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OIL SHALE

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GOVERNMENT

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HEARING  
BEFORE THE  
SUBCOMMITTEE ON  
MINERALS, MATERIALS, AND FUELS  
OF THE  
COMMITTEE ON  
INTERIOR AND INSULAR AFFAIRS  
UNITED STATES SENATE

Pursuant to S. Res. 45  
A National Fuels and Energy Policy Study

NINETY-SECOND CONGRESS

FIRST SESSION

ON

S. 2510

TO ESTABLISH A CORPORATION FOR THE DEVELOPMENT  
OF NEW ENERGY SOURCES, AND FOR OTHER PURPOSES

NOVEMBER 15, 1971

Serial No. 92-12



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## OIL SHALE

MONDAY, NOVEMBER 15, 1971

U.S. SENATE,  
SUBCOMMITTEE ON MINERALS, MATERIALS, AND FUELS OF THE  
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,  
*Washington, D.C.*

The subcommittee met pursuant to notice at 10 a.m., in room 3110, New Senate Office Building, Senator Frank E. Moss (chairman of the subcommittee) presiding.

Present: Senators Moss, Anderson, Hansen, and Bellmon.

Also present: Mary Jane Due, staff counsel; Charles Cook, minority counsel; and David Stang, assistant energy study director.

Senator Moss. The hearing will come to order.

The purpose of the hearing this morning is to review the proposed oil shale leasing program of the Department of the Interior and to take testimony on S. 2510, a bill which I have introduced to establish a corporation for the development of new energy sources.

The energy requirements of the United States dictate that the Congress must carefully examine the potential of oil shale development as well as all other potential energy sources for supplying the growing energy need of our Nation.

In June of this year the Department of the Interior announced a program for oil shale leasing. The committee desires to review the prospects for the proposed leasing program, and the provisions of the proposed leases. Matters of special interest to the committee include the provisions which have been made for protection of the environment, for avoiding monopoly control over oil shale resources, and for insuring a fair return to the Federal Government for the use of public resources.

In view of the conclusions with respect to feasibility and economics for shale oil production accompanying the Department of the Interior's proposed leasing program for oil shale and the absence of any similar Government-industry research effort, it appears that the Department believes factors are now favorable for the construction of a prototype plant now. This conclusion is supported by the timetable for commercial production of shale oil included in the departmental report.

My bill, S. 2510, had not been introduced when the departmental program was announced. It has many of the same features as does S. 1846, which would create a Coal Gasification Corporation and which the Department opposed. The major reason for this opposition, I understand, was that additional research needed to be undertaken before a prototype or commercial plant could be built and that a joint Government-industry program was in existence that was undertaking the necessary research. It would appear, therefore, that S. 2510 might be



a useful vehicle for the timely development of oil shale and other new energy sources that would offer smaller companies a means to participate in this new industry.

I would welcome comments on these points in testimony before the committee.

According to Geological Survey, our reserves of oil shale amount to about 5,000 quadrillion B.t.u.'s. By comparison, production of fossil fuels, including oil and gas, is currently running a bit over 60 quadrillion B.t.u.'s per year. Coal and shale together constitute sources of great quantities of needed energy and both can be converted to liquid and gaseous fuels to meet our energy requirements.

Mr. Edward Weinberg, a former Solicitor of the Department of the Interior, and consultant to the Senate Interior Committee, has prepared a comparison of the Department of the Interior's 1968 and 1971 oil shale leasing programs and lease forms. I will order the comparison be made a part of the record.

(The comparison referred to is in the appendix.)

I note Mr. Weinberg is pessimistic as to whether the 1971 program announced by the administration will actually achieve its goal of stimulating the timely development of commercial oil shale technology. There appears to be little incentive for industry to add to its costs by participating in this program in view of the limitation in the present law of one lease per person as well as the limitation of 5,120 acres as maximum for one lease.

There should be a massive effort to reduce costs to convert these resources to fuel free from pollution—but the cost is high. Prudent management appears reluctant to invest the large sums of money necessary.

I believe we are at the point where the Government should embark upon a realistically funded research effort to reduce the cost of producing pollution-free fuel. That is the basis for my sponsorship of the coal gasification development corporation bill, S. 1846, for coal, and my bill, S. 2510 for the development of new energy sources, such as oil shale.

First, we will place in the record a copy of the bill and report of the department on the bill, which, as I pointed out, was negative as to the enactment of this bill, and then letters by Dr. Peter Glaser of Arthur D. Little, Inc., of Massachusetts; Glen D. Weaver, the University of Wisconsin; Rocky Mountain Oil & Gas Association; Western Oil Shale Corp.; and Shell Oil Co. They will be placed in the record, because none of these individuals will be here to testify in person.

(The documents referred to follow:)



92D CONGRESS  
1ST SESSION

# S. 2510

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## IN THE SENATE OF THE UNITED STATES

SEPTEMBER 14, 1971

Mr. Moss introduced the following bill; which was read twice and referred to the Committee on Interior and Insular Affairs

---

## A BILL

To establish a corporation for the development of new energy sources, and for other purposes.

1       *Be it enacted by the Senate and House of Representa-*  
2       *tives of the United States of America in Congress assembled,*

3       (a) The Congress recognizes:

4           (1) in recent years there have been increasing  
5       difficulties in supplying all of the energy needs of the  
6       country;

7           (2) all projections forecast that the energy short-  
8       age will grow more severe unless steps are taken to  
9       increase supplies;

10          (3) the prevention of an energy shortage will  
11       require the full development and utilization of all

II



1 potential new energy resources, among which are oil  
2 shale, tar sands, and the solar resources;

3 (4) oil shale and other potential new energy sources  
4 can be used to provide nonpolluting energy forms that  
5 will meet stringent environmental standards;

6 (5) public lands of the United States contain nearly  
7 80 per centum of the total oil shale resources and the  
8 Federal Government has been unable since 1917 to  
9 develop on an economical basis the federally owned oil  
10 shale deposits;

11 (6) experimental efforts and tests on a small scale  
12 by both industry and Government have been totally  
13 inadequate to develop new energy resources;

14 (7) the Federal Government must assume leader-  
15 ship and responsibility, if the economic development of  
16 oil shale and other new energy sources is to be assured;

17 (8) providing clean fuel to the American con-  
18 sumer using indigenous resources that can be produced  
19 by American miners and other workers and which are  
20 secure from the vagaries of foreign supplies is important  
21 to the Nation's future;

22 (9) the importation of oil is one of the most impor-  
23 tant factors leading to the imbalance of payments and  
24 that this will grow larger in the future;

25 (10) the research and development effort required



1 to bring these new resources to commercial realization  
2 is too large for any single company to risk undertaking  
3 or to fully explore and a consortium of companies should  
4 be assembled under Federal leadership;

5 (11) the Federal Government, acting through the  
6 Corporation in partnership with industry, can develop  
7 new energy sources in such a manner that no single  
8 company or segment of the oil industry can establish  
9 effective control over the new energy or its sources,  
10 thus assuring ample competition; and

11 (12) the Corporation would provide a vehicle  
12 whereby industry and government moneys could be  
13 jointly expended and the anticipated results in technol-  
14 ogy would be shared by all on reasonable terms.

15 (b) It is therefore the policy of the Federal Govern-  
16 ment to bring into being the technology for commercial  
17 development of new energy sources as quickly as possible  
18 by establishing a Government-industry program jointly  
19 managed and funded to demonstrate commercial methods of  
20 producing energy from oil shale, tar sands, solar resources,  
21 and other new energy sources, as they may develop.

