedded assumptions about the life of the equipment and of future prices of competing fuel systems. Such analyses are also, as noted above, sensitive to personal discount rates.

Page 24, para 2.

The statement is made that "However synthetic fuels technologies appear to us to be the only ones which could need all three levels of financial assistance, front-end money, construction assistance, and product price support." The word "could" puts the assertion of the quotation beyond debate, but one could as easily have said could not. It is important to note that "front-end" money for socioeconomic impact assistance would be needed for only four to six large-scale, synthetic fuel plants which are expected to be built in remote areas.

Product price supports will not be needed for plants, such as high Btu coal gasification, which produce regulated fuels but might be needed for plants producing unregulated fuels. In this regard, the words "product price support" implies the need for a product price differential above predicted world price to be paid. With the possible exception of industrial fuel gas, product price guaranties (the preferred term), where required, will serve as a protection against aberrant pricing of world oil and not to provide a production cost subsidy.

ERDA disagrees with the assertion in this paragraph that synthetic fuels technology cannot compete with conventional energy sources. ERDA believes that high Btu gas presently competes successfully with its alternatives, LNG and synthetic gas from naphtha. At least one potential builder (Union Oil) of a modular shale oil plant believes that shale oil can be economically competitive. In any event, the time when these plants will come on stream is a significant factor in

making comparisons of this type because the price of competing world oil is generally expected to continue to rise.

Page 25, para 1.

The GAO report states that the cost of solar space heating, solar hot water heating, energy from municipal waste, tertiary oil recovery, and geothermal energy (hydrothermal) ". . . appear favorable . . .". The report does not state what they are favorably compared to, and does not offer any analysis to support this assertion.

Page 26, para 6.

The statement that "Tertiary oil recovery techniques may be used after primary and secondary methods no longer yield economic quantities of oil" says nothing about the economics of tertiary recovery. Tertiary recovery is not always economic. Tertiary recovery is far from an exact science. Fields differ markedly from reservoir to reservoir. Different chemicals and different techniques may be indicated for each field. Most importantly, there is no methodology for predicting from field to field which, if any, techniques for tertiary recovery will be most suitable.

Page 29, para 1.

The cost estimates given in this paragraph for tertiary recovery technologies are significant. The $8.00 to $18.00 per barrel unascribed estimates, and the more authoritative Oil and Gas Journal $20.00 to $25.00 per barrel estimate indicate both the uncertainty and the extent of the cost range for tertiary recovery. These cost estimates are not used in any analysis when discussing the relative economics of synthetic fuels and tertiary recovery.

Page 30, para 1.

The GAO report states that the environmental problems of tertiary recovery are, except for chemical disposable problems, the same as those associated with primary recovery. This statement fails to note the environmental hazards of leaking gas and leaching chemicals associated with tertiary recovery.

Page 30, para 2.

The statement that certain solar techniques appear to have economic application today is an assertion and is not supported by analysis or economic information. As noted earlier, ERDA generally does not subscribe to this view.

Page 30, para 3.

This paragraph notes that a ten-year payback is assumed assessing the cost-effectiveness of solar. This is an extremely long payback period and undoubtedly contributes to the reluctance of consumers to invest in solar equipment.

Page 31, para 4.

The GAO report makes the statement concerning solar technology that "Evaluations of system efficiency and durability, storage subsystems, backup system requirements, aesthetics and mass production costs are not complete." The next paragraph states "Life cycle costs of solar hot water and space heating are less than conventional systems in many areas of the country." The two statements are in conflict. Further, the GAO report presents no analysis of life cycle costs.

Page 33, para 5.

The GAO reports states that ". . . synthetic fuel technologies are the least econmical (sic) of all the new energy supply technologies." This does not appear consistent with a tertiary oil cost of up to $25.00 per barrel. Further, the statement is not supported by any comparative analysis. Extensive analysis carried out by the Synthetic Fuels Interagency Task Force suggest that synthetic fuels will be an economically competitive option.

Page 35, para 3.

The statement "In many foreign countries where domestic oil and gas is not as abundant as in the United States, gasification processes have been able to survive.", implies something about the potential commercial viability of synthetic fuels in the United States and the need for the sectoral analysis which is missing from the GAO report. These low and medium Btu gasification plants in Europe are generally used for industrial application where liquid fuels such as foreign imported oil cannot compete economically.

Page 36, para 1.

This paragraph speaks of ERDA's national plan "projections." ERDA's national plan scenarios are boundary or limiting case condiitons and are not expectations of the future.

Page 36, para 4.

The statement that the Synfuels Interagency Task Force estimated the prices of synfuels on a discounted cash flow basis after taxes on entire capitalization is incorrect. Prices for regulated fuels were estimated on a utility rate base method.

Page 36, para 6.

This paragraph notes ERDA's high estimate for shale oil at $18.00 per barrel, and states that recent industry estimates range up to $18.90 per barrel. The report fails to note ERDA's central estimate of $15.00 per barrel for shale oil and further does not note some of the lower industry estimates at $13.75 per barrel. The price range, whether up to $18.00 or $18.90, is fully competitive with oil produced by tertiary processes. This is the only liquid fuel technology favored by GAO. It should be noted that ERDA recommends against inclusion of high-grade coal liquids in the H.R. 12112 program since they are clearly uneconomic.

Page 37, para 1.

This paragraph overemphasizes the technical uncertainty of the processes for manufacturing synthetic fuel a constraint to private sector financing. The regulatory, environmental and institutional factors, the licensing requirements, and the questions of capital investment, risk and credit are more important than technical uncertainties. This viewpoint was repeatedly emphasized in testimony by project sponsors and the financial community.

Page 37, para 4.

The discussion in this paragraph about environmental impact is out of context because it does not compare the impacts from synthetic fuels plants with those of conventional energy conversion processes. Again, there is no quantitative or other backup to give an indication of the relative seriousness of environmental impacts produced by these plants.

Page 37, para 5.

This paragraph discusses socioeconomic considerations. It fails to state that H.R. 12112 contains provisions to mitigate the socioeconomic impacts expected from large synthetic fuels facilites.

Page 39, para 2.

GAO makes the assertion that loan guaranties ". . . generally result in only moderate shifts in cost benefit ratios. They are not normally best suited to assist technologies which require large advances to become economically competitive." This assertion seems to indicate a lack of understanding of the capital budgeting process. Investors who bear the ultimate financial risk of a project assume a 100 percent equity investment, since financial failure will convert any indebtedness into equity. Loan guaranties serve the function of transferring part of the ultimate financial risk from the investor to the taxpayer. In doing so, they permit calculation of investments which show returns only on the equity portion. The effect on project costs is significant and is indicated in Tab J of the Fact Book which ERDA prepared for this program.

Page 40, para 4.

The thrust of this paragraph is that the major effect of loan guaranties on investment decisions is their effect on reduction of borrowing costs. With regard to the H.R. 12112 loan guaranties two factors should be noted. First, the probable elimination of any risk premium because of the Federal guaranty will in all likelihood be more than offset by the at least 1 percent guaranty fee charged and the increased administrative costs which the recipient of such a guaranty will, without question, bear. The second important point is that the effectiveness of loan guaranties is in the transfer of risk for the reason noted previously, and in the provision of credit in instances when it is otherwise not available. A clear-cut example of this would be the availability of $750 million in debt to a coal gas investor whose total net worth may be half of that figure.

Page 40, para 5.

See GAO's footnote 2 regarding this paragraph.

The continuation of this paragraph on the top of page 41 implies that investments in certain energy projects (such as synthetic fuels) because of loan guaranties may come at the expense of investment in oil or gas development. This statement should be viewed in the context of recent major oil company diversifying investments. Some of these are: Mobil Oil in MARCOR Corporation (Montgomery Ward); Gulf Oil in real estate ventures, and Tenneco in an agricultural division. These investments clearly show that these companies are not restricted from oil and gas investments because of difficulty in obtaining capital, but rather are attracted to these investments because of their favorable rate of return. GAO's next paragraph concedes this point: if firms can obtain a higher rate of return on other activities, they won't invest in synthetic fuels whether or not loan guaranties are available.

Page 41, paras 3 & 4.

GAO incorrectly states that loan guaranties do not compete for funds in the budget. However, 25 percent of the face amount of the guaranties authorized by H.R. 12112 have been requested to be appropriated as a fund in case of defaults, and will appear in the budget and counted in the budget authority totals. The recommended budget approach is fully consistent with the spirit and letter of the Budget Act.

The GAO report further asserts that loan guaranties frustrate budgetary discipline because they do not compete for Federal tax money in the same manner as other programs. The GAO report fails to address this question for tax incentives.

Page 41, para 5.

As previously noted, ERDA does not agree with the blanket statement that synthetic fuel plant output is not expected to be competitive with the price of energy from traditional sources. This paragraph incorrectly asserts that synthetic fuels will need price guaranties. No price guaranties would be needed for High Btu Gas Plants. The implication of this paragraph is that price guaranties would be of a cost reimbursing nature applicable to the difference between cost of production and market prices. The principal use of price guaranties will be to protect investors in non-regulated fuels projects against aberrant reductions in world oil prices. There is a possibility that such guaranties might be used to pay higher than world prices for Industrial Fuel Gas Project (low or medium Btu gas). These, however, would not be of an open-end cost-reimbursement nature, but rather would provide support up to a fixed or indexed dollar price.

Page 44, para 2.

This paragraph implies that the program might expand to subsidize an entire industry. In doing so, it thereby indicates a lack of understanding of the very limited nature of H.R. 12112; that is, to construct and operate a few plants of each type to gather the critical information and resolve uncertainties in order to permit future timely industry investment without Federal assistance.

Page 43, paras 2 & 3.

Under the government ownership case, it should be pointed out that costs would be all on budget. The government would take all risks and, therefore, there would be no efficiency incentive. The GAO also fails to note the loss of tax revenues to the Treasury which should be considered in assessing government ownership.

Page 44, para 2.

In recapping the focus of the report, GAO broadly overstates what was done. The report inaccurately states "For each technology, we have attempted to define and assess its potential role in filling energy needs by both 1985 and 2000." Instead, the report merely quotes and agrees with selected supply and demand figures from other studies. The report contains no assessment in the sense of analysis but it contains numerous unsupported assertions and conclusions.

Page 44, para 4.

Dicussion of the "slow-down" in the growth rate for energy demand should be tempered by such considerations as price induced conservation and the

recession that the United States and indeed the world has recently suffered. This slow-down as previously discussed, appears to have ended.

We agree with the GAO report that all promising supply and conservation sources should be explored. We do not agree with the characterization of the H.R. 12112 program as commercializing synthetic fuels. We characterize it rather as an initial effort focused on resolution of uncertainties which, unless resolved, will inhibit timely private sector investment in synthetic fuel projects. The synthetic fuel production of this program is trivial when compared with our import requirements in the 1985 timeframe. No one has suggested the program as relieving that situation. It is the uncertainty of impact beyond 1985, both for synthetic fuels and for all other technologies, which requires that all be explored. The same uncertainty constrains the private sector from unassisted investment.

Page 45, last para.

H.R. 12112 limits development of initial shale plants to modular plants of 6,000 to 10,000 barrels per day capacity. The characterization of a 50,000 barrel per day plant as "... one small plant ..." is highly questionable.

Page 46, para 1.

The price of synthetic gas is characterized as being twice the recently announced FPC price for newly discovered regulated gas. However, as noted by FEA in its review of the GAO report, synthetic fuels should not be compared with the cheapest source of market supply, but rather with those sources at the margin such as LNG and naphtha conversion. It should be noted that the price of high Btu gas from coal is equal to or less than the price for gas from new LNG or naphtha conversion sources.

Page 46, para 4.

This paragraph and those which immediately follow it describe three important factors which should be carefully examined in determining financing incentive mechanisms. As previously noted, the nature of the constraint to unassisted investment must also be examined; viz: is the barrier to private sector investment a question of risk, credit, or return on investment?

Page 47, para 2.

This paragraph is true. Companies may be able to invest in synthetic fuel projects, but will not because of more attractive investment opportunities elsewhere. Providing such companies with loan guaranties which transfer risk from them to the taxpayers permits them to calculate return on only the equity portion and thereby enhances the desirability of the investment.

Page 47, para 4.

This paragraph repeats the assertions of page ii. The text, as has been pointed out above, is inconsistent with the assertion.

Page 48, para 2.

The report again asserts that synthetic fuel production is not price competitive with foreign oil. As previously noted, only certain synthetic fuel technologies should be compared with foreign oil and then only at the time of completion of the plant. High Btu gas plants when completed are presently competitive with alternative sources of gas.

Page 48, para 3.

Neither ERDA nor H.R. 12112 is proposing any "deep national commitment to uneconomic high-cost supply technologies." What both do propose is a program to resolve at or near full-scale the regulatory, socioeconomic, environmental, and other uncertainties which presently inhibit private sector investment, but which must be resolved if the private sector is to invest in a synthetic fuel industry in the mid-1980's. The purpose of the H.R. 12112 program is to preserve the synthetic fuel option, not to elect it.

Page 49, para 3, numbered point 3.

Again, the unsupported assertion that synthetic fuels are not cost-effective.

Page 50, paras 2 & 4.

On the one hand the GAO report describes the economic desirability of conservation and on the other notes its relatively unfavorable payback. This is a

contradiction. ERDA does not debate the desirability of conservation as a contributor to national energy goals. We do have problems with assertions of cost-effectiveness.

Page 50, para 3.

The discussion in this paragraph regarding tax credits should include the cost to the nation of such credits. This same paragraph notes the long payback period for conservation investments. Payback is an important measure of favorability in investment analysis. This contradiction appears several times in the GAO report.

Page 52, para 2.

This paragraph is in error when it addresses loan guaranties as the appropriate incentive to relieve concerns that the product price will not compete economically with manipulated world oil prices. The appropriate incentive to address this concern is a price guaranty.

Loan guaranties do address the questions of risk transfer, credit, and return on investment.

Page 52, para 5.

GAO believes that adequate information can be gained from smaller plants under government control. However, regulatory, environmental and socio-economic information will not be credible coming from small plants. There is a critical cut-off size below which this information cannot be extrapolated to the full-size plant. Several witnesses testified on this point before the Economic Stabilization Subcommittee of the House Banking, Currency and Housing Committee.

Page 54, para 2.

This paragraph again makes the assertion that solar hot water and solar space heating are currently economic in certain instances, but then says that they are not being implemented because of long payback periods. The two statements are inconsistent.

Page 55, para 4.

The GAO report characterizes itself as an analysis. It appears to us rather to be a series of assertions unsupported by analysis. It is really an expression of philosophy regarding energy policy. To make an effective case, GAO should provide an analysis which demonstrates that the work of the Synthetic Fuel Task Force and the continuation of that work by ERDA, is deficient or incorrect.

Mr. DINGELL. Without objection, the Chair observes that there are several appendixes, including your communication to Mr. Staats at GAO regarding the report. Those will be inserted in the record at the appropriate place.

The best thing for us to do is recognize Mr. Hughes now for comment on the points you have raised.

Mr. HUGHES. First, I wonder—I just became aware of the detailed ERDA comments over the weekend. We would like an opportunity to place a response to those detailed 70 points in the record.

Mr. DINGELL. You are referring to a document dated August 19?

Mr. HUGHES. I do not have it before me. I know there is one.

Mr. MCCORMICK. It is an attachment to my testimony, attachment 2.

Attachment 1 is a letter from Dr. Seamans to Mr. Staats. Attachment 2 is the detailed comments.

Mr. DINGELL. It is dated August 26. The 26th was Thursday last. Given the way the U.S. mails function, which is not very well, it probably just got to you about this morning—or maybe it will be next week some time.

Mr. HUGHES. We did not get it from ERDA.

In any event, we would like to respond to it and feel that we can.

Mr. DINGELL. Without objection, the record will remain open for that response.

[The following material was received for the record:]

GAO RESPONSES TO ERDA'S DETAILED COMMENTS ON GAO REPORT

1. ERDA statement: (page i, page 4). "In making the right choice among financing mechanisms, GAO has ignored as criteria the factors of risk, credit, and rate of return. These were carefully evaluated by the President's Task Force last year, but are not even addressed in the GAO report."

GAO response: Risk, credit, and rate of return were an inherent part of our analysis and considered in arriving at our conclusion. In any case, we are not convinced "risk" should be transferred to the taxpayer given the current state of these technologies.

2. ERDA statement: (page ii, para 3). "ERDA agrees that the nation should explore all promising supply and conservation alternatives. However, the agency believes that conservation alternatives, even if aggressively pursued cannot obviate the need for substantial quantities of synthetic fuels in the early 1990's. This conclusion is supported by all major supply/demand analyses in recent years."

GAO response: A number of supply/demand analyses—including ERDA's conservation scenario and the Ford Project's Zero Energy Growth Scenario—indicate no supply from synfuels. In any event, we are not questioning the need for synthetic fuels in the later part of the century but rather, ERDA's approach to providing Government assistance to industry in commercializing synthetic fuels at this time.

ERDA statement: (page ii, para 3). "The reference to the slowdown in the rate of growth in demand for energy is largely due to the post-embargo measures and more recently the national and world recessions. However, this year demand is rising rapidly as evidenced by the Edison Electric Institute figures (see August 16 Wall Street Journal) of a growth of 5.2 percent in electricity demand in the first 32 weeks of this year."

GAO response: We agree that electricity demand is up markedly and foresee a continued rise in demand for all energy sources unless the Government aggressively pursues a program of encouraging conservation. In addition, the Government needs to carefully explore all supply sources, including synthetic fuels.

ERDA statement: (page ii, para 3). "The GAO emphasis on conservation does not take into consideration how much of the potential for price-induced conservation has already been captured."

GAO response: ERDA's statement is not correct. We explicitly discuss the estimated savings to be captured by existing legislation and describe further opportunities for savings beyond those programs now in effect. Current GAO work in the conservation area indicates that only a small amount of the opportunities (including price-induced conservation) for energy savings have been captured. To increase this savings many changes will be required, such as restructuring utility rates, and incentives for reducing industrial wastefulness and retrofitting of insulation for housing.

3. ERDA statement: (page ii, para 4). "The GAO conclusion that certain conservation measures are the most cost-effective and others are more cost-effective than synthetic fuels is based on an "appearance" (last line) rather than on a sound analytic analysis. Neither the measures of cost-effectiveness are discussed in the report nor are the quantitative comparisons shown."

GAO response: Our report discusses the price of synthetic fuels as well as the price of other energy sources, as projected by various studies, without restating the details and mechanics of each study. In addition, the method of economic comparison, prices, and energy resource with which comparisons were made are explained in the report. (See pages 25, 29, 30, and 32 of our report.)

4. ERDA statement: (page iii, para 1). "This is the first of several instances in which all syntheic fuels are asserted to be not cost-effective when the cost of their output is compared to that of foreign oil. Two points must be made: (1) The economic comparison of high Btu gas produced from coal with alternatives should, as is later noted in the report, use LNG and syntheic gas from naptha as the alternatives rather than imported oil. These are the real alternatives that are available. (2) Where oil is the appropriate competing fuel the economic comparisons should be made as of the time that the syntheic fuel plants come into operation in the early 1980's rather than at the present time. All major forecasts project world oil prices to continue to rise."

GAO response: In the report we do compare high-Btu synthetic gas with liquidfied natural gas (LNG), new natural gas, and imported oil (see page 36 of the GAO report). In our view, synthetic gas will not only be compared with other new gas technologies, but also with the primary existing energy sources (natural gas and oil).

We agree with ERDA that an increase in imported oil prices is probably inevitable. At the same time, we feel that a price increase, possibly of equal magnitude, is also inevitable for synthetic fuels.

ERDA is currently proposing that Congress favorably act on legislation which would help private industry commercialize synthetic fuels. Comparing prices of energy under the various alternatives available on the basis of current dollars, in our view, provides a meaningful framework for Congress to fully evaluate the expected price the consumer will pay for future energy. In essence, such a comparison allows Congress to consider current proposals for Government financial assistance to synthetic fuels production using trade-off based on the present value of money. The decisions before Congress on synthetic fuels is an immediate one, and we believe the use of current dollars to assist in this decision is sound.

5. ERDA statement: (page iii, para 3). "The GAO questions the prudence of '. . . any natioanl commitment . . .'. H.R. 12112 does not represent a commitment but rather a preservation of the option to proceed in a timely manner with development of a synthetic fuel industry to meet the projected requirements of about 5 million barrels per day in 1995."

GAO response: We recognize that the scope of H.R. 12112 has been limited. However, the position of both ERDA and the Administration has consistently been that H.R. 12112 represents the first step of a more comprehensive program which would include the Energy Independence Authority. Loan guarantees for synthetic fuels would be folded into that larger program which would also authorize direct investments, loans, and price supports.

6. ERDA statement: (page iii, para 4). "This paragraph appears to confuse the economic evaluation of emerging technologies on an incremental (or marginal) basis with the later pricing of the output of such plants on an incremental versus a rolled-in pricing basis. In any event, the administrative analysis showing the desirability of synthetic fuels was not based on rolling in these products."

GAO response: The report does distinguish between pricing for evaluation purposes and later pricing of the output. (See page 49 of our report.)

In our view, incremental pricing should be used for evaluation purposes in order to allow the technology to be analyzed on its own merits regardless of the method used to price the actual output. We do note for the record that a draft report prepared for the Federal Power Commission entitled "Task Force Report of the Supply Technical Advisory Task Force—Regulatory Aspects of Substitute Gas", dated July 27, 1976, states the following on page G–1—"The Federal Power Commission should allow the 'rolled-in' concept in developing a new tariff schedule where synthetic gas is to be supplied to an interstate system." These conclusions seem to cover high Btu-synthetic gas from coal as well as liquid based synthetic gas.

7. ERDA statement: (page iv, para 6). "The GAO report makes the statement '. . . the projected prices are not competitive with existing or other emerging energy sources . . .' ERDA believes that high Btu gas is now competitive with existing higher priced alternative sources such as LNG and naphtha conversion. Moreover, at least one potential builder of a shale oil modular plant (Union Oil) indicates that the output of the plant will, with only a government loan guaranty, be competitive with existing world oil prices."

GAO response: We recognize in our report that high-Btu synthetic gas may compete more favorably with Liquefied Natural Gas (LNG) than with foreign oil or other conventional sources. However, a recent study by the Energy Resources Council (ERC) estimates LNG may be priced somewhat lower than our report shows—around $2.50 to $3.00 per thousand cubic feet. In ERDA's Fact Book on the Proposed Synthetic Fuels Commercial Demonstration Program, ERDA's Office of Commercialization estimates the price of high-Btu synthetic gas to be $3.28 per thousand cubic feet. In this regard, we have recently become aware of a draft interim report by C. F. Braun being jointly funded by ERDA and the American Gas Association. We understand that this draft report shows cost figures for second generation high-Btu coal gasification processes using western coal which range as high as $4.66 per MCF with utility financing and $6.68 per MCF with non-utility financing. We were unable to obtain a copy of this draft report as of the date of this transmittal.

The draft report to the FPC, cited in our answer to question 6, states on page C–12 ". . . the price of liquid based SNG ranges from $3.00 to $5.50 per MCF at the tailgate of the plant." These are the same SNG sources, such as naphtha, which ERDA argues are competitive with high-Btu synthetic gas from coal. These prices are considerably higher than LNG prices and the products are being produced by the private sector without current financial assistance from the Federal Government.

The current status of many of the proposed shale oil projects is one of dormancy. Companies have asked for and were granted a suspension of development and an extension of bonus payment obligations by the Secretary of the Interior. Shell Oil Company has very recently stated the expected cost for shale oil at around $20 a barrel.

8. ERDA statement: (page v, para 2). "The possible 15 percent cost reduction which the GAO report cites, would be applicable only to that part of the investment which represents process technology. Infrastructure, socioeconomic impact assistance, financing costs, and other elements which are insensitive to the specific coal conversion process used will not be affected."

GAO response: We agree with ERDA's statement.

9. ERDA statement: (page v, para 3). "ERDA does not agree that it is possible to gain the information sought by the H.R. 12112 program from smaller plants under government control. Only commercial-scale plants operating in the private sector will acquire a credible body of information addressing the environmental, regulatory, socioeconomic, and other uncertainties which restrain private investments without Federal assistance. GAO has not presented any evidence suggesting that the information desired from the commercial demonstration program can be obtained any other way."

GAO response: We concluded that smaller plants could be an alternative for gathering needed information on socio-economic, enviromental and regulatory impacts. We pointed out that this option could provide Congress with yearly oversight, offer enhanced potential for less costly plants, and provide greater flexibility in terminating the projects or selling them to private parties. Further evidence will be available when ERDA's studies concerning plant size are completed and reviewed. Our consistent view has been that legislative action should be delayed until all the evidence is gathered and fully evaluated. We also point out that it seems ERDA feels that such information can be gathered in other programs with less than commercial-sized plants—such as in the LMFBR program. Further, ERDA has not disagreed with the financing of smaller shale oil plants, which would be authorized under some versions of H.R. 12112, as the next appropriate step for that technology. See also our comments on ERDA statements 14 and 33.

10. ERDA statement (page vi, para 2). "The GAO report recommends that Congress" . . . place the highest priority on . . . obtaining better cost/benefit data on the whole range of conservation opportunities." This directly contradicts the numerous assertions in the GAO report about the "cost-effectiveness" of conservation opportunities."

GAO response: GAO does not feel that the statements are contradictory. We indicated that certain conservation actions are cost-effective. Many studies exist which support these specific cost-effective options. That fact, however, does not preclude the need for additional studies on a comprehensive, across the board basis to further refine economic detail and identify favorable individual conservation actions. We pointed out on page 13 of our report that the Executive Branch had contemplated at least two such studies but that one was not completed and one was not funded.

11. ERDA statement (page 1, para 1). "The GAO report does not recognize that the purpose of H.R. 12112 includes commercialization of renewable resources as well as synthetic fuels and demonstration of energy efficient facilities and equipment."

GAO response: The GAO report is not an analysis of H.R. 12112. We examined a number of emerging energy supply technologies and conservation actions which are technically feasible and estimated to have a significant supply impact by 1985 and 2000, but are not being actively commercialized by the private sector.

12. ERDA statement: (page 1, para 3). "This paragraph states that ". . . the price of synthetic fuels is almost certain to be higher than the price of energy produced from traditional energy sources. . . ." This assertion is presented without supporting analysis. ERDA believes the assertion to be not true with regard to synthetic high-Btu gas which ERDA now believes to be competitive with the alternative sources of LNG and synthetic gas from naphtha. Although it appears, with regard to non-high Btu gas synthetic fuels, to be at least partially true

now, and may remain so in the near-term, the correct time frame for this analysis is the post-1985 period when synthetic fuels will begin to be ready for substantial market penetration. Further, this discussion ignores the dimensions of risk, credit, and uncertain world oil pricing, and the part that they play in discouraging private sector investment in synthetic fuel."

GAO response: See our response to comments 1, 4, and 7.

13. ERDA statement: (page 2, para 4). "GAO lists three factors which they believe to be important in ". . . determining the incentive which would 'best' stimulate a particular energy or conservation technology. . . ." A fourth fact which ERDA believes to rank equally with these in importance is the assessment of the financial barrier to be addressed by the incentive, i.e., is the financial incentive needed because of risk, credit limitation, or a rate of return problem?"

GAO response: See GAO's response to ERDA's comment number 1.

14. ERDA statement: (page 3, para 1). "The GAO report states that ". . . no one bill . . . considers all costs associated with development. . . ." It fails to note that H.R. 12112 covers a broad range of technologies and requires consideration of all costs associated with development including socio-economic and environmental costs."

GAO response: We feel that ERDA's quote of our statement was taken out of context. Our complete statement was "Individual bills before the Congress cover a wide range of objectives and financing techniques. However, no one bill focuses on all emerging energy technologies, considers all costs associated with development, or more importantly, attempts to focus on targets of proposed actions on some consistent priority basis." We still believe this to be a valid statement. H.R. 12112 does not pretend to cover all the options. ERDA also supports additional legislation such as the Energy Independence Authority which indicates to us that H.R. 12112 is not seen by ERDA as a "comprehensive" piece of legislation.

15. ERDA statement: (page 5, para 3). "The GAO report states that the recent and perceived reduction in historical energy growth rates indicates that ". . . conservation actions may buy time to fully consider tradeoffs and make choices. . . ." A large part of the observed and perceived reduction is the consequence of conservation resulting from postembargo and one-time measures, the sharply increased price of energy, and the recent world and national recessions. The reductions have reduced the severity of the problem somewhat, but they have not eliminated it. ERDA is of the opinion that the Nation is not yet in a position to make choices and must maintain the integrity of all of our major options. If synthetic fuels demonstrations are not vigorously pursued now, there is no way we can meet the projected demand of the 1990's."

GAO response: See response to comment number 2. In addition, we agree that the synthetic fuels option should not be dropped. We believe that an aggressive program of research, development, and demonstration should be pursued rather than attempting to commercialize current, first generation technologies which are basically uneconomic and less attractive in comparison with other options.

16. ERDA statement: (page 7, para 4). "The table on page 8 is described in the GAO report as illustrating ". . . the range of choices available for the United States energy future. . . ." It should be noted that even in Scenario I wish is an optimistic case for the effect of conservation measures, that oil imports would rise in year 2000 to 21 quads. This clearly demonstrates that even with aggressive conservation and renewable resource development, these measures cannot obviate the need for synthetic fuels if we are not to increase our foreign oil dependence. In fact, all of the major supply-demand analyses including FEA's and the Ford Foundation scenarios all project a substantial requirement for synthetic fuels by the end of the century, if we are not to increase imports."

GAO response: Our report does not argue against synthetic fuels. Instead, we are suggesting that trade-offs between synthetic fuels and other new and existing technologies need to be carefully considered.

In addition, it should be noted that the Ford Foundation's Zero Energy Growth Scenario does not envision any supply from synthetic fuels by 2000. Also, as stated previously, ERDA's high conservation scenario (Scenario I) does not project any synthetic fuel supply in 2000. We are not aware of any major National Energy Outlook Scenario of FEA which projects energy supply and demand to the year 2000.

Finally, while ERDA says its conservation scenario is optimistic, there exist other conservation studies which allow for considerably larger savings from conservation than does ERDA's Scenario.

17. ERDA statement: (page 9, para 1). "ERDA agrees with GAO's assertion that both emerging supply and conservation technologies have vast potential, but disagrees with the implication that the requirements for increased imported oil and gas can be made up through conservation and application of renewable resource technologies. These approaches are not focused toward ameliorating the "liquids and gaseous fuels gap." Elsewhere in the report, GAO also fails to address the makeup of demand by energy sector.

GAO response: Based on ERDA's statement, it appears that there is considerable disagreement between us concerning the substitutability of energy sources and/or energy conservation in the time frames discussed. GAO believes that in the time frame considered in our report there exists great potential for substitution. In Chapter 3 of the GAO report (Energy Conservation) an analysis of energy demand by the residential, commercial, industrial, transportation, and utility sectors is presented along with the potential for energy savings in those sectors. See also the GAO Report, "Implications of Deregulating the Price of Natural Gas", OSP–76–1, January 14, 1976, pgs. 35–53, in which we discuss in some detail the substitution potential for natural gas over the longer run. Again, we point out that we do not wish to foreclose the synthetic fuels option.

As to the liquid and gaseous gap ERDA describes we note several items

(1) Coal liquefaction, the major source of synthetic liquids in the year 2000 under the ERDA scenarios, is not included in H.R. 12112;

(2) Shale oil, another major source of liquids in 2000, under H.R. 12112 is provided with 6,000–10,000 barrels a day plants, not full-scale commercial facilities of 50,000 barrels a day or larger;

(3) Synthetic gas, under ERDA's most optimistic scenario, is expected to provide only 3.5 quads in 2000 out of a total gas demand of about 26 quads. If LNG were substituted for this within current ERC guidelines (LNG not to exceed 10 percent of domestic gas production) it would virtually eliminate the need for high-Btu gas from coal. The remainder, about 1 quad or 4 percent of total gas supply, could easily be covered by substitutability steps (such as banning gas for boiler fuel use) over the next 20 years.

18. ERDA statement: (page 9, para 3). "Many conservation technologies are described in this paragraph as being " . . . potentially cost-effect alternatives to developing new energy supplies . . . On page ii, such technologies are asserted to be cost-effective. Nowhere in the GAO report is this assertion substantiated by analysis."

GAO response: Our analysis was largely based on work and studies already in existence. The studies we used are referenced in the appropriate places throughout the report.

19. ERDA statement: (page 9, para 5). "This paragraph cites 'estimates' of the Ford Foundation Technical Fix scenario. As previously noted, these are not really estimates, but rather boundary conditions. Further, the Ford Foundation Technical Fix scenario is generally regarded as being highly optimistic with regard to the effects of conservation and is conceded by GAO to be 'dated' at this time. Finally, even granted that the savings which appear in this scenario could be achieved, there is still a large deficit in liquid and gaseous fuels in the millions of barrels that must be met by either imports or synthetics in the mid-1990's."

GAO response: For a discussion of the estimate-boundary point, see the GAO response to ERDA's comment 26. The question of the usefulness of a dated scenario such as the Ford Foundation's work is discussed in our response to ERDA's statement 24. Our response concerning meeting the liquid and gaseous fuels supply deficit appears in GAO's response to ERDA's statement 17 and 20.

20. ERDA statement: (page 10, para 4). "This paragraph compares natural gas production in ERDA Scenarios I and V with a GAO report. The GAO report expects natural gas production to decline to levels well below those of Scenarios I and V. The nation's need for synthetic high Btu gas or imports of LNG will be even greater than ERDA or FEA projects to the extent that GAO's expectation proves correct, or alternatively, will require highly expensive and possibly unmanageable fuel switching by consumers."

GAO response: We basically agree with ERDA's interpretation of our report as it relates to future natural gas production. However, as previously stated, ERDA and GAO disagree on the substitutability of energy technologies and/or energy conservation. (See our answer to ERDA statement 17.) ERDA apparently believes that a decrease in supply from any existing source must automatically be accompanied by an increase in reliance on synthetic fuels or LNG.

GAO believes that other options—as stated in our report—are available to this Nation. Again, we point out that we do not wish to foreclose the synthetic fuels option. In our report we favor a strong RD&D program for synthetic fuels and also consideration of the "commercial pull" approach.

21. ERDA statement: (page 11, para 5). "This paragraph states that ". . . certain solar technologies *appear* to be cost-effective on a life cycle basis . . ." Page ii states that these are cost-effective. Further, since no analysis is presented it is not clear what life cycles are being compared and what fuel prices are being assumed in the comparison. ERDA believes that with the possible exception of solar hot water heating in certain parts of the country," (sic)

GAO response: While it is true that life cycle assumptions and fuel prices are not analyzed on page 11, paragraph 5, these considerations are discussed on page 30 of our report. It should be noted that the statement, including the assumptions and prices, were provided by an ERDA official currently working in the Solar area.

22. ERDA statement: (page 12, para 2). "This paragraph and those which follow quote ERDA's plan with regard to energy conservation. ERDA believes that the quotations cited are correct. It is important, however, to understand that ERDA's plan still envisions the need for aggressive development of the synthetic fuels options because all energy saved is not in the form of oil or natural gas, and that the focus of the synthetic fuels program is on oil and gas."

GAO response: See comments on statements 17 and 20.

23. ERDA statement: (page 13, para 3). "The GAO report states "The physical potential for energy conservation has been estimated in a number of studies. However, the questions of how much of the potential can be realized, in what time frame, at what cost, and with what approaches, requires much more examination." ERDA agrees with this observation. However, page ii states "GAO concluded that certain conservation measures are by far the most cost-effective way to 'produce' energy and, therefore, should have the top priority for government financial assistance." It is hard to reconcile these two statements."

GAO response: See comments on statement 10.

24. ERDA statement: (page 13 para 4). "GAO characterizes the Ford Foundation's Energy Policy Project as 'dated' and as providing 'useful estimates'. Despite this, GAO leans heavily on it as a basis for its conclusions."

GAO response: Despite being dated (late 1974), the Ford Foundation work is still the most comprehensive assessment of energy conservation which is available. The conservation estimates in the Technical Fix Scenario of that report were built upon an engineering basis, technology by technology, sector by sector, independent of overall supply and demand considerations. With only some minor modification, the conservation estimates could be overlaid on any supply/demand scenario and still remain valid. We have also strongly recommended that more up-to-date comprehensive conservation studies be conducted. We have indicated in our report two such studies which the Executive Branch failed to complete or fund.

25. ERDA statement: (page 15, para 1). "GAO states that insulation retrofitting is 'cost-effective' in 'tens of millions' of American houses". This statement is made without backup or analysis."

GAO response: This statement is based on work of the Ford Foundation and the Federal Energy Administration's Monhtly Energy Review (March 1976).

26. ERDA statement: (page 15, para 5). "The Ford Foundation Technical Fix and Historical Growth scenarios are described as 'projections'. As previously noted, the Ford Foundation report disclaims this and call them only 'possible energy futures' and states that ". . . they are illustrative, to help test and compare the consequences of different policy choices . . . and it is not likely that the real energy future will closely resemble any of our scenarios."

GAO response: We agree that the scenarios should not have been referred to as projections.

27. ERDA statement: (page 16, para 4). "In this paragraph and many which follow that describe conservation savings, a statement is made regarding the level of energy consumption without Federal action. These statements are ascribed by GAO to the Ford Foundation Technical Fix. These statements contain phrases such as 'would grow' or 'is expected to grow'. It should again be noted that Ford disclaims any claim to prediction.

GAO response: See GAO response to ERDA statement 26.

28. ERDA statement: (page 16, para 4). "The use of the words 'can' and 'could' are very significant. It does not appear that consumers are implementing the strategies outlined (such as setting back thermostats) to nearly the extent needed to achieve GAO's quoted savings."

GAO response: If indeed consumers are not yet implementing these strategies then the need for providing incentives to stimulate these actions is all the more evident.

29. ERDA statement: (page 19, para 3). "This paragraph and the following one are concerned with savings in the electric utility sector. The fifth paragraph on page 22 notes certain institutional barriers which stand in the way of achieving certain conservation goals. GAO fails to mention the role of state regulation in electric utility conservation as it is a formidable barrier to achieving the conservation goals established."

GAO response: We agree with ERDA. This, however, does not in any way change our belief that the main objective of reducing the barriers must be pursued.

30. ERDA statement: (page 20, para 4). "The statement is made that 'many of the conservation strategies discussed above are cost-effective today'. This contradicts previous paragraphs in which uncertainty was expressed regarding the costs and benefits of conservation strategies. Further, here as in other statements of a like nature, the assumptions and analysis underlying the statement are not presented. There are, of course, many conservation strategies such as lowering the thermostat or turning off the lights which would be cost-effective since their cost (to the consumer) is zero. These measures are necessarily voluntary and recent experience suggests that they cannot be sustained over a long period of time. With regard to others of a lasting nature, such as home insulation, we do not feel that most of the analyses properly account for the personal discount rate which consumers, particularly homeowners, apply to a proposed investment."

GAO response: See GAO's responses to ERDA statements 10, 18, and 23. In addition, if indeed "personal discount rate" is an overriding factor, it makes even more evident the need to stimulate specific target groups.

31. ERDA statement: (page 21,, para 4). "GAO states that '. . . many potential energy conservation actions are now cost-effective." Later in this same paragraph GAO states there is a '. . . lack of incentive for many users to improve their energy efficiency.' It is difficult to reconcile these two statements."

GAO response: The "cost-effective" statement refers to life-cycle costs. Even though life-cycle costs may be economically attractive, this does not by itself eliminate the reluctance of institutions, builders, and consumers to make large initial investments in the absence of financial incentives or with a lack of awareness of the benefits of making decisions based on life-cycle costs.

32. ERDA statement: (page 22, para 3). "GAO asserts without supporting analysis that '. . . the total life cycle cost of buying and operating an energy efficient house, car, appliance, or product would be lower.' This statement, like other similar ones in the report, carries with it embedded assumptions about the life of the equipment and of future prices of competing fuel systems. Such analyses are also, as noted above, sensitive to personal discount rates."

GAO response: See GAO's response to ERDA statement 30.

33. ERDA statement: (page 24, para 2). "The statement is made that 'However synthetic fuels technologies appear to us to be the only ones which could need all three levels of financial assistance, front-end money, construction assistance, and product price support'. The word 'could' puts the assertion of the quotation beyond debate, but one could as easily have said could not. It is important to note that 'front-end' money for socioeconomic impact assistance would be needed for only four to six large-scale, synthetic fuel plants which are expected to be built in remote areas.

Product price supports will not be needed for plants, such as high Btu coal gasification, which produce regulated fuels but might be needed for plants producing unregulated fuels. In this regard, the words 'product price support' implies the need for a product price differential above predicted world price to be paid. With the possible exception of industrial fuel gas, product price guaranties (the preferred term), where required, will serve as a protection against aberrant pricing of world oil and not to provide a production cost subsidy.

ERDA disagrees with the assertion in this paragraph that synthetic fuels technology cannot compete with conventional energy sources. ERDA believes that high Btu gas presently competes successfully with its alternatives, LNG and

synthetic gas from naphtha. At least one potential builder (Union Oil) of a modular shale oil plant believes that shale oil can be economically competitive. In any event, the time when these plants will come on stream is a significant factor in making comparisons of this type because the price of competing world oil is generally expected to continue to rise."

GAO response: The Federal Energy Development Impact Assistance Act of 1976 (H.R. 11792 and S. 3007) would, if enacted provide a $1 billion fund, administered by the Department of the Interior Secretary, to make planning and management grants to States and Indian tribes and loans and loan guarantees to States, local governments, and Indian tribes, to assist in providing public facilities necessitated by the development of Federal energy resources found in land (including the Rocky Mountain States) and in the Outer Continental Shelf. Passage of this Act would apparently provide the Secretary of the Interior with authority to provide socioeconomic assistance to synthetic fuel plant development.

In addition, the 100 or 200 synthetic fuel plants perceived as necessary by ERDA to meet their projected liquid and gaseous gap in the 1990's will also likely require varying degrees of "front end" socio-economic assistance. See also our answer to ERDA statement 14.

ERDA, in the second paragraph of their statement, seems to be agreeing with GAO that price supports will be needed for high-Btu gas. Their statement on the aberrant pricing of world oil seems to agree with the statement on page 52 of the GAO report that one basic concern underlying the need for Federal loan guarantees is concern that the world oil price could always be manipulated. We also point out, on page 48 of our report, that commitments to high cost synthetic fuel technologies could enable imported oil to become a de facto floor price for energy as opposed to its current role as an energy price ceiling. This could enable the exporting countries to achieve a better position from which to exert continued upward pressures on energy prices.

For a discussion concerning shale oil see GAO's response to ERDA statement 7. See also our response to ERDA statement 14.

34. ERDA statement: (page 25, para 1). "The GAO report states that the cost of solar space heating, solar hot water heating, energy from municipal waste, tertiary oil recovery, and geothermal energy (hydrothermal) ". . . appear favorable . . ." The report does not state what they are favoraly compared to, and does not offer any analysis to support this assertion.

GAO response: The comparison of the cost against its competing energy source for each emerging energy technology is contained within the individual section describing the technology. In our cost comparisons, we used costs provided by Executive Branch agencies. We have not yet been provided by ERDA any additional numbers which would serve to question the numbers used in our report.

35. ERDA statement: (page 26, para. 6). "The statement that 'Teritiary oil recovery techniques may be used after primary and secondary methods no longer yield economic quantities of oil' says nothing about the economics of tertiary recovery. Tertiary recovery is not always economic. Tertiary recovery is far from an exact science. Fields differ markedly from reservoir to reservoir. Different chemicals and different techniques may be indicated for each field. Most importantly, there is no methodology for predicting from field to field which, if any, techniques for tertiary recovery will be most suitable."

GAO response: We address the economics of tertiary oil recovery on pages 26–29 of our report. We agree in our report with ERDA's comment that tertiary oil recovery is not always economic. We also agree with their technical comments. GAO will be issuing a report within the next two months on tertiary recovery which deals with these points.

36. ERDA statement: (page 29, para 1). "The cost estimates given in this paragraph for tertiary recovery technologies are significant. The $8.00 to $18.00 per barrel unascribed estimates, and the more authoritative Oil and Gas Journal $20.00 to $25.00 per barrel estimate indicate both the uncertainty and the extent of the cost range for tertiary recovery. These cost estimates are not used in any analysis when discussing the relative economics of synthetic fuels and tertiary recovery.

GAO response: The $8.00 to $18.00 range was taken from a number of sources and presented in a study done for FEA by Lewin and Associates, Inc. We also present a chart on page 28 of our report from the same Lewin and Associates, Inc. study showing the range of prices at which tertiary oil will be economically attractive.

37. ERDA statement: (page 30, para 1). "The GAO report states that the environmental problems of tertiary recovery are, except for chemical disposal problems, the same as those associated with primary recovery. This statement fails to note the environmental hazards of leaking gas and leaching chemicals associated with tertiary recovery."

GAO response: We agree that there are hazards other than the ones which we stated. However, the actual statement which we made in the report was that "except for this chemical disposal problem, environment problems are principally the same as those associated with primary recovery." It was not our purpose in this report to do a detailed environmental analysis of the technologies, but to highlight some of the expected problems.

38. ERDA statement: (page 30, para 2). "The statement that certain solar techniques appear to have economic application today is an assertion and is not supported by analysis or economic information. As noted earlier, ERDA generally does not subscribe to this view."

GAO response: We did not refer to "certain solar technologies", we referred to solar hot water heating and solar space heating. The information we received about the two specific solar technologies was obtained from an ERDA official involved in their solar program, and who is in the process of completing an economic analysis of solar hot water and space heating.

39. ERDA statement: (page 30, para 3). "This paragraph notes that a ten-year payback is assumed assessing the cost-effectiveness of solar. This is an extremely long paycheck period and undoubtedly contributes to the reluctance of consumers to invest in solar equipment.

GAO response: We agree that the payback period does effect the consumer investment in solar equipment. This supports our recommendation for financial assistance to overcome this obstacle. (See report, page 54).

40. ERDA statement: (page 31, para 4). "The GAO report makes the statement concerning solar technology that 'Evaluations of system efficiency and durability, storage subsystems, backup system requirements, aesthetics and mass production costs are not complete.' The next paragraph states 'Life cycle costs of solar hot water and space heating are less than conventional systems in many areas of the country.' The two statements are in conflict. Further, the GAO report presents no analysis of life cycle costs.

GAO response: The first statement deals with questions to be answered on the solar technology. As the answers to the questions become available, they will impact on the estimated future costs of solar hot water and space heating. The second statement deals with the current "State of the Art" costs, which now appear cost-effective with electricity in 90 percent of the country. As some knowledge is gained on solar technology, the effect will likely be to lower the cost of current competitive systems.

Again the life-cycle costs were obtained from various sources, including an ERDA official who is involved in a study of the economic analysis of solar hot water and space heating. We have not seen more recent figures from ERDA which disagree with our statements.

41. ERDA statement: (page 33, para 5). "The GAO report states that '. . . synthetic fuel technologies are the least economical (sic) of all the new energy supply technologies.' This does not appear consistent with a tertiary oil cost of up to $25.00 per barrel. Further, the statement is not supported by any comparative analysis. Extensive analysis carried out by the Synthetic Fuels Interagency Task Force suggest that synthetic fuels will be an economically competitive option."

GAO response: We show the cost of tertiary oil to be a range where some, not all, oil could be recovered on a cost-effective basis. See the graph on page 28 of our report.

In Chapter 4, we compare the cost of each emerging technology with its competing energy source. In all of the emerging technologies, except for synthetic fuels from coal and shale, the technologies are shown to be competitive, within some constraints, such as geographic areas, with the competing energy sources. Thus, on this basis, the synthetic fuels from coal and shale are the least economical of these technologies.

42. ERDA statement: (page 35, para 3). "The statement 'In many foreign countries where domestic oil and gas is not as abundant as in the United States, gasification processes have been able to survive.', implies something about the potential commercial viability of synthetic fuels in the United States and the need for the sectoral analysis in which is missing from the GAO report. These

low and medium Btu gasification plants in Europe are generally used for industrial application where liquid fuels such as foreign imported oil cannot compete economically.

GAO response: There are a number of different low- and medium-Btu gasification processes which are in existence which could be (and have been) built in the United States today for industrial applications. We believe, as well as many industry officials, that the economics of the processes are a major constraint. (See the May 5, 1976, report "Status and Obstacles to the Commercialization of Coal Liquefaction and Gasification" (RED–76–81) for a discussion of the various processes.)

43. ERDA statement: (page 36, para 1). "This paragraph speaks of ERDA's national plan 'projections'. ERDA's national plan scenarios are boundary or limiting case conditions and are not expectations of the future."

GAO response: We agree.

44. ERDA statement: (page 36, para 4). "The statement that the Synfuels Interagency Task Force estimated the prices of synfuels on a discounted cash flow basis after taxes on entire capitalization is incorrect. Prices for regulated fuels were estimated on a utility rate base method."

GAO response: Our statement was partially correct. That is true for the regulated fuels. However, the task force did use a discounted cash flow method for unregulated fuels.

45. ERDA statement: (page 36, para 6). "This paragraph notes ERDA's high estimate for shale oil at $18.00 per barrel, and states that recent industry estimates range up to $18.90 per barrel. The report fails to note ERDA's central estimate of $15.00 per barrel for shale oil and further does not note some of the lower industry estimates at $13.75 per barrel. The price range, whether up to $18.00 or $18.90, is fully competitive with oil produced by tertiary processes. This is the only liquid fuel technology favored by GAO. It should be noted that ERDA recommends against inclusion of highgrade coal liquids in the H.R. 12112 program since they are clearly uneconomic.

GAO response: See our response to ERDA statement 7 on oil shale. We are not in this report saying that all tertiary oil is competitive. The cost will vary from process to process and from field to field. These costs could range from $8 to $25 a barrel (see pages 26–29 of our report for further elaboration).

It is interesting to note that ERDA in their statement 45, recommends against inclusion in H.R. 12112 of high-grade liquids from coal which they feel will be needed in the same time frame as synthetic gas. Apparently ERDA believes that they have time to answer the environmental, regulatory and socio-economic questions of coal liquefaction which ERDA's National Plan Scenario #5 show to have almost 3 times the potential supply impact that coal gasification would have by 2000.

46. ERDA statement: (page 37, para 1). "This paragraph overemphasizes the technical uncertainty of the processes for manufacturing synthetic fuel as a constraint to private sector financing. The regulatory, environmental, and institutional factors, the licensing requirements, and the questions of capital investment, risk and credit are more important than technical uncertainties. This viewpoint was repeatedly emphasized in testimony by project sponsors and the financial community."

GAO response: We agree with ERDA that these factors are more important than the technical uncertainty question expressed by the financial community. Furthermore, we believe that, as stated in our report, continued research and development on a less than commercial size can obtain needed regulatory, environmental, institutional, and other data.

47. ERDA statement: (page 37, para 4). "The discussion in this paragraph about environmental impact is out of context because it does not compare the impacts from synthetic fuels plants with those of conventional energy conversion processes. Again, there is no quantitative or other backup to give an indication of the relative seriousness of environmental impacts produced by these plants."

GAO response: This paragraph describes some of the examples of the expected problems with synthetic fuels production. It is consistent with our discussion of the environmental impacts of the other supply technologies. We have not attempted to perform a detailed environmental study of the technologies. We understand that the Office of Technology Assessment is in the process of examining the environmental impacts of synthetic fuels technologies.

48. ERDA statement: (page 37, para 5). "This paragraph discusses socio-economic considerations. It fails to state that H.R. 12112 contains provisions to mitigate the socioeconomic impacts expected from large synthetic fuels facilities."

GAO response: See our responses to ERDA statements 14 and 33.

49. ERDA statement: (page 39, para 2). "GAO makes the assertion that loan guarantees" . . . generally result in only moderate shifts in cost benefit ratios. They are not normally best suited to assist technologies which require large advances to become economically competitive." This assertion seems to indicate a lack of understanding of the capital budgeting process. Investors who bear the ultimate financial risk of a project assume a 100 percent equity investment, since financial failure will convert any indebtedness into equity. Loan guarantees serve the function of transferring part of the ultimate financial risk from the investor to the taxpayer. In doing so, they permit calculation of investments which show returns only on the equity portion. The effect on project costs is significant and is indicated in Tab J of the Fact Book which ERDA prepared for this program."

GAO Response: We agree that the investor will see it as an added benefit to transfer the risk to the taxpayer, but whether that would motivate investment in a still uneconomic technology is debatable—as is whether the taxpayer would see it as a benefit. Price supports as well as other Federal assistance would also be added incentives.

50. ERDA statement: (page 40, para 4). "The thrust of this paragraph is that the major effect of loan guarantees on investment decisions is their effect on reduction of borrowing costs. With regard to the H.R. 12112 loan guarantees two factors should be noted. First, the probable elimination of any risk premium because of the Federal guaranty will in all likelihood be more than offset by the at least 1% guaranty fee charged and the increased administrative costs which the recipient of such a guaranty will, without question, bear. The second important point is that the effectiveness of loan guarantees is in the transfer of risk for the reason noted previously, and in the provision of credit in instances when it is otherwise not available. A clear-cut example of this would be the availability of $750 million in debt to a coal gas investor whose total net worth may be half of that figure."

GAO response: If an activity is economic, the raising of capital could be achieved through various means, such as joint-ventures, consortiums, etc. We see no reason why investors in coal gas plants need to be limited to only utility or pipeline companies.

51. ERDA statement: (page 40, para 5). See GAO's footnote 2 regarding this paragraph. "The continuation of this paragraph on the top of page 41 implies that investments in certain energy projects (such as synethetic fue's) because of loan guarantees may come at the expense of investment in oil or gas development. This statement should be viewed in the context of recent major oil company diversifying investments. Some of these are: Mobil Oil in MARCOR Corporation (Montgomery Ward); Gulf Oil in real estate ventures, and Tenneco in an agricultural division. These investments clearly show that these companies are not restricted from oil and gas investments because of difficulty in obtaining capital, but rather are attracted to these investments because of their favorable rate of return. GAO's next paragraph concedes this point: if firms can obtain a higher rate of return on other activities, they won't invest in synthetic fuels whether or not loan guarantees are available."

GAO response: There really isn't any argument here. If a company can obtain higher rates of return on other activities, they won't invest in synthetic fuels with or without loan guarantees. Thus, loan guarantees may be ineffective.

52. ERDA statement: (page 41, paras 3 & 4). "GAO incorrectly states that loan guarantees do not compete for funds in the budget. However, 25 percent of the face amount of the guarantees authorized by H.R. 12112 have been requested to be appropriated as a fund in case of defaults, and will appear in the budget and counted in the budget authority totals. The recommended budget approach is fully consistent with the spirit and letter of the Budget Act.

The GAO report further asserts that loan guarantees frustrate budgetary discipline because they do not compete for Federal tax money in the same manner as other programs. The GAO report fails to address this question for tax incentives."

GAO response: The basic problem is determining the amount of default. There is no past experience with plants of this nature which would allow the computation of a reliable default amount. ERDA has admitted that the 25 percent figure

is an arbitrary number. We believe that in situations where it is difficult to predict the extent of default, the total amount approved for loan guarantees should be shown in the budget as noted in Appendix I of our report. We address the budget implications of tax incentives on page 39 of our report.

53. ERDA statement: (page 41, para 5). "As previously noted, ERDA does not agree with the blanket statement that synthetic fuel plant output is not expected to be competitive with the price of energy from traditional sources. This paragraph incorrectly asserts that synthetic fuels will need price guarantees. No price guarantees would be needed for High Btu Gas Plants. The implication of this paragraph is that price grauantees would be of a cost reimbursing nature applicable to the difference between cost of production and market prices. The principal use of price guarantees will be to protect investors in non-regulated fuels projects against aberrant reductions in world oil prices. There is a possibility that such guarantees might be used to pay higher than world prices for Industrial Fuel Gas Project (low or medium Btu gas). These, however, would not be of an open-end cost-reimbursement nature, but rather would provide support up to a fixed or indexed dollar price."

GAO response: If the FPC allows the use of rolled-in pricing, price supports may not be needed for high-Btu synthetic gas. However, the FPC has not as yet ruled on the use of rolled-in pricing for high-Btu synethetic gas or for imported LNG. As noted in earlier responses, a draft report of an FPC task force does recommend "rolled-in" pricing for high-Btu synthetic gas and a recent report of the Energy Resource Council recommends a combination of "rolled-in-" and incremental pricing for LNG. Even if the FPC does allow 'rolled-in" pricing, the State Public Utility Commissions may not allow these costs to be passed on in their states. The question of jurisdictional authority between FPC and the State Public Utility Commissions may have to be answered in the courts. For this reason, we believe that Congress should be aware that price supports may be required, even for high-Btu coal gassification. We add that the proposed Energy Independence Authority Act specifically provides for price supports for energy projects "not in widespread domestic use" which would cover high-Btu gas from coal.

54. ERDA statement: (page 42, para. 2). "This paragraph implies that the program might expand to subsidize an entire industry. In doing so, it thereby indicates a lack of understanding of the very limited nature of H.R. 12112: that is, to construct and operate a few plants of each type to gather the critical information and resolve uncertainties in order to permit future timely industry investment without Federal assistance."

GAO response: We understand the limited scope of H.R. 12112. However, there are other proposed programs which would involve price supports such as the administration's proposed Energy Independence Authority (EIA) program. ERDA's and the Administration positions have remained clear that the program envisioned under H.R. 12112 would be folded into, and become part of, the EIA program at such time as that program is authorized.

55. ERDA statement: (page 43, paras 2 & 3). "Under the government ownership case, it should be pointed out that costs would be all on budget. The government would take all risks and, therefore, there would be no efficiency incentive. The GAO also fails to note the loss of tax revenues to the Treasury should be considered in assessing government ownership."

GAO response: It seems to us that with proper management, efficiencies could be realized. The tax loss could be offset by the benefits to the using public from non-profit production.

56. ERDA statement: (page 44, para. 2). "In recapping the focus of the report, GAO broadly overstates what was done. The report inaccurately states "For each technology, we have attempted to define and assess its potential role in filling energy needs by both 1985 and 2000." Instead, the report merely quotes and agrees with selected supply and demand figures from other studies. The report contains no assessment in the sense of analysis but it contains numerous unsupported assertions and conclusions."

GAO reponse: We have based our observations and our conclusions on the most current data and facts available, as well as on recognized and major studies which relate to this highly complex area.

57. ERDA statement: (page 44, para. 4). "Discussion of the 'slow-down' in the growth rate for energy demand should be tempered by such considerations as price induced conservation and the recession that the United States and indeed the world has recently suffered. This slow-down as previously discussed, appears to have ended.

"We agreed with the GAO report that all promising supply and conservation sources should be explored. We do not agree with the characterization of the H.R. 12112 program as commercializing synthetic fuels. We characterize it rather as an initial effort focused on resolution of uncertainties which, unless resolved, will inhibit timely private sector investment in synthetic fuel projects. The synthetic fuel production of this program is trivial when compared with our import requirements in the 1985 time frame. No one has suggested the program as relieving that situation. It is the uncertainty of impact beyond 1985, both for synthetic fuels and for all other technologies, which requires that all be explored. The same uncertainty constrains the private sector from unassisted investment."

GAO response: See GAO's response to ERDA statement 2. In addition, we are not recommending foreclosure of the synfuels option. Instead, we are suggesting that synfuel development can be explored by other means.

58. ERDA statement: (page 45, last para). "H.R. 12112 limits development of initial shale plants to modular plants of 6,000 to 10,000 barrels per day capacity. The characterization of a 50,000 barrel per day plants as '. . . one small plant . . .' is highly questionable."

GAO response: A 50,000 barrel a day plant is small when compared to total demand or to domestic oil production or oil imports. If a modular plant of 6,000 to 10,000 bbls. per day capacity can enable ERDA to obtain needed socioeconomic, environmental, and regulatory data, it is difficult to understand why commercial-size plants are necessary to obtain similar type data for synthetic gas plants. (See, also ERDA statement 69 on this subject.)

59. ERDA statement: (page 46, para 1). "The price of synthetic gas is characterized as being twice the recently announced FPC price for newly discovered regulated gas. However, as noted by FEA in its review of the GAO report, synthetic fuels should not be compared with the cheapest source of market supply, but rather with those sources at the margin such as LNG and naphtha conversion. It should be noted that the price of high Btu gas from coal is equal to or less than the price for gas from new LNG or naphtha conversion sources."

GAO response: See GAO's response to ERDA's statement 4, 6, and 7.

60. ERDA statement: (page 46, para 4). "This paragraph and those which immediately follow it describe three important factors which should be carefully examined in determining financing incentive mechanisms. As previously noted, the nature of the constraint to unassisted investment must also be examined; viz: is the barrier to private sector investment a question of risk, credit, or return on investment?"

GAO response: See GAO's response to ERDA's statement 1.

61. ERDA statement: (page 47, para 2). "This paragraph is true. Companies may be able to invest in synthetic fuel projects, but will not because of more attractive investment opportunities elsewhere. Providing such companies with loan guarantees which transfer risk from them to the taxpayers permits them to calculate return on only the equity portion and thereby enhances the desirability of the investment."

GAO response: See GAO's response to ERDA's statement 51.

62. ERDA statement: (page 47, para 4). "This paragraph repeats the assertions of page ii. The text, as has been pointed out above, is inconsistent with the assertion."

GAO response: See GAO's response to ERDA's statement 3.

63. ERDA statement: (page 48, para 2). "The report again asserts that synthetic fuel production is not price competitive with foreign oil. As previously noted, only certain synthetic fuel technologies should be compared with foreign oil and then only at the time of completion of the plant. High-Btu gas plants when completed are presently competitive with alternative sources of gas."

GAO response: See GAO's response to ERDA's statement 4, 6, and 7.

64. ERDA statement: (page 48, para 3). "Neither ERDA nor H.R. 12112 is proposing any "deep national commitment to uneconomic high-cost supply technologies." What both do propose is a program to resolve at or near full-scale the regulatory, socioeconomic, environmental, and other uncertainties which presently inhibit private sector investment, but which must be resolved if the private sector is to invest in a synthetic fuel industry in the mid–1980s. The purpose of the H.R. 12112 program is to preserve the synthetic fuel option, not to elect it."

GAO response: See GAO's response to ERDA's statement 57.

65. ERDA statement: (page 49, para 3, numbered point 3). "Again, the unsupported assertion that synthetic fuels are not cost-effective."

GAO response: See GAO's response to ERDA's statement 4, 6, and 7.

66. ERDA statement: (page 50, paras 2 & 4). "On the one hand the GAO report describes the economic desirability of conservation and on the other notes its relatively unfavorable payback. This is a contradiction. ERDA does not debate the desirability of conservation as a contributor to national energy goals. We do have problems with assertions of cost-effectiveness."

GAO response: See GAO's responses to ERDA's statements 4 and 10.

67. ERDA statement: (page 50, para 3). "The discussion in this paragraph regarding tax credits should include the cost to the nation of such credits. This same paragraph notes the long payback period for conservation investments. Payback is an important measure of favorability in investment analysis. The contradiction appears several times in the GAO report."

GAO response: See GAO's response to ERDA's statement 39.

68. ERDA statement: (page 52, para 2). "This paragraph is in error when it addresses loan guarantees as the appropriate incentive to relieve concerns that the product price will not compete economically with manipulated world oil prices. The appropriate incentive to address this concern is a price guaranty.

Loan guarantees do address the questions of risk transfer, credit, and return on investment."

GAO response: Our report states that both loan guarantees and price subsidies will be needed for a synthetic fuels industry. We believe this point of view is reflected in a combination of H.R. 12112 and the proposed Energy Independence Authority legislation.

69. ERDA statement: (page 52, para 5). "GAO believes that adequate information can be gained from smaller plants under government control. However, regulatory, environmental and socioeconomic information will not be credible coming from small plants. There is a critical cut-off size below which this information cannot be extrapolated to the full-size plant. Several witnesses testified on this point before the Economic Stabilization Subcommittee of the House Banking, Currency and Housing Committee."

GAO response: ERDA is in the process of having a study completed on the information received as a function of plant size. ERDA has stated that this study is now expected to be completed within 2 months. It is interesting to note that the bill (H.R. 12112) which ERDA supports has a provision for the construction of single modular 6,000 to 10,000 barrel a day shale oil plants while a commercial size plant is expected to be 50,000 barrel a day. Apparently ERDA expects to obtain the regulatory, environmental, and socioeconomic information from this smaller than commercial size plants. See also ERDA's statement 58 and the accompanying GAO response.

70. ERDA statement: (page 54, para 2). "This paragraph again makes the assertion that solar hot water and solar space heating are currently economic in certain instances, but then says that they are not being implemented because of long payback periods. The two statements are inconsistent."

GAO response: See GAO's response to ERDA's statement 40.

71. ERDA statement: (page 55, para 4). "The GAO report characterizes itself as an analysis. It appears to us rather to be a series of assertions unsupported by analysis. It is really an expression of philosophy regarding energy policy. To make an effective case, GAO should provide an analysis which demonstrates that the work of the Synthetic Fuel Task Force and the continuation of that work by ERDA, is deficient or incorrect."

GAO response: As stated earlier, we have based our observations and our conclusions on the most current data and facts available, as well as on recognized and major studies which relate to this highly complex area.

Mr. HUGHES. With respect to Mr. McCormick's comments, the general point that I would like to address is with respect to analysis, and his allegation that the report contains little or inadequate analysis.

I think that the problem before the Congress is not an analytical problem. The problem is what to do when the analysts have run out of stuff to analyze?

We are talking about a period 20 years in the future. As I perceive the problem before you, it is a standard problem of Government: What do you do when clearly there are things that need to be done, but the experts in part disagree and in part do not know?

Our rapport is a synthesis of information from a good many sources. The references in it speak for themselves. Much of the analytical work is ERDA's own analytical work.

The other principal source that we used was the Ford energy policy study. By and large, it seems to us that the data base and the analysis is relatively well agreed upon.

The question before your committee and before the Congress is, what to do about it. Following a line of reasoning that we have attempted to set forth in our report, we think that there is an alternative to the construction of commercial sized plants of the sort contemplated.

One of the principal purposes for doing that at this point with a Federal guarantee, according to ERDA, is to gain experience with which the commercial world can deal with regulatory and environmental problems and other questions generally classifiable as socioeconomic.

It is our judgment that there is another way to achieve that result. It is a way that ERDA itself practices in some areas, and it seems to us to be feasible here.

Beyond that, we are concerned that this approach to synthetic fuels will be preemptive, that it will discourage or crowd out other approaches, and therefore, the Congress should be extremely cautious about it.

ERDA has pointed out in its statement and related documents that there is already a tremendous investment in pipelines and natural gas industry, and we would point out that these plants support and add to that investment.

There is little doubt in my mind, and I think in any reasonable man's mind, that when these plants are built, whatever their economics, their products will be fed into the system, and they will be paid for by price subsidies provided by the Federal Government, or by the users themselves in the form of higher gas prices.

The effect of all of that is to lock in an arrangement which it seems to us is not yet demonstrated to be the way to go.

We think that for now, at least, the environmental and regulatory data that we are talking about could be obtained on a research and development basis by some carefully controlled plants of much smaller size, and that that course will avoid some of the implications long-run that I have expressed concern about.

Mr. DINGELL. Mr. Canfield?

Mr. CANFIELD. Part of the problem we are working with, is some of the documentation that we would all like to have is still missing.

When we testified in the spring before three committees, including yours, we indicated that the Congress might wish to delay making a decision in this area pending some additional analysis which we thought was crucial. One was the analysis that we presented to you, the other which we thought was going to come along at about the same time was the contractual analysis that ERDA was doing on the question of the type and size and scaling of the plants, and the relative relationship of that scaling to achieve the information needed on an environmental, economic, and socioeconomic regulatory information.

Unfortunately, we do not have that analysis yet, and our latest understanding is that it will probably be available to us sometime in October or November.

To some extent it is true what Mr. McCormick says, that we are having a difficult time making a convincing case that you can achieve these things through smaller plants and different ways.

On the other hand, we do not have available to us yet the kind of analytical detail that we think is necessary to make that decision.

Mr. DINGELL. Have you requested that detail?

Mr. CANFIELD. It is just not available. The contractor is late on supplying it to ERDA. I do not believe that they could speak to it. I do not believe that they have any hope of getting the information until later this fall.

Mr. DINGELL. Who is the contractor?

Mr. CANFIELD. Stanford Research Institute.

Mr. MCCORMICK. Mr. Chairman, the documents to which Mr. Canfield refers is a series of studies, followup studies, that ERDA initiated back in the spring. I believe there are 12 or 13 of them—10 of them are complete—there are 3 left to be completed, which will be completed in the next 1½ to 2 months.

The particular two to which Mr. Canfield referred are Stanford Research Institute work that is being done for us on looking at questions of sort of optimal mix in size and strategy for the program.

I would like to point out, however——

Mr. OTTINGER. Are those not the critical questions that need to be answered?

Mr. MCCORMICK. They are critical questions, with respect to the details of implementation. With respect to the question of whether we go forward with this program, we believe that there has been a substantial amount of analysis on that subject done. We have 2,000 pages of analysis.

Mr. OTTINGER. If the conclusions of those studies is that the plants indeed that are going on line before any plants can be financed here with ERDA's demonstration of new technology will produce all the answers that you need to know about environmental, socioeconomic effects, then you have no need for this program. You say you do not want it for production.

Mr. MCCORMICK. We do not agree with that statement.

Mr. OTTINGER. Why?

Mr. MCCORMICK. We do not agree that we believe that we cannot get the kinds of information for commercial investors through the small-scale pilot and demonstration programs.

Mr. OTTINGER. That is what the studies are directed in determining.

Mr. MCCORMICK. They are not.

Mr. DINGELL. What are the studies directed at?

Mr. MCCORMICK. These two particular studies are directed at the question of optimal mix of plants for the program. Should we have two or three high Btu gas plants, should we have shale plants, how many do we need?

It is directed at that general issue of how would you tailor the program most effectively if you had a certain amount of money?

Mr. DINGELL. What are the titles of the two studies? Maybe Mr. Canfield can tell us.

Mr. McCormick. I have them right here.

Mr. Canfield. I have some ERDA information. The title of one is "Information as a Function of Plant Size." The title of the other is "Strategy and Criteria Appropriate for Optimum Plant Mix for Synthetic Fuel Information Program."

Mr. Dingell. You have two studies, the first of which—would you read the first one again?

Mr. Canfield. "Information as a Function of Plant Size." I could read to you from the ERDA factsheet, if you would like a litle more information.

Mr. Dingell. I would like for you to read it, but I would also like you to submit all information to us.

That is rather different from what you said, is it not?

Mr. McCormick. No; I believe it is the same.

Mr. Canfield. I could read you the background paragraph.

Mr. Dingell. It would be very helpful.

Mr. Canfield. It says:

Prior to a determination of the optimum technology/plant size for the synthetic fuels program, further examination is required of the relationship between plant size and information gained for each technology. It is expected that some economies of scale will prevail for these projects, but that other factors, such as site requirements, project costs and risk, infrastructure and environmental/socioeconomic impacts may result in a maximum information/cost ratio from smaller plants, (i.e., two module plants versus five module plants). The results of this study will be used in conjunction with the study entitled "Strategy and Criteria Appropriate for Optimum Plant Mix" in order to structure subsequent procurements.

The contractor will provide an assessment of the information gained from various plant sizes, for each of the major synthetic fuel technologies (oil shale, hi and low Btu coal gasification, and biomass energy). Types of information that should be taken into account in this assessment include: economies and plant costs, potential infrastructure, restrictions, socioeconomic and environmental data, technological reliability, regulatory factors, transportation requirements, mining requirements. The contractor should determine the key categories of information.

Mr. Dingell. Are you reading from an ERDA document? What is the name of the ERDA document?

Mr. Canfield. It is from their factbook on the synthetic fuels program, this yellow book, Mr. Hunt has a copy of it there.

Mr. Dingell. Which tab?

Mr. Canfield. Maybe I am misquoting the document.

We have two sheets. There is similar information required.

Mr. Dingell. I would like to have the whole submitted for the record. If you would see to it that that is done, it would be very helpful.

[Testimony resumes on p. 658.]

[The document referred to follows:]

MARCH 1976

PROPOSED SYNTHETIC FUELS COMMERCIAL DEMONSTRATION PROGRAM

FACT BOOK

UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

FACT BOOK

Synthetic Fuels Commercial Demonstration Program

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FACT BOOK

President's Program
Synthetic Fuels Commercialization

Introduction

The United States dependence on foreign sources of oil and gas continues to grow. Domestic production of oil and natural gas has been declining since the early 1970's. Even with the development of Alaskan and Outer Continental Shelf oil and gas, improved energy conservation, expansion of nuclear power capacity, and greater direct burning of coal can buy time, our dependence on foreign sources of oil and gas will continue to grow after 1990 if synthetic fuels are not produced in substantial quantities.

The Administration has proposed and is taking where possible a number of actions to deal with the near-term problem of our growing dependence on foreign supplies of oil and gas. These include:

- proposed development of the Naval Petroleum Reserves;
- phased decontrol of domestic oil and proposed price deregulation of interstate gas;
- conversion of selected oil and gas burning power generating stations to coal;
- incentives for conservation through home insulation, auto fuel economy standards, car pooling, energy efficienct appliances, etc.;
- proposed Energy Independence Authority to encourage greater domestic production of supplies; and
- the development of a strategic oil storage system and emergency preparedness measures to deal with potential embargoes.

Successful implementation of these initiatives will, in the short term, help minimize our growing dependence on foreign oil and gas. However, this dependence will continue to grow particularly after 1990. For this important reason, the President continues to propose that we now undertake the first important step toward the development of a synthetic fuels industry--a Federally sponsored Synthetic Fuels Commercial Demonstration Program.

The Proposed Program

The proposed program would encourage the private sector to construct and operate "first-of-a-kind" commercial-scale synthetic fuel plants. These initial plants include:

- shale conversion to synthetic petroleum;
- coal conversion to gas and clean boiler fuels;
- waste conversion to gas, oil and other fuels.

The major objectives of the Synthetic Fuels Commercial Demonstration Program are:

- to gain early information and to initiate development of industry infrastructure by:
  - investigating financing, environemntal, economic, institutional, technical, and other potential problems; and
  - promoting a limited amount of private sector synthetic fuels experience.
- to supplement existing and planned domestic energy production by:
  - reducing reliance on imports; and
  - providing less expensive energy if world oil prices rise.
- to improve U.S. international position in energy matters by:
  - demonstrating U.S. capability to tap its vast resources (see Exhibit A); and
  - establishing U.S. leadership among consuming nations in energy development.

The President is requesting early Congressional enactment of the Program and is requesting supplemental FY 1976 funding for Federal loan guarantees to initiate the first phase of a synthetic fuels commercial demonstration program designed to achieve about 350,000 barrels/day of oil equivalent production by the early 1980's.

This is the first phase of a possible two-phase program which could ultimately encourage up to 1 million barrels equivalent daily production of synthetic fuels in the 1985 time frame. The President has designated ERDA to administer the first phase, 350,000 bbl/day program since it is a commercial demonstration program. When it is enacted, the President's proposed Energy Independence Authority would assume the financing responsibilities for the synthetic fuels program and similar energy programs involving Federal financial incentives.

The remainder of this fact book provides information on the size and content of the proposed program, its scope and method of implementation as well as a discussion of the potential environmental, socio-economic and other impacts of the program, and the measures recommended to limit their impacts.

A

FACT SHEET

Need for Early Commercial Demonstration

A program should be initiated now to encourage the construction and operation of a limited number of first-of-a-kind synthetic fuel commercial demonstration plants. This program is necessary because of the large projected demand for synthetic fuels in the 1990's, the lead time (10-15 years minimum) required to build a new industry, and the present financial and other risks associated with investments in first-of-a-kind commercial-scale synthetic fuel plants. Each of these three points is discussed separately.

- Domestic supplies of oil and gas are projected to decline beginning in the late 1980's. Production of domestic oil and natural gas has already fallen in the last several years and even with deregulation and decontrol, domestic oil and gas supplies would only be sufficient to limit further growth in imports for another 5-10 years. Even using advanced oil and gas recovery techniques and extensive production from the Outer Continental Shelf and Alaska, imports would continue to rise substantially if synthetic fuels were not available in substantial quantities by 1990's.

- The projection that synthetic fuels will be needed in substantial quantities in the 1990's is based on realistic estimates of domestic production of oil and gas and also assumes substantial growth in nuclear power as well as optimistic projections of the contributions from energy conservation and from alternative supply sources such as solar and geothermal. If any of these domestic energy supplies fails to provide its expected contribution, then the need for synthetic fuels could be more than the currently estimated demand for 1995 (5 million barrels per day).

- Initiating a synthetic fuels industry to be financed in the private sector and capable of providing about 5 million equivalent barrels/day of production capacity (i.e., about 100 major plants) by 1995 will require an early "commercial demonstration program" to resolve a number of uncertainties related to regulation, environment, financing, labor, economics, and transportation. These uncertainties must be resolved by the middle 1980's in order to enable adequate plant investment in the late 1980's. Thus, the lead times involved require the construction and operation over the next 5 to 10 years of a representative mix of synthetic fuels plants to obtain all the necessary data and information needed prior to a major industry expansion.

- There are at the present time a number of serious impediments to private sector commercialization of synthetic fuels. The uncertainty in the future prices of world oil is an important factor discouraging

private investment. If world oil prices were to fall substantially, forcing synthetic fuel prices down with them, large plant investments could not be paid off from revenues of low price, but initially high cost, synthetic fuels. In addition to the large plant capital risks, there are numerous environmental uncertainties, regulations that must be met, and uncertainties concerning the adequacy of available labor and materials. Federal Government involvement is needed to reduce the risks posed by these uncertainties.

B

FACT SHEET

Need for Federal Assistance

Although there are many commercial-scale synthetic fuel plants in various stages of planning and design, none has yet proceeded to construction or has even obtained firm financing. The general reason for this is that there are, at the present time, large financial risks associated with constructing these "first-of-a-kind" commercial demonstration plants even though in some cases the fuels produced from these plants are expected to be competitive (e.g., shale oil) or are in great need (e.g., synthetic gas).

Specifically, the major reasons why industry has not, and is not likely in the next few years to make large synthetic fuel plant investments are:

- The present uncertainties about the future costs of synthetic fuels. Although in almost all cases, the technologies that would be included in this program are well known and have either been domestically demonstrated at the pilot plant scale or at larger scale outside the U.S., there are still uncertainties about the product costs due to inflation, timely availability of labor, equipment and raw materials and potential scale-up problems that may arise in constructing a "first-of-a-kind" plant.

- Uncertainty in the future competitive price of world oil. The product of a large synthetic fuel plant, such as an oil shale plant, must compete in a managed market against world oil. If the investor in a $1 billion plant does not have good assurance that the product of his plant can be sold at a price which will allow amortization of his debt plus a reasonable return on investment, then no investment will be made. If the OPEC producers drop the world oil price, even if temporarily, this could cause a default on plant debt. Thus, even though shale oil may be priced at 13-14/bbl. which is competitive with today's world oil price, there is no assurance to the investor that it will be competitive over the next 5-10 years. As world oil supplies decrease in the late 1980's to the point where world oil price will be governed by supply/demand relationship and not by cartel pricing policies, it is expected that synthetic fuels will become increasingly competitive.

- Large capital risks relative to company assets. The net worth of many of the companies which might sponsor synthetic fuels plants are not large compared to the investments required for the plants. This is especially the case for gas pipeline

companies, the largest of which has a net worth of less than $1 billion which is less than required capital investment for a $1 billion synthetic gas plant. Even for large companies such an investment is significant and would be made only if there were reasonable assurance of a favorable return on investment. For the largest companies, raising the required capital for a project which is sound is not a problem, the problem with synthetic fuels ventures is they are relatively more risky than other potential energy and non-energy investments.

- Risk of major project delays. Another reason industry is reluctant to make large synthetic fuel plant investments is the risk of major project delays during construction or start-up due to environmental, regulatory or other reasons. Since no synthetic fuel project has been completely through the regulatory processes, there is uncertainty about the nature and extent of potential delays.