22 SEC. 2. (a) There is hereby established a New Energy  
23 Sources Corporation (hereinafter called the "Corporation").  
24 The Corporation shall have a Board of nine Directors con-  
25 sisting of individuals who are citizens of the United States,



1 of whom one shall be elected annually by the Board to  
2 serve as Chairman. Five members of the Board shall be ap-  
3 pointed by the President of the United States, by and  
4 with the advice and consent of the Senate, and four mem-  
5 bers of the Board shall be appointed by the President on  
6 the basis of recommendations received by him from any  
7 private entity or entities entering into contractual arrange-  
8 ments pursuant to subsection (d) of this section. Pending  
9 the appointment of such Directors on the basis of the afore-  
10 mentioned recommendations, three members shall constitute  
11 a quorum for the purpose of conducting the business of the  
12 Board. The President of the United States shall call the  
13 first meeting of the Board of Directors. Each Director of  
14 the Board not employed by the Federal Government shall  
15 receive compensation at the rate of \$300 for each meeting  
16 of the Board he attends. In addition, each Director shall be  
17 reimbursed for necessary travel and subsistence expenses  
18 incurred in attending the meetings of the Board.

19 (b) The Board of Directors is empowered to adopt and  
20 amend bylaws, consistent with the provisions of this Act,  
21 governing the operation of the Corporation.

22 (c) The Corporation shall have a President and such  
23 other officers and employees as may be named and appointed  
24 by the Board. The rates of compensation of all officers and  
25 employees shall be fixed by the Board. No individual other



1 than a citizen of the United States may be an officer of the  
2 Corporation.

3 (d) In order to assemble and organize industry par-  
4 ticipation in carrying out the purposes and functions of the  
5 Corporation, the Corporation, by its Chairman, is authorized  
6 to enter into contractual arrangements with any private or  
7 public entity or entities under which such entities agree to  
8 participate in the carrying out of such purposes and func-  
9 tions, including the furnishing of financial assistance in con-  
10 nection therewith. Such contract or contracts shall include  
11 terms and conditions consistent with this Act and the appli-  
12 cable regulations of the General Accounting Office.

13 SEC. 3. (a) OIL SHALE.—(1) It shall be the function of  
14 the Corporation to select from the proposed methods of de-  
15 velopment of oil shale at least two of the most feasible  
16 methods from a technical, economical, and environmental  
17 standpoint for manufacturing petroleum products from  
18 shale. The Corporation is authorized to design, construct, op-  
19 erate, and maintain demonstration-type facilities for under-  
20 ground mining techniques, for retorting processes, for in situ  
21 processes, or for any other method deemed feasible in the  
22 judgment of the Board to develop the oil shale resource. If,  
23 on the basis of the operation of such a demonstration facility,  
24 the Corporation determines that the methods so demonstrated  
25 are technically and economically feasible for manufacturing



1 petroleum products from shale on a commercial scale, the  
2 Corporation is authorized to design, construct, operate, and  
3 maintain, for each such method demonstrated, a single full-  
4 scale, commercial-size facility to manufacture petroleum  
5 products from oil shale by such method.

6 (2) The Department of the Interior is authorized to  
7 make available to the Corporation, any public domain lands  
8 presently withdrawn under EO5327 and known to be valu-  
9 able for oil shale deposits, with sufficient reserves to carry  
10 out the purposes of this Act, without limitation as to acre-  
11 age. The commercial companies participating in this venture  
12 shall not be charged with the acreage limitations set forth  
13 in section 241 of title 30, United States Code.

14 (3) Contributions to the Corporation in the form of  
15 land and water resources may be accepted by the Corpora-  
16 tion in lieu of cash from private entities or by States in the  
17 industry-government sharing of costs as hereinafter  
18 provided.

19 (4) Associated minerals encountered during the devel-  
20 opment of the prototype facilities herein provided for may  
21 be developed and processed if markets exist for their dis-  
22 posal. Approval of the Secretary of the Interior shall be ob-  
23 tained as to the method of extraction considering the relative  
24 values of the shale and associated minerals. An appropriate



1 royalty is to be established and paid in accordance with the  
2 Mineral Leasing Act of 1920.

3 (b) TAR SANDS.—(1) The Corporation shall select the  
4 most feasible method for the development of a synthetic crude  
5 from tar sands as defined in section 181 of title 30, United  
6 States Code. The Corporation is authorized to design, con-  
7 struct, operate, and maintain a demonstration-type facility to  
8 mine and extract (by either aboveground or in situ methods)  
9 the tar sand resources. If, on the basis of the operation of such  
10 a facility, the Corporation determines that the method  
11 demonstrated is technically and economically feasible, the  
12 Corporation is authorized to design, construct, operate, and  
13 maintain a single full-scale commercial size facility to  
14 manufacture petroleum products from tar sands.

15 (2) Deposits of tar sands on the public domain will be  
16 made available to the Corporation by the Department of  
17 Interior in sufficient quantities and of satisfactory quality to  
18 carry out the purposes of this Act.

19 (3) Contributions to the Corporation in the form of  
20 land and water resources may be accepted by the Corpora-  
21 tion in lieu of cash from private entities or by States in the  
22 industry-government sharing of costs as hereinafter provided.

23 (4) Associated minerals encountered during the de-  
24 veloping of the prototype facilities herein provided for may  
25 be developed and processed if markets exist for their disposal.



1 Approval of the Secretary of Interior shall be obtained as  
2 to the method of extraction considering the relative values  
3 of the tar sands and associated minerals. An appropriate  
4 royalty is to be established and paid in accordance with the  
5 Mineral Leasing Act of 1920.

6 (c) SOLAR ENERGY.—(1) The Corporation will select  
7 among the most feasible methods for the utilization of solar  
8 energy when such processes have reached the stage of  
9 development that they are ready to be demonstrated. The  
10 Corporation is authorized to design, construct, operate, and  
11 maintain such demonstration-type facilities that are required  
12 to prove the technical and economic feasibility of the  
13 processes selected. If, on the basis of the operation of such  
14 demonstration facilities, the Corporation determines that  
15 methods so demonstrated are technically and economically  
16 feasible for producing energy on a commercial scale, the  
17 Corporation is authorized to produce energy by such method.

18 (2) Where Federal lands are required, the Department  
19 of the Interior is authorized to make available any public  
20 lands needed in carrying out the purposes of this Act.

21 (3) Contributions to the Corporation in the form of land  
22 and water resources may be accepted by the Corporation in  
23 lieu of cash from private entities or by States in the  
24 industry-government sharing of costs as hereinafter  
25 provided.



1 (d) OTHER NEW ENERGY SOURCES.—(1) The Corpo-  
2 ration is authorized to select such other new processes, or  
3 methods, for the production of energy (for example, tidal,  
4 wind, et cetera) when in its opinion they have reached the  
5 stage of development that they are ready to be demonstrated.

6 (2) Where Federal lands are required, the Department  
7 of the Interior is authorized to make available any public  
8 lands needed in carrying out the purposes of this Act.

9 (3) Contributions to the Corporation in the form of  
10 land and water resources may be accepted by the Corpora-  
11 tion in lieu of cash from private entities or by States in the  
12 industry-government sharing of costs as hereinafter provided.

13 SEC. 4. (1) Fuels or other energy or associated min-  
14 erals produced by such commercial facilities shall be disposed  
15 of in such manner and under such terms and conditions as  
16 the Corporation shall prescribe. The Corporation shall arrange  
17 to deliver any fuel or energy products to such buyers as may  
18 be authorized, by contract or otherwise, by the Corporation.  
19 All revenues received by the Corporation from the sale of  
20 such fuel or energy shall be available to the Corporation for  
21 use by it in defraying expenses incurred in connection with  
22 carrying out its functions under this Act.

23 (2) The Corporation shall make available, by license or  
24 otherwise, on a nonexclusive royalty free basis without terri-  
25 torial limitation the use of any patent obtained Corporation



1 under any law of the United States or any foreign country  
2 for or with respect to any invention made in the performance  
3 of any activity conducted pursuant to this Act. As each new  
4 energy source is brought to commercial production stage the  
5 Corporation will cease to function in that area. On or after  
6 the completion of the demonstration of any new technology  
7 on a commercial scale or on the dissolution of the Corpora-  
8 tion and the transfer of its patent rights in accordance with  
9 section 7, the Administrator of General Services shall  
10 administer such patents rights in accordance with the provi-  
11 sions of this subsection.

12 SEC. 5. In carrying out its functions under this Act, the  
13 Corporation is authorized to enter into contracts, leases, or  
14 other arrangements; to own, manage, operate, or contract  
15 for the operation of facilities authorized by this Act; to  
16 conduct research and development related to its mission; and  
17 to acquire by construction or purchase, or to contract for  
18 the use of, physical facilities, equipment, and devices which  
19 it determines necessary in carrying out such functions. To  
20 carry out its functions, the Corporation shall have, in addi-  
21 tion to the powers conferred by this Act, the usual powers  
22 conferred upon corporations by the District of Columbia  
23 Business Corporation Act. Leases, contracts, and other  
24 arrangements entered into by the Corporation, regardless of



1 the place where the same may be executed, shall be governed  
2 by the laws of the District of Columbia.

3 SEC. 6. The Corporation shall transmit to the President  
4 of the United States and the Congress, annually, commencing  
5 one year from the date of the enactment of this Act, and at  
6 such other times as it deems desirable, a comprehensive and  
7 detailed report of its operations, activities, and accomplish-  
8 ments under this Act, including a statement of receipts and  
9 expenditures for the previous year. At the time of its annual  
10 report, the Corporation shall submit such legislative recom-  
11 mendations as it deems desirable, including the amount of  
12 financial assistance needed for operations and for capital  
13 improvements, the manner and form in which the amount of  
14 such assistance should be computed, and the sources from  
15 which such assistance should be derived. Such report shall  
16 be available to the public.

17 (b) All reports, plans, specifications, cost and op-  
18 erating data of the Corporation acquired by it in connection  
19 with the carrying out of its duties under this Act shall be  
20 made available by the Corporation in accordance with the  
21 provisions of section 552 of title 5 of the United States  
22 Code.

23 (c) The Corporation shall make annual reports avail-  
24 able to interested parties on the progress of its operations.



1 Such reports shall be in sufficient detail so that inde-  
2 pendent engineering and economic judgments can be made  
3 based on such reports. Detailed drawings and other infor-  
4 mation of value to those who might be interested in com-  
5 mercial development shall be placed on open file by the  
6 Corporation on a continuing basis for examination by  
7 interested parties.

8       SEC. 7. The Board of Directors shall take such action,  
9 when the commercial demonstration of a new technology  
10 has been accomplished, to dispose of those physical facilities  
11 of the Corporation that were used in the demonstration in  
12 such manner and subject to such terms and conditions as  
13 the Board determines are in the public interest. All such  
14 assets of the Corporation, including the proceeds from the  
15 disposition of such facilities, shall be made available to the  
16 United States and deposited in the United States Treasury  
17 as miscellaneous receipts. All patent rights of the Corpora-  
18 tion shall be vested in the Administrator of General Services,  
19 when no additional new technologies are to be tested.

20       SEC. 8. (a) Each department, agency, and instru-  
21 mentality of the executive branch of the Government, in-  
22 cluding independent agencies, is authorized and directed  
23 to furnish to the Corporation, upon its request, any infor-  
24 mation or other data which the Corporation deems necessary  
25 to carry out its duties under this Act.



1       (b) The Corporation is authorized to utilize, on a reim-  
2       bursable basis, the services of any personnel made available  
3       by any department, agency, or instrumentality, including any  
4       independent agency, of the Government.

5       (c) The Corporation may procure the services of ex-  
6       perts and consultants without regard to the provisions of title  
7       5, United States Code, governing appointments in the com-  
8       petitive service, and may compensate such experts and con-  
9       sultants without regard to the provisions of chapter 51 and  
10      subchapter III of chapter 53 of that title relating to classi-  
11      fication and General Schedule pay rates, in accordance with  
12      section 3109 of that title.

13      SEC. 9. There are authorized to be appropriated to the  
14      Corporation, for the fiscal year beginning July 1, 1972, the  
15      sum of \$5,000,000, to permit the initial organization of the  
16      Corporation, and for each of the next five succeeding fiscal  
17      years, such sums as may be necessary. All funds appropriated  
18      pursuant to this section shall remain available until ex-  
19      pended. Notwithstanding any other provisions of this Act,  
20      in no case shall funds appropriated pursuant to this section  
21      for any fiscal year be expended in an amount in excess of  
22      60 per centum of the costs to the Corporation in connection  
23      with the carrying out of its duties under this Act for that  
24      fiscal year.



U.S. DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
Washington, D.C., November 12, 1971.

HON. HENRY M. JACKSON,  
Chairman, Committee on Interior and Insular Affairs,  
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Your Committee has requested the views of this Department on S. 2510, a bill "To establish a corporation for the development of new energy sources, and for other purposes."

We recommend against enactment of this bill.

S. 2510 would declare Federal policy to be the promotion of technology for the commercial development of new energy sources by establishing a Government-industry corporation, jointly managed and funded, to demonstrate commercial scale methods of producing energy from oil shale, tar sands, solar resources and other new energy sources. Specifically, the bill establishes a New Energy Sources Corporation [the "Corporation"] whose principal function would be to select the two most feasible methods, from a technical, economical and environmental standpoint, for manufacturing petroleum products from oil shale. The Corporation would be authorized to design, construct, operate and maintain demonstration-type facilities for underground mining techniques, retorting processes, in situ processes, or for any other feasible method of developing oil shale resources. S. 2510 would also authorize similar activities for the development of synthetic crude oil from tar sands, the utilization of solar energy and the development of other new energy sources (e.g., tidal, wind, etc.). Further, S. 2510 authorizes the Secretary of the Interior to make available to the Corporation certain public domain lands in order to carry out the purposes of this bill and requires that the Secretary must approve the method of extraction of the shale and associated minerals. The Corporation would be required to cease functioning in a development area as each new energy source is brought into commercial production. S. 2510 authorizes an appropriation of \$5,000,000 to the Corporation for the fiscal year beginning July 1, 1972, and such sums as may be necessary for the succeeding 5 years, but in no case shall the funds appropriated for any fiscal year constitute more than 60 per centum of the costs to the Corporation for carrying out its duties under this bill.

The Department of the Interior has had underway for several years a coordinated program of research into an appropriate leasing program to develop this country's vast oil shale resources commensurate with the satisfactory resolution of the environmental questions involved in such development. The President's June 4 Clean Energy Message requested the Secretary of the Interior to expedite the orderly development of an oil shale leasing program.

On June 29, 1971, the Secretary of the Interior announced this Department's "prototype program" of oil shale development which would involve public and industry participation in selecting up to six oil shale leasing tracts, two each in Colorado, Utah, and Wyoming, to be offered for lease sale by sealed, competitive bid late in 1972. On June 30, 1971, this Department published in the *Federal Register* (36 FR 12319) a notice inviting applications for permits to conduct informational core drilling on federally-owned shale lands in those three states. The purpose of these permits is to encourage the acquisition of more detailed information on the oil shale deposits and to obtain the necessary environmental impact data to determine the effect on a specific locale and to assess fully the environmental impact of the program. To date, six applications for 22 core holes have been filed by industry to engage in such informational core drilling. We view this response as indicating that private industry is willing to determine, through research and development at its own expense, by means of a progressive development program in coordination with the Federal, state and local governments, whether oil from shale can compete on an economical and environmentally sound basis with other energy sources under competitive market conditions.