In summary, without Federal financial incentives, it is unlikely that significant quantities of synthetic fuels will be produced by 1985. Without such production, many uncertainties associated with the viability of synthetics cannot be resolved, thus permitting large scale private investment for production capacity by the middle 1990's.

C

FACT SHEET

Information Gained from the Synthetic Fuels Program

Since the early 1950's, U.S. efforts related to synthetic fuels development concentrated on pre-commercial R&D efforts concerned primarily with coal conversion and surface retorting of shale. Over the past five years a number of refinements to these technologies have taken place. These evolutionary developments, however, still remain untested at commercial scale in the U.S. Because of the significant capital costs involved, the regulatory uncertainties and the unknowns concerning OPEC cartel pricing policies, investors are reluctant to assume the large risk associated with first-of-a-kind commercial-scale synthetic fuel plants. The proposed Synthetic Fuel Commercial Demonstration Program is designed to reduce the risk to investors in the initial plants while at the same time providing valuable information on the environmental, economic, institutional and other factors which will influence the initiation of a synthetic fuels industry. This information is vital in formulating U.S. energy policy since a determination should be made in the next 5 to 10 years as to whether synthetic fuels can, in fact, offer a significant alternative to foreign sources of oil and gas beginning in the later 1980's.

If, as projected, a U.S. synthetic fuels industry capable of providing about 5 million equivalent barrels/day of production capacity (i.e., about 100 major plants) will be needed by 1995, the proposed commercial demonstration program is required in the immediate future. This is due to the need to resolve the economic, environmental, regulatory and other uncertainties by the middle 1980's in order that adequate plant captial investment can be made in the later 1980's to achieve significant synthetic fuel produciton levels prior to the turn of the century. Thus, the lead times involved require the construction and operation within the next 10 years of a representative mix of commercial-scale synthetic fuel plants to obtain the necessary data and information related to commercial viability.

The first phase of the program would involve the construction and operation of about 12-17 commercial demonstration plants using different energy resources (e.g., coal, oil shale, municipal wastes) and technologies that would result in a total synthetic fuel production capacity of an equivalent of about 350,000 barrels/day of oil. Specifically, the information to be gained and deemed to be necessary to facilitate the commercial introduction of either first or second generation synthetic fuels technologies includes:

1. Engineering Plant Operations Data

The main differences expected in terms of information obtained from commercial-scale operations as opposed to demonstration/pilot program levels include:

- Continuous plant operations

  Commercial-scale plants involve continuous plant operation which provide information on integrated component durability and lifetimes; whereas, pilot and demonstration operations are characterized by many short runs that test the technology. Also, continuous commercial-scale operations will verify product quality and uniformity which is particularly significant for liquid products such as oil from shale.

- System reliability/operability

  A commercial-scale plant is typically operated by crews largely composed of skilled or semi-skilled workers -- not engineers. A pilot or demonstration plant is usually more extensively instrumented to obtain technical and engineering data and is operated by a crew that has an unusually large percentage of technical and professional skills. The reliability of a commercial plant as an ongoing system can be more confidently estimated from data gained during typical commercial plant operations than from the atypical testing procedures and personnel used in pilot and demonstration plant operation.

- Occupational health and safety data

  Normal operating procedures of a commercial-scale plant will give realistic information that could not be gained from small-scale pilot or demonstration operations.

2. Environmental and Socio-Economic Information

A pilot or demonstration plant allows for estimating pollutants emitted from larger size plants. Yet, it is only through the construction of commercial size facilities that reliable information can be obtained about the combination of environmental impacts. Such facilities would demonstrate the combined impacts of the plant itself, large population migrations (with attendant demands on air, water, and community services), as well as providing the opportunity to formulate effective measures for controlling these impacts to acceptable levels.

- Air Quality

  Commercial scale plants are required to design and test effective control measures to minimize air pollution and meet applicable air quality control standards. Furthermore, commercial-scale plants will be needed to provide a sound basis for determining new source performance standards.

- Water Quality

  It is currently expected that synthetic fuels plants will contain total water reuse systems and will have zero discharge to surface or ground waters. A full scale commercial facility is necessary to see if, in fact, this system can be implemented. Additionally, for oil shale operations there are many uncertainties concerning the impacts on water quality of mining and reclamation. The small scale tests that have already been carried out have not resolved these uncertainties because the size of the effected region is too small to model a large-scale operation realistically.

- Land Disturbance

  Huge spoil piles that result from coal surface mining operations can be regraded to approximate the original contour and vegetative cover can be reestablished. The revegetation steps, however, are presently at an experimental stage. Commercial scale synthetic fuel facilities requiring coal and oil shale mining operations will provide opportunities for extensive, realistic field experiments to confirm the results of research already being sponsored on a small scale by the U.S. Environmental Protection Agency and the U.S. Department of Agriculture.

- State and Local Socio-Economic Impact

  A commercial size coal gasification or oil shale plant might require a total worker and family population of about 20,000 during the construction period and about 10,000 during normal operations. Should this population have to move into a remote area, additional investments in community facilities for increased water supply, sewage and solid waste treatment, fire service, recreation, police and health services, etc. would be required. Since the Synthetic Fuels Commercial Demonstration Program would contain community planning and impact assistance provisions, valuable experience would be gained in effectively dealing with these impacts in the future at a minimum risk to the affected community.

3. Plant and Mining Facility Economic Data

Small scale pilot or demonstration projects are designed mainly to answer questions associated with the "workability" of the technology. In general, economic data related to final product costs are of lesser importance in such sub-commercial scale operations. Large scale (commercial) projects, on the other hand provide a basis for obtaining a range of economic information:

- Capital Investment Costs

  The construction of a commercial scale plant and its associated ancillary facilities (i.e., mine, product distribution system, etc.) will provide reliable information on capital costs thus enabling preliminary rate-of-return estimates based on smaller scale projects to be validated or improved.

- Operating and Maintenance Costs

  Operating commercial scale plants on a continuous basis as opposed to a pilot/demonstration plant which typically operate intermittently, allows ongoing operating and maintenance schedules to be examined in order to establish the most efficient (least cost/technological and environmentally sound) procedures. Potential cost reductions in operations will have a significant impact on the eventual competitiveness of synthetic fuels.

- Economies of Scale

  In general, large industrial plants experience decreasing costs per unit of output as plant size increases. These economies are usually related in a non-linear fashion to the level of production. The magnitude and range of output over which these economies of scale pertain to synthetic fuels plants can only be accurately determined by commercial-scale operations.

- Comparative Economies of Competing Technologies

  Significant differences in final product prices among competing technologies (e.g., Tosco, Union or Paraho oil shale retorting technologies) can be established only as the price relationships are verified in scaling up to commercial plant sizes.

- Overall Economics of Venture

  In addition to information on the direct cost of construction and plant operation, other cost information essential to product pricing can be obtained from commercial-scale operations, e.g., transportation costs, reclamation costs, marketability of by-products, impact of regulation etc., can be examined. Information on these costs cannot adequately be obtained from small-scale pilot or demonstration projects since the plants are not designed to examine the economic viability of an integrated industrial complex.

- Advanced Mining and Feed Systems

  Related to economies of scale is the adoption or development of more sophisticated, higher output mining and feed systems most especially in the area of oil shale mining. Gaining operational information on advanced mining operations on a commercial scale for synthetic fuel plants will make future adaption periods much smoother, reducing costs and the time to attain efficient plant capacity utilization.

4. Project Financing Information

   - Investment Uncertainty

     Commercial demonstration projects will provide much of the information necessary to remove or mitigate uncertainties that presently inhibit investment in synthetic fuels plants. Removal of these uncertainties will most likely result in establishing the commercial viability of the processes involved. This will resolve financial community (equity investors and lenders) uncertainties and will permit the private sector in the mid 1980's to analyze more accurately investment risks and to make better investment decisions regarding synthetic fuels. Without realistic commercial scale operations, it is doubtful the financial community would be convinced that synthetic fuels technologies represent reasonable investment opportunities.

   - Private Sector Financing Experience

     Unlike pilot and demonstration plants which are financed as R&D investments either entirely with Federal funds or through a combination of Federal and participating company funds, the plants to be constructed under the ERDA commercial demonstration program would be financed in the private sector although partially guaranteed by the Federal government. The essential difference, however, is that valuable experience in financing these new projects will be gained both by the lenders involved and by the project sponsors.

5. Product Distribution and Marketing Information

   - Product Substitution

     Commercial demonstration projects should be designed, in part, to assist in the establishment of the acceptability of the projects, including determintion of their competitive posture in the marketplace, and to expose any anomalous marketing characteristics. This information will arise

from the requirement that the large commercial quantities being produced by the plants will have to be marketed and sold in markets where they must compete with their naturally derived counterparts and other proposed substitutes. This is typically not the case for smaller quantities of products produced through pilot and demonstration plants.

6. Regulatory Information

- Federal and State Requirements

  One of the major information benefits of the synthetic fuels commercial demonstration program will be derived from having synthetic fuels projects complete the applicable Federal and state regulatory processes. Although many regulatory requirements apply to smaller demonstration plants, such realistic regulatory issues as Indian lands and resources, rate proceedings before the Federal Power Commission and state regulatory authorities will only be examined with commercial-scale plants. Finally, substantial questions regarding the implications of state regulations will require early resolution before commercial investments will be made.

7. Water Requirements Data

- Water requirements for coal and oil shale mining operations are almost exclusively for dust control and land reclamation. Many synthetic fuel plants will also require substantial quantities of water as a feed stock or raw material. While supplying large quantities of water may not present serious problems in the East, water is scarce in many parts of the West. Commercial operations in the West will, in many instances, require deep well drilling to obtain the necessary water from acquifers, whereas from small scale pilot or demonstration plants enough water can be obtained from surface sources. The effect of such water withdrawals on aquifer recharge rate presently is unknown.

8. Information Concerning Public Acceptance

- An important category of information for potential future investors in synthetic fuels plants is whether such plants will be publicly acceptable. Experience in the electric power area has demonstrated that this issue is an important determinant in utility decision making. By constructing and operating a variety of commercial-scale plants, significantly better information will be obtained concerning the likely outcome of the public acceptance issue as it applies to the various synthetic fuel categories.

9. Manpower & Equipment Needs

- Pilot or small scale demonstration projects operate at levels for which unique equipment or non-professional skilled manpower requirements are minimal. On the other hand, a commercial demonstration project generally requires a wider range of equipment and a large number of non-technical and engineering manpower skills. For example, to produce 50,000 bbls/day, a shale oil complex will mine some 65 to 70 thousant tons of shale per day utilizing current technology. This is more than three times the output of present day large scale coal mines. The scaling-up of the equipment, general operational reliabilities, and magnitude of the operation required to extract, transport, and process this amount of shale can only be verified by actually developing a commercial-size operation. Similarily, the technical skills to operate a large, integrated and first-of-a-kind industrial complex can only be developed gradually and under commercial scale conditions.

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D

FACT BOOK

Description of Proposed Program

The President has proposed a goal of assuring the production of up to 1 million barrels/day oil equivalent of synthetic fuels by 1985. This goal has led to the development of a contingent two-phased program.

The first phase of the program is designed to demonstrate the technical, economic and environmental feasibility of commercial-scale plants using available technologies. This phase involves the construction and operation of about 12-17 commercial-size plants using different energy resources and technologies and resulting in a total capacity of about 350,000 oil equivalent barrels/day. The President recommended proceeding with this phase and is requesting the Congress to permit its implementation.

Decision to proceed to a second phase of the program is not anticipated until the 1979/1980 time frame and will depend on:

- more information on environmental and other impacts;
- results of ERDA's second generation technology R&D efforts in terms of modifications permitting lower cost production.
- better information on the world energy situation; and
- industry response to Phase I.

The first phase of the synthetic fuels program includes:

- providing on a competitive basis, limited financial incentives to the private sector for commercial demonstration plants to overcome existing financial uncertainty;
- expediting, through administrative action, the necessary Federal regulatory permits and clearances;
- providing financial guarantees or assistance to localities for needed socio-economic infrastructure planning and development;
- ensuring rigorous environmental protection through an environmental protection strategy; and
- assuring that the technology utilized in the initial commercial demonstration plants will be made available to all interested firms at a reasonable cost.

The commercial demonstration program would include a mix of plants and technologies designed to provide maximum information on the operation of synthetic fuel plants. A possible plant technology/resource mix and production capacity for the program is:

Type of Plant	Possible Number	Est. Production Capacity-Each Plant (bbl/day oil equivalent)	Affected Industry
• High BTU Coal	3	up to 40,000	Pipeline gas
• Oil shale Conversion	2-3	up to 50,000	Petroleum
• Substitute Fuels Utility/Industrial	4-6	up to 25,000	Utilities/ Industrial Users
• Biomass Conversion (Gas/Liquid)	3-5	up to 6,000	Various
Totals	12-17	up to 350,000	

The actual plant sizes and number of plants may vary somewhat depending on the proposals received from interested firms and the estimated environmental impacts.

Recommended Financial Incentives

The proposed approach is to encourage the construction and operation of these plants by providing limited financial incentives to the private sector. The government would also administratively assist firms in securing Federal regulatory permits and clearances required for synthetic fuel plants.

The form of financial assistance to be provided under the program varies by the type of plant and whether the affected industry is regulated or nonregulated. The basic proposed forms of financial assistance to be offered are loan guarantees, price guarantees and construction grants. For each type of synthetic fuel plant, a specific type of incentive(s) will be provided to at least partially remove the financial and market risks associated with plant construction and operation. The proposed approach is to share the underlying risks between the developer, the government, and the consumer. The risk sharing approach is designed to minimize, to any single party, the catastrophic financial effects entailed in failure of a plant which may cost in excess of a billion dollars. A competitive award process is planned. The evaluation of offers to build a synthetic fuels commercial demonstration project will include consideration of the amount of Federal assistance required by the offerer.

The following table summarizes the incentives identified as appropriate for each plant type:

Plant Technology	Affected Industry Regulated/Nonreg.	Construction Incentive	Operating Incentive
• High Btu Gasification (pipeline gas)	Regulated	Non-Recourse loan guaranty of up to 75% of estimated project cost	Not necessary if regulatory ruling permits cost of service recovery
• Oil Shale and Unregulated Utility/ Industrial Fuels Conversion	Nonregulated	Non-Recourse loan guaranty of up to 50% of estimated project cost	Price guaranty
• Utility/Industry Substitute Fuels	Regulated	Construction grant of up to 50% of estimated project cost	Not necessary if regulatory ruling permits cost of service recovery
• Biomass Conversion	Nonregulated	Non-Recourse loan guaranty of up to 75% of estimated project cost	None

Each incentive combination is designed to provide enough Federal assistance to encourage plant development. Each combination also requires considerable financial commitment by a private firm.

E

Relationship of RD&D Program to Commercial Demonstration Program

ERDA has, as a major aspect of its non-nuclear energy activities, the development of alternative technologies to reduce America's dependency on diminishing domestic supplies of oil and gas. Such technologies would make use of coal and oil shale, as well as organic wastes, and would result in the conversion of these materials into clean synthetic fuels including gas and oil. The demand for synthetic fuels in the U.S. for the middle 1990's is projected to be about five million equivalent barrels/day of production capacity. If synthetic fuels are not available in such quantities by the 1990's, imports would continue to rise substantially.

Because of the long lead times required to design, construct, and bring into operation commercial-scale synthetic fuel plants, and because of the need to have a substantial production capability for synthetic fuels in place in the 1990's, there is a need to proceed in parallel with two kinds of activity. The first is ERDA's Fossil Energy research, development, and demonstration program which is associated with advanced or second-generation synthetic fuels technologies. These second-generation technologies are not as yet sufficiently mature to be the basis for commercial-scale plants, although it is eventually expected that they will be economically superior to present technology. The second kind of activity is commercial-scale demonstration of first-generation or available technologies in order to gain early information and experience for the industry and investment community related to the commercial viability of synthetic fuel ventures. (See TAB C for a more complete discussion of the information to be gained from this program).

These two kinds of activity are very different: the first emphasizes scientific and technical feasibility of components and processes, while the second emphasizes resolving economic, environmental, regulatory, social and other uncertainties which inhibit early commercialization.

From an operational standpoint, the programs differ in the following respects:

- ERDA's Fossil Energy RD&D program will be funded on a cost-shared basis with industry and will result in the construction and operation of single module demonstration plants using advanced technology components near commercial scale. The cost-sharing approach is used because of the greater technical risk associated with advanced technology demonstration plants and the need for the government to reduce the costs to industry of such projects.

- The proposed Synthetic Fuels Commercial Demonstration Program would be operated primarily with loan and price guaranties and, in general, would result in the construction and operation of commercial plants with several modules of commercial-scale equipment. The guarantee approach is recommended because of the lower technical risk, although there are still substantial financial risks associated with first-of-a-kind commercial-scale plants. (See TAB B for a more complete discussion of these risks and TAB F for a discussion of the recommended financial incentives).

F

FACT SHEET

Rationale for Recommended Incentives

The recommended financial incentives were arrived at after consideration of the overall goal and objectives of the commercial demonstration program. Specifically, the goal of accelerating synthetic fuel production in the 1976-1985 time frame can only be met with incentives that address the financial economic and regulatory uncertainties that currently constrain investment in synthetic fuels by private industry.

The financial incentives considered included loans, loan guaranties, purchase agreements, price guaranties, construction grants, government ownership, and tax changes including investment tax credit, construction expensing and accelerated depreciation. The criteria used to compare the incentives were:

- expected cost to the government;
- effectiveness in assuring target production;
- breadth of industry participation and competitiveness;
- minimizing Federal management involvement;
- complexity in administering the incentives;
- flexibility in program size and scope; and
- existence of necessary statutory authorities.

In general, it was concluded that:

- The price guaranty is the least costly and most effective way to overcome the uncertainty of future price competitiveness.
- The loan guaranty is the least costly and most effective way to share the front-end capital risk.
- The construction grant was needed in the electric utility sector because of debt financing restrictions.

For each synthetic fuel category, a consistent methodology was used to assess the economic barriers to investment and the associated need for financial incentives, to develop alternative incentives, to evaluate these alternatives and to select the optimum incentive. The following constraints to private sector investment in synthetic fuels were determined:

- Synthetic Oil. Except for the very largest firms (i.e., major oil companies, etc.), capital availability is a substantial barrier. Risk to capital or an inadequate or uncertain return on investment is a major concern for all potential producers. Note that only unregulated firms were determined to be viable potential producers of these synthetic fuel types (e.g., shale oil).

- Synthetic Natural Gas. All producers would be subject to price regulation by the Federal Power Commission. Accordingly, the ability to pass production costs through to consumers mitigates the constraint of return on investment. However, capital availability and exposure are significant barriers to investment for all potential project sponsors, most of which are regulated gas pipeline companies.

- Utility Fuels. Potential producers of these synthetic fuels are also regulated, and the return on investment barrier, again, is mitigated somewhat by the ability to pass costs through to the consumers. Synthetic utility fuels may in many cases cost more than the fuels they displace and the required consumer electric rate increases present potential problems with regard to regulatory approval of such projects. Capital availability has in the past been also a significant problem for potential producers of this synthetic fuel type.

- Industrial Fuels. Capital availability and exposure are major barriers to all except the very largest of these producers. The risk of inadequate return or profitability is also a constraining factor for potential producers in this sector.

Thus, the major financial risks are of two types:

- Front-end or capital risk associated with a plant failure or with a long delay which results in loan default and loss of capital.

- Price uncertainty associated with uncertain future price of world oil.

The overall assessments and the recommended incentives are shown by size of firm and by fuel type in the following table.

INDUSTRY CONCERNS AND INCENTIVE RECOMMENDED

Synfuel Category	Financial Needs: Capital Availability	Financial Needs: Capital Exposure	Financial Needs: Return on Investment	Recommended Incentive Competitively Awarded
Synthetic Oil	Not Regulated			Non-Recourse loan guaranty of up to 50% of estimated project cost.
• Major Firm	-	-	x	
• Middle Size Firm	x	x	x	
• Independent Venture	x	x	x	
• Small Firm	x	x	x	
Synthetic Natural Gas-Regulated Biomass-Not Regulated				Non-Recourse loan guaranty of up to 75% of estimated project cost.
• Major Firm	x	x	-	
• Middle Size Firm	x	x	-	
• Independent Venture	x	x	-	
• Small Firm	x	x	-	
Utility Fuels	Regulated			Construction grant of up to 50% of estimated project cost.
• Major Firm	x	-	-	
• Middle Size Firm	x	-	-	
• Independent Venture	x	x	-	
• Small Firm	x	x	-	
Industrial Fuels	Not Regulated			Non-Recourse loan guaranty of up to 75% of estimated project cost.
• Major Firm	-	-	x	
• Middle Size Firm	x	x	x	
• Independent Venture	x	x	x	
• Small Firm	x	x	x	

x serious constraint
- not a constraint

Illustrative Example - Competitive Bidding

The following example for an oil shale plant illustrates the use of the loan and price guaranty incentives and the competitive bidding approach envisioned under the proposed program.

The United States Government (USG) would solicit offers from interested and qualified firms. The amount of loan guaranty and the market price guaranty level that each firm proposes is expected to vary. If an oil shale plant were estimated to cost $1.0 billion, a firm might propose a loan guaranty to 50% of project cost or $500 million and a market price guaranty level of $12 per barrel. Another firm may propose no loan guaranty but a market price guaranty level of $15 per barrel. The meaning of a price guaranty level of $15 is as follows: Should the market price of oil fall below $15 per barrel, say to $12, the USG would pay the firm $3 per barrel for each barrel produced. Should the market price rise to $17, then the USG would pay nothing and receive as revenue a portion of the $2 in excess of the agreed-to guaranty price.

An evaluation of the expected net present value (cost) to the USG when combined with other factors characterizing the proposals would indicate which was of greatest benefit to the nation. Under the arrangement for loan guaranties for part of the project cost arrangement, the private sector company has a substantial investment of its own resources. The USG would select the best offer(s) based on least cost and on the objectives of the program. Under the proposed incentives, the USG mainly guarantees against plant failure and market price uncertainty. The USG would pay only if the plant failed or the market price of oil remained below the guaranty price. The USG would have recourse to the plant assets should a default occur but not to the assets of any parent company. It is important to recognize that the private sector will have substantial investments in funds, personnel, technology and expertise in each plant that would be a loss should the plant fail.

G

FACT SHEET

Program Budget Estimates - Synthetic Fuels Commercial Demonstration Program

Estimating the exact expected cost and corresponding budgetary authority necessary for the commercial demonstration program is complicated by the long-term nature of the synthetic fuel plant construction and operation (25-30 years) and by other significant uncertainties including:

- the future foreign/domestic market prices of oil and gas;
- the cumulative effect of inflation over this time frame;
- the overall success/failure rate of the plants.

In view of these uncertainties and the need to develop "best possible" estimates for the program, a rigorous financial analysis effort has been completed. This analysis included:

- detailed plant cost estimates for the various technologies
- detailed social infrastructure development cost estimates based on estimated increases in population in a locality attributable to the synthetic fuel plants
- use of a series of computerized cost models for each plant type with flexibility to change plant mixes to evaluate differing programs and the capacity to estimate capital as well as operating phases for each plant
- the capability to alter key assumptions for future market prices, inflation rates, plant and operating costs and the cost of energy resources used by the conversion technologies.

In the process of developing budgetary estimates, numerous program cost scenarios were estimated by changing assumptions for the market price of oil, inflation rates, cost of coal resources. Extreme scenarios were calculated based on pessimistic assumptions, e.g., market price of oil $7 per barrel. As a result of the many differing calculations, recommended budgetary requests have been formulated that are adequate for the program and will be ample to cover most unforeseen contingencies. The estimates are for the full term of the program and unless extremely adverse developments occur, the authorizations will be adequate to complete the program. It must be recognized that the budgetary authorization estimates do not represent actual cost to the government but rather reasonable estimates of funding authority necessary to implement the program.

Authorizations

Exhibits 1 and 2 show the individual plant cost estimates by type of plant including social infrastructure costs and the estimated number to be included in the commercial demonstration program. The basic assumptions used in developing these estimates are enumerated on the Exhibits. The anticipated levels of funding authorizations for loan guarantees, price guarantees and construction grants are shown at the bottom of the Exhibits and derived directly from the plant cost and operating estimates.

The President is requesting an initial $2 billion in loan guaranty authorization for FY 1976 to initiate the program in ERDA. The remaining funding authorization for loan guarantees and for price guarantees is contained in the Administration's funding request for the Energy Independence Authority for FY 1977. In the event EIA is not enacted in 1976, ERDA would need an additional authorization of $4 billion in loan guarantees and would request price guarantee and grant authorization on a project by project basis. In that event, the following authorization levels will be needed to allow execution of Phase I of the Synthetic Fuels Commercial Demonstration Program:

Loan Guaranty.....	$6.0 billion
Price Guaranty.....	4.5
Construction Grants.....	.6
Total Budgetary Authority....	$11.1 billion

Up to $425 million of the $6 billion authorization might be needed for guaranty of debt service for municipal financing of necessary social infrastructure caused by substantial increases in local population because of a synthetic fuel plant. Under this proposal the ERDA Administrator would be given the authority to guaranty debt service of municipal bonds that are necessary to finance the construction of essential capital facilities (e.g., sewers, water, public safety) to service the influx of new population caused directly by the synthetic fuel plant. A detailed description of this proposal is contained in the Socio-economic Impact Assistance fact sheet. (Tab O)

In order for the government to proceed with the complete program, the requested authorizations are needed prior to the execution of any agreements with the private sector. However, certain plants can be initiated with only a loan guaranty authorization.

While the total authorizations requested for the program exceed $11 billion, the actual cost to the government of the program is expected to be a small fraction of the requested authorization because:

- most loan guarantees are expected to be repaid and at least a portion of any defaults will be covered by fees charged for the loan guaranty and sale of any project assets that are recovered.

- actual price guaranty payments are likely to be significantly lower than than the requested authorization if the world price of oil continues to increase, which is likely.

Costs to the government will be incurred for the construction grants up to $600 million and for expenses to administer the program estimated at $10-$15 million annually. The possible cost to the Government for the program over its 20 to 30 year life is about $2.1 billion (Exhibit 5).

Borrowing Authority/Appropriation Approach/Estimates

Although there is a good possibility that loan guarantees and a somewhat lesser possibility that price guarantees will never result in the expenditure of Federal funds, the ERDA Administrator must, in order to make the recommended guarantees credible and effective, have the full authority to outlay funds in the very unpredictable circumstances when they may become needed. To accomplish this purpose, it is proposed that the ERDA Administrator be provided with a limited, renewable authority to issue notes or other obligations to the Treasury should payments be required in connection with either loan or price guarantees.

The authority to borrow from the Treasury to make payment, if required, for guarantees, was selected in favor of no specific appropriation authority or an advance appropriation arrangement for several reasons including:

- Credibility. It is important for the ERDA Administrator to have, in advance, a clear-cut authority to make payments in the event of either default or on account of the requirements of price guarantees. Such authority is necessary to remove the uncertainty on the part of investors about the timeliness of payment and/or the USG intent to pay.

- Continuity. Default or price guaranty payments are not likely to occur for a number of years.

- Surety. The precise amount of such payments are difficult to estimate and may not occur if favorable conditions result in the future.

In view of these factors, giving the ERDA Administrator limited authority to issue debt, if and when the need arises, is the most expeditious and efficient means of financing the program. Repayment of ERDA's obligations held by the Treasury would be accomplished through subsequent specific Congressional appropriations.

The Administration will transmit to the Congress separate appropriation requests for the borrowing authority consistent with the terms of the Budget Reform Act.

The following basic factors were considered in assessing the amount of borrowing authority needed:

- Time-phasing of project starts over the 1977-1979 period.
- Likelihood of projects simultaneously defaulting on loan guarantees and likely cost of default to the government.
- The expected future market price of oil and gas and any indicated price guaranty disbursements.
- The 20 to 30-year economic life of the synfuel projects.
- The need for flexible and credible program administration as well as periodic accountability to the Congress.

After analyzing these factors, it is recommended that $1.5 billion in loan guaranty borrowing authority be provided to cover possible loan default costs. ERDA debt outstanding under this authority could not exceed $1.5 billion at any time. Outstanding debt would be repaid by the ERDA Administrator by obtaining specific appropriations. This amount is 25% of the gross Federal loan guaranty liability of $6 billion (Exhibit 3). Although default costs could exceed 25%, it is very unlikely that this would occur before Congress had the opportunity to repay ERDA's debt to the Treasury. The $1.0 billion borrowing authority recommended for price guarantees will provide for about 3 years of price guaranty payments under the very pessimistic assumption that oil prices fall to $7 per barrel. Should recent trends continue for the price of oil, it is unlikely that any price guaranty payments will be made.

Construction grants are different from loan and price guarantees because they will require budgetary expenditures. A straightforward appropriation request will be made for this incentive. Consequently, even though construction grant outlays are not anticipated during FY 1976 because of the lead time in incurring construction costs, the full authorization of $600 million in grants is expected to be needed to enter into contractual agreements during FY 1977 even though outlays will be spread over a number of subsequent years.

In the event EIA is not enacted and the program were funded in ERDA, the following borrowing authorities and appropriations would be needed:

Loan Guaranty.....	$1.5 billion
Price Guaranty.....	1.0
Total Borrowing Authority.....	$2.5 billion
Construction Grants.....	$ .6 billion
Total Appropriations.....	$3.1 billion

The program's five-year projections for construction grants, administrative costs, and guaranty fees are shown in Exhibit 4..

Exhibit 1
Phase I Program Budget Authorizations
($ million, statistics include 7% annual inflation)

Plant Type	Number Scheduled for 1976-1978	Total Capital Invested	Construction Phase		Operation Phase
			Loan Guaranty	Construction Grant	Price Guaranty
High BTU Gas (regulated)	3	2,700	2,000	-	-
Shale Oil (unregulated)	2	2,100	1,050	-	900
Utility/Industrial Fuel (unregulated)	2	1,300	650	-	3,600
Utility Industrial Fuel (regulated)	2	1,000	-	500	-
Biomass (regulated & unreg.)	5	1,200	900	-	-
Social/infrastructure asst.			425		
CONTINGENCY			975	100	-
TOTAL BUDGET AUTHORIZATION REQUESTED			6,000	600	4,500

Specific Key Assumptions:
- Assumes recommended incentives of 50% loan guaranty for unregulated utility/industrial fuel, and oil shale plants; 75% loan guaranty for biomass and high-BTU gas plants; and price guaranties for shale oil and unregulated utility/industrial fuel. Should higher than recommended percentages for loan guaranties be necessary, the Contingency Reserve could accommodate.
- All statistics include 7% annual inflation rate for capital and operating costs.
- Total project investment is based on a 7-year development schedule for all plants, except for biomass conversion which are expected to be completed in a 3-year period. Plants are assumed to have a 20-year operating life.
- Investment totals do not include costs of such auxiliary developments as coal mines, roads, pipelines, etc., which, if they occur, could be accommodated by the Contingency Reserve.
- Loan guaranty statistics refer to the gross Federal commitment. The cost of an actual default will be less depending on the number of defaults if any, the timing of the default and the amount of recoverable assets.
- The contingency amount for loan guaranties and construction grants provides for construction delays, extraordinary inflation, different plant mixes, increased incentives, etc.
- The price guaranty statistics were calculated assuming that the market price for shale oil rises at 7% per year from a 1976 base of $7 per barrel, and for utility/industrial fuels, the price rises from a base of $9 per barrel. The statistics further assume that no revenues accrue to the government even if market prices exceed the guaranty level.

Synthetic Fuels Commercialization Program Budget

Exhibit 2 - Individual Project Statistics 1/

Plant Type	Size (bbl/d)	Investment 2/	Loan 3/ Guaranty	Construction Grant	Price 4/ Guaranty
Shale Oil	50,000	1000	500	-	450
High-Btu Gas	40,000	870	650	-	-
Utility/Industrial Fuel Regulated	25,000	460	-	230	-
Unregulated	25,000	610	300	-	1800
Biomass	6,000	230	170	-	-

1/ Data are rounded and a detailed cost analysis is available in the Synthetic Fuels Commercialization Task Force Report, Volume III.

2/ The 7% annual inflation rate is included, and the projects are all assumed to start in 1976.

3/ Presumes recommended incentives of 50% loan guaranty for unregulated utility/industrial fuel, and oil shale plants; 75% loan guaranty for biomass and high-Btu gas plants; and price guaranties for shale oil and unregulated utility/industrial fuel.

4/ Contingent costs for price guaranties were estimated assuming that the price of shale oil rises at 7% per year from a 1976 base of $7/bbl and for utility/industrial fuels, the price rises from a base of $9/bbl; and further assuming that no revenues accrue to the government even if market prices exceed the guaranty level.

Synthetic Fuels Commercialization Program Budget

Exhibit 3 - Possible Outlay Schedule for Price Guaranty Payments [1]

($ millions)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total Payments Thru 2005
Payments to Unregulated Utility/Industrial Fuel Plants [2]										
$9 Oil Scenario:	50	109	166	233	229	225	220	215	209	3600
$11 Oil Scenario:	34	71	106	144	134	123	111	98	84	1100
Payments to Oil Shale Plants										
$7 Oil Scenario: [3]	167	153	137	120	102	83	63	41	18	900
$9 Oil Scenario:	58	35	12	-	-	-	-	-	-	105
$11 Oil Scenario:	-	-	-	-	-	-	-	-	-	0

1/ Calculations assume 7% per year inflation in capital and variable operating costs; projects start according to the schedule of Exhibit I.

2/ No payments are assumed to accrue to the government even if oil and gas prices exceed the synthetic fuel price guaranty level.

3/ Oil and gas prices are presumed to rise at 7% per year from a 1976 base of $7 per barrel for oil and $1.65 per MMBtu for gas. The $9 and $11 scenario have proportionately higher bases, but same inflation rate.

Synthetic Fuels Commercial Demonstration Program Budget

Exhibit 4: Five-year Budget Projections for 350,000 bbl/day Program

($ in millions)

	FY 1976&TQ	FY 1977[1]/	FY 1978[1]/	FY 1979[1]/	FY 1980[1]/	FY 1981[1]/
Net Budget Outlays	3	12	26	37	55	91
Administration	3	10	15	15	15	15
Loan Guarantee[2]/	0	0	0	0	0	0
Price Guarantee[2]/	0	0	0	0	0	0
Grants	0	7	23	42	71	115
Loan Guarantee Fees Collected	(0)	(5)	(12)	(20)	(31)	(39)
New Budget Authority	503	2,610	15	15	15	15
Loan Guarantees	500	1,000	0	0	0	0
Price Guarantees	0	1,000	0	0	0	0
Grants	0	600	0	0	0	0
Administration	3	10	15	15	15	15
New Credit Authority	2,000	8,500	0	0	0	0
Loan Guarantees	2,000	4,000	0	0	0	0
Price Guarantees	0	4,500	0	0	0	0

1/ Funding for FY 1977 and beyond are shown for illustrative purposes as if these programs were funded in ERDA. If, however, EIA is created in FY 1977, the Synthetic Fuels Program would be transferred to it.

2/ No payments for either loan guarantee defaulst or price guaranties are anticipated during this period.

Exhibit 5
Possible Total Cost to Government (FY 76 thru 2005)
350,000 bbl/day Program
($ million)

Financial Incentive	Fiscal Years '76-'81	Fiscal Years 1982 - 2005	Total Cost of Program FY 76 - 2005
Loan Guarantees -Defaults (2 plants)/1	-	$ 1000	$ 1000
- Fee collected by Government (Revenue) (1% annually-debt outstanding) /2	$ (108)	(720)	(828)
Price Guarantees (assumes $11 oil scenario)	-	1,100	1,100
Construction grants	258	242	500
Administrative (assumes $10-$15 million annually)/3	74	240	314
TOTAL COST TO GOVERNMENT/4	$ 224	$ 1862	$ 2086

/1 From Exhibit 1, 12 plants require $6 billion in loan guarantees. If two plants default then, at most, $1 billion would be lost.
/2 See Exhibit 4 for Fiscal Years '76-'81. Calculation for 1982-2005 assumes average annual outstanding debt over the 24 years of $3 billion.
/3 FY 76-C1 statistic from Exhibit 4, and FY 1982-2005 assumes $10 million/year for 24 years.
/4 Fees are subtracted from outlays.

H

FACT SHEET

Status of Available Technologies

Introduction:

Technology is available that would allow construction to begin, early in 1977, on plants that could provide significant amounts of the synthetic fuels identified in this report. Operation of these plants would also lead to information that could be the basis for establishing commercial synthetic fuels industries.

Oil Shale Conversion:

The richest U.S. oil shale deposits and center of interest for current commercialization studies are in Utah and Colorado. Oil shale is a fine sedimentary rock rich in insoluble organic material called kerogen. Upon heating to 850 to 900°F, the kerogen is converted directly to liquid hydrocarbon vapors, gas and residual carbon. This heating or retorting is the key step in any propspective commercial oil shale operation. Based on the Bureau of Mines and industry research and development, several technologies recovering oil from shale are now considered ready for scale up to full size equipment. These include:

- Modified in-situ retorting in which low grade shale is mined to create a void in which to do the retorting.
- Underground room and pillar mining with surface retorting.
- Surface mining and retorting.

The surface retorting technologies that are most advanced and therefore of greatest interest to prospective U.S. oil shale operators are:

- The Oil Shale Company solid-to-solid heat transfer retort (TOSCO II).
- The Union Oil Company gas retort (Union Retort B).
- The Development Engineering Incorporated gas retort (Paraho).

Each of these has been tested at the semiworks scale (500-1000 tons/day/retort) providing a basis for commercial scale desings (10,000 tons/day/retort). Other important technologies evolving from Russian and Brazilian oil shale operations are being scaled up in these countries. The Superior Oil Company multimineral approach, now being tested at the pilot plant scale, may be of great importance to recover all mineral values in the mineral rich Piceance Creek Basin shales of Colorado.

Other steps in recovering oil from oil shale are mining, crushing, upgrading the shale oil, and waste disposal. Each have had unique technical, economic and environmental problems, the resolution of which must be confirmed by commercial scale operations.

High-Btu Gas:

High-Btu gas can be made from coal by gasification with steam and oxygen, using the Lurgi Pressure Gasification process, followed by several other processes which result in a gas that is essentially pure methane and has a heating value of about 950-970 Btu/scf.

All of the process steps have been demonstrated on a scale which provides a basis for technical confidence. The gasification process and its combination with the gas conditioning processes are based on forty years of continuous development work, and the experience from 14 commercial plants with a total of 65 gasifiers. Specifically, American coals of the kinds that would be used in the present candidate projects have been evaluated in similar gasifiers located at Westfield, Scotland and at Sasolburg, in South Africa. The tests at Westfield were made between August, 1973, and April, 1974, on Rosebud (Montana), Illinois NO. 5, Illinois No. 6, and Pittsburgh No. 8 coals. The tests at Sasolburg were made in September, 1974, on 10,000 tons of North Dakota lignite.

There has been no commercial-scale methanation of coal gasification product gas, but there is a high degree of technical confidence in this step, based on two pilot plant methanation test programs using gas from coal, and from commercial manufacture of synthetic natural gas (SNG) from naphtha (in which a pure gas containing carbon monoxide and hydrogen is reacted to make methane).

Substitute Fuels for Utility and Industrial Users:

Various fuel forms, and also various technological processes to produce these fuel forms, might be candidates in this category. Among those for which the technology appears to be ready, and for which there also appear to be interested users, are the following categories of candidates:

- Industrial fuel gas: a medium-Btu gas, essentially carbon monoxide and hydrogen, made by gasifying coal with steam and oxygen. Various commercially developed gasifiers are available for this application, including: Lurgi, Koppers-Totzek, Woodall-Duckham, Texaco, Riley-Morgan, Wilputte, Wellman-Galusha, etc. Background on the Lurgi has been discussed earlier; the Koppers-Totzek gasifier has been used widely abroad to make synthesis gas for ammonia manufacture, the

Woodall-Duckham gasifier is in use in Europe for making town gas from coal, the Texaco gasifier gasifies a coal-water slurry and is a development for the widely-used partial oxidation of oil to make gas.

The other gasifiers are smaller capacity units, with substantial experience behind them. The Riley-Morgan gasifier is a `modernized` version of the established Morgan gasifier.

Various industrial gas users and pipeline gas companies have expressed interest in using 300-Btu cu. ft. gas, made by one of the above technologies.

- Fuel methanol: methanol, possibly containing some water and other impurities, which do not interfere with its use as a fuel but may reduce its cost substantially below that for chemical methanol. This fuel is of interest as a clean storable fuel for electric utility peaking applications. It would be made from a synthesis gas ($CO+2H_2$), made by a gasifying coal in a conventional gasifier such as those cited above for making medium-Btu fuel gas. Methanol is traditionally made from a similar synthesis gas made by partial oxidation of natural gas or oil. In any case, the synthesis gas is passed over a catalyst to make the methanol. Until natural gas became cheap and abundant, methanol was made by the coal gasification route. DuPont operated a full-scale plant of this kind in West Virginia until the early 1950`s.

- Solvent refined coal (SRC): is a product made by hydrogenation of coal in a solvent derived from the process itself. The ash contained in the coal behaves as a catalyst for the process. Depending on the amount of hydrogen used, the product can be either a substitute coal (from which the ash and most of the sulfur have been removed) or a clean boiler fuel. The major development activity is underway at Fort Lewis, Washington. Scale-up to commercial capacity depends on developing a superior solid separation system to that presently available. Combustion tests on 3000 tons of the substitute coal, at a power station in Georgia, should be complete in the fall of 1976. Combustion tests of smaller scale are also in progress at the facilities of Babcock and Wilcox of Combustion Engineering.

Biomass Conversion to Gas or Liquid:

Municipal Solid Wastes (MSW) constitutes about 70 percent of the available heat content of all solid wastes, and other significant sources of combustible solid wastes include agricultural (feedlot manure), wood industry, and industrial plant trash. Energy recovery from MSW is an alternative to traditional approaches such as landfills and burning. Among the candidate technical options which result in a liquid or a gas are:

- Pyrolysis of MSW to a fuel gas.
- Pyrolysis of MSW to a fuel oil.
- Anaerobic digestion of MSW to a fuel gas.

All of these approaches are technically feasible, but their rate of acceptance will depend largely on relative efficiency and on economic considerations.

The process for pyrolysis to a fuel gas that appears closest to commercialization is the Purox process of Union Carbide Corporation. This has been demonstrated at the 200 ton/day scale at South Charleston, West Virginia, and is being offered on the market at a module size of about 300 ton/day. It produces a fuel gas with a heat content of about 300 Btu/scf. The reactor consists of three zones: drying, pyrolysis, and combustion of char. Oxygen is injected into the combustion zone at the bottom of the reactor, where it reacts with the carbon char residue from the pyrolysis zone. The specified oxygen-to-refuse ratio is about 0.2 ton of oxygen to 1.0 ton of MSW. The reactor is operated so that the temperature of the slag is about 3000°F.

The process for pyrolysis to a fuel oil that appears closest to commercialization is that of Garrett Research and Development Company. Details of the reactor design are proprietary. The process has been demonstrated at the 4 tons/day scale, and a 200 tons/day demonstration plant has been built in San Diego County.

Anaerobic digestion is a bacterial decomposition process that takes place in the absence of oxygen. Methane and carbon dioxide are produced, in an approximate ratio of 55:45. This technique might be especially useful in exploiting existing landfills. The rate of decomposition of the fill is an important variable in operating such a process. A study by the Los Angeles Department of Water and Power indicates that the methane content in the gas is 50-55% after 2-3 years, but falls to 7-8% after 5-10 years. Processes of this kind appear feasible, but there are, as yet, no large-scale demonstrations.

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FACT SHEET

Identified Candidate Synthetic Fuel Projects

Identified candidate projects for the proposed program in four synthetic fuel categories are shown in the attached table. For some of these projects the sponsors have already invested considerable capital, acquired sites and leases, made detailed development plans, and tested the chosen technology at a demonstration level. Other projects are still in the formative stage but could commit to construction by January, 1979.

In general, the following is concluded regarding these potential projects:

- $250,000 to $210,000,000 per project have already been invested and committed by industry in commercialization planning and designing activities, for a total identified investment of $800,000,000.
- Government incentives support will be needed to accelerate development schedules since no project has yet committed to construction.
- Assistance may be needed to help individual projects resolve schedule delays caused by legal and regulatory constraints.
- Most projects identified plan to use established technologies rather than "second-generation" types now under development in ERDA.
- The estimated total investment cost of all candidate projects is about $12.5 billion.

Of the eight Shale Oil projects, Rio Blanco, Superior and White River have active programs underway. Development progress appears to have slowed considerably for Colony Development and Federal Shale Lease Tract C-b. Superior Oil stated that their activity will proceed independent of incentives support.

For High BTU Synthetic Natural Gas (SNG) projects, ESCO, ANG, El Paso (Burnham), Panhandle Eastern, and Dunn Center have already completed most of their planning and design activities. Their readiness to commit to construction, however, still requires one or more of the following:

- Full financial commitments
- Applicable government permits
- Environmental impact statements

- Coal and water resource commitments
- Established and acceptable product market prices.

All of these active projects plan to use proven Lurgi technology.

Candidate projects in the Utility/Industrial Fuels category include low/medium BTU gas, and liquid fuels from coal. These projects generally are both smaller in capacity and cost than the shale oil or SNG plants.

Many projects are underway for converting municipal solid waste. Biomass combustion plants were excluded from this category since this application appears to be growing significantly without incentives. Only a few projects were identified which plan to use pyrolysis techniques to produce gas or oil products and can meet the timing criterion for initial commercialization incentives.

Synfuel Product	Project Name	Synfuel Produced	Plant Size	Location	Technology Used	Beginning of Construction/ Beginning of Operation	Funds Expended to Date	Project Cost	Project Status
Shale Oil	Colony Development	Shale Oil	48M B/D	Parachute Creek, Colo.	Underground mining, TOSCO II retorting	1977/1980 (contingent on incentives)	204.1MM	1.1B	Suspended state; P & D of commercial plant completed
	Occidental Petroleum	Shale Oil	40M B/D	Garfield County, Colo.	Modified in-situ retorting	1977/1980 (estimate - firm dates contingent on demonstration)	30MM	400-600MM	In-situ commercial size demo. started December 1975; full commercial expansion contingent on demo. perform.
	Rio Blanco	Shale Oil	50M B/D	Piceance Creek Basin, Colo.	Open pit or underground mining, TOSCO II retorting	1977/1980	5MM	1.0B	DDP to be submitted in March 1976, site development to start in April 1977 contingent on DDP
	Superior Oil	Shale Oil, Minerals	50M B/D	Piceance Ck. Basin, Colo.	Underground mining, prop. retorting proc.	1978/1982	Not available	600MM +	Schedule contingent on land exchange; EIA underway
	TOSCO Sand Wash	Refined Shale Oil	75M B/D	Uintah Basin, Utah	Underground mining, TOSCO II retorting	1982/1985	1.0MM	1.5B	Planning & feasibility studies; mine exploration
	Tract C-b	Shale Oil	50M B/D	Piceance Ck. Basin, Colo.	Underground mining, TOSCO II retorting	1979/1983	117.8MM (or committed)	973MM	DDP being prepared; site development contingent on DDP
	Union Oil	Shale Oil	50M B/D	Parachute Creek, Colo.	Underground mining, Union "B" retort	1977/1979 (7000 B/D)	Not available	110MM (7000 B/D)	Project construction is pending financing, (7000 B/D first module)
	White River Shale Oil Corp.	Shale Oil	50M B/D	Uintah County, Utah	Underground mining, TOSCO II & Paraho retorting	1976/1980 (10,000 B/D module)	129.7MM (or committed)	600MM-1B	DDP being prepared; site development to start in 1977 contingent on DDP
High BTU Gas	ANG Coal Gasification Co.	SNG	250MM CFD (40M B/D)	Beulah North Dakota	Surface mining, Lurgi gasifier w/methanation	1977/1981	25MM (or committed)	900MM	Construction pending financing and FPC certification
	Dunn Center (Nat. Gas Pipe.)	SNG	250MM CFD (40M B/D)	Dunn County, North Dakota	Surface mining, Lurgi gasifier w/methanation	1978/1982	11MM	1.0B	FPC filing in 1976; construction pending FPC certification
	El Paso (Burnham)	SNG	250MM CFD (40M B/D)	San Juan Cty. New Mexico	Surface mining, Lurgi gasifier w/methanation	1977/1980	12MM (or committed)	1.0B	Construction pending financing and FPC certification; coal lease being renegotiated
	Panhandle Eastern	SNG	250MM CFD (40M B/D)	Converse Cty. Wyoming	Surface mining, Lurgi gasifier w/methanation	1978/1982	10MM	1.0-1.2B	Construction pending final financing plan and FPC certification
	WESCO	SNG	250MM CFD (40M B/D)	San Juan Cty. New Mexico	Surface mining, Lurgi gasifier w/methanation	1976/1980	20.0MM	825MM	Pending FPC certification; preliminary plant engineering completed
Utility/ Industrial Fuels	Columbia Coal Gas. Corp.	300 BTU Gas	21B BTU/D (3750 CBE/D)	Coatesville, Pa.	Koppers-Totzek	Operational 50 months after go-ahead	Not available	114MM	Preliminary study completed
	Consolidated Natural Gas - 3 projects	300 BTU Gas	70B-100B BTU/D (4900-7000 CBE/D)	Cleveland; Ohio River/ West Va.; Pa.	Koppers-Totzek; Babcock & Wilcox; or Texaco Partial Oxidation	1977/1980	25MM	120MM (Cleveland plant)	Exploratory studies

Synfuel Product	Project Name	Synfuel Produced	Plant Size	Location	Technology Used	Beginning of Construction/ Beginning of Operation	Funds Expended to Date	Project Cost	Project Status
Utility/ Industrial Fuels (Cont.)	Consumers Power	300 BTU Gas	188MM CFD (12,000 CBE/D)	Bay City, Michigan	Riley Stoker or Koppers-Totzek	1977/1980	20M	178MM	Preproposal
	LAMPCO	140 GTu Gas	115 MWe (5000 CBE/D)	Baldwin, Louisiana	Texaco Partial Oxidation	1977/1980	Not available	62MM	Economic and engineering reports finalized and documented
	UGI	Methanol	2500 T/D (9500 CBE/D)	Pennsylvania or Ohio	Texaco	1976/1981	500M	300MM	Planning
	Wheelabrator-Frye	Boiler Grade Fuel, Naphtha	46M B/D Boiler Fuel, 4M B/D naphtha	North Central Alabama	SRC Process	1977/1980 (Plant No.1)	28MM	100MM (Plant No. 1)	Feasibility study
Biomass	Baltimore, Md.	Pyrolysis Gas	1000 B/D	Baltimore, Md	Monsanto Landgard	1974/1978	16.0MM (or committed)	Not available	Halt in operation to add additional pollution control equipment
	Minneapolis-St. Paul, Minn.	Pyrolysis Gas & Oil, Char	360 B/D	Minneapolis-St.Paul,Minn.	Union Carbide Purox	1977/1980	Not available	20.0MM	Feasibility study
	New York Metropolitan Area	Pyrolysis Gas	3500 B/D	New York City	Union Carbide Purox		Not available	Not determined yet	Feasibility study
	*Brooklyn Navy Yard					1980/1981			
	*Fountain Avenue					1981/1983			
	*Northern Queens					1982/1984			
	San Diego Cal.	Pyrolysis Oil	110 B/D	San Diego County, Cal.	Garrett Flash Pyrolysis	1974/1976	9.0MM (or committed)	Not available	Under construction

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FACT SHEET

Synthetic Fuel Product Prices

Estimates of typical prices for several synthetic fuel types follow. No commercial-scale product fuel plants have been built in the United States and therefore no firm prices for fuel from such plants can be quoted.

In addition to the assumptions shown on each cost sheet, the prices are subject to a variety of assumptions. The most critical are:

- The estimated rate of inflation during the period between January 1, 1976, and the date when construction starts.
- The time period required for construction.
- Plant life is assumed to be 20 years--a minimum estimate.
- Return on investment is calculated as a 15% discounted cash flow (dcf) for the "no incentive" cases and 20% dcf on the equity portion of the "with incentives" cases.
- Capital estimates to build plants and the required returns on capital.

Note, the required selling price for synthetic fuels is particularly sensitive to capital charges. An illustration of this sensitivity for one fuel - shale oil - follows the price illustrations (Exhibit E). A relatively sharp rise in selling price accompanies increases in assumed discounted cash flow rate. Note also that at a 15% discounted cash flow rate, an addition of 25 cents per barrel in capital cost raises the required selling price of the fuel from $14.45 per barrel to $15.98 per barrel.

EXHIBIT A

HIGH BTU (PIPELINE QUALITY) GAS — REGULATED CASE

Product Price Per 1000 SCF in 1-1-76 Dollars

OFFICE OF COMMERCIALIZATION ESTIMATES

Without Incentives			With Incentives	
$***	%		$***	%
3.28	*100.0*	Total	3.28	*100.0*
.37	*11.3*	Interest	.37	*11.3*
.22	*6.7*	Profit	.22	*6.7*
.21	*6.4*	Tax	.21	*6.4*
.95	*29.0*	Feedstock	.95	*29.0*
1.06	*32.3*	Operating and Maintenance	1.06	*32.3*
.47	*14.3*	Amortization of Plant	.47	*14.3*

SIZE OF TYPICAL PLANT:	250 million SCF per day
INCENTIVE ASSUMPTION:	Non-recourse loan guaranty for 75% of project cost
RESOURCE BASE:	Western Coal — $9 ton*
FINANCING ASSUMPTION:	Debt equity ratio: with or without incentive 75/25 Interest: 9%
COMPETES WITH:	LNG at nominal price of $3.00 per million Btu and naptha conversion at $3.25 to $5.00 per million Btu
TYPICAL INDUSTRY PRODUCT PRICE PRICE ESTIMATES:	WESCO — $2.50 ** Panhandle — 2.90 El Paso Natural Gas — 3.17 *** American Natural Gas — 3.13 ***
REGULATION:	Product price and method of pricing subject to FPC regulation and to regulation by State PUC in state of re-sale

* A $1 per ton change in coal price will change the OCOM estimates of both the regulated and unregulated product feedstock cost, and total product price by $.11 per M SCF.

** Initial rate to be permitted by FPC per order of 11/21/75. Order recognizes that this price will not permit full recoupment of costs, and provides for adjustments.

*** Assumes a charge levied on present customers to pay for financing costs during period of construction.

EXHIBIT B

SHALE OIL — UNREGULATED CASE

Product Price Per Barrel in 1-1-76 Dollars

OFFICE OF COMMERCIALIZATION ESTIMATES

FULL-SCALE PLANT

Without Incentives			With Incentives	
$	%		$	%
14.45	*100.0*	Total	13.31	*100.0*
		Interest	1.51	*11.3*
4.57	*31.6*	Profit	3.08	*23.1*
4.05	*28.0*	Tax	2.89	*21.7*
.68	*4.7*	Feedstock	.68	*5.1*
3.50	*24.2*	Operating and Maintenance	3.50	*26.3*
1.65	*11.4*	Plant	1.65	*12.4*

SIZE OF TYPICAL PLANT:	Full-scale — 50,000 bpd Single train — 8000 bpd
INCENTIVE ASSUMPTION:	Full-scale — mortgage loan* guaranty Single train — construction loan* guaranty
RESOURCE BASE:	Oil shale
FINANCING ASSUMPTION:	Debt equity ratio with incentive — 50/50 without incentive - 0/100 Interest — 9%
COMPETES WITH:	Crude oil — but upgraded shale oil will be a superior product
TYPICAL INDUSTRY PRODUCT PRICE ESTIMATES — ALL EQUITY ON BASIS COMPARABLE TO OCOM $14.45:	Union — $13.75/$15.50** TOSCO — $18.90

* Non-recourse loan guarantee for 50% of project cost plus product price support.

** Assumes no inflation, no delays. $13.75/bbl for single train product; $15.50 for full-scale. Single train product is not upgraded; full-scale product is.

EXHIBIT C

MEDIUM BTU GAS (AS PROXY FOR SUBSTITUTE FUELS GENERALLY) — REGULATED CASE

Product Price Per 1,000,000 BTU's

OFFICE OF COMMERCIALIZATION ESTIMATES

Without Incentives $	Without Incentives %		With Incentives $	With Incentives %
2.64	*100.0*	• Total •	2.26	*100.0*
.24	*9.1*	• Interest		
.13	*4.9*	• Profit		
.12	*4.6*	• Tax Interest •	.12	*5.3*
		Profit •	.07	*3.1*
		Tax •	.07	*3.1*
.83	*31.4*	• Feedstock •	.83	*36.7*
1.02	*38.6*	• Operating and Maintenance •	1.02	*45.1*
.30	*11.4*	• Plant •	.15	*6.6*

SIZE OF TYPICAL PLANT:	25,000 Cbe/day 290 MM SCF cubic feet/day at 500 Btu/cubic foot)
INCENTIVE ASSUMPTION:	Grant for 50% of project cost
RESOURCE BASE:	Illinois Coal — $9/ton*
FINANCING ASSUMPTION:	With incentive 50% Grant 37 ½% Debt 12 ½% Equity Without incentive 75% Debt 25% Equity Interest — 9%
COMPETES WITH:	LNG at nominal price of $3.00 per million Btu and naptha conversion at $3.25 to $5.00 per million Btu
TYPICAL INDUSTRY PRODUCT PRICE ESTIMATES:	CNG — $3.06
REGULATION:	Subject to state regulation. If used for generating electric power for resale, may also be subject to FPC jurisdiction

* A $1 per ton change in coal price will change the OCOM estimates of both the regulated and unregulated product feedstock cost, and total product price by $.09 per MM Btu.

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EXHIBIT D

MEDIUM BTU GAS (AS PROXY FOR SUBSTITUTE FUELS GENERALLY) — UNREGULATED CASE

Product Price Per 1,000,000 BTU's

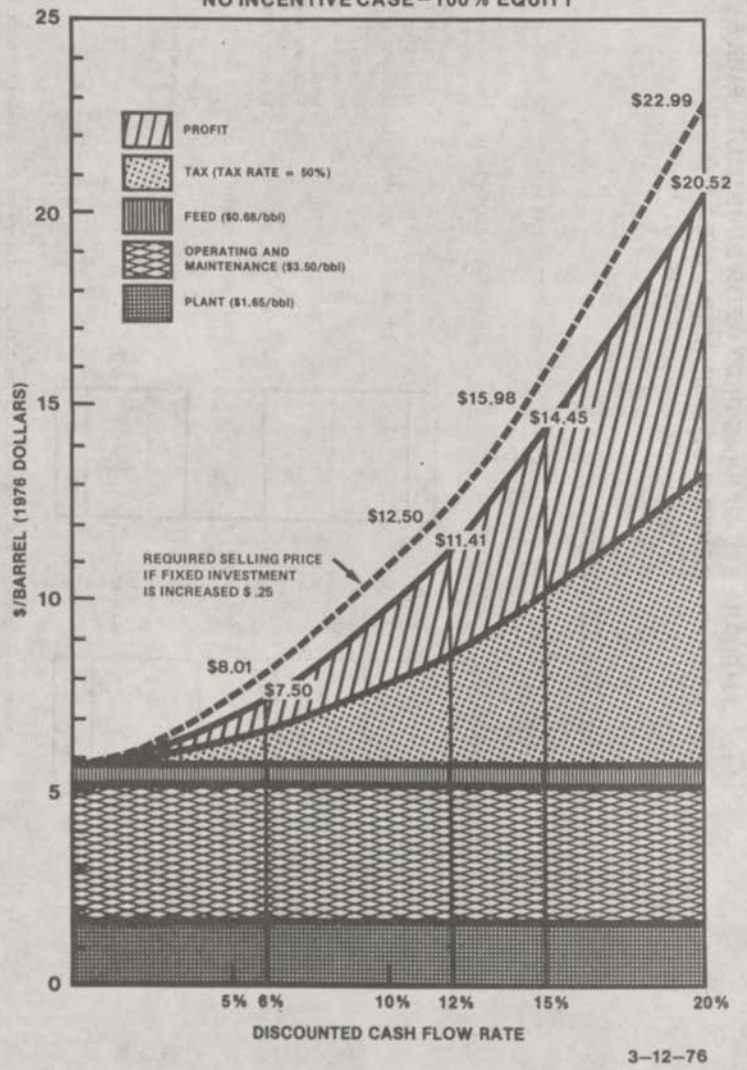
OFFICE OF COMMERCIALIZATION ESTIMATES

Without Incentives $	Without Incentives %		With Incentives $	With Incentives %
4.23	*100.0*	Total	3.96	*100.0*
		Interest	.26	*6.6*
1.05	*24.8*	Profit	.78	*19.7*
1.00	*23.6*	Tax	.74	*18.7*
.83	*19.6*	Feedstock	.83	*21.0*
1.01	*23.9*	Operating And Maintenance	1.01	*25.5*
.34	*8.0*	Plant	.34	*8.6*

SIZE OF TYPICAL PLANT:	25,000 Cbe/day (290 MM SCF cubic feet/day at 500 Btu/cubic foot)
INCENTIVE ASSUMPTION:	Non-recourse loan guaranty for 50% of project cost plus product price support
RESOURCE BASE:	Illinois Coal $9/ton*
FINANCING ASSUMPTION:	Debt equity ratio with incentive — 50/50 without incentive - 0/100 Interest — 9%
COMPETES WITH:	LNG at nominal price of $3.00 per million Btu and naptha conversion at $3.25 to $5.00 per million Btu
TYPICAL INDUSTRY PRODUCT PRICE ESTIMATES:	Non-available — see regulated case

* A $1 per ton change in coal price will change the OCOM estimates of both the regulated and unregulated product feedstock cost, and total product price by $.09 per MM Btu.

EXHIBIT E
REQUIRED SHALE OIL SELLING PRICE AS FUNCTION OF DISCOUNTED CASH FLOW
NO INCENTIVE CASE – 100% EQUITY



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FACT SHEET

Patents and Technology

In conducting the proposed synthetic fuels program, it will be necessary to balance the interests of the United States with the need to provide an incentive to firms which have made substantial investments in developing technologies which might be commercially demonstrated under the Program. In balancing these interests, it is necessary to consider the patents and technology existing prior to, and relied upon during the demonstration as well as the improvements made during the construction and initial start-up of the facility. In this regard, it is expected that most of the technologies that will be commercially demonstrated by this program already exist and are patented. Thus, no completely new developments are likely, although there may be refinements in the form of improvements to already patented technologies.

As to preexisting patents and technology, a factor that will be considered in awarding each guaranty will be the availability of such patents and technology to other parties desiring to construct and operate plants utilizing the processes demonstrated. Provisions will be considered for each guaranty which are directed to the availability and licensing of background patents and technology.

Technology developed during the course of the demonstration is generally to be considered a project asset and, in the case of default, would be treated similar to all other project assets. Of course the default provisions of the guaranty will include a requirement that in the event of a default the applicable technology and patent rights are to be made available to the government or its designee if needed to complete and operate the facility.

ERDA has interpreted Sec. 9 of the Federal Nonnuclear R&D Act of 1974, which requires ERDA to obtain title to the inventions made under its contracts, as not being applicable to loan guaranties, because guaranties provide only limited financial assistance, rather than outright Federal support of all or most of the cost project. It is not generally the practice for the Federal Government to acquire title to incremental improvements to existing patented technologies where such limited assistance is provided. For example, other government agencies, (e.g., HUD, Maritime Administration, Department of Agriculture, SBA) that administer loan guaranty programs do not acquire patent rights under agreements they have executed.

Outright Government acquisition of title to inventions under guaranties could have a negative impact on the willingness of certain companies to participate in this program. However, the legislative proposal reported

by the House-Senate Conference last year specifically required that the title and waiver of title provisions of Sec. 9 apply to loan guaranties. In any event, whether or not Sec. 9 applies, the guaranty provisions included in subsequent regulations would protect the public's interest in the availability of inventions. If Sec. 9 applied and waivers of patent rights were granted, the Government would reserve the right to require the waiver recipient to license on reasonable terms to other parties desiring to construct and operate such plants to ensure that the technology is available for rapid commercialization. If Sec. 9 is inapplicable, the background rights provisions generally considered by ERDA would include these inventions and their availability for use by others. An example of such a background provision is found in the ERDA proposed Geothermal Loan Guaranty Regulations, 10 CFR 790.44, 40 Fed. Reg. 50100-50107, October 28, 1975.

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FACT SHEET

Capital Market Impact of Program

The precise impact of the Synthetic Fuels Commercial Demonstration Program on capital markets depends on the general availability of investment capital and the demand for funds by the program in any specific time period. However, in general, investments projected to total $8.4 billion for the period 1977-1986 and $9.5 billion over the full term of the 350,000 bbl/day Synthetic Fuels Commercial Demonstration Program are not expected to materially affect conditions in the U.S. capital market for the following reasons:

- The most recent forecasts of the capital market do not envision a general capital shortage for the energy industry through 1985.
- The maximum investment in synthetic fuel plants projected for a single year (1981) totals $1.6 billion (Exhibit 1).
- The peak of net projected Federal budget outlays in connection with the program equals only $195 million in 1985 (Exhibit 1).
- Program investment in 1981 equals only 2.3 percent of the total investment projected for all energy industries and 0.4 percent of total business fixed investment (Exhibit 2).
- Savings (funds) induced by the program will be recycled to the capital market.
- The impact of the program on short-term interest rates during the peak year of investment (1981) is estimated to be insignificant--ranging from 0.005 to 0.05 percent.

Capital Shortage or Adequacy

In recent years a number of studies[1/] have suggested that the energy industries may face a capital shortage in the near future. If realized, the proposed synthetic fuels program would of course be affected by such a shortage. On the other hand, studies by the Brookings Institution, the Department of Labor, Data Resources, Inc. and most recently the Bankers Trust Company found that a general shortage of capital through 1985 can be avoided provided appropriate economic policies are adopted.[2/] In this regard, the study prepared by the Energy Group of Bankers Trust Company concludes that capital markets can adequately meet the needs of the energy industries even if the accelerated investment targets embodied in U.S. energy independence goals are adopted.

Investment Requirements

The combination of financial incentives (i.e., loan guaranties, price guaranties and construction grants) that are proposed for the 350,000 bbl/day synthetic fuels program would result in plant investment totalling about $7.4 billion between 1977 and 1986. Exhibit 1 presents the annual private sector outlays for capital investment in synthetic fuels commercial demonstration plants along with the time phasing of plant construction and production. In addition, Exhibit 1 details the anticipated annual net Federal Government budget outlays between 1977 and 1986. Adding these costs to private sector capital requirements the total investment requirements for the program equals $8.4 billion for the period 1977 - 1986 and $9.5 billion through the year 2005 (see Tab G for more detailed estimates of the cost of the Government). The peak year for the combined private sector and Federal investment is 1981 when approximately $1.6 billion is expected to be expended.

Induced Savings

Although the Synthetic Fuels Commercial Demonstration Program entails a demand for investment capital, savings induced by the program will in turn recycle funds to the capital market. To what extent such savings represent new savings (savings not otherwise forthcoming) cannot be determined since it is not known what investments may be foregone as a result of the program. The amount of ordinary savings generated by the program for capital market use depends on the impact of the program on Gross National Product and the savings rate applicable at the time of impact. The effect of the program on GNP over a specific period will be determined by the level of employment in the economy during that period and the amount of investment, operation and maintenance costs, efficiency improvement and import substitution arising from the synthetic fuels program. Initial estimates indicate gross savings in current dollars induced by the 350,000 bbl/day synthetic fuels program would range from 45 to 90 percent of total program investment ($8.4 billion) for the period 1977 - 1986.

Interest Rates

The effect on interest rates from the program can be inferred from the size of capital investment in synthetic fuels commercial demonstration plants relative to total energy investment requirements and total business fixed investment. These data are presented graphically in Exhibit 2. Comparison of the data reveals that total investment in synthetic fuel plants is very small relative to the totals for all energy industries and business fixed investment. The relative effect on capital markets of the projected investment in synthetic fuels commercial demonstration plants would therefore be minimal. Thus,

the range of interest rates prevailing in the U.S. capital markets at the time investment capital is needed for the commercial demonstration plants will be minimally affected by the demand for funds to invest in such plants.

In order to quantify the impact on interest rates, two econometric models were utilized.[3/] The results of the Data Resources Incorporated analysis indicate that under normal conditions interest rates would be affected by about 2 "basis points", i.e., a .02 percent increase in interest rates (e.g., during 1981 interest rates move from 8 percent to 8.02 percent). However, if the capital market is "tight" as forecast by the New York Stock Exchange and Chase Econometric Associates, the impact on interest rates would equal about 5 "basis points" (interest rates would move from 8 percent to 8.05 percent). On the basis of the Federal Reserve Board model the impact of the program on interest rates is estimated to range in the thousandths of a percent (e.g., interest rates increase from 8 percent to 8.005 percent). These results were to be expected considering the fact that the proposed $1.6 million peak year investment for the synthetic fuels program represents 0.6 percent of the privately held Federal debt in 1975 and 0.2 percent of corporate debt.

1/ The two most pessimistic studies were published by the New York Stock Exchange and the Chase Econometric Associates, Inc.: The Capital Needs and Savings Potential of the U.S. Economy; Projections Through 1985 (The New York Stock Exchange, September 1974); Michael K. Evans, Long-Term Forecast: The Next Ten Years, Inflation, Recession, and Capital Shortage (Chase Econometric Associates, Inc., August 1975).

2/ Barry Bosworth, James S. Duesenberry, and Andrew S. Carron, Capital Needs in the Seventies (Brookings Institution, 1975). Special Study Group, Unpublished materials partially based on The Structure of the U.S. Economy in 1980 and 1985, BLS Bulletin 1831 (U.S. Department of Labor, 1975). Allen Sinai and Roger E. Brinner, The Capital Shortage: Near Term Outlook and Long-Term Prospects, Economic Studies Series #8 (Data Resources, Inc., 1975). The Energy Group, Capital Resources for Energy Through the Year 1990 (Bankers Trust Company, 1976).

3/ Data Resources Incorporated (DRI) Econometric Model for the United States and the Federal Reserve Board (FRB) Quarterly Econometric Model. More detailed information about the methodology and results can be obtained from Allen Sinai (DRI) and Galen Burghard (FRB).

CAPITAL MARKET IMPACT OF SYNTHETIC FUELS PROGRAM

Exhibit 1 - Investment Requirements, Construction, and Production Schedule -- Information Option (350,000 bbl/day) 1/

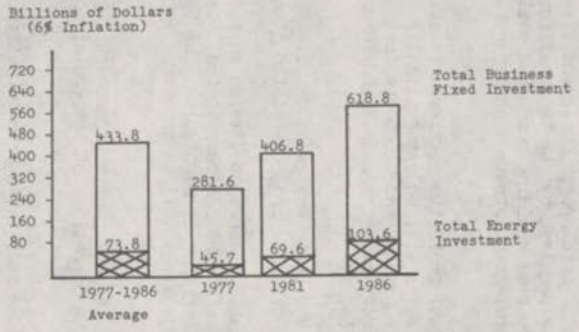
Year	Private Sector Capital	Net Budget Outlay 2/	Total Investment Requirements	Plants in Construction	Plants in Production	Cumulative Prod. Capacity
		($ millions)		(Number)	(Number)	(1,000 bbl/day)
1977	380	12	392	9	0	0
1978	620	26	646	11	0	0
1979	1050	37	1087	14	0	0
1980	1235	55	1290	11	3	18
1981	1520	91	1611	10	4	24
1982	1235	144	1379	9	5	30
1983	855	131	986	3	11	260
1984	380	165	545	2	12	300
1985	95	195	290	0	14	350
1986	50	144	194	0	14	350
1977-86	7420	1000	8420			
1977-2005	7420	2080	9500			

1/ Based on Exhibit 1 of Fact Sheet for Program Budget Estimates (Tab G) and the Synthetic Fuels Commercialization Task Force Report, Volume III, page D-39.

2/ Anticipated Federal expenditures minus loan guarantee fees; $11 oil scenario.

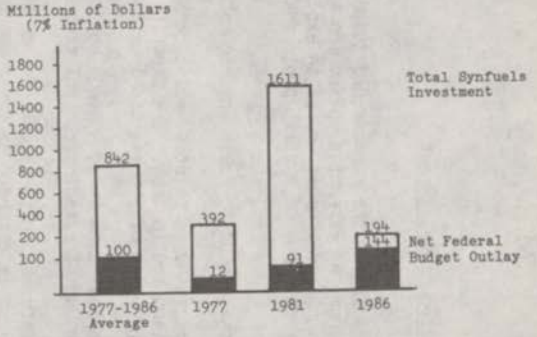
CAPITAL MARKET IMPACT OF SYNTHETIC FUELS PROGRAM

Exhibit 2 - Investment Requirements For The 350,000 bbl/day Synthetic Fuels Program In Relation To Total Energy And Business Investments



Source: Bankers Trust Company - 1974 prices. Their data was adjusted by the historic (1966-1975) implicit price deflator for gross private fixed investment.

Figure 1 - Share of Capital Investment by Business Going to the Energy Industry.



Source: Exhibit 1.

Figure 2 - Investment Requirements for the Synthetic Fuels Commercial Demonstration Program.

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FACT SHEET

Environmental Impact

As part of the analysis leading to the recommended 350,000 bbl/day first phase Synthetic Fuels program, an extensive environmental analysis was completed. The analysis included formulation of an explicit environmental protection strategy and preparation of a draft programmatic Environmental Impact Statement (EIS).

The major conclusions of the Synthetic Fuels environmental analysis are:

- Numerous environmental uncertainties exist concerning effluents, pollutant mechanisms and impacts. The severity and types of impacts depend on choice of process and location of plant.

- However, environmental impacts at 350,000 bbl/day level can be minimized through use of existing control technology and programs.

- Considering the information to be gained from the 350,000 bbl/day program, the program is regarded as environmentally advantageous.

In addition to preparation of both programmatic and site-specific environmental impact statements as required by the National Environmental Policy Act, the Synthetic Fuels program would be conducted utilizing a strict methodical environmental protection strategy incorporating the following five major elements:

- Use of environmental protection criteria in evaluation of project proposals. Candidates will be systematically compared with regard to probable primary and secondary environmental impacts, including both direct plant residuals and forecasted secondary and cumulative effects.

- Federal approval and State review of detailed site development plans, as well as off-site project-related plans.

- Extensive coordinated efforts to develop an environmental data base that will benefit the EPA-coordinated Interagency Energy/Environment R&D Program. In particular, the following two Interagency Program objectives will be supported by the environmental data base:

  -- determination of potential environmental impacts of synthetic fuel processing operations of commercial scale.

  -- develop control technology to minimize negative impacts and diseconomies associated with retrofitting.

- Comprehensive environmental monitoring of plants, including ambient air quality, water quality at key well and stream locations on- and off-site, noise levels, continuing investigations into revegetation dynamics and other ecological aspects, and survey of land use changes.

- Environmental advisory committee with state and other representation to ensure regional and state participation in decision process.

Finally, it is intended that the Synthetic Fuels program be carried out in such a manner as to meet or exceed all applicable Federal and State environmental laws and regulations.

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FACT SHEET

Water Resources

Water resources considerations for the Synthetic Fuels Commercialization Program focus primarily on water consumption and availability where required. Water supplies in all the potentially affected basins are believed to be sufficient to support the complete 350,000 bbl/day Program, along with anticipated non-energy and in-stream uses.

Water Consumption:

Each kind of plant that could be included in the commercial demonstration program consumes water--both within plant processes and through evaporative losses from cooling systems. Water consumption rates for various standard size synthetic fuel plants are compared with consumption rates associated with other major energy facilities in Chart I.*

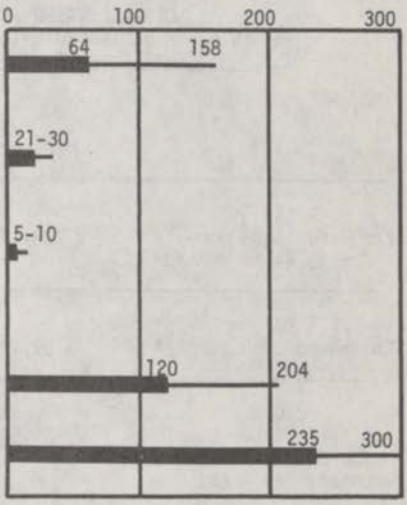
In addition to these direct operating water uses, other water requirements assocated with any major coal energy plant--either synthetic fuels or conventional power--would include:

- Mine and plant construction: relatively small water amounts for dust control and sanitation.
- Mined area reclamation: major water consumption for revegetation and/or irrigation.
- Spent shale deposition: major water usage for reclamation purposes.
- Municipal demand increases: about 2-3.6 million gallons per day per standard size plant (from CEQ, Sixth Annual Report, Table 30).

*Sources: Radian Corporation, Western Regional Energy Development Study, August 1975, Table B-6.
USGS, Circular 703, 1974, Page 8.
FEA, Project Independence Blueprint Water Report, November 1974, Table (from WRC and USGS data).
CEQ, Sixth Annual Report, Table 28.

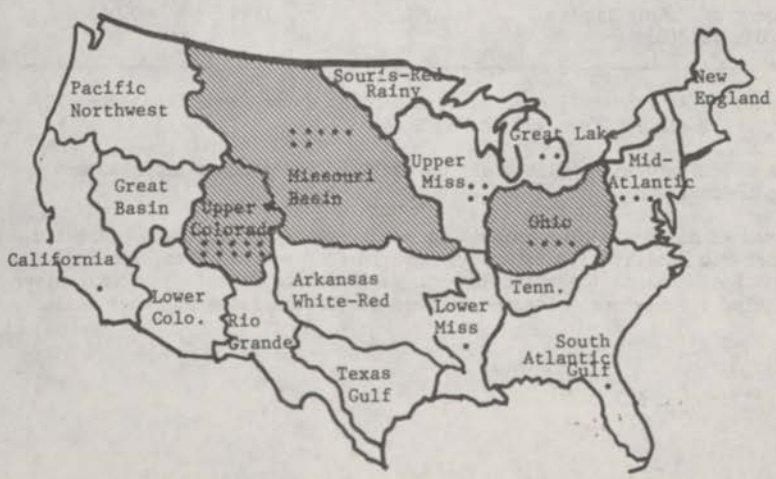
WATER CONSUMED
(million of gallons per day)

Standard Size Units	... per Standard Size Unit	...per Quadrillion Btu Produced Daily (low and high estimates)
• High Btu coal gasification--40,000 bbl/day equivalent	5.8	64 – 158
• Oil shale conversion 50,000 bbl/day	7.3	21-30
• Substitute fuels 25,000 bbl/day equivalent	1.6	5-10
Others for Comparison		
• Coal-fired power plant--1000 mw	7.9 - 13.4	120 – 204
• Nuclear--1000 mw boiling water reactor	15.4 - 19.6	235 – 300



Water Availability:

All identified candidate synthetic fuel projects are located on the map below with respect to the eighteen river basins in the continental United States:



The significant water-using candidates for commercial development are situated mainly in the three shaded basins--the Missouri, Upper Colorado, and Ohio River Basins. Gross water availability within these basins is estimated as follows:

OVERALL WATER AVAILABILITY
IN RIVER BASINS POTENTIALLY MOST AFFECTED
(millions of gallons per day)

	Missouri River Basin	Upper Colorado River Basin	Ohio River Basin
(A) Projected 1985 non-Energy Water Demand	13,600	4,200	1,500
(B) Estimated 1970 Supply*	39,100	5,700	14,800
(C) Available Water Supplies for Energy and In-stream Uses: (B) - (A)	25,500	1,500	13,300
(D) Estimated Water required for 350,000 bbl/day Program**	13	21	5
(E) Percent of Total Supply: 100 x (D)/(C)	0.05%	1.4%	0.04%

Source: FEA, Project Independence Blueprint Water Report, November 1974, Table 11 (from WRC and USGS data).

*Includes natural regulated and unregulated fresh water supplies and groundwater.