S. 2510 would place primary responsibility for the economic development of oil shale and other new energy sources in the Federal Government, and potentially place it in competition with private industry for the sale of fuels and associated minerals. In addition, the provisions on patents (section 4(2)) and reporting of data (sections 6(b) and (c)) in S. 2510 are incompatible with the emphasis on flexibility in Government patent policy as contained in the President's "Memorandum, and State of Government Patent Policy" (36 FR 16887) and would inhibit potential industry participants by placing virtually all patents



and data in the public domain. This Department's proposed oil shale leasing program seeks to stimulate the timely development of commercial oil shale technology by private enterprise, and emphasizes that the development should proceed "in a manner that will assure the minimum possible impact on the present environment while providing for the future restoration of the immediate and surrounding area." (*Program Statement for the Proposed Prototype Oil Shale Leasing Program*, U.S. Department of the Interior, June 1971, p. 1-2.) A balanced program for the development of alternate sources of energy necessarily includes the development of environmental safeguards. The extensive coordination thus required can be more effectively conducted in the Department of the Interior which has considerable experience in energy sources research and development (e.g., coal gasification, coal liquification, geothermal steam, etc.) than under the Corporation as proposed in S. 2510. Specifically, while deposits of tar sands are known to be of widespread occurrence in the United States, there has been no extensive development of this potential energy source. Deterrents to tar sands development have been largely legal in nature as a result of confusion over entitlement to deposits among holders of oil and gas and tar sands leases on public lands. However, this confusion would be eliminated and tar sands development facilitated by enactment of the Administration's proposed "Mineral Leasing Act of 1971" (introduced in the Senate as S. 2726). This bill amends the existing mineral leasing laws by, among other things, incorporating specific requirements to protect the environment, by concentrating greater responsibility for the leasing or sale of federally-owned minerals in the Department of the Interior and would include tar sands deposits within oil and gas leases. Enactment of the Administration's "Mineral Leasing Act of 1971" would provide a workable solution to the present problems involved in the development of tar sands as an energy source, and would be consistent with the Department's attempts to foster balanced energy sources development.

Enactment of S. 2510 would further fragment efforts to develop new sources of energy, and would be incompatible with the philosophy of the President's proposed reorganization of the Federal Government. The President's proposal would group most of the energy functions of the Federal Government into the Department of Natural Resources. We firmly believe that the planning and funding of energy research and development should be accomplished within an agency charged with the mission of insuring that the total energy resources of the Nation are effectively utilized.

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

Sincerely yours,

HOLLIS M. DOLE,  
*Assistant Secretary of the Interior.*

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EXECUTIVE OFFICE OF THE PRESIDENT,  
OFFICE OF MANAGEMENT AND BUDGET,  
Washington, D.C., November 12, 1971.

HON. HENRY M. JACKSON,  
*Chairman, Committee on Interior and Insular Affairs,  
New Senate Office Building, Washington, D.C.*

DEAR MR. CHAIRMAN: This is in response to your request of September 28, 1971, for the views of the Office of Management and Budget on S. 2510, a bill "To establish a corporation for the development of new energy sources, and for other purposes."

The Office of Management and Budget concurs in the views of the Department of the Interior in its report on S. 2510, and accordingly recommends against enactment of the bill.

Sincerely,

WILFRED H. ROMMEL,  
*Assistant Director for Legislative Reference.*



ARTHUR D. LITTLE, INC.,  
Cambridge, Mass., October 19, 1971.

Senator FRANK E. MOSS,  
U.S. Senate,  
Washington, D.C.

DEAR SENATOR MOSS: Thank you very much for your letter of September 27 and the enclosed Bill, S. 2510, for the development of new energy sources including solar energy. Your Bill is of substantial interest to us because we are investigating aspects of large-scale solar energy use.

Enclosed are recent papers which express my views on this subject. I fully concur with the intent of your Bill to establish a corporation for the development of new energy sources. It will be essential to form a partnership between the Federal Government and industry to accomplish one of our major national objectives: to meet projected energy demands without major environmental impact and consistent with national energy policies.

It may be advantageous to consider several Government-industry partnerships, with each one devoted to the exploitation of one major class of energy sources. Thus, a corporation with the charter to develop the large-scale use of solar energy could investigate and select for demonstration the methods based on this one energy source which would have the potential to meet future U.S. energy demands provided their technical and economic feasibility, and social desirability can be established.

The recent substantial interest of Federal agencies and industry in various approaches to harness solar energy on a large-scale indicates that there is every reason to expect that such a corporation could successfully accomplish man's long standing dream—to tap the bounty of the sun.

Please call on me to supply any additional information of interest to you. Should you so desire, I shall be happy to arrange to meet with you at your convenience.

Sincerely yours,

PETER E. GLASER.

UNIVERSITY OF WISCONSIN,  
DEPARTMENT OF GEOGRAPHY,  
Milwaukee, Wis., October 18, 1971.

Senator FRANK E. MOSS,  
Subcommittee on Minerals, Materials, and Fuels, Committee on Interior and Insular Affairs, Washington, D.C.

DEAR SENATOR MOSS: Please include the attached document in your upcoming hearings on the Department of the Interior prototype oil shale leasing program.

I do not oppose leasing of federal shale lands per se. However, the attached Review paper and Environmental Hazards study indicate that Interior's draft environmental impact statement provides insufficient information and analysis for effective public decisionmaking.

I sincerely hope that your Subcommittee hearings will elicit testimony from a wide spectrum of interests. My involvement in oil-shale research over the past three years leads me to believe that the basic data needed for decisionmaking can be assembled in the type of public forum your Subcommittee hearings will provide.

Respectfully,

GLEN D. WEAVER,  
Instructor in Geography.

Enclosure.



CRITICAL REVIEW OF THE U.S. DEPARTMENT OF THE INTERIOR DRAFT  
ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

Glen D. Weaver  
Department of Geography  
University of Wisconsin-Milwaukee

October 18, 1971



Scope of Study

Interior's Impact Statement<sup>1</sup> considers only those lands directly involved in the prototype leasing program, or about 0.5 percent of the total oil-shale area having present or potential economic interest. The study does not project the effects of a mature oil-shale industry, it does not consider the cumulative effects of oil-shale development over time, nor does it adequately appraise the potential impact of oil-shale development on water resources in the Lower Colorado River Basin.

The environmental impact of a prototype program, affecting only a small area for a limited time period, is obviously far different from the impact of a large-scale industry operating for many years. This failure to consider large-scale and long-range consequences is analogous to Interior's handling of the Santa Barbara disaster, whereby the effective decision to permit oil production was made as a routine matter when the oil companies were permitted to explore for oil in the Channel. After the oil was discovered, and after millions of dollars had been spent in finding it, the Interior Department was understandably reluctant in denying the companies' demands for production rights. I foresee the same situation occurring with respect to oil shale; i.e., if the prototype program demonstrates the private profitability of oil shale, Interior will be in a difficult position to shut down the industry even if the environmental effects prove to be grossly unacceptable.

Inasmuch as the oil-shale region forms a major portion of the Upper Colorado River Basin, it seems equally incredible that Interior should neglect a detailed examination of potential impacts on downstream water



quality. This is an especially critical omission since the waters of the Colorado River are subject to both interstate and international compacts.<sup>2</sup>

### Land Reclamation

Interior's comments on land reclamation deserve very careful reading.

Consider the following:

Page III-9: "In the long-term, open pits refilled with overburden and processed spent shale could be revegetated and restored to a reasonable approximation of their original state."

Page III-19: "To prevent future ground water contamination (from leaching of spent shale), however, it may be necessary to construct a permanent impermeable floor where the waste material is to be deposited."