**Assumed oil shale plant sites: 1 each in Utah and Colorado. Assumed high-Btu gasification sites: 1 each in four corners area, Wyoming, and North Dakota. Assumed low-Btu gasification sites: 3 in Ohio River Basin, 1 elsewhere. Assumed biomass conversion sites in other basins.

Other factors influence the availability of water for synthetic fuel projects in these basins, including Indian and other legal rights, concurrent municipal and industrial development, and the progress of water resource developments.

Summary:

From the foregoing, water demanded by the complete 350,000 bbl/day commercial demonstration program is a small portion of available water supplies in all potentially effected basins, accounting generally for less than 1%. Irrigation, municipal, and industrial consumption will continue to demand the majority of available supplies. Finally, it is noted that most of the major water-using candidate synthetic fuel plants have already made needed arrangements for obtaining water rights at their planned sites.

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FACT SHEET

Socio-Economic Impact Assistance for
Synthetic Fuels Commercial Demonstration Program

State and Local Concerns:

Factors which inhibit the ability to raise and invest public capital on a lead time basis give rise to state and local governments' concerns about the secondary impacts of synthetic fuels development. The ability to raise front-end money is a primary factor in preventing or mitigating the adverse social impacts of rapid growth and "boom towns."

These factors include revenue lags, local statutory constraints, inability to market bonds due to the substantial risks involved with synthetic fuels, exposure to risk after bonding due to possible plant delay or failure, and, in the case of Indian tribes, lack of access to traditional sources of revenue and credit.

Need for Federal Aid:

Front-End Money. State and local governments may not be able to raise sufficient front-end capital for planning and development of infrastructure through issuance of bonds because of the uncertainty associated with a plant's ultimate success, particularly if plants are built in remote, undeveloped areas.

Continued Ability to Amortize Debt. After front-end capital is raised and invested in infrastructure, a delay in plant construction or premature shut-down would jeopardize a community's ability to service its debt from plant-generated revenues and could put the community into default.

Estimated Total Costs of Public Infrastructure:

The expected cost of Federally assisted additional public infrastructure development necessitated by the 350,000 bbl/day program is estimated to be in the neighborhood of $425MM over the next 5-10 years. (See Table 1 for derivation of cost estimate.) It is expected that normal and customary State and local taxation will, over twenty years, be more than enough to pay such costs including interest. The problem is how to make sure that happens.

Possible Solutions to Problem:

Analysis was made of several options including use of existing Federal programs; a new grant program; industry financing; and ERDA guarantee of debt service derived from expected tax payments from projects.

The Recommended Solution:

Eligibility:

- A government jurisdiction or Indian Tribe is eligible if a major increase in its total population will occur as a direct result of a synthetic fuels commercial demonstration plant and additional public facilities are required.

- In general, there are three types of areas that will be impacted by synthetic fuel plants.

  (1) A well developed area with significant existing population and supporting facilities; the influx of population caused by the synthetic fuels plant would be small in comparison to existing population.

  (2) Areas with some existing population and supporting facilities; the influx of population caused by the synthetic fuels plant would be a major increase to the existing population.

  (3) Areas with little or virtually no population and supporting facilities; the influx of population caused by the synthetic fuels plant would be an explosive increase.

- In general, undeveloped and partially developed areas and areas of which they are a subdivision would be eligible. Well developed areas and areas of which they are a subdivision would generally not be eligible.

- The ERDA Administrator will promulgate regulations on eligibility consistent with the preceding requirement and after consultation with affected State/local governments. The ERDA Administrator will make final determinations on eligibility. No project application would be approved by ERDA unless adequate State/local planning has occurred and adequate provision has been made for financing and any necessary revenue sharing agreements between jurisdictions. It is expected that the ERDA Administrator will make planning grants available for such planning.

Estimation of Community Facility Needs:

based on Nation-wide average costs:

- The cost of eligible public infrastructure needed is expected to be $5,500 per capita.

- In remote, undeveloped locations an additional $1,500 per capita may be needed.

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- An estimate of total capital necessary for public infrastructure is determined by multiplying the per capita cost by the total plant employment and associated population increase (See Table 1 and accompanying footnotes). In addition, this amount will be adjusted for:

  ---increases due to inflation during the construction period (the per capita amounts of $5,500 and $1,500 are based on 1976 costs);

  ---public infrastructure existing in the area prior to plant construction;

  ---density of population existing prior to plant construction.

Types of Assistance:

The ERDA Administrator will determine which form of assistance is appropriate in each case. Possible forms of assistance include:

Direct loans

Loan guaranties

Guaranty of an annual tax revenue stream

Requiring applicant to prepay taxes

Requiring applicant to bear infrastructure costs

Planning grants

Scope of Assistance:

Depending on local community needs, there will be some restriction on the types of facilities eligible for inclusion in this program. It is not anticipated that assistance will be provided for operating expenses.

The program should:

- make assistance available only where needed,
- make assistance available when needed (at front-end),
- limit assistance to appropriate purposes and in appropriate amounts,
- be relatively easy to administer,

- rely on State and local community participation in decision-making and development of the necessary facilities,
- enhance rather than replace State and local access to capital markets, and
- encourage pass-through of costs to the end user.

Form of Securities:

- Guaranty will be provided if:

  --Interest on bonds will be subject to Federal Income Tax.

  --Municipality(s) agree to earmark sufficient direct tax revenues received from plant (property and other) to amortize debt.

  --Term of debt is limited to two-thirds of the useful plant life, to be fully amortized by equal annual installments.

  --Debt is issued within five years from the start of construction by the plant developer.

- Debt instrument may be called for redemption by guarantor.
- Administrator is authorized to pay interest differential between tax exempt and taxable debt as determined by Secretary of Treasury.

Administration:

- ERDA will administer the assistance program, subject to Treasury concurrence in specified areas.
- ERDA will negotiate directly with the appropriate jurisdiction, generally the affected municipalities on the terms and agreements.
- ERDA will consult with State and local governments, communities and Indian Tribes.

Cost of the Program:

The total of public infrastructure for the 350,000 barrel per day program is estimated to be about $465MM. Allowing $5MM for planning grants for the synthetic fuels plants assumed to be built in partially developed or remote areas, and deducting $45MM for non-Federally assisted facilities, the total estimated cost of Federally assisted public infrastructure for this level of program would be $425 MM.

The current estimated cost of public infrastructure is greater than the $350MM reported previously. The reasons for the increase are:

- Higher cost estimates on certain facilities based on re-evaluation of previous analysis.
- The amount of support for eligible community development projects is increased from a maximum of 75% to a maximum of 100%.
- The new estimates are based on 1976 costs whereas the $350MM estimate was based on 1974 costs.

TABLE 1

POPULATION IMPACTS AND INFRASTRUCTURE COSTS [1/]

Type Plant	During Peak Construction Population	Costs (000)	During Operation & Mining Population	**Additional Costs (000)	**Additional Costs if New Towns Needed (000)	Total Costs (000)
Shale 2 Western in remote areas	21,952	$81,000	21,354	$39,000	$32,000	$152,000
Hight BTU 2 Western in remote areas in 1 Eastern (surface mine) in partially developed area	53,760	$199,000	23,720	$43,000	$22,000	$264,000
Low BTU 1 Western & 1 Eastern (underground mine) in partially developed areas & 2 Eastern (surface mine) in well developed areas	4,480	$17,000	8,795	$32,000	--	$48,000
TOTAL		$297,000		$113,000	$54,000	$465,000 [2/]

1/ See following background material on per capita community costs, additional community expenses because of varying population, new town supplemental expenses, etc.

2/ Exclude $45MM for non-federally assisted projects to be determined at time of local planning analysis and include $5MM for ERDA planning grants.

Per Capita Costs of Community Facilities 1/

(4th Quarter, 1975)

A. Permanent Population.

1.	Water	
	Pipeline	$ 525
	Source Development	58
		$ 583
2.	Sewage and Storm Drainage	
	Sewer Pipeline	$ 181
	Dumping Station & Treatment Plant	93
	Drainage Pipeline	329
		$ 603
3.	Solid Waste	$ 10
4.	Fire	$ 25
5.	Police	$ 46
6.	Recreation	
	Parks & Playgrounds	$ 102
	Open Space Development	16
		$ 118
7.	Libraries	$ 45
8.	Health	$ 241
9.	Education	
	Elementary	$ 1,130
	Secondary	548
		$ 1,678
10.	Streets and Roads	$ 1,144
11.	Government Administration	$ 22
12.	Land Acquisition	$ 377 2/
	TOTAL, 4th Quarter, 1975	$ 4,892 3/
	ESTIMATED 1976 TOTAL	$ 5,500

b. Construction population.

Assumes cost of $3,700 per capita. (Based on analysis done for Wyoming Select Committee which estimates 2/3 of total infrastructure would be in place during this phase.)

c. New town supplement.

Assumes cost of $1,500 per capita. (Based on analysis done for Wyoming Select Committee which estimates infrastructure costs 1/3 more if built in new town than added to existing town.

**Additional Costs are calculated as follows:

A. $1,600 additional per capita for permanent population if permanent population is less than or equal to construction population. Assumes total cost of infrastructure for permanent population is $5,500 per capita and that infrastructure built at $3,700 per capita for construction population is entirely available for permanent population.

b. $5,500 additional per capita for permanent population in excess of construction population.

C. $1,500 additional per capita for permanent population if new town is involved.

Footnotes:

1/ All cost estimates are taken from The Costs of Sprawl, prepared for CEQ, HUD, and EPA by Real Estate Research Corporation (April, 1974) and have been inflated to fourth quarter 1975 dollars using indices provided by the Government Division of the Bureau of Economic Analysis, Department of Commerce.

Costs are based on a community size of 33,000. No economies or diseconomies of scale have been taken into account. It is assumed that the community has a mix of housing types and that the development has been planned.

Costs include allowances for vehicles and equipment.

Costs are based on national averages and reflect present technologies, construction practices and service standards.

Assumptions about capacity and use are in The Costs of Sprawl: Detailed Cost Analysis pp. 90-130.

2/ 32 acres per 1,000 population at $9,000 per acre, from The Costs of Sprawl, pp. 92 and 194.

3/ Costs for Alaska are estimated to be about 45% higher or $7,250 per capita.

P

FACT SHEET

State and Local Participation

It is the Administration's intent in planning and in executing the synthetic fuels program to involve fully state and local governments which are likely to be affected by synthetic fuels projects. In particular, a Synfuels Environmental Advisory Board (SEAB) will be established to provide an effective mechanism for ensuring that State and local governments and the public will have a continuing voice in the Synthetic Fuels Commercialization Program. SEAB will advise ERDA officials regarding the overall strategy and implementation of programs for environmental protection, including socio-economic concerns. In particular, SEAB will provide continuing consultation on meeting the main objectives of the environmental protection strategy:

- to ensure that synfuels projects selected are environmentally sound in design, construction, and operation;
- to mitigate or prevent any significant adverse impacts that may otherwise result from a project included in the program; and,
- to develop a complete environmental knowledge base for subsequent decisions concerning synfuels commercialization.

SEAB will advise ERDA with respect to environmental and socio-economic matters concerning the Synthetic Fuels Commercialization Program. The membership of the SEAB would include representatives nominated by Governors, the National Academies of Science and Engineering and ERDA.

As implementation of the program begins, ERDA would publish solicitations for specific synfuels projects only after the Programmatic EIS is completed and the final decision has been made to actually implement the program. A separate solicitation would be issued for each different type of project. Industry would respond with detailed project proposals developed in coordination with State and local governments. Before construction begins on any individual project, site-specific development plans and EIS's would need to be prepared, publically reviewed, and approved. Also, the proposed Environmental Protection Strategy provides substantial opportunities for State and local inputs into the process of selecting individual projects and ensuring environmentally sound construction and plant operations.

Q

FACT SHEET

Program Implementation

The President has decided to proceed with implementation of the 350,000 bbl/day commercial demonstration program involving 12-17 plants. The overall life of the program may extend for 25-30 years depending on the actual operating life of the plants that are included.

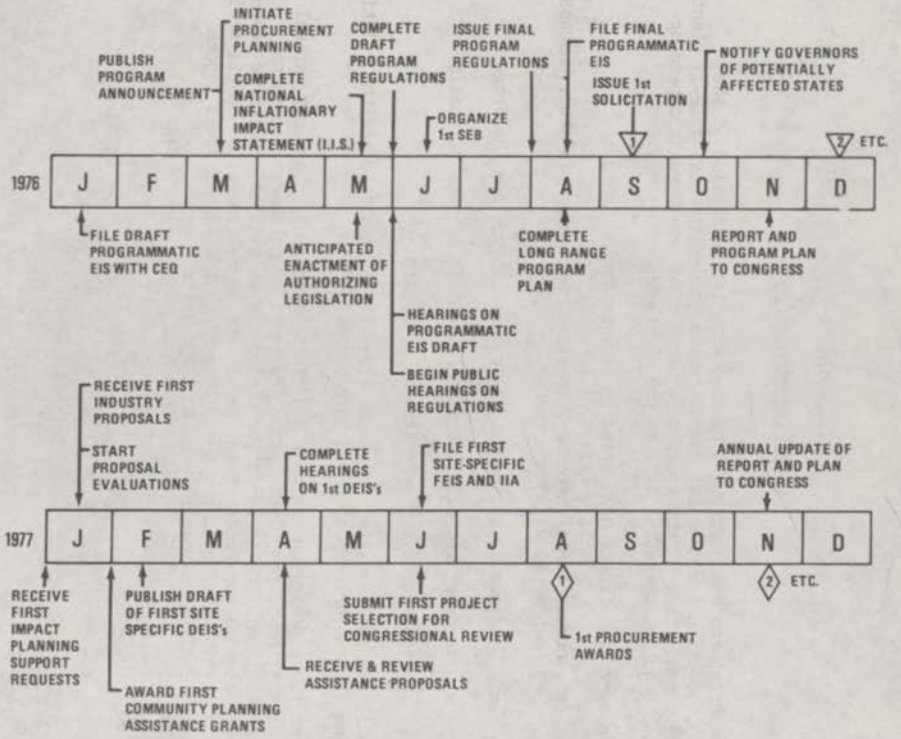
The more significant next steps in implementation include:

- completion of necessary analyses, announcements, etc., necessary to proceed with the program
- Congress providing funding authorizations for the program
- issuance of solicitation for specific project proposals
- evaluation and selection of proposals.

Exhibit A outlines the individual items to be completed and the relative time frames for completion of this phase.

Once final decisions are made and plant selections determined, actual construction of the plants could proceed if regulatory clearances are obtained. The construction period may be as little as three years for a biomass conversion plant to as long as 6-7 years for an oil shale or high BTU gasification plant. Thereafter the plants would become operational and may operate up to 20-30 years.

INTEGRATED SCHEDULE OF MAJOR EVENTS



R

FACT SHEET

Relationship of the Commercial Demonstration Program to the Energy Independence Authority

The proposed Commercial Demonstration Program is intended to provide Federal assistance to construct and operate a limited number of synthetic fuel plants to provide economic, environmental and other information to enable industry and government to make appropriate decisions on the future role of synthetic fuels. The Energy Independence Authority on the other hand, would provide a wide range Federal financial assistance to help achieve energy independence goals. The EIA could provide a variety of kinds of financial assistance, including direct loans, to a large number of energy projects, many of which would not necessarily involve emerging technologies. The proposed synthetic fuels information program on the other hand, involves a set of financial tools to assist a specific group of emerging technologies (synthetic fuels).

Much of the planning work for Program initiation has already been completed by the Interagency Synthetic Fuels Task Force and implementation of the program could occur very soon after enactment of the proposed legislation (See TAB Q). It is expected that the EIA will involve lengthy Congressional consideration and would involve some start-up period, delaying early synthetic fuel commercial demonstration efforts. After the EIA has been formed the Synthetic Fuels Program will be transferred to EIA, possibly with construction of some projects well underway.

In the event that the EIA is not enacted, the Synthetic Fuels Commercial Demonstration Program would remain a part of ERDA. ERDA would then request additional authorizations for FY 1977 to fund the full information program.

In the 1979-1980 time frame a decision would be made on the need for a second phase of the program to achieve the President's million barrel per day goal by 1985.

Mr. DINGELL. Is this an ERDA document?

Mr. MCCORMICK. It is in this book.

Mr. DINGELL. Let me ask this Mr. Canfield, Is this information Congress should have before it makes a decision as to the number and size of plants and kind of program?

Mr. HUGHES. The answer is "Yes." We said that last March, or whenever we testified, that in our judgment it was a part of the information we thought, together with what we were trying to do, would be helpful.

Mr. DINGELL. Would you like to comment? Do you feel we ought to know that before we go enacting legislation on this?

Mr. MCCORMICK. I believe that there is plenty of information around.

Mr. DINGELL. Let's stay with the question, if you do not mind.

Do you think we should have the information?

Mr. MCCORMICK. If you can get it, but I do not think you will have it.

Mr. Chairman, until proposers come in with specific proposals, we will never have that information.

Mr. DINGELL. Who was the contractor for this information? ERDA, or somebody else?

Mr. MCCORMICK. We contracted.

Mr. DINGELL. Why did you contract it?

Mr. MCCORMICK. We believe that before ERDA should make final selections on projects, it needs to know this kind of information.

Mr. DINGELL. ERDA is on a different position on this point than the Congress is, is what I am trying to figure out? Congress is elected to make these judgments. Maybe ERDA is elected to make these judgments. I do not know.

ERDA should have this information, but Congress should not, or Congress should not, but ERDA should? Who should have this information before the decision is made?

Mr. MCCORMICK. The Congress will have it.

Mr. DINGELL. When will we get it?

Mr. MCCORMICK. Under the proposed legislation, it will have approval over all projects.

Mr. DINGELL. Will we get it before or after the enactment of the legislation?

Mr. MCCORMICK. Before.

Mr. DINGELL. Let's refer to the legislation. Should we have this before we enact this legislation, or have that after?

Mr. MCCORMICK. Mr. Chairman, there is a countless amount of information you can have before you make a final decision.

Mr. DINGELL. Please stay with my question.

Mr. MCCORMICK. Mr. Chairman, I would like to answer the question in the best way that I can.

Mr. DINGELL. Should we have this information before we arrive at the decision in the Congress?

Mr. MCCORMICK. I do not believe you need it.

Mr. DINGELL. Why do you not believe we need it?

Mr. MCCORMICK. We have told the Congress that most of the information we need to make this decision is compiled and extensive analysis of it has been done.

We have given this committee and others 2,000 pages of ERDA analysis.

Mr. DINGELL. I have this unfortunate capacity of thinking in certain ways

Mr. MCCORMICK. It focuses primarily——

Mr. DINGELL. If you do not mind, Mr. McCormick, if you would just answer the question. I will just ask the questions.

Now, if you need the information, why is it that we do not?

Mr. MCCORMICK. We do not believe the information is needed until we get to the point of evaluating proposals. We do not believe the proposals will come until the legislation is enacted.

We do not believe that we need the information for the purpose of the legislation. We testified on that.

Mr. DINGELL. Is this not like the White Queen in "Through the Looking-glass" in finding them guilty and then holding the trial?

Mr. MCCORMICK. We do not feel that the information contained in these studies is essential to the issue of whether you go forward in the program. We have made this issue repeatedly.

We believe this information is concerned mainly with details of the program implementation.

Mr. DINGELL. You do not believe that we should have the information here in Congress before we enact the legislation?

Mr. MCCORMICK. I do not believe you need the information to make a good decision on this program.

Mr. DINGELL. Let us go back. My question was you do not think we need the information before we enact the program?

Mr. MCCORMICK. That is correct.

Mr. DINGELL. Can you explain to me why you at ERDA need the information at all?

Mr. MCCORMICK. We need it prior to making a contract award. We believe, in order to make the best evaluation of various proposals, we need that kind of information. In order to select one project from another, we are going to need to know what precisely is the most effective size of the plant.

Mr. DINGELL. Should that have not already been decided in the legislation?

Mr. MCCORMICK. No.

Mr. DINGELL. 250,000 Btu plants?

Mr. MCCORMICK. That number is not contained in the report at all, or the bill.

Mr. DINGELL. Where does this number come from?

Mr. MCCORMICK. The proposed legislation says nothing about program size except in oil shale.

Mr. OTTINGER. Will the gentleman yield?

Mr. DINGELL. Let me yield to counsel for a question here. I find this reasoning most curious.

Mr. OTTINGER. May I ask one question?

Mr. DINGELL. I am going to yield to counsel now.

Mr. NORDHAUS. One of the points you made in earlier testimony before this subcommittee, Mr. McCormick, was the plants that you were funding under the current demonstration projects programs under existing law are not of commercial size.

Mr. MCCORMICK. That is correct.

Mr. NORDHAUS. One of the questions that Mr. Dingell would be interested in having an answer to, how could you reach that conclusion without the benefit of this study, the results of which will not be available until October?

Mr. MCCORMICK. How can we reach the conclusion that ERDA's pilot and demonstration plants are not of commercial size?

Mr. NORDHAUS. Yes.

Mr. MCCORMICK. We know, from all the studies that previously have been done, that they are far too small. There is no way that they can produce economic fuel.

Mr. DINGELL. How much are you going to spend on this study.

Mr. MCCORMICK. Which study?

Mr. DINGELL. The study that we have just been addressing ourselves to.

Mr. MCCORMICK. I do not recall the precise amount. Together they may be somewhere slightly over $100,000.

Mr. DINGELL. We are going to spend over $100,000 for a study that the Congress does not need, but ERDA needs. Why does ERDA need the study, paying $100,000, if Congress does not?

Mr. MCCORMICK. I did not say that Congress did not need it. I said before we make a project selection between the various proposals, we need that information, and the Congress needs it.

What I said is that we do not think that particular information is vital to the decision about whether or not to go ahead and authorize this legislation. That information is more concerned with the details of program implementation, not with the question of whether you should go forward.

Mr. DINGELL. Is not the size of the plant an important part of what goes into the authorizing legislation?

Mr. MCCORMICK. You cannot put the size of the plant in the authorizing legislation, because you do not know what kinds of plants various sponsors——

Mr. DINGELL. Does not the size of a plant go into the amount that is going to be authorized? In other words, if we are going to go to 250,000 Btu plants, we will go one way in an authorization.

Mr. MCCORMICK. It will depend on the particular project proposals, and depend on the applications involved. We cannot know those ahead of time, until we go out for proposals. We cannot go out for proposals until we have the authorizing legislation.

Mr. DINGELL. Maybe you can explain to me what the function of the study is.

Mr. MCCORMICK. The function of the study, as I said before, is to provide ERDA with more detailed information that would allow it to pick the best project proposal, after we have received proposals. That will be after we go over a request, which would be after the authorizing legislation is passed.

Mr. OTTINGER. Will the gentleman yield at that point?

Mr. DINGELL. The Chair will return to this. I am going to start recognizing members of the subcommittee for questions.

The Chair is going to recognize the members in their order of appearance.

First the gentleman from New York, Mr. Ottinger.

Mr. OTTINGER. The purpose of this study is to find out the size that is needed. As you say—I do not believe you—you say this is not for commercial production. You say it is to find out certain environmental and socioeconomic factors with respect to the construction of these plants.

If that study comes out and says the optimal size plant is indeed the size plant that you are already financing under the $460 million research program that is going forward, then you would not have any need for this program.

Mr. MCCORMICK. Mr. Ottinger, I think maybe I can clarify the purpose of the study even further. I am not sure you quite understand.

We know right away that the size of these plants is going to have to be on the order of commercial scale to get the kind of information that we need. The question is, in the case of a synthetic, high Btu gas, is that 420 million cubic feet, 250 or whatever, we know that is in the range of commercial size.

Mr. OTTINGER. What is your largest plant being financed now?

Mr. MCCORMICK. 60 million cubic feet per day, four times smaller.

There is absolutely no way that the projects currently being funded with the second generation technology are going to be anywhere near the scale we need. We know that on the face of it.

Mr. OTTINGER. To get environmental and socioeconomic information, I do not think that that is apparent at all.

Mr. MCCORMICK. In terms of an investor making a big decision without Government assistance, they are not going to make a decision based on the Government's previous experience on a 40 or 60 million cubic foot a day Government-owned demonstration project.

Mr. OTTINGER. That is the purpose of the study you are financing. You testified before this committee in its prior hearings that the then $2 billion loan guarantee program that was being considered would stand on its own, and was not a part, and did not rely on the $6 billion program that was previously rejected by the House.

The President made a submission, which is in the Congressional Record of July 22, called "Unfinished Agenda of Legislative Business, House Document 94–564," which he states legislation that he would like to have passed in this Congress, and under synthetic fuels, the President says, "The administration supports legislation to amend the Energy Research and Development Administration's existing authorities to provide $2 billion in loan guarantees during 1977 for the commercial demonstration of synthetic fuel production from coal, oil shale and other domestic sources. A total of $6 billion in loan guarantees is expected to be necessary over the 1976 to 1978 period to reach the 1985 objective of the 350,000 barrels per day of synthetic fuel production capacity.

"With the enactment of the Energy Independence Authority legislation, these projects will be transferred to the Energy Independence Authority."

It seems to me that the President is in direct conflict with what you said. He says that $2 billion is just a bite of the $6 billion apple.

I wonder if you would like to explain that inconsistency?

Mr. MCCORMICK. I do not believe that that is an inconsistency. I think the President's position on this is clear, and has been clear. He

supports the synthetic fuels bill and supports the synthetic fuels program. He also supports a larger, more comprehensive program called the Energy Independence Authority.

Mr. OTTINGER. What we are buying, if we do this, is the first step to it, a $250 billion energy independence?

Mr. MCCORMICK. What the Congress is buying and what the President wants could be the same, it could be different. In the case of synthetic fuels, certain committees of the Congress have indicated they are willing to buy less than what the administration proposed.

For example, H.R. 12112 is a $4 billion program. We originally proposed a bigger one. I do not know what the Congress is going to buy.

Mr. OTTINGER. You testified before the Science Committee a short while ago that price guarantees are going to be required as a part of this program.

Mr. MCCORMICK. That is not quite accurate. What I said was that there are certain projects which may require price guarantees. There are other projects which would require loan guarantees.

I believe that many of the projects which we propose to undertake could be done with loan guarantees. Some others would require price guarantees. None would require both.

Mr. OTTINGER. None would require both?

Mr. MCCORMICK. That is correct.

Mr. OTTINGER. Your original submission to the Science Committee called for $6 billion in loan guarantees, $4.5 billion in price supports, and it was stated at that time the reason you had to have that $4.5 billion in price supports was because the product that was going to be produced would not be salable. It would be too high.

Therefore, you anticipated that you would have price supports in order to be able to sell the product.

Mr. MCCORMICK. We never anticipated a need for price supports on any projects on which loan guarantees would be provided.

Mr. OTTINGER. That is just plain inaccurate in terms of the previous testimony. The estimates are that the production of this stuff is going to come out somewhere in the neighborhood of $18 to $20 a barrel equivalent. It is not going to be salable at that price, as far as we can anticipate.

Mr. MCCORMICK. As I mentioned a little earlier this morning, we have in production in this country today a 250 billion cubic foot plant that converts imported petroleum into gas, which is producing it at an equivalent of $24 a barrel today. That is being sold.

Mr. OTTINGER. As I pointed out, if that were true, then private industry could go ahead with this.

Mr. MCCORMICK. No, the reason for that is simply that the conversion of naphtha or petroleum products into high Btu gas is a relatively straightforward exercise that involves little risk and the Federal Power Commission has been willing to give tariffs to produce this gas and sell it at prices that we estimate are higher than synthetic gas, so it seems to me, in those particular cases, we have the worst of both worlds. Not only are we paying $25 equivalent a barrel for this gas, but it is imported.

Mr. OTTINGER. I read to you from this proposed synthetic fuels commercialization program something called "exhibit 1, phase 1 program, budget authorizations," in which for both shale oil and utility

industrial fuel regulated, you show both loan guarantees and price guarantees. In the case of the gas, it is 650 shown for loan guarantees and 3,600 for price guarantees on the same item.

Mr. McCormick. The reason that is shown, Mr. Ottinger, some companies have indicated a desire for loan guarantees. Others have indicated a desire for price guarantees.

However, in our discussions with those companies and with discussions before this and other committees, they have made it clear that they do not consider a need for both incentives, and neither do we.

Mr. Ottinger. If that is so, in this production of synthetic gas and it comes out at an equivalent of $18 to $20 a barrel oil and it cannot be sold, what are you going to do? Is ERDA going to eat it?

Mr. McCormick. I do not agree with the assumption that is implied in that question, that it cannot be sold. I think the gas companies stated that problem before this committee, and others have testified that they can sell this gas.

The fact that a synthetic gas from naphtha is being sold at $24 a barrel today proves that it can be sold. It is not a question of whether it can be sold or not. As a matter of fact, that is why we do not think that there is any need for other than loan guarantees in the case of synthetic gas.

Mr. Ottinger. Mr. Hughes, do you want to comment on this?

Mr. Hughes. I was going to say that there are ways of disposing of high price gas or other high price petroleum products other than direct price supports. It can be rolled in, pumped into the pipeline, and the overall price of gas adjusted to accommodate that, which puts the burden on the user rather than directly on the taxpayer.

One way or another, it is pretty clear that the products of these plants are going to be marketed. It will be marketed, perhaps with a subsidy, perhaps rolled in one way or another to other prices that the company collects.

Mr. Ottinger. We attempted to provide them mechanism in the Commerce Committee with respect to high Btu gas. We would act as a facilitator between companies that found they were likely to experience shortages and people who wanted to build synthetic high Btu coal plants, that we would assure them that they could make that kind of contract, not subject to price controls, not subject to curtailments, and we could eliminate the subsidy altogether.

I do not think that ERDA has ever commented on that.

Mr. McCormick. I think we have provided the committee with comments on that. We do not believe that that scheme embodied in that legislation is workable. As a matter of fact, some of the companies have provided comments to the committee such as the American Natural Gas and others who have also testified.

Mr. Ottinger. As long as you are dangling $6 billion loan guarantees in front of them, I do not think they would want it.

Mr. McCormick. My point was not that rolled in prices are necessarily good. The problem with them, it encourages production of products that may not be as cost-effective as other products which are susceptible to the rolling in process.

We think that each of the alternatives that confronts this committee and Congress should be examined on its merits and the cost of the product looked at on its merits.

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The roll-in, if undertaken, should be recognized for what it is, a fairly well-concealed price increase in which the high cost of synthetics is lost in a larger volume of natural gas.

I would like to comment on this question of roll-in. I think it is specious. We have never suggested that these prices be hidden in a roll-in. Nowhere in our analysis have synthetic fuels been done on a roll-in basis. We have done all the comparisons on an incremental basis, competing on an incremental basis with other alternative sources of supply.

Mr. OTTINGER. Your own charts show that you intend to use price supports as a way to market your product. It is right in the chart here.

Mr. MCCORMICK. Not in the case of synthetic gas. We do not feel that that is necessary. We do not feel it is necessary to roll-in.

Mr. DINGELL. Will the gentleman yield?

Mr. OTTINGER. Yes.

Mr. DINGELL. Can you tell us the price of producing synthetic gas per thousand cubic feet?

Mr. MCCORMICK. The estimates range anywhere—on the low side, people believe $2.75; we do not believe it is that low, to the high side of around $4. Our own estimate——

Mr. DINGELL. What do you feel the price is?

Mr. MCCORMICK. Our estimates are between $3.25 to $3.50.

Mr. DINGELL. Right now the price is $1.42.

Mr. MCCORMICK. That is for regulated interstate.

Mr. DINGELL. Regulated gas. How is that going to go into the pipelines to be priced?

Mr. MCCORMICK. The question of how synthetic gas will be handled in the pipeline, at least initially, has gotten some attention from the Federal Power Commission. They are talking about doing it thus far on an incremental basis. Whether they decide to roll it in on the pipeline or not is the question that I cannot answer, whether they will finally come to that conclusion.

I will only point that that there are customers today willing to purchase that gas at $3.50 on an incremental basis. The proof of that is that there are customers who are already buying, as I said before, $4.20 gas that is being produced from imported naphtha and propane, and that is the proper comparison that ought to be made, not the interstate regulated price of natural gas.

Mr. DINGELL. Your testimony does not rule out incremental or rolled in. It leaves that question?

Mr. MCCORMICK. We are not taking a position on that particular issue. We do not believe you have to make a decision on it to make the case.

Mr. DINGELL. The Chair observes that the time of the gentleman has expired.

The Chair recognizes the gentleman from Colorado, Mr. Wirth.

Mr. WIRTH. I find this fascinating, Mr. Chairman. It seems to me that a number of us on the Science Committee and this committee have been going after this a long time, raising to the surface the two sides of the equation, the supply side and the demand side.

We spent too much time, in my opinion, in the last 20 months working only on the supply side. GAO has once again done us a good service by raising the conservation or demand side of the equation up to some sort of parity.

Mr. McCormick, you would not disagree with the importance of raising conservation and program elements; right?

Mr. McCormick. We agree that it is extremely important. What we are saying, I think very briefly, even if you make optimistic assumptions about what the conservation programs can buy you, we are still going to see a real requirement.

Mr. LeGassie wanted to comment on your question.

Mr. LeGassie. If I might, since I did not have an opportunity when the other members at the table were being asked to make opening comments, I do agree with what the member just said as to the importance of conservation. In fact, with respect to the entire list of technologies that the GAO report considers in addition to synthetic fuels, conservation, geothermal, waste, solar heating and cooling, ERDA, as I am sure the committee is aware, has sufficient programs and in a study submitted to the Congress, ERDA–48, we have a scenario V where we exercise all of those technologies as a part of that scenario, and on the demand side as a result of including conservation, came to the result, close to the energy policy report and the GAO report.

We are really not disagreeing about the importance of conservation, or what can be done with it.

Mr. Wirth. If I may reclaim my limited time, I would disagree with your pious statements about the interest the administration has had with this. You remember when you were in front of the Science Committee you presented us with a budget that cut conservation in the ERDA budget.

When the FEA was up here, they presented this subcommittee with a cut in the conservation budget, and the President signed the most recent FEA authorization only after we, in fact, thrust it down his throat and tied up in stripper decontrol.

This is the first time that we have really seen this administration, it seems to me, coming out and being a little bit positive about conservation. I just want to make that point.

I am glad that you are both here. I am glad that you are all now beginning to think a little bit about conservation. It seems to me what is before us today is a bit of apples and oranges. While we are going down the road of conservation as much as possible, as suggested by all of you, at the same time we have to think, I think, beyond where the savings on conservation are going to come, and where supply in the late eighties and nineties is going to come from.

Is that generally where you would both be in agreement, that we have a lot of work to do on conservation now that is only going to have so much return, then we are going to be back in the supply crunch later on down the line? Is that correct, Mr. Hughes?

Mr. Hughes. Not quite, Mr. Wirth. If you could recognize the tremendous amount of flexibility in conservation results, the answer to your question is affirmative. We feel that the potential for conservation really has not yet been scratched.

Mr. WIRTH. I am in agreement with that.

Mr. HUGHES. I would point out that conservation savings are in a sense, forever. What is produced by conservation is a permanent savings. The value and the cost effectiveness of the savings increase as time passes.

Mr. WIRTH. The point still remains that while we spent a great deal on energy in the Congress, getting conservation up to a point where it is being recognized by the administration and by the country as something that is important. Even the great savings possible through conservation measures will not eliminate the need to find additional sources of energy.

I am trying to find where some common ground is. I am sure you would all agree with me.

Mr. MCCORMICK. Absolutely.

Mr. WIRTH. Let me ask this specific point, if I might, from the GAO report.

Your report, as I read it, recognized that the greatest areas for conservation lie in the industrial sector, more than double that of the residential sector. I think that was on page 18 or 19, early on in your report.

I was wondering if you did feel that conservation alone will supply the industrial sector with sufficient energy needed in the years ahead.

Mr. HUGHES. I think the short answer is no, Mr. Wirth. We will need energy supplies as well as conservation.

Really, this gets to the heart of the matter. The question is what we need to do now, and in what array, with respect to energy.

Mr. WIRTH. Fine.

Let us get onto that, one, two, three, four. There is great potential on the conservation side, but that is not going to be adequate to meet all of the energy needs of the industrial sector.

Then we ask what do we do in terms of the supply side to fill in those ultimate needs. That is the next, following question, right?

Mr. HUGHES. Yes.

Mr. WIRTH. What are GAO's recommendations specifically, a quick summary, if you might. You want to add more in the record on that as to what kind of priorities you see for that supply side.

Mr. HUGHES. Let me try first, and then my colleagues may supplement it. I will try to do it very rapidly.

First of all, let me emphasize again, we are not saying abandon synthetic fuels by any means. We are not saying slow up.

Mr. WIRTH. Let us go back.

You are not saying——

Mr. HUGHES. Abandon, or slow up.

Mr. WIRTH. You are not saying abandon synthetic fuels, or slow up synthetic fuels?

Mr. HUGHES. We are saying pursue research and development very diligently, that we think the environmental and regulatory information that is being talkd about can be obtained through the course of that research and development process, and without construction of commerical-size plants.

Mr. WIRTH. Maybe you could submit to us for the record, where, on the industrial side, conservation is going to leave a gap to be filled by additional supplies, how that gap is going to be filled, what priorities you see in terms of filling that gap. Is that possible?

Mr. HUGHES. We can give you a range of alternatives, Mr. Wirth. Some of that is what the argument is about.

Mr. WIRTH. That would be very helpful. I would like, on my limited time, to return to my own particular concern, which is shale oil, if I might.

Mr. HUGHES. Part of the pursuit of synthetics is shale, of course.

Mr. WIRTH. Let me jump into shale. I know you have heard me say on a number of occasions that I have great concern for my area of the country and the whole Rocky Mountain area. Were there to be another embargo or another kind of disaster, unless we have in shape and agreed upon what the technology can do and cannot do, the plug would be pulled, and we would see every energy developer in the country ripping off a lot of that area, probably in a pretty mindless fashion.

We have talked about this a number of times. It is very important to get in place the kind of foundation that we think we can agree upon, what technology works, what technology does not work.

Let us understand that before we go whole hog into it. I think that is your position, and I think that is now ERDA's position. Is that correct, Mr. McCormick?

Mr. MCCORMICK. Yes, sir.

Mr. WIRTH. Let us turn very specifically to what it is that we might be doing in oil shale.

In H.R. 12112 that very famous and consensus piece of legislation, the program required for oil shale would only build 6,000- to 10,000-barrels-a-day plants. All the testimony that we have had for the last 15 months supported a demonstration program.

Does that fit into GAO's definition of what a demonstration program would be?

Mr. HUGHES. In general terms, the answer is "Yes," Mr. Wirth. The question is partly a question that we would like to hear ERDA answer. Why the near-commercial program, not just in oil shale, but across the board?

Mr. WIRTH. We have been very careful in the legislation to limit it to the modular approach of 6,000 to 10,000 barrels a day, have one or two surface retorts. That is it. ERDA was in agreement with that. Industry was in agreement with that. I understand all the committees were in agreement with that. I wonder if that also was agreed upon in the GAO.

Mr. HUGHES. The size of the plant, I think we would accept. The question becomes, how do you do it? The financing, Federal participation, and so on.

Mr. WIRTH. Your position on oil shale would be in agreement with the ERDA position of a modular approach?

Mr. HUGHES. With respect to size.

Mr. OTTINGER. Would the gentleman yield?

Mr. WIRTH. I would be happy to yield.

Mr. OTTINGER. Is there not still a provision in H.R. 12112 for a major loan guarantee program after this first phase that would have to come back to Congress?

Mr. WIRTH. Mr. McCormick may comment on that.

Mr. MCCORMICK. What H.R. 12112 in its present form provides is that no larger plant than 6,000 to 10,000 barrels a day in the case of shale could be guaranteed until a 6,000- to 10,000-barrel-per-day dem-

onstration plant were successfully operated. The report language has some words about what constitutes successful operation.

Mr. OTTINGER. It does authorize loan guarantees for larger plants subsequent to that?

Mr. MCCORMICK. If they were successfully operated, yes, sir.

Mr. WIRTH. That was dropped out of the Commerce Committee version of the bill.

Mr. OTTINGER. That is my recollection, but not in the Science Committee version of the bill, or the Banking Committee's.

Mr. WIRTH. If I might, Mr. Chairman, I have one further question of the GAO report. You endorsed the existing ERDA R. & D. programs as a way that ought to be continued.

Mr. HUGHES. With some expansion. We would have no objection to expanding that program.

Mr. WIRTH. I should point out in the ERDA R. & D. there is as I understand it—you might correct me on this, Mr. McCormick—there is no provision in there for any kind of surface retort program.

It is important to get into the mix, the kind of surface retort program that would be necessary to prove that out.

Again, from my perspective, we are following a very delicate line here between how much should we be doing and how much can we safely do to understand that technology and at the same time create the kind of base.

Were there to be another boycott, or whatever, we do not want to be overwhelmed by every schlock technical outfit in the country coming in in the great West to "do something" about energy. It is a clear balance, it seems to me, between the two.

I would assume on the subject of oil shale for the most part that GAO and ERDA are in agreement on what we ought to be doing. Is that correct?

Mr. HUGHES. On the kind of thing we ought to be doing. We have some problems on the financing.

Mr. WIRTH. A lot of people do. We are talking about what the technology ought to be, what the size of the project ought to be, and sort of the scope and scale of it.

I think we are in agreement that the main issue is a financing one, which hopefully we can come back and get into.

Thank you, Mr. Chairman.

Mr. DINGELL. The time of the gentleman has expired.

The Chair recognizes the gentleman from California.

Mr. MOORHEAD. The one thing I was concerned about in the GAO report, the prices that they show for synthetic gas are compared with the regulated price now being charged for natural gas. In areas like ours in California where we are running out of natural gas and are having to talk about bringing in frozen gas from Indonesia and other places, the prices are going to be much higher than synthetic gas.

To be realistic, do you not have to compare the price of gas with what we are going to have to be paying?

Mr. HUGHES. We tried to spread out an array of prices in the report, including a comparison of prices with LNG.

Mr. MOORHEAD. Where was that?

Mr. WIRTH. If the gentleman would yield, on the top of page 38, the GAO report states that synthetic fuels production is not price com-

petitive with foreign oil. On page 36, it states that it compared more favorably with the current price of liquid and natural gas at the $3 per thousand cubic feet, which I think goes to the point that the gentleman from California is making.

Mr. MOORHEAD. One other problem you have of course is that you cannot always depend on what you can bring in. Frozen fuels from abroad, there is a certain need that we have to be able to get the fuels we have to get in our own country in case of war or anything else which is not available if we are totally dependent on long-range shipping.

Mr. HUGHES. We are certainly aware of the concern. We are aware of the fact that oil imports are very substantial, much more substantial than they were at the time of the embargo and are rising and will continue to rise for some time. That is an obvious point of concern for anybody who is worrying about our country. The thing to do about it now, or the mix of things to do about it is the question we are trying to address.

We say that question is best addressed by a range of answers, very prominent among them, conservation. Also, however, we will continue to pursue the synthetic fuel option, but we think that there are some other things besides conservation that offer hope and are more cost effective, at least in the short run.

Mr. CANFIELD. The President's Energy Resources Council came out last week with an estimate that it would be politically desirable for this country to restrict its imports of LNG to approximately 10 percent of the energy that it would be importing.

If we took that standard, the administration's standard, and applied it to estimates for synthetic gas required, by the year 2000 that would provide something over 2 quads, roughly 2 trillion cubic feet. That would leave a requirement for synthetic gas in that time frame of something over 1 quad.

I am not suggesting that you make that tradeoff, but if you accept that estimate, that 10 percent could be imported safely without too much damage to our national security, then demand requirements for synthetic gas under this kind of an assumption would be something on the order of 1 quad.

Mr. MOORHEAD. In making your report, did you consider the possibility that we may be cut off from the overseas gas in the future, and while conservation is great when you absolutely need it, you have to have something to conserve?

Mr. HUGHES. You are quite right, Mr. Moorhead. We did consider it. We have tried to address the alternatives in our report, including synthetic fuels.

We think however, that at least for now, there are other opportunities that are much greater if we are going to put Federal resources to work.

Mr. MOORHEAD. I would like to have ERDA's comment.

Mr. LEGASSIE. If I may make a few comments, perhaps Dr. McCormick would add something as well.

I think we are continually put on a false trail here by the references to these other technologies, conservation, enhanced oil recovery, and so on, because we have done the analyses—and they have not been challenged—which indicates that even after one exercises all of those

technologies to the maximum extent that anyone feels credible, there is still a significant shortfall of demand for liquid gases.

This is verified even by the energy policy report and the GAO report had itself a substantial demand for synthetic fuels, and would have substantially greater demand if it used realistic projections of the availability of domestic oil at the time that the foreign policy study was done.

The USDS and National Academy studies of the remaining resources of oil in this country have not been completed, and the foreign policy study used a study of about twice the current estimate of what can be produced at the end of the century domestically from oil and gas, but even with that high figure, there is still a substantial demand for synthetic fuels in that study and in ERDA's Scenario V that has the same demand levels, and therefore it is doing equally well with conservation. All of these studies show that we need synthetic fuels.

Mr. Hughes has said that it is not the GAO's intent to slow down the effort to move in this direction, but it seems to me, as one who has spent a considerable part of his life analyzing market penetration of new technologies, that one cannot go from a level of 60 plant size to a level of 500 for plant size and not go through 250, and the question is, if we do not want to get some experience at the 250 level, then we are slowing down the rate of penetration and emergence of this technology.

Mr. OTTINGER. Mr. Chairman.

Mr. DINGELL. Will the gentleman yield?

How did you arrive at this figure as a plant size, if you are having studies made as to what the plant size should be? Could you advise me of this? This is the most extraordinary sort of reasoning. Maybe you understand why you do these things. I find that while you are having these wondrous studies made, it is in open conflict with the statement that you do not need the information.

Mr. MCCORMICK. We do not know the precise size that we are talking about. Various companies have indicated they want to build a 250 million. Another company has indicated they want to build 125 million cubic foot per day. There are a range of estimates.

The fact that we are doing some analysis to try to help us decide at the time that we need to make a project selection, what the best size would be seems to me to be fully consistent with the fact, we talk about 250 million cubic foot a day plants, because that is where most of the major project sponsors think——

Mr. DINGELL. Do you think it is curious that Congress may like the same information——

Mr. MCCORMICK. No, I do not.

Mr. DINGELL [continuing]. Before we arrive at the decision?

Mr. MCCORMICK. We fully intend to provide it when it is available.

Mr. DINGELL. After the Congress has authorized the program, you will provide us with the information? That may be the way it works elsewhere in the Congress. That is never the way it has worked on this subcommittee. I am curious as to why we should change our ways.

Mr. MCCORMICK. As I said before, Mr. Chairman, we believe that the kind of information that those studies will provide is pertinent to the details of implementation, not essential to the decision about whether we need to go ahead and proceed on this program.

Mr. DINGELL. Not essential to the decisionmaking process?

Mr. MCCORMICK. Not essential, in our view, to the decision about whether we need this program. I think the numbers we have talked about today in the supply-demand situation and the critical shortage we are having in gas and oil——

Mr. DINGELL. Do those figures go into the amount that these plants are going to cost?

Mr. MCCORMICK. Which figures? We certainly analyzed——

Mr. DINGELL. Mr. McCormick, you seem to have difficulty understanding my questions, or responding to them. If you have any difficulties understanding what I am saying, I would appreciate your telling me, rather than giving me an answer to someone else's question or a question I did not ask.

Are not the figures with regard to the size of the plant relevant to the cost of the plant?

Mr. MCCORMICK. Certainly.

Mr. DINGELL. The Chair thanks the gentleman.

Mr. MOORHEAD. Have you completed the comments you wanted to make on the question?

Mr. MCCORMICK. I would only make one final addition to what Mr. LeGassie said.

I cannot agree with Mr. Hughes that they are not recommending a slowdown in synthetic fuels. There is no possible way, by holding up on this commercial demonstration program that the commercialization of synthetic fuels will not be slowed down, because ERDA's research and development efforts are currently ongoing and in the case of synthetic gas, for example, a pipeline quality gas demonstration plant has a 60 million cubic foot per day level, a relatively small level that would not come on line until the early or mid-1980's.

It is only after, if we proceeded with the kind of program that I think GAO is suggesting, only after that time that you could then go to the larger scale.

What we are proposing is, in effect, a parallel approach so that we get the advanced technology data on the one hand through ERDA's R. & D. program and get the financial regulatory and other information through the demonstration program, so that in the middle to late 1980's, the industry has the ability and information on which to make the large-scale investments to meet the 100 or so plants that we think we are going to need in the middle 1990's.

Mr. DINGELL. If the gentleman would yield, is this information going to be based on a technology that is not being used?

Mr. MCCORMICK. We testified before that the technologies we are going to demonstrate in this program are somewhat similar to the ones that are being used in the case of synthetic gas. We expect the advanced technologies to be perhaps 15 percent more economic and only involve substantial changes in one minor, extremely important part of the plant, but in terms of the cost, in the case of gas, the gasifier itself.

We expect much of the information that we gain from this to be directly applicable to the advanced technologies. In fact, to lay a foundation for the accelerated introduction.

Mr. DINGELL. If the gentleman would yield further, here is a quote—who is Mr. Fri? Do you know Mr. Fri?

Mr. McCormick. Yes, sir. Mr. Fri is the Deputy Administrator of ERDA.

Mr. Dingell. Is he authorized to speak for ERDA?

Mr. McCormick. Yes, sir.

Mr. Dingell. Here is a question from Mr. Dingell to Mr. Fri:

All right. You indicated to the committee that the tchnology which would be put up by the private sector in 1980 is not the technology for which the loan guarantees will be issued under H.R. 12112. That is, that it is not the Lurgi process that was involved in these, but rather it is a second generation technology that would be generated under the ERDA authorization project.

Mr. Fri. That is true.

Are you in agreement with Mr. Fri? Do you folks talk down there, or not?

Mr. McCormick. I indicated that yes, the technologies are different. We believe the information you gain from the first generation plant, the Lurgi technology, is so similar to what you gain from the second generation technology in the case of the categories of information that we are talking about that it would be directly applicable.

We believe that therefore it would permit aceleration of the commercial introduction of the second generation technology.

Mr. Ottinger. If the gentleman would yield, why do we not avoid the $4 billion bill to the taxpayer and just do this research on the second technology that is going to be here at the same time anyway?

Mr. McCormick. We tried to indicate that trying to carry out the commercial demonstration program, we could accelerate the schedule to meet the demand of synthetics that we think we are going to need from the early to mid-1990's. Without this program, we do not think that the R. & D. program could put us on a time phasing that would meet that schedule.

Mr. Moorhead. I have a few more questions. I would like to use——

Mr. Dingell. The gentleman has been very generous with his time. The gentleman from California may continue.

Mr. Moorhead. One of the things you were trying to point out, is that what you have in your statement, that one need only consider the present contribution of nuclear power. Twenty years after the first commercial power reactor in Pennsylvania came on line, it provides only 9 percent of our electricity. It takes a long time to get this additional source of energy on line, and we cannot totally predict what is going to happen in the future and how long it will take to develop these new energies.

We have to be working on everything along the line that we are going to be caught short.

Mr. McCormick. Mr. Moorhead, that is precisely right. I pointed out earlier this morning, if we get started now building these commercial plants, in order to meet the 5 million barrels a day capacity of synthetic fuels that we think we are going to need in 1995, for example, we would have to build by then 100 plants and the industry would have to grow at a compounded annual rate of 17 percent.

We do not believe that that kind of growth rate is such that we ought to delay this program 1 minute longer.

Mr. Moorhead. I have read an article in the New York Times last Wednesday in which they interpret your report. They say, "the congressional agencies suggested today that importing more oil might be a better national policy than enacting the administration proposal for Federal financing. Although the report in Congress by the General

Accounting Office did not express an outright preference for oil imports as against some alternative, informed sources confirmed that the report's authors meant to imply just that."

Are you coming to us and saying that you think a better solution to our policy is to be more dependent on foreign imports, that we spend a little money and get a little security against foreign attack?

Mr. HUGHES. Far from it. The report speaks for itself. We have tried to spread out an array of opportunities that seem to us constitute the best way to go about reducing our reliance on foreign imports. That is all we are trying to do.

Some of the conversation here—but I am on your time, I guess, Mr. Moorhead.

Mr. MOORHEAD. That is all right. We are trying to get information.

Mr. OTTINGER. The New York Times article is inaccurate?

Mr. HUGHES. Yes, I certainly agree with that. The report speaks for itself. We will just rest on that.

Mr. DINGELL. If the gentleman will yield, maybe Mr. McMormick can tell us, is the "informed source" in that New York Times article ERDA?

Mr. MCCORMICK. Not to my knowledge, Mr. Chairman.

Mr. HUGHES. I would like to address the question of national needs in the year 2000, at some point, as well as the alternative approaches to meeting those needs.

I do not want to use anybody's time but my own, if I can help it.

Mr. MOORHEAD. Let's go to one or the other approach. You recommend against full-sized syn facilities because it will lock us in in pursuing syn gas?

Mr. HUGHES. Yes, sir.

Mr. MOORHEAD. How would this be so under the program of H.R. 12112? Why would smaller scale plants producing uneconomically competitive gas not do the same thing?

Mr. HUGHES. First, these larger plants, by general definition, are not going to be economic either. What we are talking about is a Government research and development program to explore regulatory and the environmental problems. It seems to us these problems can be explored in a different fashion. As evidence of that, I point to the fact that ERDA follows the technique we are suggesting in other areas. Further, if one looks at their scenario V which we have printed on page 8 of our report, a very substantial part of the national needs in the year 2000 are liquids from coal.

Mr. MOORHEAD. Do you think two plants here would lock us in?

Mr. HUGHES. I think $6 billion worth of investments will have that tendency. It does not irrefutably commit us, but the more we go in this direction, the less opportunity and the less interest, perhaps, there will be in looking at other things that it seems to us are very worthwhile.

Mr. MOORHEAD. I want to ask you one more question. I see that we have another gentleman who will have a lot of questions for you also here.

How big a factor did our national security play in your determination of your conclusions in your cost-effectiveness analysis?

Mr. HUGHES. We are trying to do the same thing that I think the committee and ERDA are trying to do. We are trying to reduce imports.

We are aware that they have been increasing. We think that they are going to continue to increase unless, and maybe even if, we take some fairly drastic action on the conservation side.

If I could come back to the question of supply in scenario V, liquids from coal are as far more significant share of the requirements in the year 2000 than gas.

But this bill addresses gas only.

Mr. LEGASSIE. There are two comments on that. First, the reason that scenario V does not show as large a gas problem as it does a liquids problems is because we made some very optimistic assumptions, being R. & D. people, putting that scenario together with respect to what could be done with enhanced stimulation of gas recovery from tight fields.

The recent experience in that endeavor is not proving to be all that encouraging, so if that matter is taken into account, the gas supply shown in that scenario is not at all guaranteed, in fact.

Perhaps Dr. McCormick may like to comment.

Mr. HUGHES. What we are dealing with obviously in scenarios are speculations about how things will be 25 years in the future. We really do not know what it is going to look like then.

If we have an acute need for liquids from coal, that need cries out for addressing also.

Mr. MOORHEAD. My feeling is—I am not too crazy about the Government financing any of these programs either. Can we afford to gamble?

We do not know what it will be like 25 years from now. Can we afford to put our Nation on the line to the point that we could lose everything 25 years from now if we have not taken the steps necessary?

Mr. HUGHES. We are not urging that, Mr. Moorhead. We are trying to point out a course of action that seems to us is preferable to that suggested by ERDA.

Mr. MCCORMICK. I would point out with respect to the comment that Mr. Hughes made about the bill being gas-oriented, we are talking about a range of synthetic fuels under the legislation and the ERDA scenario V suggests that the total oil shale, liquids from gas and coal would total 10 million barrels a day requirement by the year 2000.

Mr. MOORHEAD. Does anybody know this? I will ask GAO first.

Do you know if the LNG tankers are being built with Federal loan guarantees?

Mr. HUGHES. I do not know if they are guarantees. If they are being built in the United States, they are being built, I think, under general legislation that involves subsidies.

Mr. MOORHEAD. Regardless of which way you go, the Government is involved. If you take the foreign fuel one way and if you take the synthetic fuels in the other, the Government pays for it anyway.

Mr. HUGHES. There is another range of options other than LNG and synthetics that we think should be considered.

Mr. OTTINGER. Mr. Chairman?

Mr. DINGELL. The time of the gentleman from California has expired.

For what purpose does the gentleman seek recognition?

Mr. OTTINGER. I have one question I would like to ask.

Mr. DINGELL. The Chair has to recognize the gentleman from Ohio at this time.

Mr. OTTINGER. Will the gentleman from Ohio let me ask a question?

Mr. DINGELL. The Chair recognizes the gentleman from Ohio.

Mr. OTTINGER. Would the gentleman from Ohio yield for one short question?

Mr. BROWN. I have not had a chance to ask any questions. I do not know if the gentleman from New York has had an opportunity or not.

Mr. OTTINGER. Yes; I have.

Mr. BROWN. Let me ask my question, if I may, and I will yield at the end if I have time.

Mr. Chairman and gentlemen, thank you very much for the opportunity to ask questions. I used to be in the newspaper business actively when I was not in Congress and I never will forget one time when I got a little lecture from my mentor in the business for starting employees at a certain wage which he thought was too high, and I had to remind him that his memory of what had been done to the minimum wage by the Congress required that, and I must say his argument fell apart a little on the fact that he was not current on what the minimum wage was.

On page 36 of the report you make reference to the price of foreign oil at $12 a barrel. I do not know where you got your figures, but foreign oil has not been $12 a barrel since 1974, and early 1974 at that, and I have to look at a figure like that and wonder whether the conclusions that you have reached would be in any way impacted or obscured by that fundamentally erroneous information.

Mr. HUGHES. The question arose at an earlier hearing as to whether that $12 was an accurate figure.

It is our understanding that there is a range of prices at which oil is imported and the range is from perhaps as low as $11, $11.25, $11.50 to perhaps $13.50.

Mr. BROWN. The current figure is $13.50, according to FEA—$13.27, as an average, not as a low, but as an average.

Mr. HUGHES. If the price averages $13.50, it seems to us that the problem remains essentially the same.

Mr. BROWN. I would say that it does make a rather significant difference.

If the figures that you are using are 10 percent off in terms of the cost of foreign oil and the impact of that on our economy, I just saw over the weekend that our balance of payments has been negatively impacted. For the first time in some time we had a negative balance of payments, and the impact is attributed to the increased import of foreign oil, which means that there is some need for us to develop some other kind of source.

What that is and how we do it is what we are really talking about here, and in that regard, let me ask you, there seems to be a considerable reliance on conservation, and I think that all of us have some enthusiasm for conservation in a whole lot of areas, but did you put into your calculations on the impact of conservation figures that reference the impact on the economy what that does to the U.S. economy?

Unfortunately we are based in our transportation largely on the internal combustion engine, and the change from that is just not an overnight—cannot be accomplished overnight, and likewise, in our household heating and so forth, we have got the problem that most of our heating services now have been converted from gas to oil and we cannot make those changes overnight.

Was there any allowance for this made in the GAO report? I do not recall seeing it.

Mr. HUGHES. The answer to your question is we did endeavor to take account of those factors.

Mr. BROWN. How? Could you explain to me where that is taken into account?

It seems to me that if we save a great deal of oil and natural gas now, it means that the economy will not run quite as well as it did because the nature of the economy seems to track almost exactly the consumption of fossil fuels.

Mr. HUGHES. I do not think that we would agree with the latter assumption that the economy must track the consumption of fossil fuels.

Mr. BROWN. You do not argue that that has been the case? There may be some radical change that would cause it not to be the case. I have some difficulty figuring out what that would be.

Mr. HUGHES. It could be a variety of things. Conservation is not waste, and it is not necessarily economically bad to conserve.

Mr. BROWN. I say we are all for that, everybody is. It is like motherhood—well, maybe not the same thing.

Mr. HUGHES. You cannot say that any more.

Mr. BROWN. The idea of conservation is a good idea. The question is, How do we conserve?

Mr. HUGHES. One of the ways that change will come about is that there will be some substitution over time of solar or nuclear energy for fossil fuels. It depends on who you listen to, how fast that substitution will be, although nuclear is going more slowly than we anticipated.

Mr. BROWN. Why is it slow?

Mr. HUGHES. There are environmental problems, regulatory problems, technological problems.

Mr. BROWN. All of which have thrown it back considerably from what many people who are the purveyors of energy would like to have accomplished.

Mr. HUGHES. Yes, sir.

Mr. BROWN. That adds to their cost; right? So that there is a need, perhaps then for the synthetic fuels legislation which says (A) we are going to clear some of the snarls and redtape and so forth out of this in the hope of encouraging the use——

Mr. HUGHES. Certainly there is the need for a very diligent high-priority pursuit of synthetic fuel technology of the regulatory and environmental problems associated with that. The question is how that should be gone about.

Mr. LEGASSIE. If I could contribute to the dialog. I think if the point that the member is trying to make, as I understand it, that if

we rely on conservation only as opposed to conservation plus the addition of some new technologies, that there will be an impact on the economy.

A study has been done by ERDA exactly on that point, and the member's findings are in fact confirmed.

Mr. BROWN. Mine are not findings, mine are questions.

Mr. LEGASSIE. The view that you are asking about, it has been confirmed by the study, and of course, one should put all the caveats on that that one can, that conservation without new technologies will significantly impact the real growth of GNP in this country, inflation, unemployment, and other matters of this kind which affect our economic health, that the situation is improved if we add to conservation only some explicit assistance in the area of new technology development.

Mr. BROWN. Do you have something specific by way of report that you could make reference that would be available for this committee and might, even if it is appropriate, be included in the record at this point?

Mr. LEGASSIE. Yes; we will do that. It is a published report, and we will provide some material for the record.

Mr. BROWN. Mr. Chairman?

Mr. OTTINGER [presiding]. Without objection, it will be included. Could you give us the title of the published report?

Mr. LEGASSIE. I do not have it in my head, but it is published and we will provide you not only the complete report, but also summary material that you can put in the record.

[The material requested had not been received at the time the hearings were printed.]

Mr. OTTINGER. Do you know who performed it?

Mr. LEGASSIE. It was performed under my direction by Brookhaven National Laboratory.

Mr. BROWN. A Federal installation?

Mr. LEGASSIE. A Federal installation.

The report and the effort was reviewed for the Congress by the Office of Technology Assessment, as a part of this review of ERDA. ERDA was complimented on the study and they indicated that we were using some of the most modern and up-to-date approaches in this area.

So this is something that OTA has looked at for you and found to be a high-quality project.

Mr. BROWN. If we conserve our current fuel sources, oil and natural gas, it seems that you have two choices, one to drop the GNP or to substitute something else—talking about domestic fuels now—or substitute something else for it.

The substitutions that have come in for the last few months have been foreign imports which has a negative impact on our total economy also.

I am all for it, as I know Mr. Ottinger and other members of this committee are, for the development of solar energy, anything that we can do to develop solar and nuclear energy we ought to be enthusiastic about, but we have been on the atomic energy kick for some time and we have run into some rather severe problems. After having a vote in

California, turning down the idea of further slowing up the development of atomic energy, we now in Ohio are going to be faced with a similar vote this fall to see if we cannot stop atomic energy development in Ohio.

So that philosophy has not really been put down yet. We still have the efforts to terminate development, or slow it, in the atomic energy area.

I do not know that anybody has discovered that we will get skin cancer yet from developing solar energy. I assume that kind of reaction will set in somewhere along the line on solar energy too.

Mr. HUGHES. Solar is one of the energy sources that we think is substitutable for much present energy fossil fuel consumption.

Mr. BROWN. I would agree that it could be done in some ways, but I am not sure how it will run an internal combustion engine.

Of course, the internal combustion engine is the end-motivating force that also has to be applied to the use of solar energy. That question, and the question of how readily we make a decision on solar energy, are two different things, both of which I think are right now big question marks, and the assumptions it seems to me, in the GAO report were rather optimistic.

What I am getting around to, do you have any information that we do not have that tells us that it is right around the corner?

Mr. HUGHES. No.

Mr. OTTINGER. Will the gentleman yield at that point?

Mr. BROWN. If I could get an answer, then I would be glad to yield.

Mr. HUGHES. The question of substitutability is a very important one, and in industry, the substitution of direct burning of coal for oil and gas is particularly important. In home heating, the substitution of solar space heating or water heating is very important, conserving oil and gas for their highest priority use or those uses where substitution is not possible.

Mr. BROWN. As a personal matter, 2 years ago in the coming November, our house blew up because of a bad furnace, and we had to rebuild a substantial old Victorian house—high ceilings, a house built in the middle of the 19th century, and I looked into solar energy for our home, and I found out that I could heat three rooms in that house for an installation that will cost $30,000.

That was five times what the heating system for the rest of the house cost. That did not seem to me—I am talking about the structure, the whole business, not just the solar panels—that did not seem to me to be exactly a consumer investment that was going to move with great speed.

Obviously, if you built a house from scratch, we might very well save considerably on that cost, but unfortunately ours was an old house, and we found that installation of a gas furnace and a few other things were better, and we have saved considerably on our gas bills—as a matter of fact, our gas bill is back where it was 4 or 5 years ago because of the insulation.

Mr. OTTINGER. The time of the gentleman has expired.

Mr. BROWN. Could the gentleman from ERDA respond?

Mr. LEGASSIE. I must protest on the substitutability in the sense that this could make the demand for oil and liquids go away, because in the

cases that ERDA put together and have not been refuted by GAO, or even analyzed, to the best of my knowledge, we put in very high levels for solar heating and cooling, solar electricity, geothermal and all of those resources, and we still found that we were unable to meet the demands for liquids and gases, including conservation estimates, without importing or without synthetic fuel, so I think that the statements made here about substitutability are misleading to the members.

Mr. OTTINGER. The gentleman has consumed 14 minutes. The time of the gentleman has expired.

With respect to solar energy, there is a technical memorandum issued July 27, 1976, entitled "Inexpensive Economic Solar Heating Systems for Homes."

In the abstract, it says the report describes a low-cost solar home heating system to supplement the homeowner's present warm air heating system. The report is written in three parts: a brief background on solar heating. Langley's experience with the demonstration system. If the homeowner wishes to construct such a system, instructions are given to the homeowner for installation that supplies all the labor necessary to install off-the-shelf components, estimated at costing $2,000.

So I do think that this, combined with other experiences going around in the country that it shows that solar is within relative economic reach.

Mr. BROWN. Obviously my contractor did not have the bulletin.

Mr. OTTINGER. Mr. McCormick, with respect to this study that is listed as one of those 13 that have been completed, that study, entitled "Information as a Function of Plant Size," which some of us feel is rather critical, in your description of this, it says that the final report is due on June 15, 1976 with interim reports as necessary to meet congressional inquiries.

I would like to find out from you why the final report is now delayed, as I understand, until some time in November, whether there have been interim reports, if not, why you have not insisted on interim reports, and lastly, whether you folks are sitting on this thing, because the findings are such that would indicate that the plant size is smaller than that you would like to build, are included in the study.

Mr. MCCORMICK. With respect to your last comment, there is no reason that we would sit on it. The work just has not been completed. That whole contract got negotiated—the whole contract negotiation period was longer than we expected. Those studies did not get underway until the early part of the summer.

It will be done in a month and a half—10 of the 13 studies have been completed. We have provided you, at your request, some materials on those about that high [indicating].

Mr. OTTINGER. I asked for those on July 30 and did not get a reply at all from you until this morning, and they were dumped on my desk. I will try to sort them as best I can.

Have there been any interim reports under the SRI study?

Mr. MCCORMICK. There have not been.

Mr. OTTINGER. Why have you not requested any interim report?

Mr. MCCORMICK. They have only gotten to the point now where they are really doing analysis. Up until the last we met with that

contractor several weeks ago and discussed where they were, they only had gotten to the point where they had developed the models, and they had not actually started to exercise the models, so they do not have any results to report on.

Mr. OTTINGER. So we could not get an interim report on them before possible consideration of this legislation?

Mr. MCCORMICK. We probably could get an interim report within the next month, after they have completed some of their analysis. I do not know whether we will be able to get an interim report before the House completes its consideration on this legislation or not. It depends on when that is.

Mr. OTTINGER. With respect to the study entitled "Strategy and Criteria Appropriate for Optimum Plant Mix for the Synthetic Fuel Program," it says the timing of the report, interim report, delivered June 1, 1976, and final report on August 1, 1976.

Mr. MCCORMICK. That is the same contractor for those two reports.

Mr. OTTINGER. Was an interim report delivered on June 1, 1976?

Mr. MCCORMICK. I indicated that both of those—the work for that contractor was delayed in contract negotiations, as were several of the others. We did not get started on some of those contracts.

I would like to further emphasize that we do not regard those studies as studies that affect a major——

Mr. OTTINGER. We have been over the background enough.

Mr. Hunt, do you have any questions?

Mr. HUNT. No, sir.

Mr. OTTINGER. Mr. Nordhaus?

Mr. NORDHAUS. I would like to pursue, Mr. Hughes, for the committee's hearing record, your recommendation that, or thoughts, as to what type of program Congress ought to be pursuing in this area.

You said earlier that you did feel that the existing demonstration program that is being carried out under the Non-Nuclear Act is something that you feel ought to be strongly pursued.

Let me follow that up with a question as to whether you think that there is any need at all for a loan guarantee program to demonstrate new energy technologies, particularly if there is a need for a program for municipal waste, biomass.

Mr. HUGHES. Yes; we indicate in our report, one of the recommendations, that we thought the loan guarantee approach was appropriate, in that set of circumstances.

Mr. NORDHAUS. I did not want to put you in a position of endorsing particular pieces of legislation.

Mr. BROWN. Unless there is a GAO justification based on GAO's competence in this area, I think that is appropriate, but in the scientific area, I am not sure that GAO is really that competent.

Mr. HUGHES. Mr. Brown, I have commented earlier, that while the science, the technology, and the analysis are very important in this area, it is pretty clear that we are speculating about events well in the future, and there is much here that is "government" rather than science or technology.

It is in that context that we are trying to address the question. We have tried to base our observations and our recommendations on facts as best one can arrive at them in this complex area, and on projections that are reasonable as best that can be determined.

The Congress is up against a problem that it is frequently up against: there is uncertainty and disagreement among the exports, and we have tried to present to this committee and to others in the Congress as a whole, an approach that we think makes sense in light of the data we have.

Mr. BROWN. We are always careful on this committee not to ask the staff for policy recommendations. I am sure the staff would not want to ask GAO for policy recommendations, but rather for facts.

Mr. OTTINGER. This, it seems to me, boils down to a large extent to the question of where it is appropriate to use off-budget loan guarantees. That is an area of expertise that the GAO does possess, and what they have recommended, I take it, is in line with the legislation that we reported out of this committee, that the loan guarantee not be used to finance large investments. As I read from their comment on page IV, 4, they do support loan guarantees to support industries that do not have access to capital, the smaller industries who are involved in biomass and solar development.

Mr. HUGHES. It seems to me that Mr. Brown, Mr. Chairman, that whom we are trying to influence is quite important in deciding the technique to use and what the ultimate consequences of what our actions will be is also important.

It seems highly unlikely with respect to large plants of commercial, or near-commercial, size that those plants will be constructed and then allowed to sit idle. It seems to me, one way or the other, that the output of those plants is going to be pumped in—rather literally—pumped into the system, either with Federal price supports to subsidize the difference between the cost of the output of those plants and whatever the market is, or with a price roll-in that, in effect, puts the burden on the customer, without his hardly knowing it, if the roll-in is gradual.

Either way, it seems to us that—and ERDA agrees on this—that we should examine the cost of whatever technology is being developed as an incremental proposition and avoid any traps that are inherent in the roll-in.

Mr. OTTINGER. Mr. Hughes, I take it that title I of the bill as reported from Commerce, which did not have the loan guarantees for large, commercial plants, can you tell us whether that is consistent with your report, your view?

Mr. HUGHES. A short answer to your question is, I do not know.

Mr. OTTINGER. We would be grateful if you would supply that for the record.

[At the time the hearings were printed the information requested had not been received.]

Mr. OTTINGER. We do have a quorum call. Mr. McCormick, did you want to add a word with respect to what Mr. Hughes just said?

Mr. MCCORMICK. I was just going to say that we do not agree with the implication that these synthetic fuels will all, or even most of them, will require price subsidy.

As I said earlier, there are several sources of synthetic gas around today that are being produced from imported oil that are more expensive today and in operation today than some of the synthetics we are talking about.

Mr. OTTINGER. As I said before, if that establishes the market, then indeed, you would be able to finance the synthetic gas without loan guarantees. If that were the marketplace price, no question that these

plants would presently be economical, because you anticipate they are going to come in at $3?

Mr. McCormick. We think they would be price competitive with those sources, but because of the completion risk, the uncertainty of the environmental and regulatory climate that the plants have not been built in this country, that investors face completion of delay risks——

Mr. Brown. That you would never get the plants built.

I have one other question for the record that I would like to submit, if I could, to Mr. Hughes, and then if he could answer that.

Mr. Ottinger. Without objection, so ordered. It will be submitted.

I want to thank you for appearing and for your time and patience.

One more question from Mr. Nordhaus.

Mr. Nordhaus. In your review, and in the nature of the substitute reported out by the Commerce Committee, could you also look at titles II and III and in your response to Mr. Ottinger's question, indicate whether your view of titles II and III are consistent with GAO's recommendations as well as Title I.

Mr. Hughes. Surely.

Mr. Nordhaus. It would be very helpful for the committee to have that information in the future.

[The following letter and attachments were received for the record:]

Comptroller General of the United States,
Washington, D.C., September 14, 1976.

Hon. John D. Dingell,
Chairman, Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, House of Representatives

Dear Mr. Chairman: We are enclosing the corrected transcript of our testimony before your Subcommittee pertaining to the GAO report "An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies" for the hearing records.

During the hearings before your Subcommittee, witnesses of the Energy Research and Development Administration provided with their testimony a number of detailed comments on our report. As agreed with you, we are enclosing our responses to these detailed comments for inclusion in the hearing record. We are also enclosing (1) a copy of our letter to questions raised by Congressman Brown of your Subcommittee during the hearings for insertion in the hearing record at the appropriate point, and (2) a comparison of Titles I, II, and III of H.R. 12112 as reported from the Committee on Interstate and Foreign Commerce to the conclusions reached in our report.

As agreed with your staff, an appropriate quantity of the enclosures are being provided for distribution to Subcommittee members.

We trust the enclosures will complete the hearing records.

Sincerely yours,

Elmer B. Staats,
Comptroller General of the United States.

Enclosures.

U.S. General Accounting Office,
Washington, D.C., September 13, 1976.

Hon. Clarence J. Brown,
House of Representatives

Dear Mr. Brown: In hearings before the House Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce on August 30, 1976, you expressed concern over GAO's statement about the Nation becoming locked into synthetic fuels and the accuracy of the cost figure for imported oil cited on page 36 of our report entitled "An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies."

We believe that, if synthetic fuel plants are built on a commercial scale, due to the Government's substantial financial interest they will be kept in operation—whatever their economics. The products of the plants will be fed into the Nation's

energy system and either higher prices or further Government subsidy will be required. If the Government did not choose to subsidize the product of an uneconomic technology, the loan may be defaulted.

To commit to commercial-size plants without first developing better information on the institutional constraints and further refining the essential economic considerations is in our view, not desirable.

With respect to our cost figure for imported oil, FEA has reported that in March 1976, the price of a barrel of imported oil ranged from $11.71 to $13.94 with an unweighted average price of $13.22. While recognizing that the inclusion of this range and unweighted average price in our report would have been useful, the use of a $13.22 figure would not have changed our conclusions regarding the cost effectiveness of synthetic fuels.

We should also note that certain cost estimates included in our report for synthetic fuels were probably conservative. For example, on page 36 we cite the Synfuels Interagency Task Force's estimate of the regulated price of high-Btu synthetic gas of $2.61 to $3.02 per thousand cubic feet (MCF). More recent ERDA estimates in their March 1976 Fact Book on the Proposed Synthetic Fuels Commercial Demonstration Program estimates the cost of high-Btu gas at $3.28 per MCF (about $19 a barrel oil equivalent). We have also been made aware of a draft interim report jointly funded by ERDA and the American Gas Association which shows ranges of estimated costs for various second-generation, high-Btu coal gasification projects using Western coal that go considerably higher. However, we have been unable as yet to obtain a copy of the report so that we may review it in detail.

We are enclosing a copy of our responses to ERDA's detailed comments on our report which will be included in the hearing records of our testimony before the Committee on Science and Technology and the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce.

We are furnishing a copy of this letter to the Chairman, Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce so that it can also be inserted in the hearing record.

I hope this clarification is useful to you.

Sincerely yours,

MONTE CANFIELD, Jr.,
Director.

RELATIONSHIP OF THE INTERSTATE AND FOREIGN COMMERCE COMMITTEE'S VERSION OF H.R. 12112 WITH GAO'S REPORT "AN EVALUATION OF PROPOSED FEDERAL ASSISTANCE FOR FINANCING COMMERCIALIZATION OF EMERGING ENERGY TECHNOLOGIES"

The Committee's version of H.R. 12112 encompasses three broad areas:

Nonrecourse loan guarantees for financing demonstration facilities of (1) synthetic fuel from biomass and other domestic resources (excluding coal and oil shale); (2) energy from renewable resources; (3) modular size oil shale plants; (4) energy-efficient industrial equipment, and (5) geothermal resources development,

A program to assist private sector financing of synthetic gas production and delivery in interstate commerce, and

Price guarantees and purchase agreements for certain demonstration facilities.

In our report we recommend different incentives for each of the various technologies. We concluded that there are other federal incentives which would be more appropriate than loan guarantees. In only one case, biomass, did we recommend the use of loan guarantees.

The section of this bill dealing with the program to assist private sector financing of synthetic gas production and delivery in interstate commerce is apparently an alternative to the use of loan guarantees. We understand that it would allow, if certificated by the FPC, the synthetic gas producer to contract with industrial or other large users of natural gas for the purchase of the output of the plant at whatever price and terms the parties agree to. However, we further understand, that FPC could only certify such contracts when it found the pipeline had adequate capacity to serve existing high priority users.

We did not specifically address this issue in our report. However, we note that this approach would allow synthetic natural gas to be priced incrementally. As

indicated in our report we believe the incremental cost standard is the only realistic one for making sound economic judgments and treating all emerging technologies equally.

The last segment of the bill appears to authorize a demonstration program under which ERDA may enter into price guarantee agreements for non-regulated synthetic gas and contract for purchase of synthetic gas and liquids. The guarantee price or purchase price would not exceed the price of imported oil at the time the agreement or contract is entered into.

In the conclusions of our report, we presented for consideration as an alternative to loan guarantees, when commercialization of the technology is the prime objective, the use of the so-called "commercial pull" approach. Under this approach, the Government could announce that it would purchase a set amount of synthetic oil or gas at some future point in time and request bids from industry. The Government could then select the lowest bid that appeared technically feasible. We believe this method may prove to be a less cumbersome and perhaps less costly way of stimulating the construction and operation of a desired number of synthetic fuel plants.

In our view, portions of the last segment appear to be consistent with our position in that both provide for the purchase by the Government to stimulate commercialization.

Mr. OTTINGER. Again, thank you very much for appearing. The hearing is adjourned.

[The following statements, letters, and telegram were received for the record:]

STATEMENT OF JOSEPH R. RENSCH, CHAIRMAN, GOVERNMENT RELATIONS COMMITTEE, AMERICAN GAS ASSOCIATION AND PRESIDENT, PACIFIC LIGHTING CORP.

STATEMENT SUMMARY

The natural gas industry has long played a key role in supplying our nation's energy needs. We are committed to continue this role. Natural gas supplies about 40 percent of the primary energy consumed by homes, commercial establishments, and industry.

The nation is facing a serious shortage of natural gas. Under average weather conditions, the FPC estimated current levels of curtailment of interstate pipelines at 2.9 Tcf per year. This curtailment is equivalent to five times the quantity of electricity generated by all the nation's nuclear power plants in 1975.