Page III-11: "It has been experimentally demonstrated that vegetation can be grown on processed oil shale with adequate reseeded, fertilization, and watering. For example, Kentucky blue grass, western wheat and crested wheat have been successfully grown, and initial findings indicate that, once established, some of these species may become permanently established without further maintenance.....However, a significant body of research experience indicates that re-establishment of the fuller range of native browse and cover species, such as mountain mahogany, shadbush and bitterbrush, is difficult and time-consuming." (Underlining added)

In other words, backfilling of open pits (or underground mine sites) with processed spent shale may contaminate ground waters and surface waters receiving ground-water base flow unless the pit floors and sides are permanently sealed. Also, revegetation of the backfilled surface to provide a good wildlife habitat will be "difficult and time-consuming," if not altogether infeasible.

I find it unreasonable to assume that open pit mines would be completely backfilled under any circumstances. Both overburden and spent shale would have to be stored off-site during initial years of pit development, which Interior estimates to be six years for a 50,000 bbl/day open-pit operation (p. III-7--III-8). Returning this stored material to



the mine site would involve tremendous economic expense.

Furthermore, since the shale volume after retorting exceeds the in-place volume before mining, it is patently impossible to return all of the spent shale waste and overburden to the mine site without creating an elevated land surface.

Should oil-shale development evolve into a million barrel per day industry, it would generate enough spent shale in a year's time to cover an area the size of Washington, D.C., to a depth of six feet.<sup>3</sup> Wherever stored, the spent shale must be permanently shielded from percolating groundwaters and surface runoff. Engineering safeguards may be effective during the lifetime of the oil-shale plant, but who is to maintain the protection works after the site is abandoned? Will diversion structures and retention dams in canyon sites be built to withstand the 10-year, 100-year, or 1,000-year flood? Unfortunately these questions are not even raised, much less answered, by the Interior study.

#### Water Quality

According to the Impact Statement (p. III-16--III-17), all foreseeable water quality problems are "controllable with present technology" and the goal of the prototype leasing program is to permit "no degradation in the quality of the naturally occurring waters of the oil shale region."

The goal of "no degradation" is patently impossible in an operational sense, as the prototype program will divert and consumptively use water from the Colorado River or its tributaries. Consumptive use inevitably reduces the quantity of water available for dilution of downstream pollution loadings. Unfortunately, oil-shale processing will be a high-consumptive use industry (e.g., page V-3 of the Impact Statement indicates that 40 to 63 percent of the water diverted will be used consumptively).



One must also question whether the quality of return flows from oil-shale processing and related urban requirements can be kept within the "no degradation" goal.

Here I would again point out the need for assessing the impact of a mature industry rather than simply considering the impact of a prototype program.

Additionally, it is completely unrealistic to divorce the impact of oil-shale from other water-using developments expected to accrue in the Colorado River Basin. For example, the Colorado River Basin Water Quality Control Project<sup>4</sup> estimates that the salt load of the Colorado River at Hoover Dam will increase from its present 725 ppm to 947 ppm by the year 2010. Most of the increased salt load is projected on the basis of increased consumptive use of water in the Upper Basin without an oil-shale industry. Conclusion: If the oil-shale industry achieves its "no degradation" goal, it will indeed be unique!

#### Air Quality

The Impact Statement (p. III-22--III-24) fails to consider the air pollution meteorology of the oil-shale region. This is particularly serious, inasmuch as valley locations throughout the region are characterized by persistent nocturnal temperature inversions which favor accumulation rather than dispersion of atmospheric contaminants.<sup>5,6</sup> Unfortunately, valley locations are also favored spots for the siting of aboveground crushers and retorts, refinery plants, electric-power generating facilities, and new population centers.

Unless stringent emission standards are adopted, the oil-shale region could become another Four Corners disaster area in terms of air quality.



### Wildlife Resources

Interior (p. V-6) acknowledges that certain wildlife populations, such as mountain lion, bear, elk, and mule deer, would decline as a result of the prototype program. The declines are not expected to be "dramatic," but this assumption is predicated upon the effects of a prototype program only. Entirely neglected are the potential effects of a mature industry operating over many years and possibly disturbing several thousand square miles of land.

All oil-shale areas of major economic interest presently contain large and varied wildlife populations. Colorado's Piceance Creek Basin, for example, provides summer range or critical wintering grounds for up to 15 to 20 percent of the state's total mule deer population.<sup>7</sup> Since the late 1950's, however, forage and browse shortages have necessitated special post- and pre-season hunts in order to bring the herd size into equilibrium with the available resources.<sup>8</sup> Any increased industrial activity in the basin would simply mean more adversity for wildlife, in general, and deer, in particular.<sup>9</sup>

### In-Situ Processing

The Impact Statement (p. III-38--III-39) gives an extraordinarily brief and superficial evaluation of the environmental effects of in-situ processing; yet proposes to allow "limited in-situ operations" in the current leasing program.

As discussed in a companion study,<sup>10</sup> in-situ recovery of shale oil poses numerous environmental threats. These hazards should be carefully examined in conjunction with on-going field projects being conducted by the U.S. Bureau of Mines, Equity Oil Company, and Shell Oil Company before any consideration is given to promoting additional experiments.



### Alternative Energy Sources

Interior's prototype oil-shale leasing program should be assessed against alternative methods of meeting the Nation's long-term energy needs. The alternative adjustments include:

- 1) increasing the rate of domestic crude oil exploration;
- 2) increasing the rate of domestic crude oil recovery;
- 3) increasing the quantity of allowable foreign imports of crude oil and oil products;
- 4) developing synthetic liquid fuels from coal and tar sands;
- 5) substituting with such non-liquid energy sources as nuclear fuels, hydropower, and solar power; and
- 6) increasing the efficiency of energy utilization and/or decreasing the demands for energy.

Interior has dealt with some of these alternatives in a related report.<sup>11</sup> The discussion of alternative 4 (liquifaction of coal) is particularly weak, however. Alternative 6 has been neglected entirely despite its tremendous relevance to the issue of whether oil-shale development is in the best overall public interest.

### References

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- 3 U.S. Department of the Interior, 1968, United States petroleum through 1980: Washington, D.C., U.S. Dept. Interior, Office of Oil and Gas, p. 75.
- 4 Colorado River Basin Water Quality Control Project, 1968, General background on the mineral pollution problem in the Colorado River Basin, preliminary draft: Denver, Colorado River Basin Water Quality Control Project, 31 p.
- 5 Holzworth, G. C., 1962, A study of air pollution potential for the western United States: Jour. Applied Meteor., v. 1, p. 366-382.
- 6 Hosler, C. R., 1961, Low-level inversion frequency in the contiguous United States: Monthly Weather Review, v. 89, p. 319-339.



- 7 Special Committee of the Governor's Oil Shale Advisory Committee, 1971, Report on economics of environmental protection for a federal oil shale leasing program: Denver, Colo., Report prepared for State Director of Natural Resources, p. 43.
- 8 Minger, J. A., 1968, Public access to public domain lands: U.S. Dept. Agr. Misc. Pub. No. 1122, p. 16.
- 9 Baker, B. D., 1970, Big game winter range analysis, Game Unit 22--Piceance: Fort Collins, Colo., Wildlife Research Center, p. 10.
- 10 Weaver, G. D., 1971, Environmental hazards of shale oil recovery by in-situ methods: Milwaukee, Univ. Wis.--Milwaukee, Dept. Geography, mimeo, 67 p.
- 11 U.S. Department of the Interior, 1971, Program statement for the proposed prototype oil shale leasing program: Washington, D.C., U.S. Dept. Interior, p. VI-1--VI-26.



ROCKY MOUNTAIN OIL & GAS ASSOCIATION,  
*Denver, Colo., November 10, 1971.*

HON. HENRY M. JACKSON,  
*Chairman, Senate Interior and Insular Affairs Committee,  
 Senate Office Building, Washington, D.C.*

DEAR SENATOR JACKSON: The Rocky Mountain Oil and Gas Association is interested in oil shale as a source of energy and has established a committee on Oil Shale and Synthetic Fuels. This committee reviewed Senate Bill 2510 and we would like to submit the following statement of our views on this Bill:

The Rocky Mountain Oil and Gas Association supports the principle that this country should continue to rely on the force of competition and the profit motive to foster and encourage private enterprise to develop ways and means of providing adequate low-cost energy fuel supplies consistent with the Mining and Minerals Policy Act of 1970. The establishment of a *New Energy Sources Corporation* by the Federal Government to encourage the development of an oil shale industry as proposed in S. 2510 does not appear to be consistent with this principle. Congress should allow the current *Federal Leasing Program* to be fully implemented prior to considering the necessity for S. 2510.

The private sector has spent and is spending many millions of dollars for research and development to accomplish the purpose of the proposed *New Energy Sources Corporation* with demonstrable results.

RMOGA recommends, as immediate alternatives to S. 2510, that the Congress improve the planning and economic climate for an initial oil shale industry by: 1) adjusting the rate of percentage depletion for oil shale to place it on an equal basis with conventional resource crude; 2) eliminating the 50% of taxable income on percentage depletion as applicable to shale oil; 3) providing adequate investment tax credits to stimulate investment in shale oil plants and equipment; and 4) establishing a National Energy Policy.

Yours very truly,

JOHN S. HUTCHINS,  
*Chairman, Oil Shale and Synthetic Fuels Committee.*

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WESTERN OIL SHALE CORP.,  
*Salt Lake City, Utah, October 18, 1971.*

MR. MITCHELL MELICH,  
*Solicitor, Department of the Interior,  
 Interior Building, Washington, D.C.*

DEAR MITCH: On November 15, the Interior Department is scheduled to testify before the Senate Interior Committee on the subject bill. The bill would create a public corporation to develop technology for recovering oil from shale and other so-called "exotic" materials. We strongly favor the concept of S-2510 at least as it relates to oil shale. We believe no significant research and development effort in this area will be undertaken by industry so long as (a) the government owns essentially all the resource, (b) the government has total control of nuclear energy, the only energy source potent enough to impart permeability to shale and (c) industry participation in any nuclear experimentation will expose background patents.

If the Secretary recognizes that there is an energy crisis, if he recognizes that no consequential part of the oil contained in the Utah-Colorado oil shale deposition will ever be recovered by mining (even if the waste disposal problems could be solved to the satisfaction of conservationists), and, finally, if he recognizes that in situ processing of shale is possible only if massive fracturing of the naturally impermeable shale formation is accomplished, he must, we believe, recognize that the government must take the initiative in investigating the nuclear approach to recovering oil from shale.

These are the critical facts:

1. Virtually all the rich deep-lying shale (the basis for the calculations of trillions of barrels of oil content) is held by the U.S. and cannot intelligently be made the subject of leasing before technology is developed.



2. The only source of energy for fracturing this shale belongs to the government.

3. Whatever costs are involved in following the nuclear concept to its logical conclusion can be recovered easily if results are favorable.

4. The idea of a nuclear shot in oil shale has been endorsed by all the involved executive departments since 1959, and the shot is no closer to reality now than it was at the conclusion of the first conference on Bronco.

I'm enclosing a transcript of the symposium on Project Utah conducted by the Bureau of Mines in Laramie last February. It documents our conviction that the Uintah Basin Oil shale deposition is ideal for nuclear experimentation. Nevertheless, industry would not underwrite the experiment. [In Committee Files.]

If we can in any way influence the Secretary to think positively about S-2510, we should like the opportunity to do so. We can, of course, elaborate on the statements we have made here either in writing or in person.

Very truly yours,

FRANK J. ALLEN.

SHELL OIL Co.,

Houston, Tex., November 12, 1971.

HON. FRANK E. MOSS,

Chairman, Subcommittee on Minerals, Materials and Fuels, Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Shell Oil Company welcomes the opportunity to submit our views on Senate Bill S. 2510 to establish a corporation for development of new energy sources. We respectfully request that it be included in the record of the November 15 hearing.

We believe Senate Bill S. 2510 to establish a corporation for development of new energy sources represents an unnecessarily deep involvement of government in oil shale development which is undesirable until milder alternatives have been exhausted. Oil shale development by industry with suitable encouragement from the federal government should be fully tested before federal funds are used for direct support. A stable long-range oil shale leasing program as well as economic incentives such as accelerated writeoffs, investment tax credits, changes in depletion regulations, or reduced royalty may be necessary. If reasonable encouragement is offered, we believe private commercial development of oil shale is likely. Accordingly, enactment of S. 2510 at this time appears premature.

We would also like to offer the following specific comments:

(1) We doubt that contribution of funds to the proposed New Energy Sources Corporation would be of advantage to a private company except one which owns or controls oil shale land.

(2) The bill does not specify the disposition of any federal oil shale land made available to the Corporation when the Corporation ultimately disposes of its demonstration facilities nor does it include proper limits on the land assigned.

(3) In view of the patent provisions in the bill (the Corporation must make patents available on a royalty free basis), we doubt that much of the existing oil shale recovery technology, covered by privately held patents, would be available to the Corporation.

Very truly yours,

KEITH DOIG.

Senator Moss. We have today Government witnesses primarily and then some of the companies that are involved, but we are going to begin first with hearing the Assistant Secretary for Mineral Resources, Mr. Hollis M. Dole, who has been before our committee several times, and on whom we rely to keep us abreast of the administration's policy.

I am afraid Mr. Dole is not in favor of the bill, and I would like to find out why.

Would you come forward, please, Mr. Secretary?



**STATEMENT OF HOLLIS M. DOLE, ASSISTANT SECRETARY, MINERAL RESOURCES, DEPARTMENT OF THE INTERIOR; ACCOMPANIED BY JACK RIGG AND REID STONE**

Mr. DOLE. Thank you, Mr. Chairman. We will be pleased to try to respond to your questions.

With your permission, I would like to have my deputy Mr. Jack Rigg and Mr. Reid Stone, Oil Shale Coordinator with the department up here with me.

Senator Moss. We are pleased to have you gentlemen present with Mr. Dole, and look forward to hearing you.

Mr. DOLE. Mr. Chairman and members of the committee, it is indeed a pleasure to appear before this committee to review the Department of the Interior's proposed prototype oil shale leasing program and to testify on S. 2510, a bill to establish a corporation for the development of new energy sources. A number of significant events have occurred since May 21, 1970, when we last had the opportunity to outline our proposed program. This hearing is a welcome opportunity to share with you a summary of these developments.

As you will recall, the broad scope of the department's proposed prototype leasing program was outlined last year as follows:

Only two tracts in each State would be offered;

A nomination and exploration core drilling period;

Leases would be offered to private industry for development on the basis of sealed competitive bonus bids at a fixed royalty rate over a 20-year primary term. Minimum royalty payments would escalate annually after the 5th year; and

Interior contemplates strict enforcement of regulations to prevent pollution and assure restoration of the affected areas.

Within the week following our last appearance before this committee, the Secretary of the Interior invited the Governors of Colorado, Utah, and Wyoming to form panels to analyze the impact upon the environment that might result if oil shale leases were developed in their State and to determine the costs of appropriate environmental controls. The letter requesting that study and the suggested guidelines is labeled "Exhibit No. 1" in the material following these remarks.