All forms of new gas supplies are needed by our nation—traditional onshore and offshore from the lower 48, as well as supplementals from the North Slope of Alaska, southern Alaska, coal gasification, liquid hydrocarbon gasification, and imported LNG.

Coal gas can utilize our nation's available gas pipeline system for delivery to customers throughout the nation. This pipeline system is highly efficient, reliable, and environmentally attractive.

High Btu coal gasification provides one of the significant answers to the question of how to effectively utilize our nation's abundant coal resources.

Coal gasification is a premium use of coal. It is energy efficient, providing one-quarter more useful energy than electricity per unit of coal. It is capital efficient, requiring only one-half to one-sixth the investment for equivalent coal/electric systems, and it is environmentally attractive. Only 15 percent of the coal is burned. The remaining 85 percent is reacted chemically in enclosed vessels producing essentially no air pollution.

The nation should move ahead with proven commercial plants now to be ready for the decade of the 80's. R&D work on improved processes is inherently long term. It should be continued so that improved processes will be available in the decade of the 90's.

A commercial plant will be, in effect, a demonstration plant for present and future high Btu technology. Later on it can be an ideal location for one or more second generation demonstration plants.

There is no reason for delay. The nation urgently needs the gas now; and for every single day of delay inflation adds $220,000 to the plant costs.

Natural gas, with synthetic gas from coal, will continue to have an economic advantage over other fuels.

Private industry is ready to move ahead with commercial development, but financing presents a problem.

The investment for a single commercial plant exceeds the equity of most sponsors, and lenders require additional assurances.

Lenders have concerns about a procedure that has never before been carried out in the quantity of product indicated—the 250 million cubic feet per day plants are considerably larger than existing plants.

Lenders are also concerned about possible governmental interference or regulatory action that could delay construction, interrupt production, or impair the flow of revenues required to pay interest and principal when due. They ask about protection against new mining laws that could cut off coal supply, against new environmental laws that could impair operation of the plant, and so forth.

Only the federal government can provide the necessary assurance.

The loan guarantee bill, HR 12112, is an essential part of our program. This loan guarantee is not a matter of bailing out a financially troubled industry or providing a guarantee for excess profits. The output of the plants will be regulated by the Federal Power Commission, and the sale of synthetic gas to ultimate consumers will be regulated by state utility commissions.

The loan guarantee approach calls for minimum government participation. Plants will be built with private investment, and direct expenditure of government funds is required only in the highly unlikely event the plant is no completed or fails to operate satisfactorily.

If our nation is serious about moving toward energy self-sufficiency, we must use our readily available resources and commercial processes. The loan guarantee legislation will assure that coal gasification can contribute its share.

PREPARED STATEMENT

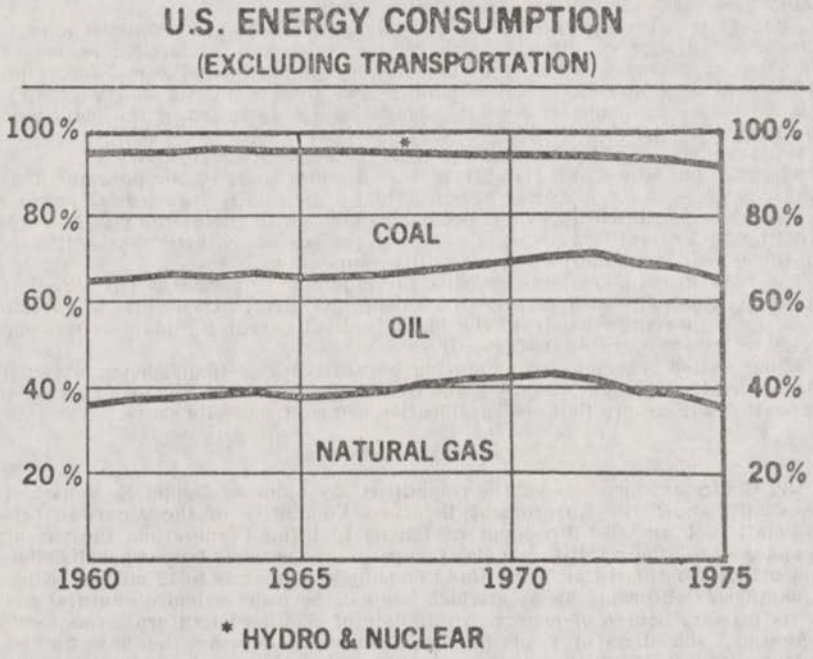
Mr. Chairman, members of the committee, my name is Joseph R. Rensch. I am Chairman of the Government Relations Committee of the American Gas Association. I am also President of Pacific Lighting Corporation, the parent company of Southern California Gas Company—the nation's largest gas distribution utility. Southern California Gas Company supplies gas to 12 million people in southern California—an area which has long been dependent on natural gas as its primary source of energy. An affiliate of Southern California Gas Company and a subsidiary of Texas Eastern Transmission Corporation have formed a joint venture—WESCO—which is planning a high Btu coal gasification plant in northwest New Mexico. Because of my affiliation with Pacific Lighting, I am keenly interested in the topic of coal gasification loan guarantees. I appreciate the opportunity to give you some background on the role of gas in meeting the nation's energy needs and to ask for your support of HR 12112, which will promote the establishment of a synthetic fuels industry.

I shall begin with a brief review of the role of natural gas in our nation's overall energy picture, the benefits of synthetic gas from coal, and the gas industry's need for federal legislation. I will not dwell on what is painfully apparent, that we are experiencing a progressively severe natural gas shortage. I have attached a chart to my statement as an example of the very serious situation we are facing in southern California. Our gas supplies have decreased 20 percent during the last three years, and before the end of this decade, we will be turning off our small commercial and industrial customers, who are unable to switch to alternate fuels. With the hardships and unemployment this portends, you can imagine why we get so upset when more delays to develop solutions are suggested. We have no room for additional delays. We are out of time and must proceed as quickly as possible. Those who suggest further delays and studies should also be aware that because of inflation we estimate that the cost of our WESCO facility is increasing by $220,000 per day. These added costs will be borne by our customers.

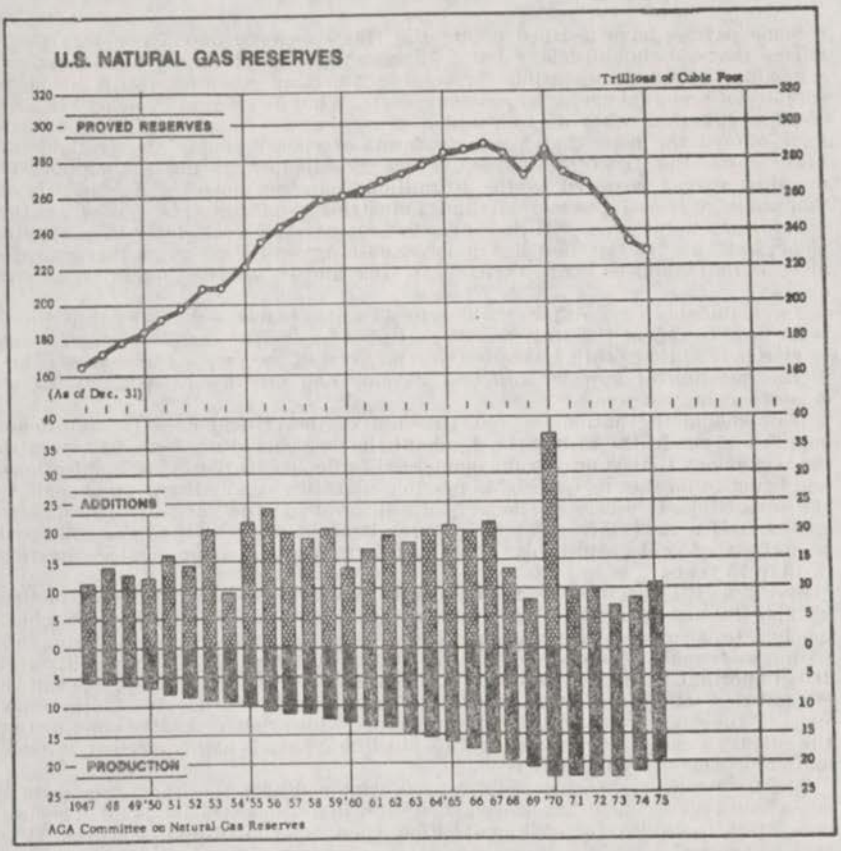
As one key step, the natural gas industry is ready to move ahead in providing an important new source of energy for the nation—coal gasification. As I will explain more fully later on in my statement, the gas industry is blocked from proceeding with large-scale, commercial coal gasification now without a federal loan guarantee program.

Natural gas supplies about 40 percent of the primary energy consumed in our nation's homes, commercial establishments and industry. The gas industry's ability to continue its role of providing economic supplies of premium energy

is now in jeopardy. The nation needs to supplement its declining gas supplies. In many parts of the country (such as ours) there are no readily available, economic alternatives to replace gas in high priority uses. The severity of the natural gas supply problem is indicated by a recent estimate by the Federal Power Commission that curtailment by major interstate gas pipelines is now at



a level of about 2.9 trillion cubic feet per year. To show the significance of this gas shortage, we can compare it to other familiar energy forms. For example, the curtailment level is equivalent to five times the quantity of electricity generated by all the nation's nuclear power plants during the 1975; to three times the energy generated by all nation's hydro plants last year; or to 1.4 million barrels of oil per day.



The production of our nation's natural gas began to level off in 1970, and began to decline in 1973. Deregulation of the price that producers can receive for gas newly dedicated to the interstate market will increase the quantity of gas available for that market. This is a very important step, but it will not satisfy all of our needs. An acceleration of outer continental shelf leasing by the Department of the Interior will also increase the availability of gas—but even this together with deregulation is not enough. To offset the decline in traditional domestic supplies, we also need supplemental supplies of gas from North Slope of Alaska, from southern Alaska, from coal gasification, from gasification of liquid hydrocarbons, and from imported liquefied natural gas (LNG). The need for these supplemental supply sources is urgent. The lead time for major gas supply projects is long and there is no room for additional delay.

Some parties have testified before the House Science and Technology Committee that we should delay—but I suggest these people are not speaking for companies who are responsible for serving American consumers with adequate supplies of premium energy at economic costs. What do we gain by delay? Higher costs as inflation takes its toll, and a worsening gas supply situation. Others have offered the hope that alternate forms of energy supply are available at lower costs. But these less expensive energy supplies are not the supplies of premium energy required by the 40 million American homes and hundreds of thousands of small commercial and industrial establishments served by the natural gas industry. I will present some comparative costs later in my statement; but I assure you there are no lower cost supplies of premium energy available, or that could be made available in time and in sufficient quantity for our needs.

The abundance of coal here within our 48 states is well established, and there is no need to repeat the statistics of that abundance. The main message I want to give here is that coal gasification provides one of the very significant answers to the question of how we can best develop and use this existing, abundant domestic energy source.

How should the nation proceed? In view of the critical need for additional supplies of gas in the near term, I submit that we should move ahead now with the technology that is proven in commercial or demonstration plant applications, and bring to market as quickly as possible high Btu synthetic gas from coal. At the same time, it serves the longer-term interests of the nation to continue to emphasize the necessary research and development work on the more advanced technology of coal gasification, to bring this into broad commercial application in 10 to 15 years.

Specifically, I urge that we get underway now with the commercial production of high Btu gas from coal. Current technology is that of the Lurgi process, which has long been commercially proven at the medium Btu level, and of combining this with a methanation process to raise the Btu level to that of pipeline quality gas. It is important to achieve this high Btu content so that the synthetic gas can be commingled wih the existing supplies of natural gas now moving in the pipelines of the country, these being the pipelines which deliver nearly one-third of the country's energy requirements. This pipeline system is highly efficient, reliable and environmentally attractive.

The methanation step has not yet been combined with the Lurgi process in a commercial plant, but it has proved successful in a demonstration plant. The first generation technology of coal gasification, then, is at hand and is proven. It is time to proceed.

The other avenues that can and should be pursued concurrently include the technologies and applications of low and medium Btu gas. These gases can be produced from coal by known processes. The potential uses, however, are limited by comparison with high Btu gas. Low Btu gas (which has a heating value of 100 to 200 Btu's per cubic foot) would appear to be limited to applications in certain turbine operations for power generation. Medium Btu gas (which has a heating value of 300 to 500 Btu's per cubic foot) has potential applications to certain industrial fuel needs, where gasification can take place at or near the point of use; but it does not have the flexibility or saleability of high Btu gas. Low and medium Btu gas, which can serve in some important ways in localized, special situations, cannot contribute to the major requirement of serving the gas industry's 40 million customers who are in homes, small businesses and small industries. These users have no practical way of switching to non-compatible fuels.

There are, on the other hand, several new technologies for producing high Btu gas from coal that are in various stages of development. These are the second generation technologies that are moving forward under programs such as those sponsored by ERDA or jointly sponsored by ERDA and the American Gas Association. These include Hygas, CO_2 Acceptor, Bi-Gas, Steam-Iron, Chem Systems, Synthane, Hydrane, and others. Their current states of development range from design to construction to operational test runs.

The ultimate objective of these programs under ERDA and AGA is the selection of the best second generation process, or the best combination of components from the various processes, which will go into the design of a demonstration plant. Such a plant would be developed to produce high Btu gas from coal more efficiently than existing first generation technology, and would also be aimed at broader applications to different types of coal. For the past five years, Gas com-

panies throughout the United States have been devoting approximately $10 million a year to this joint government-industry program, through the American Gas Association.

Under the ERDA demonstration plant schedule for second generation technology, commercial size plants will not be a reality until the late 1980's or early 1990's. Research and development are inherently long term. This only underscores the importance of proceeding now with a plant or plants using the proven first generation technology. There is an urgency if for no other reason than the serious near-term natural gas shortage. We must be moving forward now with a commercial demonstration of the technical compatibility of the various processes that make up a high Btu coal gasification plant. We must be determining what U.S. coals can be gasified with existing processes. We must be improving and optimizing the existing processes, and developing markets for by-products.

A commercial plant will be, in effect, a demonstration plant for present and future high Btu technology. Amongst other things, it will demonstrate the social, economic and environmental attractions of a full size operation. It can be the first unit of an installation that will in turn be scaled up with additional units to higher levels of commercial production as the benefits are confirmed. It can, later on, be an ideal location for one or more demonstration plants incorporating second generation technology.

The efficiency of the high Btu coal gasification process, using present technology, is in the range of 65 to 70 percent. The overall energy efficiency—from the mine to and including the ultimate use at the consumer's appliance—is approximately 40 percent. This is one and a quarter times the overall efficiency obtained by converting coal to electricity in a conventional power plant.

Gasifying coal is also environmentally attractive. As little as 15 percent of the coal is actually burned in the process. The remaining 85 percent or so is reacted chemically in enclosed vessels, producing essentially no air pollution.

One of the most significant statements that can be made in favor of early action on coal gasification, is that the means of delivering the gas to the user is in existence now and is available for use. A large network of gas pipelines, distribution systems and underground storage fields is in being. It is a very efficient transportation system and it is not being used to its full capability because of the progressively worsening curtailments of domestic natural gas supplies. The idled capacity of this system becomes a real bargain when it can be put to use transporting an interchangeable gas from a new source. High Btu gas from coal need only be fed into this system and it has an easy route to existing natural gas consumers. Not only would a major new supply of gas be provided at a time when sorely needed, but a timely and important use would be made of an idled pipeline capacity. This underground network represents an investment of $50 billion and is a national asset of major importance to the population centers it serves.

Over the years, the natural gas customer has had an economic advantage over other fuel customers in meeting his heat energy needs. This advantage will continue as synthetic gas from coal is introduced. In many areas of the country the only alternative energy for residential, commercial, and small industrial customers is electricity. A coal fired electric generating plant together with necessary transmission and distribution facilities requires from two to six times the investment required for a coal gasification plant delivering an equivalent energy output. The residential customer ends up paying twice as much for electrical energy from coal as he does for gas energy from coal. This cost differential is due to the lower thermal efficiency of electric generating plants, more expensive transmission and distribution facilities, and the high cost of meeting electric peak demands.

In California—and this is according to a recently published analysis made by the California Public Utilities Commission staff—the cost of energy delivered to the point of use from new nuclear or coal-fired generating facilities will be upward from $12 per million Btu. The cost of gas from the particular coal gasification project we are involved in—the Western Gasification Company, WESCO, using existing facilities for delivery to the point of use, has been figured at less than $3 per million Btu's in terms of 1976 dollars. Even assuming the worst in terms of further delays and cost escalation, the energy from the synthetic gas made from coal will continue to have a substantial cost advantage, by comparison with the electric alternative, for our southern California gas consumers.

The biggest remaining hurdle in the path of the WESCO project, and the hurdle that faces the gas industry generally with respect to new sources of

supply, is financing. Entering into these enormously capital intensive projects is a new dimension for most natural gas companies. We are talking about investments per unit of deliverability in new energy systems that are as much as ten times prior capital expenditures for natural gas pipelines.

The gas industry's current heavy financing requirements relate not only to coal gasification, but also to expensive liquefied natural gas projects and pipelines that traverse Arctic terrain with conditions never before confronted. There is a giant step to be taken from where the industry is now to where it has to go, to a vastly higher capital plateau. We have found that that step is going to require help.

When we look at the enormous capital requirements of each of these projects, in relation to the size of the sponsoring natural gas companies, it is understandable that lenders are unwilling to rely on such companies to provide the credit assurances they demand. The cost of just one coal gasification plant will exceed the total net worth of many of the nation's largest gas companies. Even though they might desire to do so, these companies simply do not have the resources to finance such projects exclusively on their own credit. They must also maintain their ability to finance and keep up their existing facilities used to serve the consuming public.

Potential lends are reluctant to extend financing to a new project which is so large in relation to the size of the sponsors, particularly when the processes or products are new and unfamiliar. Lenders have concerns about a procedure that has never before been carried out in the quantity of product indicated by the design. The 250 million feet per day plants that are proposed are considerably larger than other plants now in existence; in addition, they will employ a methanation process for increasing the Btu content which has not yet been proven in a commercial size coal gasification plant.

Until a plant of this size and capability is proven in the United States, lenders will require assurance of repayment in the unlikely event the process will not perform as the engineers say it will. They are also concerned about possible governmental interference or regulatory action that could delay construction, interrupt production or impair the flow of revenues required to pay their interest and principal when due. They will ask about protections against new mining laws that could cut off the coal supply, against new environmental laws that could complicate or impair operation of the plant, and so forth. Delays resulting from such developments during construction could result in serious cost overruns.

With all of these unknowns, the lenders insist upon assurance that their loans will be repaid. It follows that such assurance must come from the federal government. The synthetic fuels loan guarantee bill, H.R. 12112, provides these assurances. Its early passage is essential to the gas industry and the nation. If enacted, we who are sponsoring the WESCO project will promptly seek approval of a loan guarantee for that pioneer plant, and will take every action we can to hasten its construction and completion.

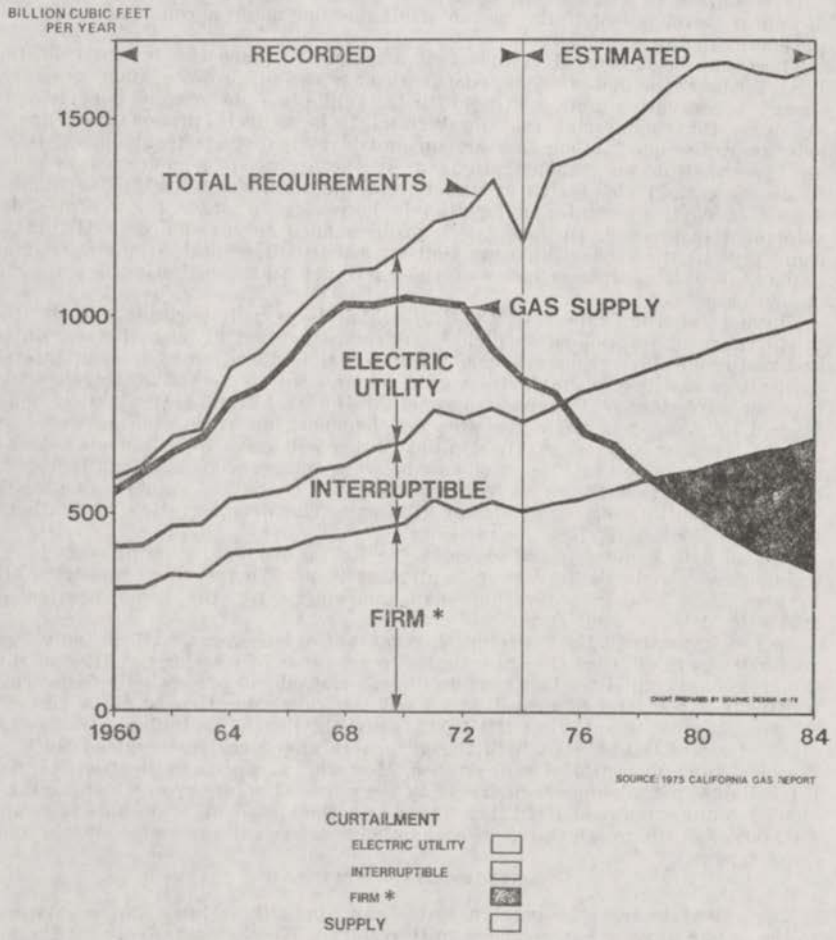
Here again, other parties have suggested that a federal loan guarantee is not required to proceed. But do these parties have viable, ready-to-go alternate energy supply programs? In particular, do they offer any program for utilizing coal, our nation's most abundant fossil fuel resource, in environmentally superior ways, to produce premium energy supplies for homes and small businesses at lower costs; in the amounts and on the same early delivery schedule as proposed by the gas industry? I think not. Further, none of those parties stated that they found investors willing to provide capital for this type of venture without a federal loan guarantee nor did they say they were willing to provide the necessary capital themselves. The question is not what might be desirable if the nation changed its way of regulation, taxation, and so forth, or of what could be done in an abstract theoretical study. The question is what can we accomplish now with the resources and technology at hand to produce a needed commercial product.

Limited support from the federal government is a key concept for the early plants, because this is the only way these plants will be built by the private sector. The loan guarantee approach in HR 12112 calls for a minimum of government participation. The plant or plants will be built with private investment; the direct expenditure of government funds will be required only in the highly unlikely event that the plant is not completed or fails to operate satisfactorily.

The loan guarantee is not a matter of bailing out a financially troubled industry. It is a matter of simply providing a minimum level of support that

this vital energy industry requires as it moves from one capital plateau to a much higher one. There are few matters confronting our nation today that have any greater significance than the subject of energy and supplying the needs of our citizens for premium energy in the most economic manner. H.R. 12112 is an essential involvement of government, backing up the gas industry as it takes a giant step into the future.

SOUTHERN CALIFORNIA GAS COMPANY
GAS SUPPLY - REQUIREMENTS 1960-1984



STATEMENT OF GOVERNOR RICHARD D. LAMM [1] OF COLORADO

It is awkward for a Governor to address a specific measure such as this dealing with the stimulation of synthetic fuels, apart from such issues as

[1] Governor of Colorado and Chairman of the Synthetic Fuels Task Force of the Natural Resource and Environmental Management Committee of the National Governors' Conference.

energy conservation and alternative energy resources. However, because of this nation's vulnerability, we are not afforded the luxury of withholding action until such a policy is developed.

Although my purpose is to address matters concerning the production of fuel through synthetic processes, I feel compelled to begin by underscoring the need for Congress to deal with energy conservation in an imaginative and aggressive way. As we stand on the verge of initiating federal support for the demonstration of synthetic fuels technologies and observe that perhaps as much as 30 percent of the potential we hope to harness will be wasted because of imperfect conservation technologies and consumptive lifestyles, one must be drawn to the realization that energy conservation must be the keystone of any natural energy plan or policy.

It is unfair to ask certain citizens of this country to suffer the impacts of energy development if the nation itself has not made a commitment to use the energy in a sensible fashion.

There has been general criticism of attempts to place the integrity of the U.S. Treasury behind various energy demonstration projects such as solar, energy conservation and synthetic fuels. While we do not support federal subsidies for commercial fuel production, it is entirely proper to utilize a loan guarantee mechanism to start up and investigate new technologies. Such an investigation or demonstration of synthetic fuels technology is needed to do more than simply better understand the technology itself. The highest degree of environmental amelioration is necessary in order for synfuels development to proceed. Demonstration projects such as envisioned in HR 12112 could give us the critical answers that we need with respect to environmental impact, as well as answer many of the environmental questions which remain unanswered.

There is another aspect of the Bill which is very important, that is, the broad range of technologies which is addressed dealing in both the renewable and non-renewable resource areas. While a strict allocation of loan guarantee ability across these technologies would be unwise, we feel that there should be some direction by Congress to see that the $2 billion authorization benefits not only non-renewable resource development, but renewable as well.

Over the next few years, the United States will have to call upon a broad mix of technologies to close the gap between energy consumption. It is certainly in the national interest to investigate in a controlled manner all promising and potential sources of closing this gap. The demonstration of synthetic fuels technologies falls into this category.

Just as with exploration of space in the 1960's, demonstration of new energy technologies should be important to all Americans. We therefore support a bill to provide a moderate level of loan guarantees for the demonstration of synthetic fuels.

As you know, both the National Governors' Conference as well as individual governors were afforded the opportunity to appear before a subcommittee of this Congressional committee last year, to discuss the subject of synthetic fuels. That testimony is a matter of record, and I will not take your time in going through it again. It must be said that HR 12112 is a sophisticated beginning, and does include many of the points which the governors have previously raised, such as the need for gubernatorial concurrence. However, as presently drafted, we feel the Bill does not adequately address two very crucial points upon which we must condition our support of HR 12112. These are: the applicability of state laws and methods of dealing with the socio/economic impact resulting from synthetic fuels development.

APPLICABILITY OF STATE LAW

The extent to which sovereign states can apply their laws and regulations to the public domain has not been fully resolved. We obviously feel that the application of our laws, which serve to protect the health, welfare and safety of Coloradans, is a proper exercise of the policy power both on and off federal land.

In a number of cases, however, Congress has avoided the uncertainty of this constitutional debate. That is when Congress specifically has delegated authority to the states, together with the requirement that certain minimum standards be honored as with air and water pollution control laws.

Because of this precedent and because of the fact that synthetic fuels development is a high risk venture, I deem it completely appropriate and necessary for the federal government to clearly acknowledge the applicability of state reclamation and facility siting laws if they are as stringent as the federal, to these very limited facilities.

Such a specific acknowledgment should be found in the legislation itself so that there is no question as to the federal intent of allowing the states to apply their laws to the projects which would be guaranteed under HR 12112. The states feel this is an extremely important condition to our support. In order to address our pressing energy problems in a timely fashion, the federal government is going to need the full cooperation and partnership of states. There is no better way to insure such a partnership than to allow states the full ability to assure for the protection of their citizens.

SOCIO/ECONOMIC IMPACT

The purpose of the loan guarantee strategy is to reduce the level of uncertainty and risk involved with building a commercial demonstration facility. Recognizing that such synthetic fuels projects have the potential of causing a high level of socio/economic impact, the states are asking the federal government for an equal level of certainty that such impacts can and will be ameliorated.

H.R. 12112 does provide a number of specific tools for dealing with community impact. The major delivery mechanisms, however, appear to be loan guarantees and direct loans. It is vitally important that the community impact assistance mechanisms be immediately available upon finalization of a guarantee for plant construction. A system based on loans to states and local governments may not provide the criterion of immediacy. The utilization of a loan or even a loan guarantee may hinge upon substantial institutional changes, requiring either legislation or constitutional modification.

In addition, the ability to deal with the impact in a "front end" manner may be frustrated by the inability to successfully pass a local bond proposal. Local citizens, in energy impact areas, have become very suspicious of programs which force them to bear the responsibility of dealing with the impact of the intrusion of energy related growth.

I can understand why local residents are apprehensive. Jack Gilmore, a leading authority on community impact, from the Denver Research Institute, predicts that even under the best circumstances of a federally guaranteed loan, local debt service might increase the total householder's burden of taxes and fees to 1½ to 2 times its present rate.

These issues, such as limits to bonded indebtedness, individual tax burdens and the ability to successfully adopt local bond proposals, are extremely awkward mechanisms around which to build a comprehensive impact amelioration system.

The limited nature of this synthetic fuels demonstration program, together with the high risk that it carries, would dictate in our minds a more straightforward and expeditious approach for dealing with the socio/economic impacts. I would suggest that in this case it would be proper to utilize a special grant system for community development costs, resulting from the development guaranteed under H.R. 12112. Congress has recognized the necessity for utilizing grants in the case of Outer Continental Shelf legislation, which is pending in both Houses. Such an application might very well be necessary in the case of synthetic fuels development.

In addition, the legislation still does not provide an assurance that socio/economic impacts will be ameliorated. H.R. 12112 simply provides that the Administrator must determine that the impacts resulting from the proposed facility have been evaluated and that effective steps have either been taken or are planned to be taken to finance such community planning and development costs. We strongly feel that it is incumbent upon the Administrator to not only find that the situation has been properly evaluated, but that the steps which either are being taken or will be taken are adequate to properly ameliorate socio/economic impacts. There must be an assumption of responsibility in this area, and we think that it is proper for the Administrator to assume the responsibility of seeing that these impacts are being adequately dealt with prior to finalizing any loan guarantees. It would simply not be acceptable to be in a situation where the construction of a facility was proceeding, but community development programs languished either while appropriations bills wound their way through Congress or where a state was unable to fully utilize federal assistance because of it being spread among numerous uncoordinated programs.

Oil shale development has gained a great deal of attention within the legislation. It is a potential fuel source that only affects two or perhaps three states. As the Chief Executive of one of those states, however, I would like to address the subject with a degree of specificity.

Oil from shale may some day be an important part of fuel mix. However, there are enormous questions for which there are simply not adequate answers at this time. These questions deal not only with the technical feasibility of the retort process, but run directly to the matter of whether or not oil shale development can proceed to full scale commercialization is an environmentally, socially and economically accepted manner. It makes a great deal of sense to investigate the technology, through a modular demonstration approach now when we clearly have the time to understand both the costs and benefits of oil shale development.

In supporting the inclusion of oil shale in H.R. 12112, I feel that it is important to make a number of specific points:

1. We view H.R. 12112, together with its authorization for two billion dollars in loan guarantees as a complete demonstration package relative to oil shale development. The bill should assure that a few single retort plants will be built, which will demonstrate varying technologies and give all parties the important information that is needed to better judge the potential of oil shale. We expect to be able to monitor and evaluate any plants constructed with the assistance of this authorization, prior to any expansion of the program dealing with oil shale. Colorado will not be a party to a piecemeal approach. We assume that the authorization found in H.R. 12112 is sufficient to answer the major questions currently surrounding oil shale, and we would oppose an expansion of authorization in the near term, until the performance under this initial phase has been evaluated.

2. Any utilization of H.R. 12112 to demonstrate the potential of oil shale must distribute the projects among the various technologies available. We place a very high emphasis on in situ development in Colorado because of its potential for being the least damaging approach. We also feel that projects should be distributed in an equitable manner between the states which possess an oil shale potential.

One of the unanswered questions which a demonstration project must address, in our opinion, is whether or not oil shale development can proceed in an environmentally acceptable manner. In order to investigate problems, it is vital that the best technology, commercially available, be employed to ameliorate the environmental impact of the demonstration projects.

Because of the very high risk and uncertainty of oil shale development, there must be clearly understood limits placed on the scale of demonstration facilities. There is in our minds a method of exploring the technology in a manner that will not only give us answers to important questions, but will allow us properly to monitor and evaluate the technology and its impacts.

We are referring to a "modular approach" for oil shale development. A modular approach is one utilizing a single retort of a limited size in order to demonstrate the technology and judge the impacts. It is important to understand that the manner in which a full scale commercial oil shale operation is built is to employ the sequential construction of a number of "modules," each with a capacity of processing up to 12,000 tons of shale rock per day.

We strongly feel that limiting the size of the facility to a maximum of 12,000 tons per day is wholly consistent with the demonstration nature of this legislation. While H.R. 12112 does address the modular approach, the present draft suffers from a degree of vagueness. Therefore, a specific limitation in the legislation would remove much of the uncertainty that we have with respect to the impacts of this legislation upon the State of Colorado.

The relationship of a modular approach to federal subsidies for the demonstration of oil shale technologies is important to understand. We strongly feel that regardless of whether the technology is demonstrated with or without federal assistance . . . on or off federal land, a modular approach makes sense. We simply must have a greater degree of knowledge before making a commitment for full scale commercial production.

However, restricting industry to modular development during this demonstration phase will necessarily provide an uneconomic condition for industry. Weighing the benefits of a paced, modular approach, I find sufficient justification for federal assistance for industry in this initial demonstration phase.

STATEMENT OF THOMAS P. SALMON, GOVERNOR OF VERMONT, AND CHAIRMAN, NATURAL RESOURCE AND ENVIRONMENTAL MANAGEMENT COMMITTEE OF THE NATIONAL GOVERNORS' CONFERENCE

I appear before you today in my capacity as Chairman of the National Governors' Conference Committee on Natural Resources and Environmental Management. As many of you recall, a number of my colleagues and I testified before this Committee's Fossil Fuels Subcommittee last October, with respect to key provisions necessary for a successful synthetic fuels program. Although we are here again to address many of the same provisions, I would be remiss if I did not commend this Committee for incorporating a number of our most important concerns in H.R. 12112. The proposed Synthetic Fuels Demonstration Bill we have before us today is a far cry from the legislative proposal that we considered late last fall.

Mr. Chairman, I sense that the character of this Committee is one of integrity and understanding. You have all labored over a massive proposal by the Administration that purports to move this country closer to Energy Independence. None of us doubt that we should strive toward the attainment of such a goal; however, the means to that end often differs with ones individual philosophy of government's proper role in the entire energy situation.

The Nation's Governors are committed to a National Energy Policy and program that is comprehensive in scope. Such a policy and program must address itself to a wide variety of energy development and conservation alternatives. The Governors of this country have called such efforts on numerous occasions, and stand ready to assist the Congress and Administration in their efforts to develop the long range plans that are necessary to achieve that goal.

The National Governors' Conference has reviewed the proposed synthetic fuels program with great care and interest. A task force has been created under the auspices of the NGC Committee which I chair, and is led by Governor Richard D. Lamm of Colorado. Other distinguished Governors on the task force include two former Chairmen of the National Governors' Conference, Governor Arch A. Moore, Jr. of West Virginia, and Governor Daniel J. Evans of Washington. They are also joined by Governor Julian M. Carroll of Kentucky, Governor Ed Herschler of Wyoming, and Governor Arthur A. Link of North Dakota.

The task force has examined a wide variety of issues concerning ERDA's synfuels proposals. The magnitude of the program would have a great impact on a number of our states. As a result, we firmly believe that the decision to proceed with the program should only come after full debate on impacts that the program may produce—both positive and negative. As Governor Lamm pointed out last October, "The decision which Congress makes on synthetic fuels would have a massive effect on all our states. In some states, it could prove to be the most important piece of federal legislation in two centuries."

We are entering a phase in our country's energy future which must be approached not only with great caution, but with even greater foresight and determination. If this or any other large scale proposal is to work, we must assure at a minimum that the communities that must host energy facilities can, and will, survive as viable communities. As public officials, each of us can settle for nothing less. In the final analysis, this must be an overriding concern.

The proposal before us today calls for the need to demonstrate the commercial feasibility of producing synthetic fuels from coal, oil shale, and to employ other energy resources and forms of energy. Energy conservation demonstration is also included in the program. Available program dollars can only be allocated to a limited number of these areas at this time. However, this does not lessen the role conservation can play in our overall strategy. Should the program be authorized, it is imperative that the Congress insist on demonstrating conservations commercially feasible role before the program moves very far ahead.

The need and desirability of demonstrating the commercial feasibility of producing synthetic gas and petroleum is essential as our domestic production of fuel declines. We are all aware of the growing dependence on imported foreign oil. This February, for the first time in our nation's history, we imported more oil than we produced. Continued movement in this direction without corrective steps, could cause disastrous balance of payment and national security problems. We must supplement our dwindling domestic natural gas and petroleum production.

As holders of 25 percent of the world's coal reserves, a program to foster its wise and environmentally acceptable use is a long overdue national priority. Much of the emphasis of the proposed synfuels program addresses the utilization of various domestic coals for high and low Btu gas demonstration facilities, and at a later stage, conversion processess that liquefy coal are to be incorporated into the demonstration program. Should these processes prove to be commercially feasible, significant additions may be added to our domestic energy supply of natural gas and petroleum.

As indicated earlier, I believe that H.R. 12112 has been strengthened by the addition of several provisions which address the question of amelioration of adverse socio-economic impacts. The mere recognition that these concerns were addressed can only bolster the point that any adverse impacts experienced by our communities must be eliminated if this proposed program is to succeed.

In this regard, the NGC Synthetic Fuels Task Force has recommended that a number of key elements become part of any synfuels demonstration program. These recommendations have been approved by the NGC Committee on Natural Resources and Environmental Management, and are offered for your consideration as follows:

TASK FORCE RECOMMENDATION NO. 1

"All synthetic fuels demonstration and development projects receiving Federal loan guarantees should be made subject to state laws and regulations regarding health, land use, land reclamation, water rights, and taxation."

Section 17(u) indicates that a borrower who receives a guarantee under this program shall comply with Federal and State environmental, land use, water, and health and safety laws, and to obtain applicable Federal and State permits, licenses and certificates. It is the strong recommendation of the Task Force that state laws regarding reclamation and facility siting be applied to synfuel projects where such laws are more protective than comparable federal laws. The Governors also insist on fulfilling their constitutional mandates to protect the public health, safety and welfare of their citizenry.

TASK FORCE RECOMMENDATION NO. 2

"The Energy Research and Development Administration should secure a Governor's concurrence prior to finalizing any loan guarantee for a synthetic fuels demonstration or development project within the Chief Executive's state.

The language contained in Section 17(e) concerning the Governor's concurrence is acceptable to the Task Force. If projects proposed under this program are to be successful, it is only common sense that the Governors should be involved in the decision-making process. The states have their own long-range development plans, which may or may not be consistent with proposed projects for a variety of reasons. The state and federal government, as well as the industrial developer, must be fully apprised of the expectations and potential impacts which occur with large scale development.

TASK FORCE RECOMMENDATION NO. 3

"Congress should provide a mechanism within any loan guarantee program to fully involve the states as partners in the decision-making process for synthetic fuels demonstration and development."

This recommendation is partially addressed in Section 17(e) whereby the Administration is to inform the Governor of the affected state and officials of each political subdivision and Indian Tribe which may be impacted by a demonstration facility.

Although not specifically addressed in the legislation, ERDA has been formulating plans to create a Synthetic Fuels Environmental Advisory Board which would allow representatives of affected states to participate in a number of decisions surrounding synthetic fuels demonstration and commercialization. The Task Force recommends that ERDA create this Advisory Board before any project awards are granted, in order that affected parties can officially provide input to the Administrator on proposed demonstration projects.

TASK FORCE RECOMMENDATION NO. 4

"As a condition precedent to any loan guaranteed project, a full assessment of the direct and indirect cost to the state should be made and their ameliora-

tion should be assured. Local residents should not unfairly bear the cost of synthetic fuels development."

Although the issue of impacts directly resulting from proposed facilities is covered in Section 17(c)(5), we urge that amelioration of all impacts should be assured. The legislation does provide a number of mechanisms for dealing with community development as necessitated by loan guaranteed projects under this section. Various mechanisms, including loan guarantees to communities, direct loans, planning grants, as well as the ability for the Administration to "internalize" community development costs into the "total cost of the facility" are financing tools which are essential. In some cases, however, it may be absolutely necessary that direct grants be made available to off-set front-end financing problems for local political sub-divisions.

Depending on where a particular facility may be located, there will be a need for new schools, water and sewer facilities, police and fire protection, roads and highways, and a health program. In many sparsely settled areas there is virtually no local government. The bonding capacity of many states and counties is hampered by statutory dollar limitations and other restrictions, including a requirement in several states that there be a referendum before bonds can be issued. This could cause problems of uncertainties and delay which would frustrate a national effort.