In June of 1970, an Interior Department team visited each of the oil shale States. Public meetings were held to discuss the concept of oil shale development and to receive firsthand information concerning the cooperative efforts involved in our proposed program. The Governors' panels were formed and sites typical of those that may be developed under our proposed program were selected for study. An inspection of these sites was made by an interdisciplinary review team during August as detailed in the news release, exhibit No. 2. Interior representatives also participated in 14 other meetings with environmental groups and other public bodies from August through December 1970.

By February 1971, all of the State reports had been completed and formally transmitted to the Secretary of the Interior—exhibits 3, 4,



and 5. These studies proved extremely valuable in outlining the scope and nature of the environmental problems and the controls needed. Although the costs of these environmental controls could not be precisely determined, the capital and operating costs were each estimated to be approximately 7 percent of total costs.

Using the State studies as the basis for subsequent analysis, Interior's staff incorporated the ideas of the State governments, other Federal agencies, local governments, industry, and the public into our proposed program. The Program Statement and Draft Environmental impact statement were completed and released for public and agency review and comment on July 29, 1971—exhibits 6 and 7.

Over 150 professionals of diverse backgrounds were involved in these studies. The scope of this effort, which produced the five major reports, is represented by exhibit 8 which outlines the organization designed specifically to develop a viable oil shale program.

Guidelines for program implementation were provided by President Nixon in his June 4, 1971, clean energy message to Congress. That message requested the Secretary of the Interior to expedite a leasing program that would lead to oil shale development on public lands, provided that environmental questions can be satisfactorily resolved. Within the congressional authority provided by the Mineral Leasing Act of 1920, as amended, and the policy contained within the Mining and Minerals Policy Act of 1970, we believe that such a program has been drafted. Before analyzing the basis for this conclusion, we would like to give you a more in-depth overview of the proposed program. For this, we have prepared a short 12-minute slide and tape presentation which we are prepared to show with your approval. We would be pleased to show that at this hearing following my statement or at your convenience at any other time or place. The complete text of this presentation has been included as exhibit No. 9.

Industrial interest in the exploratory phase of the program has been increasing. To date, we have received applications to core at 22 different locations, 19 of which are located in Colorado and three in your home State of Utah. This represents over \$2 million in exploration and evaluation expenditures for the announced industrial participants in the coring program detailed in exhibit No. 10. Several other firms are known to be actively considering participation.

We have spotted the locations of the core holes on the map we have brought with us today. Each site was investigated in the field by an interdisciplinary task group prior to approving the application to drill. Actual operations are being closely supervised by Interior representatives to insure compliance with regulations designed to avoid environmental damage and to obtain better resource data.

The pattern of drilling applications indicates considerable interest in the north and west flanks of the Piceance Creek Basin in Colorado and the east flank of the Uinta Basin in Utah. Surface cover in these areas is believed to be relatively thin, on the order of several hundred feet, indicating interest in surface mining. The core locations near the center of the Piceance Basin indicate interest in the more deeply buried oil shale which can only be developed by underground mining or, possibly, by in situ techniques.



We have opened the period for lease nominations as indicated in exhibit No. 11. These nominations will identify those sites of greatest interest and focus our efforts to fully assess the environmental impact of development.

In addition to the leasing program, we are proposing to reactivate, under lease, the Bureau of Mines' Anvil Points Oil Shale Research Facility near Rifle, Colo. This facility, established under the Synthetic Liquid Fuels Act of 1944, was operated by the bureau from 1944 to 1956, and, under lease, by the Colorado School of Mines Research Foundation, Inc., over the period 1964-68. The operations proposed to be conducted by Development Engineering, Inc., of Denver, Colo., include the construction of a vertical kiln retort and the mining, crushing, retorting, and disposal of about 600,000 tons of oil shale. This action would accomplish two objectives: It would encourage further research on surface processing of oil shale while at the same time provide experience and information on waste management techniques. We are prepared to approve this lease pending the satisfactory completion of the final environmental statement on this proposal. A draft statement was issued October 15 for review and comment, exhibit No. 12.

We were most impressed with the Colony Development Co. operations which seem to place the environmental considerations associated with development on a level commensurate with economic considerations. During our August 20 tour of this facility with Secretary Morton, Senators Allott and Dominick, Representative Aspinall and Lieutenant Governor Vanderhoof, all of Colorado, Mr. R. O. Anderson, chairman of the board for the Atlantic Richfield Co., outlined the environmental safeguards planned in the event commercial operations are initiated.

Interest at the State level has remained high. The initial studies by the State of Colorado are being expanded and will be refined under a 47-member environmental committee composed of State, Federal, and local agencies, as well as the industry, academic, and private sectors. Additionally, Mesa, Rio Blanco, and Garfield Counties have formed an 18-member oil shale regional planning commission to investigate the regional development requirements associated with a developing shale oil industry. For the first time, Mr. Chairman, all interests are involved in the planning required to develop oil shale in harmony with the existing environment.

Public interest in oil shale development is hard to gage at this time. As a rough measure, we have analyzed the kinds of letters the department has received. Of the 156 letters received over the first 10 months of 1971 commenting directly on the proposed program, 88 percent have been favorable to the proposed development.

Private and public interest in oil shale has increased significantly in recent years. The orderly development of this great energy resource, however, requires the resolution of a number of thorny problems.

The validity of oil shale claims is a particularly time-consuming problem, but significant progress is being made. Our intensive title clearance program was initiated nearly 3 years ago. Some 200,000 acres of claims have been cleared through relinquishments and court



contests. Test cases on claims on an additional 250,000 acres are now pending before the department. In addition, the Supreme Court decision of last December has established a precedent which may help resolve thousands of the oil shale mining claim conflicts.

Senator HANSEN. Mr. Chairman, I wonder if I might interrupt the witness a moment to say I regret very much I am going to have to go on the floor to be on hand for consideration of the tax bill before us. I would like, if I may, with your permission, to get permission to ask Secretary Dole and other witnesses questions that I might mail to them, and I hope that my questions might be incorporated in the record at the appropriate spot, if that would meet with your approval?

Senator MOSS. Without objection, we will make that the order and I am sure the witness will be glad to respond in writing to written requests you may submit, and we will be glad to place that in the record.

Senator HANSEN. Thank you, Mr. Chairman.

There are other witnesses whose testimony I am interested in and I hope I would have the same privilege.

Mr. DOLE. Mr. Chairman, I know of Senator Hansen's deep interest in this and I can assure you, Senator, we will respond to them the best way possible and as soon as possible.

Senator MOSS. You may proceed.

Mr. DOLE. Lands within unpatented mining claims nominated for leasing under our prototype program may be leased according to a recent decision by Department of the Interior Solicitor Melich—exhibit 13. This opinion is particularly relevant at this time as it provides that development could proceed and that revenues be held in escrow pending final decision on the claims.

In another significant action, the Solicitor of the Department ruled only last Friday that, under the Mineral Leasing Act, a person, association, or a corporation may take and hold indirect interests in oil shale leases as a member of associations or as a stockholder in corporations who hold an oil shale lease. However, the pro rata shares of such leases together with the acreage embraced in an oil shale lease directly held by that person, association, or corporation, must not exceed the aggregate allowable oil shale acreage of 5,120 acres. Such indirect holdings would be chargeable to a person where he is the beneficial owner of more than a 10 percent interest in an association or corporation holding the lease.

The solicitor also ruled that a person, association, or corporation may take and hold directly only one oil shale lease which shall not exceed 5,120 acres. However, if that lease should expire or terminate for any reason, or be transferred, the leasee would not be barred from acquiring another oil shale lease. The complete text of the ruling is attached as exhibit No. 14.

The solicitor's latest opinion is expected to lead to increased industrial interest in the development of oil shale on public lands.