America has long since learned that a community consists of more than physical services. A community must be planned so that there is an integrity to the activities which occur within its limits. Local government must relate to the activities and the population. Population should not be solely a function of a single industry.

A community must fulfill the needs of a variety of people who want different opportunities for recreation, social interaction and life styles. Different income groups must be accommodated and different age groups should be included if there is to be stability. Indeed, executives of a major industry in today's world knows that there will be a range of people needed to staff a new facility in a complex technology. Recruiting and maintaining a workforce may be impossible in an area where the "new town" does not serve the range of interests that a diverse population seeks.

We must learn from our experiences from the classic "boom towns." The increased incidences of alcoholism, boredom, crime and resulting decline in productivity must be ameliorated if we expect these projects to succeed.

Particular attention must be given to building infrastructure capacity that will accommodate the population influx during the construction phase of synfuel facilities. Many of the services that are normally borne by the private sector may be provided because of limited life expectancies. A number of these services will have to be provided from the public sector.

Therefore, funding must be provided to plan the new communities in a comprehensive way, and special techniques must be provided to fund the public services that will be required to accommodate people in a way which will be an asset to the state in which the new technology occurs.

The states have reviewed the various alternative means of helping to finance public services which will be required by some of the new synthetic fuels demonstration facilities. Several facts become evident from the review. First, the diversity among states and their subdivisions is so great that no single approach could cover all of the variations. Second, the problems will vary depending on the site selected and the nature of the plant to be constructed and operated; thus, it is impossible to devise a single approach that will cover all contingencies or even the range of predictable variations.

The Governors believe that the states and their subdivisions will be assuming risks and burdens as a result of these new, untried facilities and it would be unfair to ask them to assume the additional risks of the costs of the public services required to make these nationally sponsored efforts more feasible. It should be made clear that the solutions to any particular problem may require a mix of different approaches depending on the levels and differences among public facilities and services. Flexibility is the quality that can help the program succeed.

TASK FORCE RECOMMENDATION NO. 5

"Care should be taken within any loan guarantee program to see that synthetic fuels opportunities are developed throughout the country."

The legislation does not specifically address this important issue. The task

force felt strongly that all regions of the country should be considered when demonstrating the commercial feasibility of various processes. A number of technologies can utilize a variety of different coals, and the true test of commercial feasibility should take this fact into consideration.

Section 17(e) requires the Administrator to submit a report to the Congress setting forth his recommendations on the best opportunities to implement a program of federal financial assistance. The Administrator's report shall include a comprehensive plan and program to acquire information and evaluate the environmental, socio/economic and technological impacts of the demonstration program.

I would like to propose an amendment that would aid in assuring that all parts of this nation are considered when reviewing various technologies. The amendment would be added as sub-section (3)(F) of Section 17(1) and read as follows:

"Extent to which it is feasible to commercialize the technologies as it affects different regions of the country."

The effect of the amendment would in essence require that the Administrator also consider all regions of the country when reviewing various demonstration proposals.

TASK FORCE RECOMMENDATION NO. 6

"Oil shale development should be included in the initial stages of a Federal synthetic fuels program designed to assess the feasibility of such a technology. This initial stage of federally supported program to demonstrate the feasibility of oil shale development should support the smallest sized projects needed to understand and either approve or disapprove the technology in question."

This recommendation is appropriately addressed in the legislative proposal before you. My colleague, Governor Richard D. Lamm of Colorado, will address the specifics of this issue in his remarks before the Committee.

TASK FORCE RECOMMENDATION NO. 7

"Working with the states, it is the responsibility of the Federal Government to see that new technologies are tested and refined prior to full-scale commercial application. Therefore, we would support a Federal loan guarantee program for the purpose of demonstrating the commercial feasibility of synthetic fuels production, recognizing that the commercial production of energy should be provided by the private sector."

The Governors concur that it is the proper role of the Federal Government to demonstrate new technologies for the purpose of assessing their commercial viability. At the same time, we also feel that it is the proper role of the private sector to commercially produce energy in the long term.

Our recommendation of supporting a Federal loan guarantee program for purposes of demonstrating commercial feasibility should in no way be construed to recommend at this time, a federal program of price supports or regulatory modification for cost of service inclusion in the state utility rate base of synthetic gas. The Governors will respond to these issues as legislation or appropriation requests in these areas are considered.

Again, we are entering a unique phase in our domestic energy future. Traditionally, technology evolution has proceeded to the commercial stage only after careful development in our laboratories. The synthetic fuels proposal before us takes a different course than the incremental approaches of the past. It takes first generation technologies to the demonstration stage much faster. There are economic risks, but also great benefits should we succeeed. With the proper safeguards, the risks can be minimized.

The information that this program may yield in the environmental and socio/economic areas can be extremely valuable toward the goal of reducing our dependence on foreign energy products. We must monitor and evaluate the programs findings with great care, being mindful of the consequences both pro and con.

Mr. Chairman, let me thank you and the members of this Committee for extending to the National Governors' Conference the opportunity to comment on this important piece of energy legislation. The nation's Governors continue to stand ready to assist in the development of our National Energy Policy. In addition, I would like to personally thank you, Mr. Chairman, for the personal invitation to appear before you today.

STATEMENT OF JOHN H. ROBSON, PRESIDENT, OIL HEAT MARKETERS ASSOCIATION, 535 NORTH MICHIGAN AVENUE, CHICAGO, ILL.

WHY THE COMPROMISE GAS PRICING BILL WOULD CAUSE THE RAPID DEPLETION OF THE NATION'S TOTAL NATURAL GAS RESERVES

INTRODUCTION

Although the main purpose of this paper is to explain why the passage of bills that hold consumer gas prices below other fuels would lead to more serious energy problems by encouraging the rapid depletion of that fuel that is most rapidly being depleted—this paper also explains the following:

1. How the control of natural gas prices caused the increasing requirements for oil imports;
2. Why natural gas utilities (even those experiencing supply curtailments) are aggressively converting users of other fuels to gas;
3. Why gas distributing companies encourage the wasteful use of gas by those able to burn coal—as they ask for federal help to build coal gasification plants;
4. Why the failure to increase consumer gas prices to a parity with alternative fuels would lead to disaster.

The paper ends with a list of ten recommendations for a sound natural gas policy.

HOW THE CONTROL OF NATURAL GAS PRICES CAUSED INCREASING REQUIREMENTS FOR OIL IMPORTS

During the past 21 years, the policy of artificially pricing natural gas at low levels undermined the nation's total energy industry—as it simultaneously encouraged the design and construction of energy-wasting structures and equipment. The introduction of gas into most states at low prices affected the economic forces influencing the production and utilization of natural gas and all competing fuels. As natural gas was made available to large fuel users at low "interruptible" and "firm" industrial rates, it undermined markets for coal and residual oil, traditionally used as industrial fuels. And as "cheap" natural gas cut more deeply into the sales of residual and distillate fuel oils, it forced refiners to invest in cracking equipment to convert larger percentages of each barrel of crude into gasoline, helping cause the gasoline surpluses and chronic price wars of the 1960's that caused American drivers to become addicted to large gas-guzzling cars.

Because the control of natural gas prices discouraged investments in domestic energy production and encouraged consumers to become increasingly committed to habits of excessive energy consumption, it has been the single most important cause of the nation's total energy problem, It is primarily because of the artificially low natural gas prices, that our nation must now rely on increasing quantities of imported oil to fill the domestic energy gap.

THE GAS UTILITIES ARE CONTINUING TO CONVERT USERS OF OTHER FUELS TO GAS

The gas utilities have been exploiting the disparity between the controlled gas prices and the prices of other fuels. Even though the natural gas distributing companies are experiencing increasing supply curtailments, many gas utilities are still continuing to eagerly accept new residential customers—including the conversions of thousands of homes and apartments being heated with coal and fuel oil. As their supplies continue to decrease, these companies are expanding their sales to that class of customers that pays the highest prices per unit of gas, increasing their residential space-heating loads to the limits of their winter peaking capabilities. The gas utilities will obtain the supplies they will need for their additional residential customers by curtailing gas to their existing firm industrial, chemical, and agricultural customers—all in accordance to the curtailment policies as established under FPC Order 467–B. The gas companies will then be able to say that the curtailments of these larger fuel users (those paying the lowest rates) are required in order that the company will have sufficient gas to supply the "human need" of their residential customers (those paying the highest rates).

Because the gas utilities do not want to arouse the disfavor of certain federal agencies, they have been careful in their efforts to encourage people to switch from other fuels to gas. As the utilities have been attaching new residential

loads, including those conversions from other fuels, they have been telling the public that there will be plenty of gas for their residential customers—that because the residential users have the highest priority, they will be unaffected by fuel shortages during the foreseeable future. And as the gas utilities have made their many "public service" announcements urging gas customers to use gas more wisely, they have been reminding the public that natural gas still remains the best fuel bargain.

The two largest gas utilities in Illinois have been most successful in their efforts to convert residential users of other fuels to gas. Of the 257,000 total conversions reported for the entire U.S. in the AGA's 27th Annual Househeating Survey, Illinois had 81,000. Of this 81,000, Peoples Gas Light and Coke Company reported 62,432 (including the 1,702 conversions reported by their subsidiary, North Shore Gas), and Northern Illinois Gas reported 15,500 conversions. Together, these two companies accounted for 30.3 percent of the total gas conversions reported for the entire U.S. for that year!

Although no comparative figures are available for 1975, the Oil Heat Marketers Association estimates that members have been losing customers to the gas utilities at an annual rate of about 20 percent during both 1974 and 1975.

NATURAL GAS IS BEING CONSUMED BY FUEL USERS HAVING THE ABILITY TO USE COAL

Not only are the gas distributing companies continuing to convert residential users from other fuels to gas, they also are continuing to urge large fuel users, capable of using coal, to burn gas whenever it's available.

The North Shore Gas Company, a division of Peoples Gas, is presently receiving synthetic gas from the SNG plant being operated by Peoples Gas. In the process of converting the naphtha into synthetic gas, approximately 90 percent of the Btu content of the feedstock is converted into gas, the remainder is consumed as process fuel or lost. The SNG plant being operated by Peoples Gas will probably waste about 1.2 million barrels of naphtha per year—equivalent to the quantity of fuel oil required to heat about 38,000 average six-room homes in Chicago for one entire year. And as the gas companies are continuing to wastefully convert this petroleum into synthetic gas, they are also continuing to convert users of fuel oil to gas.

And because of the synthetic gas being produced by the SNG plant, the North Shore Gas Company now has a surplus of gas—even though the FEA allocation of petroleum feedstocks to the SNG plant was undoubtedly made, based on the gas company's claim that the SNG gas was needed to fill the requirements of their firm customers. Because North Shore Gas has a surplus, in mid-February they informed the Winnetka municipal power plant (a curtailed interruptible gas customer) that North Shore could again supply unlimited quantities of gas to fire their boilers.

Today, even though that power plant is able to meet environmental emission requirements while burning a special Wyoming coal, those boilers are continuing to be fired by gas. Recently, during a brief period when the plant was operating on coal (to make emission tests), the plant engineer was informed by a representative of the gas company that the gas company wanted the power plant to consume more gas.

And as that gas distributing company continues to encourage fuel users to use gas rather than coal, the nation's gas utilities are trying to get the Federal Government to guarantee the financing of billion-dollar coal gasification plants that would convert coal into "syngas", costing between $4 and $5 per Mcf—equivalent to oil costing between $24 and $30 per barrel!

It is interesting to note that because the Winnetka power plant—when on coal—consumes about six 70-ton cars of Wyoming coal per week (having a Btu content of 10,459 per pound), the daily fuel consumption equates to about 1,255 million Btu's—equivalent to less than half that required to meet the 3,000 Mcf per day definition of a "boiler fuel user" stated in the compromise gas pricing bill. Because the compromise bill provides no requirements that those having coal-firing capabilities must use coal—the Winnetka power plant could legally continue to burn gas for as long as the North Shore Gas Company continues to make it available. And if the plant's generating capacity should happen to exceed the 25 megawatt limit, or for some other reason falls within the definition of a "boiler fuel user", it would only mean that they would have to discontinue burning gas at the end of 10 years!

Because the gas distributing companies are more concerned about their short-term profits than wise use of our non-renewable resources, they encourage fuel users to burn gas rather than more plentiful fuels. And because gas (a premium fuel) is available to most fuel consumers at prices that are below those of other fuels, there is no incentive for fuel consumers to use any fuel other than gas—and little incentive for gas consumers to conserve.

HOW THE NATURAL GAS UTILITIES ENCOURAGED GAS PRICING POLICIES THAT CAUSED THE NATURAL GAS SHORTAGE

For many years the natural gas distributing companies encouraged the continuation of the Federal control of interstate natural gas prices, because the low wellhead prices made it easy for the utilities to undercut competing fuels. The low wellhead prices, in combination with the promotional rate structures established by the state utility commissions, permitted the gas industry to rapidly expand their markets and caused gas consumption to increase far beyond the producers' ability to maintain supply. Because the gas utilities have learned that price controls cause supply shortages, they have been begging Congress to decontrol "new" interstate gas.

THE IRONIC CONTRAST BETWEEN FOOD AND FUEL PRICE POLICIES

There is an ironic contrast between the federal price programs for food and fuel. For many years the Federal Government has been following a policy of supporting the prices of agricultural products to assure a reliable future supply of these products for consumers. Under this program the consumers have been paying higher prices for food than they would have been paying without government price support programs. But because more farm products can be grown in the future, farm products are "renewable resources". Yet—as the government was using price supports to assure the future supply of these "renewable resources"—it was artificially depressing natural gas prices—assuring the rapid depletion of a *non-renewable resource!*

THE COMPROMISE GAS PRICING BILL

Now that many members of Congress recognize that the control of gas prices has been the cause of the nation's natural gas shortage, they have been proposing legislation to stimulate the development of new production. But because they want to "protect" present gas consumers from higher energy prices, they have been proposing legislation that would increase essentially only the prices of that gas that would come from future dedications to interstate markets—while continuing comparatively low ceilings on essentially all existing interstate production. And although the bill would result in the continuation of a disparity between the prices of natural gas and other fuels, the bill does nothing to prohibit most users of those other fuels from shifting to gas—or to prevent most fuel users having the capability of burning coal from consuming gas.

Under the compromise gas pricing bill the "new" on-shore gas would be controlled for a seven-year period at a price of $1.60 per Mcf, adjusted quarterly for inflation (the bill defines "new" gas as that gas dedicated to interstate sales after January 1, 1976 and "old" gas as that dedicated prior to January 1, 1976). The "new" off-shore gas would be permanently controlled at a price equivalent to the domestic crude oil price, on a Btu equivalency basis, as of the date of enactment (this would put the ceiling at about $1.35 per Mcf). This ceiling would be adjusted by the FPC every 5 years thereafter. All the "old" gas would be under permanent federal control with the prices set at current ceilings of 52 cents per Mcf, after existing contracts expire. A ceiling of 52 cents would be equivalent to a crude oil price of about $3.12 per barrel. This ceiling would be revised every 2 years.

The compromise gas pricing bill also contains a so-called "conservation" provision that would phase out, over a ten-year period, those gas-fired boilers that can consumer more than 3,000 Mcf of gas per day (this would be equivalent to more than 22,000 gallons of No. 2 oil per day).

The bill also contains an incremental pricing provision that limits incremental pricing to boiler fuel users for that portion of the pipeline's gas costs which exceed the ceiling on the "new" off-shore gas, except that no boiler fuel users could be required to pay more than 120 percent of the average price of heating oil, on a Btu equivalency basis.

The bill also places a higher priority on the unrestricted use of gas for heating homes, than it does for hospitals, food processing, crop drying and other essential purposes.

WHY SHOULD THE GAS PRICING POLICY BE DESIGNED TO FORCE GREATER CONSUMPTION OF THAT FUEL THAT IS MOST RAPIDLY BEING DEPLETED?

Although the limiting of higher wellhead gas prices to only the "new" gas would seem to be a good political compromise—because it would result in the increasing availability of gas during the short term, and result in gradual increases in consumer gas prices—such a plan would be well designed for the purpose of forcing the rapid depletion of the nation's total gas reserves. The very fact that consumer gas prices would increase slowly and would continue to stay below other sources of energy for a long period would mean that nothing had been done to curb the present wasteful consumption of that precious resource. And because the compromise gas pricing bill does nothing to prohibit further conversions to gas by present users of other fuels, the passage of that bill would mean that the demand for gas would further increase—causing reserves to be depleted still faster.

Our Federal natural gas policy must not be designed to provide gas at the lowest "reasonable" cost to consumers by Federally controlling the wellhead price of gas. Such a policy would be reasonable only if our nation's natural gas reserves were almost infinite, and easy to find. A Federal natural gas policy based in the short-sighted objective of providing gas to consumers at low prices now, will only guarantee that we will continue to wastefully consume our reserves and greatly increase the probability that our children's homes will be heated with wood or coal.

Our Federal natural gas policy should be designed to benefit the entire nation over the long haul. It should encourage the development of new sources of gas and all other forms of energy—not discourage it. It should encourage the conservation of all fuels—and especially those in shortest supply. It should make out nation more self-sufficient—able to produce from domestic sources the fuels we will need in the years ahead. Our failure to develop a gas policy that will accomplish these objectives would allow our nation to drift further into catastrophic energy problems. The United States stands alone in the world today in our extravagant and wasteful use of natural gas. Natural gas is a premium fuel that is rapidly disappearing. Its price must reflect that fact.

BUT WHY SHOULD WE ALLOW THOSE ARABS TO SET OUR NATURAL GAS PRICES?

The members of Congress that want to continue "protecting" present consumers from higher gas prices by continuing price controls frequently cite this argument:

"But why should we allow the Arabs to set our natural gas prices? If we decontrol natural gas, gas prices will increase to equal our oil prices—which, if they are decontrolled, will be set by the OPEC cartel."

Although few people may like the idea of allowing the Arabs to set our natural gas prices—what would be the result of the alternative policy?

To keep natural gas prices below other fuels by the use of price controls would simply provide no incentive for fuel consumers to use any fuel other than gas, causing a continuation of the wasteful and rapid consumption of that fuel which is most rapidly depleted. The rapid depletion of the nation's total gas reserves would cause an energy disaster that could destroy our society. Unfortunately—the alternative to allowing world oil prices to establish our domestic gas prices would be eventual disaster.

OUR RECOMMENDATIONS

1. Increase gas prices to a parity with oil prices by the decontrol of wellhead prices, the use of uniform rates for all gas consumers, the use of "advance-payment" programs to finance new gas development—and if necessary, the implementation of an excise tax.

2. Prohibit gas utilities from converting present coal users to gas.

3. Prohibit gas utilities from converting present oil users to gas if the utilities are experiencing supply curtailments—or if they are wastefully converting petroleum products into synthetic gas.

4. Prohibit the gas utilities from attaching any new residential loads (including new construction), if the utilities are experiencing supply shortages that will force curtailments of industrial or agricultural gas users that are unable to utilize alternative fuels.

5. Establish new gas end-use priorities which are consistent with the priorities for fuel oil. The new priorities must give the highest priorities to industrial agricultural, and petrochemical gas users that are unable to use other fuel. Residential gas consumers should not receive high priorities for more than minimal needs.

6. Relax air quality standards sufficiently to permit large fuel users to switch to coal

7. Prohibit those facilities presently having the capability of burning coal from burning natural gas or fuel oil—except during environmental emergencies.

8. Require the interconnection of gas systems and obtain the authority to force the transfer of gas from areas having surpluses to those areas suffering most from curtailments (prices paid for this gas must be sufficiently high to encourage the utilities selling the gas to continue investing in the development of new supplies).

9. Make low-interest loans available to help consumers finance those modifications of structure and equipment that would increase energy use efficiency.

10. Place a "waste tax" on all classes of gas consumers to force mandatory conservation during periods of severe shortage, by taxing those that do not reduce fuel consumption by specific percentages.

Because the energy problem has been developing since the government began controlling interstate gas prices, the time has passed when any action by government can prevent a painful and crippling natural gas crisis. The policies we recommend would not cause excessive or unacceptable hardships in view of the much greater hardships that would inevitably be experienced if such recommendations are not quickly implemented. The American people will accept the tough decisions—if they are given all the facts.

Should Congress fail to adopt a policy that increases gas prices to a proper relationship with other fuels, Congress must pass a law to prohibit present users of other fuels from "going" to gas and prohibit those having the capability of using coal from burning gas. Should Congress fail to adopt this policy. Congress will have sentenced our nation to an energy catastrophe—all in the name of "protecting consumers."

STATEMENT OF DIANE YALE SAUTER, RESEARCH DIRECTOR, EMERGENCY TASK FORCE ON ENERGY OPTIONS, SCIENTISTS' INSTITUTE FOR PUBLIC INFORMATION

The Scientists' Institute for Public Information (SIPI) intends, in this testimony, to comment upon the internal conflict exhibited by ERDA in the presentation of its synthetic fuels program. ERDA seems to be of two minds, with one admitting there is no doubt of a definite cancer risk and meticulously defining its nature, and the other straining to charge ahead immediately with full commercialization. Meanwhile, industry is able to exploit the situation to its own benefit. It is reasonable to expect ERDA to resolve its own confusion and formulate a clear and consistent position before requesting Congress to consider funding of its program under H.R. 12112.

The administration of ERDA is actively seeking $4 billion loan guarantee authority and authorization to promote full-scale synfuels demonstration projects. At the same time, ERDA's biomedical research staff acknowledges that data is lacking to conduct a cost/benefit analysis of the synfuels program. That data would include quantification of the health effects and population size that would be exposed by the demonstration projects as well as full commercialization. ERDA's biomedical research efforts have just recently been reprogrammed to explore the ability—which they admit—of synfuels technology to increase the rate of cancer in workers and the public.

The staff is only now in the process of collecting printed references which have long been available on what they call "deleterious impacts" of synfuels production and use. ERDA labs are only beginning to identify the carcinogenic potential of the agents released in these technologies, to determine their composition and size, to characterize their activity and interactions, the degree of their toxicity, the possibility of recovery from their effects. They are cooperating with other agencies, so that studies just designed and initiated by the Environmental Protection Agency would be available to them—studies to characterize potential plant emissions, survey the adequacy of existing protective equipment, and determine the need for new equipment.

From what is known so far, ERDA's biomedical staff is able to state unequivocally that in the developmental phase—what we are talking about in the loan guarantee program—occupational exposure to potentially hazardous organic and inorganic agents will occur; that these agents will be found in process streams, products and effluents of the facilities; that some, the polycyclic aromatic hydrocarbons, are known to be carcinogenic, and that others not yet characterized are suspect, but that most have not been evaluated for mutagenic, teratogenic, or carcinogenic activity! They also state that the general population near demonstration or commercial facilities will be exposed.

Yet they are able to declare with premeditation that detection and characterization of hazardous agents is an important part of the strategy during the development phase to secure environmentally acceptable technologies. Although workers will be assured union scale wages for working on demonstration projects, what premium will they and local communities be paid for participating in this unprecedented experimentation?

In no testimony that we have seen before Congress has the administration of ERDA named these very real cancer risks and their costs, although environmentally caused cancer is becoming acknowledged as an emerging national epidemic. Parenthetically, the state of New Jersey is in process of determining whether there is a direct connection between the high concentration of chemical industries and its cancer mortality rate, which is the highest in the nation. It is expecting Federal government grants to help pay the millions needed to find retrospective answers and institute remedial measures.

Robert Fri, in his May 25, 1976 testimony before the Subcommittee on Energy and Power, is still referring vaguely to the value of the demonstration programs in providing vital information on "environmental acceptability." While he details key modifications made to H.R. 12112 by Science and Technology, he fails to list the proposal adopted to require ERDA to study possible carcinogenic impacts of synthetic fuels. Likewise, the cancer hazard is not named as such in the Fact Book made available to Congress and to the media for the transmittal of information to the public. Again, there are only references to "determining environmental impacts of commercialization." If cancer is going to be a problem, what is the administration waiting for in issuing warnings?

Dr. James Liverman, ERDA's Assistant Administrator for Environmental Safety, offers a guarded prognosis in defense of synfuels development. In his opinion, potential risks may be minimized by identification of hazardous agents and development and employment of safety and control technologies. He anticipates that protective strategies will be implemented that would limit worker contact, which probably, he believes, accounts for low incidence of toxic effect in petroleum refinery workers. It should be pointed out that studies are only now being initiated by ERDA to compare the toxicity of petroleum distillates with that of synthetic fuels distillates. Additionally, indications are that synthetic fuels plants will be more expensive than petroleum refineries to bring to the same degree of occupational and environmental safety.

This then raises the question of what standards the current projects will be constructed to meet. According to ERDA's biomedical staff, the air quality standards for agents that cause cancer to occupational groups are based on acute disorders produced by exposure to high levels of pollutants. Little is known or accounted for in present standards about the long-term health risk associated with low-level exposure, or the progression of the biological processes that may lead to cancer. Current water quality standards do not regulate the release of some carcinogenic agents to the public because the information for setting those standards is inadequate or non-existent. ERDA admits that continuous low level exposure may in the long run be the major health cost.

ERDA is relying on industry cooperation to "self-regulate" to prevent what it terms the "expensive retrofitting of control devices and methods" at some later time. Moreover, we understand that monitoring will be the responsibility of industry, not ERDA, at each individual project.

So we must ask, with what honesty is industry approaching the reality of this situation? A case in point is the behavior of the Oil Shale Corporation, which is engaged in a public relations campaign to convince us of the safety of their product. Their representative, Dr. R. Merril Coomes, spoke at the 9th Oil Shale Symposium at the Colorado School of Mines in April 1976. He doubted whether cancer-causing agents could pose any direct threat to workers at a modern oil-shale complex, ignoring the difficulty of describing with certainty the qualities of a complex that does not exist.

He asserted that modern industrial hygiene practices would keep the cancer risk low, without admitting that it is unclear what exposure would be considered low risk, or that industry may not be willing or indeed able to spend the money required to keep the risk low.

Most deceptively, he described the results of an experiment where mice were bedded on raw shale rock and spent shale, and developed no skin cancer. He failed to report on the condition of the lungs of the mice, although inhalation of particles represents a greater cancer hazard from raw and spent shale than contact does in inducing skin cancer. He also failed to report on a previous experiment he has conducted, where whole shale oil produced skin tumors in 78% of the mice tested, and upgraded shale oil produced tumors in 10% of the animals.

In conclusion, we would like to ask just what Congress would be guaranteeing and for whom in agreeing prematurely to a synthetic fuels loan guarantee program. Will it be asking the American public to subsidize, with its long-term anguish, the short-term profit of a few corporations? A valid accounting would include figures on how many people will be exposed and can be expected to contract cancer, what the cost of their health care would be, what the costs will be of enclosing and automating the synfuels facilities, of removing and containing toxic substances from air and water emission, of building in these precautions or retrofitting later, and how this will affect the true costs of gas and oil produced by synthetic fuels technology.

We are including for the hearing record testimony we submitted on April 14, 1976 to the House Science and Technology Committee, our paper of November 1975 on "Synthetic Fuels and Cancer," Dr. Liverman's letter of May 21, 1976 to the Scientists' Institute for Public Information, and ERDA's "Health Effects of Coal Combustion and Conversion."

STATE OF MONTANA,
OFFICE OF THE GOVERNOR,
Helena, June 18, 1976.

HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce, Rayburn House Office Building, Washington, D.C.

DEAR CHAIRMAN STAGGERS: As Chairman of the Western Governors' Regional Energy Policy Office (WGREPO), which is comprised of the States of Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah and Wyoming, I am forwarding to you a position Statement on the pending legislation, H.R. 12112, for a loan guarantee demonstration program.

This Position Statement has been approved by nine governors of WGREPO. In addition, Governor Herschler of Wyoming approved the Position Statement with the insertion of the wording "and enforcement thereof" between 'laws' and 'should' in the first line of point (2). This statement contains four specific requests for further additions or changes to H.R. 12112, as H.R. 12112 was reported out of the House Science and Technology Committee on May 11, 1976.

Our WGREPO Position Statement also may be considered a supplement to the individual statements which several of the western governors have previously submitted to the House Science and Technology Committee.

We are aware and appreciative of the several provisions which have already been incorporated into H.R. 12112 in response to previous requests of the western governors.

Therefore, we trust that the enclosed Position Statement will also receive serious consideration by the U.S. House of Representatives and U.S. Senate.

Sincerely,

THOMAS L. JUDGE,
Governor of Montana, Chairman of the Western Governors' Regional Energy Policy Office.

Enclosure.

POSITION STATEMENT OF THE WESTERN GOVERNORS' REGIONAL ENERGY POLICY OFFICE ON H.R. 12112: "LOAN GUARANTEES FOR DEMONSTRATION FACILITIES"

We wish to make the following suggestions that will strengthen HR 12112.

(1) Grants to states, political subdivisions, and Indian tribes should be made the mechanism for providing community impact assistance and front-end financing; grant money should be authorized and appropriated by Congress coincident with the authorization of the commercial demonstration program.

Use of loans and loan guarantees for impact aid to communities are not feasible in some western states because of institutional and constitutional barriers. In addition, many of our communities are near or at their debt limits.

The grant money should be authorized and appropriated by Congress coincident with the authorization of the Commercial Demonstration Program and channelled through state governments. This aid will be effective only if it is readily available, in advance of the final approval of individual facilities, and independent of separate congressional approvals.

(2) All state laws should apply to all federally supported commercial demonstration projects, provided that the state laws are at least as stringent as the corresponding federal laws or regulations, and regardless of whether the projects are located on private, state or federal lands. The states have demonstrated that they are not only capable but, more important, best qualified to reflect the needs of their citizens in the areas of health, land use, land reclamation, water rights, taxation, and environmental protection. Congress should take this opportunity to guarantee that all state laws will apply to Commercial Demonstration Project.

(3) Any social, economic, environmental, or technical research to be conducted by the federal government which relates to facilities supported by the synfuels program should, wherever possible, use resources and personnel where the facilities are located. We believe that concentrating the research, development, and demonstration funding among the state, private, and industrial research institutions within that state or region would assist in building research facilities and expertise.

Two important objectives would be accomplished:

Jobs would be provided for graduates of our universities and technical schools who would otherwise have to move out of the area to participate in such research, and

The technology developed would be shaped by those most sensitive to and concerned by its effects.

(4) The development and commercialization of renewable resources, as provided for in HR 12112 (Committee Print dated May 11, 1976), should be preserved in the final legislation.

(5) All information, including findings and conclusions, regarding the demonstrated projects should be available to the public. It is essential that states have access to such information to insure proper energy decisions and adequate planning.

We wish to have the above set of recommendations seriously considered in the language of HR 12112.

THOMAS L. JUDGE,
Governor of Montana, Chairman of the Western Governors' Regional Energy Policy Office.

RIO BLANCO OIL SHALE PROJECT,
Denver, Colo., May 24, 1976.

Hon. HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: We have previously communicated our support for H.R. 12112 to Chairman Teague of the Committee on Science and Technology, and are appending a copy of our letter to him to this letter. Chairman Teague's committee has now reported out the bill and in some substantially different form. The bill is now before your committee for consideration.

We want to state for the record our continuing support of H.R. 12112 as it has been amended by Chairman Teague's Committee on Science and Technology. We believe the bill merits your support and will be an important first step, if passed, in getting the United States on the road to development of synthetic fuels so that they can play their role in helping meet our energy supply problems.

We would appreciate it if you would make this letter and enclosure a part of the record of your committee, and also hope that we may have your personal support in favor of the bill.

Sincerely,

WALTER T. HERGET, *President.*

Enclosure.

APRIL 6, 1976.

Hon. OLIN E. TEAGUE,
Chairman, Committee on Science and Technology, U.S. House of Representatives, Rayburn Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: Thank you for your invitations of March 26, 1976, to each of us to comment on the subject bill. Gulf Oil Corporation and Standard Oil Company (Indiana) are owners of one of the four shale leases issued in early 1974 under the Department of Interior Federal Oil Shale Leasing Program pursuant to competitive bidding. We support Bill H.R. 12112 and are filing the following comments together regarding the application of the bill to shale oil production.

At the time our companies submitted the successful bid for our tract, we were convinced of the government's intention to proceed in the general direction envisioned by Project Independence. We saw the need for accelerated development of domestic energy resources, and an important future for shale oil. To date, we have spent about $150 million on our shale oil program in anticipation of commercial operations.

Events of the past two years have created a climate which requires that we reevaluate this position. A combination of rapid inflation in construction costs and continued government price controls has had a substantial adverse effect on the potential for commercial shale oil operations.

We support Bill H.R. 12112 because of our conviction that it is in the national interest to develop, and gain experience with, commercial size shale retort modules even if full commercialization is not practical at this time. The widely available projects of oil supply and demand must make it clear to everyone that the United States' position is deteriorating and will continue to deteriorate, even with sustained international tranquility. It would be a tragedy to allow the consequent disruptions to our economy, while leaving undeveloped potential oil shale reserves in the United States which may exceed the total proved oil reserves of the Middle East. In the worldwide sellers' market expected in the future, oil prices presumably will be high enough to warrant full commercial development and production of shale oil. However, lead times are such that it will take around ten years to build the first commercial size shale retort modules and incorporate improvements based on a reasonable amount of experience. If we wait until market forces permit development of shale oil, we will be faced either with a long delay before production is available or with a crash program, with attendant extraordinary costs, dislocations and inefficiencies.

Oil shale technology is still in its infancy. Development of a commercial size retort module from existing experimental units involves a scale up factor of at least ten. The history of first generation, new technology facilities is strewn with cost overruns, long debugging periods and redesign based on operating experience which, in essence, leaves the original model outmoded. Industry expects to shoulder such hazards when the profit potential is commensurate with risk, which is clearly not the case with shale oil at this time. Thus, precommercial development of oil shale will require the Federal Government to make appropriate incentives available to industry, and to remove disincentives such as price controls on oil produced from shale.

The loan guarantee contemplated in Bill H.R. 12112 is a step in the right direction because it reduces the drain of an oil shale project on corporate funds. However, if the loan guarantee feature is to serve the desired purpose, it must be clear that the intent of the guarantee is to support these first generation plants not only by facilitating initial construction, but also eliminating the potential burden on private industry in the event oil shale projects do not become economically viable. The loan guarantee should support future interest payments and the repayment of principal at any point at which the cash flow from the shale oil operation itself is inadequate without any expectation of recourse to owners' corporate funds.

Loan guarantees do little to help project economics, which are unacceptable to private enterprise at the present time, especially for a first generation module which would forego the economies of scale of later multi-module commercial plants. Because of this limitation of loan guarantees and because different companies, different shale properties and different technologies have their individual characteristics, more than one type of incentive will undoubtedly be required to secure the broad industry participation in development necessary for the evolution of efficient technologies. Therefore, other legislation or authorizations will be necessary in the future. Nevertheless, passage of Bill H.R. 12112 would cer-

tainly encourage private enterprise to continue its efforts in development of shale oil resources by this show of Government interest and support.

In summary, we support Bill H.R. 12112 as the first step of a comprehensive program directed toward recognizing and solving the nation's energy problems.

(Original signed by L. V. Lombardi.)

L. V. LOMBARDI,
Gulf Mineral Resources Co.
(A Division of Gulf Oil Corp.)

Very truly yours,
(Original signed by R. M. Lieber.)

R. M. LIEBER,
Standard Oil Co. (Indiana).

[Telegram]

A STATEMENT OF CHARLES R. FRICKE ON H.R. 12112, ADMINISTRATOR REPRESENTING NEBRASKA GASOHOL PROGRAM, BEFORE THE UNITED STATES HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON ENERGY AND POWER, MAY 27, 1976

Mr. Chairman and members of the Energy and Power Subcommittee: I am pleased to have this opportunity to provide you with testimony in favor of H.R. 12112. The Nebraska Gasohol program is sponsored by a government agency of the State of Nebraska. This agency is called the agricultural products industrial utilization committee. This agency was created by the Nebraska legislature in 1971. This agency was charged with the following objectives:

(1) Establishment of procedures and processes to manufacture market agricultural ethyl alcohol-blended fuels.

(2) Establish procedures to make the blended fuel marketable by private enterprise.

(3) Analysis of the marketing process and testing of marketing procedures to assure acceptance in the private marketplace of such blended fuels and by-products resulting from its manufacture.

(4) Cooperation with private industry to establish privately owned agricultural ethyl alcohol manufacturing plants in Nebraska to supply demand for such product.

(5) Sponsoring research and development of uses for byproducts resulting from the manufacture of agricultural ethyl alcohol in order to enhance economic feasibility for alcohol.

(6) Confirm the acceptability of the utilization of an alcohol-gasoline blend as an automotive fuel.

Goals to be achieved: Ultimate goal is production of alcohol from grains or other agricultural products on an economical basis in the State of Nebraska. The alcohol to be utilized in industrial applications and as a motor fuel.

The committee has accomplished numbers 1, 2, 3, 5 and 6. The committee is currently making progress on the remaining objective, number 49.

Gasohol is an internal combustion engine fuel blend consisting of 10 percent agriculturally derived ethyl alcohol and 90 percent gasoline. The 200-proof ethyl alcohol used in gasohol was derived from fermented tree sugars as waste material from Georgia-Pacific, Inc., of Portland, Oreg. This is a well-known wood products processing company. The 200-proof ethyl-alcohol is not available from grain or waste grains in the United States at the present time; however, the ethanol from Georgia-Pacific, Inc., is chemically identical to the type of grain alcohol that could be produced in the Midwest, especially in Nebraska.

The Nebraska gasohol program has underway a 2 million mile road test experimentally comparing gasohol with no-lead and regular gasolines. There are 45 vehicles in this road test. The 1 million mile mark was reached in this road test on March 30, 1976, without mechanical and technical problems. This experiment is being conducted according to all national standards and regulations established by the Environmental Protection Agency and other Federal, State, and local regulations as well.

Gasohol was sold to the public in a consumer acceptance test and marketing survey conducted in Nebraska in the summer of 1975. The acceptance and marketability were overwhelmingly positive. The number of gallons sold during an 11-week test period was 93,000 gallons. The test results and data are available from the committee's office in Lincoln, Nebr.

The preceding test and other research information are available also. The committee is currently pursuing application information for loan guarantees and for grant funds for further research from the U.S. Department of Agriculture and the Energy Research and Development Administration in Washington, D.C.

The purpose of my testimony is quite clear. It would benefit the Nebraska Gasohol program tremendously if H.B. 12112 is passed by Congress and approved by the President of the United States this summer. The synthetic-fuel commercialization loan guarantees would provide the incentives for energy conservation in the short term in Nebraska and the Midwest. If the Nebraska Gasohol program succeeds with help from ERDA, then the other large grain growing States can develop similar type industries which will help conserve old energy and create new energy.

The State of Nebraska is proposing to build a $21 million grain alcohol plant. This plant would produce 20 million gallons of alcohol per year. Nebraska needs help financing this grain alcohol plant. Nebraska is looking for a $15 million loan guarantee. This is a small amount when one considers the potential benefits derived from such an industry. Basically, Nebraska could begin creating new energy and new food supplies if the Federal Government is conscientious and objective in its energy development planning. The alcohol plant that Nebraska wants to build would provide enough gasohol for 25 percent of the State's gasoline consumption. This production of alcohol would be using 1 percent of Nebraska's grain production. Nebraska could increase the supply of gasohol for all of the State's major vehicle fuel consumption by using less than 5 percent of Nebraska's grain production.

In conclusion, I feel that the Federal Government should follow the Nebraska gasohol motto—"Food and fuel for the future" in the Midwest. I would like to reserve the privilege on supplying this subcommittee with a brief summary report of the economics of the Nebraska gasohol program written by Dr. William A. Scheller, chairman of the chemical engineering department at the University of Nebraska-Lincoln. Dr. Scheller is responsible for the technical and portions of the economic research on gasohol. Dr. Scheller is also the technical advisor to the A.P.I.U.C.

I thank you gentlemen for your time and consideration.

Respectfully submitted by Charles R. Fricke, Administrator A.P.I.U.C.

[Whereupon, at 12:10 p.m., the hearings were adjourned.]

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