Another longer term problem has been the provisions of the mineral leasing laws which fail to recognize the amount of land required for large-scale oil shale operations. The present laws limit the amount of land to 5,120 acres per party. We have moved to correct this and other



major deficiencies in the existing laws under our proposed "Mineral Leasing Act of 1971" which was introduced in the Senate as S. 2726 on October 20, 1971. Under the proposed law, the maximum oil shale acreage that may be held by one party in any one State would total 10,240 acres.

Our outline today of the steps that have been taken toward the orderly development of the Nation's oil shale resources indicates, we believe, significant progress. However many more steps must be taken. Our proposed schedule during 1972 can be summarized as follows:

Within the period January to April, evaluate nominated sites and prepare individual site evaluations for completion of the draft environmental statement.

In the period April to July, hold public hearings on the draft environmental statement.

During July to August, if the program is implemented, publish the final environmental statement and final lease terms.

Through August to December, complete resource evaluation.

In December 1972, begin competitive sales of lease tracts.

There is a strong increasing interest and support by State and local governments, industry, and the general public in oil shale development. We believe the proposed program can accomplish its stated goal and provide a new source of energy for the Nation by stimulating the timely development of commercial oil shale technology by private enterprise, and do so in a manner that will accommodate all essential environmental considerations.

Against this background, we have reviewed with considerable interest Senate bill 2510 of September 14, 1971, to establish a corporation for the development of new energy sources and for other purposes. This corporation would provide a mechanism for industry and Government, under Federal leadership, to develop commercial technology for extracting shale and tar sand oils, and for the development of other energy sources, including solar.

While the bill seeks to accelerate the development of new energy sources, we believe that, at this time, it would tend to short circuit the efforts being made to encourage development of the Nation's oil shale and tar sand resources through private enterprise under the governing philosophy of the Mining and Minerals Policy Act.

S. 2510 would place primary responsibility for the economic development of oil shale and other new energy sources in the Federal Government, and potentially place it in competition with private industry for the sale of fuels and associated minerals. The concept that the Federal Government should assume leadership within a corporation to develop new energy sources is based on section 1(a)(10) which states that " \* \* \* the research and development effort \* \* \* is too large for any single company \* \* \* and a consortium of companies should be assembled under Federal leadership \* \* \*." Yet, private industry has demonstrated that it is willing and able to form joint ventures to develop the technology for the commercial extraction of supplemental fuels. Testimony of this is the Canadian tar sands project funded in excess of \$300 million; the multimillion-dollar Colony Development Co.'s oil shale development program in Colorado; and past and proposed research at the Bureau of Mines Oil Shale Research Facility near Rifle, Colo.



The patent provisions of S. 2510 are incompatible with the administration's patent policy announced August 23, 1971, which provides for the retention of certain rights to the industrial participants. Under the conditions of S. 2510, any information acquired by the participant would also be available at no cost to the nonparticipant. Those companies now holding patents to the most promising extraction approaches would not gain any competitive advantage by participating in such a corporation and the threat of a large Government competitor would tend to retard further technologic developments by these firms.

The complex management provisions and other provisions to allow private interests to contribute land, minerals, or water rights rather than dollars could lead to charges of unfair treatment between participants, particularly if public lands are involved.

Tar sand deposits are known to be of widespread occurrence in the United States, but there has been no extensive development of this potential energy source. Although technology is a factor, tar sand development has also been retarded by confusion over entitlement to deposits among holders of oil and gas and tar sand leases on public lands. However, this confusion could be eliminated and tar sand development facilitated by enactment of the administration's proposed "Mineral Leasing Act of 1971."

The total impact of S. 2510, if enacted, would be to further fragment efforts to develop adequate amounts of new energy supplies, and would be incompatible with the philosophy of the President's proposed reorganization of the Federal Government. The President's proposal would group most of the energy functions of the Federal Government into the Department of Natural Resources. We firmly believe that the planning and funding of energy research and development should be accomplished within an agency charged with the mission of ensuring that the total energy resources of the Nation are effectively utilized.

Moreover, as I have noted earlier, we believe that S. 2510 which provides for extensive Government participation in energy development runs counter to the philosophy of the present Mining and Minerals Policy Act, which specifies that the Government's principal role is to encourage private enterprise to develop the Nation's mineral resources.

Other legislative action, however, can significantly increase the probability that our Nation's oil shale and tar sand resources will be developed in time to help satisfy future energy needs. Favorable action on S. 2726 to reform the mineral leasing laws will help achieve this goal. Positive Federal leadership—without undue intrusion into the proper concerns of the private sector—is the other ingredient needed to provide the economic and administrative climate necessary to foster supplemental fuels development under private initiative. We believe that the proposed prototype oil shale leasing program provides a model of such leadership, which will induce a full range of cooperation and benefits needed to develop our oil shale resources.

In summary, we believe that domestic fuels from the Nation's supplemental energy sources must be developed; however, we do not believe that Senate bill 2510 would contribute to this objective at this time.

Thank you very much for allowing us to make this statement.

Senator Moss. Thank you, Mr. Secretary, and your presentation of all of these various exhibits, of course, fills out your testimony. All of them will be included in the record by reference.



I appreciate your statement.

Mr. DOLE. Mr. Chairman, we would be pleased to have them referred to by reference, and we would be pleased to furnish these to anyone who would care to inquire. All they need to do is address the Department of Interior, Washington, D.C., and we will be sure they get them.

Senator Moss. Thank you for that announcement, too, because there may be a number of people who would like to have these documents. They fill a folder of large dimension and therefore if they could receive them by simply inquiring of the Department, that would be helpful, I am sure.

We have prepared some questions that did not get to you on time, and I apologize for that. What we will do is ask if you could respond to these perhaps in writing, since they were not delivered in time for you to be able to testify on them today. Do you have those with you?

Mr. DOLE. Yes, sir, Mr. Chairman. They were received in our office late Friday afternoon and we have not had an opportunity to delve into them as they need be. We will be happy to supply answers to all of the questions you asked, and we will do so in the shortest time possible.

Senator Moss. Thank you very much.

(The questions submitted to the Department by Senators Hansen and Moss and their responses follow:)

U.S. SENATE,  
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,  
Washington, D.C., November 19, 1971.

Hon. HOLLIS M. DOLE,  
Assistant Secretary,  
Department of the Interior,  
Washington, D.C.

DEAR HOLLIS: I certainly appreciate the opportunity of submitting these additional questions relative to the hearings which were heard on November 15 concerning the development of the Administration's oil shale program.

From the testimony presented at the hearings, I understand that there have been twenty-two core drillings made to date relative to possible leasing of oil shale. Nineteen of these core drillings occurred in the Piceance Basin in Colorado with three additional drillings in Utah. My question is what does the Administration and the Department plan to do if, in fact, there are no applications for leases in Utah and Wyoming?

If the Department does not receive any lease bids for oil shale development in Wyoming and Utah, do they envision going forward in the program and, in fact, leasing lands in Colorado? If so, how does the Department envision stimulating interest in the oil shale lands of Wyoming and Utah?

I wish to thank you again for your help and assistance in this matter and will look forward to your early reply.

With best regards,  
Sincerely,

CLIFFORD P. HANSEN.

U.S. DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
Washington, D.C., December 6, 1971.

Hon. CLIFFORD P. HANSEN,  
U.S. Senate,  
Washington, D.C.

DEAR SENATOR HANSEN: Thank you for your letter of November 19, 1971, submitting additional questions relative to the hearings of November 15 concerning our proposed oil shale leasing program. I have enclosed our responses to the three questions you have posed.



I have also enclosed our responses to the fifteen questions concerning the proposed program which were submitted by Chairman Jackson and a copy of the Department's section-by-section analysis of its proposed Mineral Leasing Act of 1971.

If I can be of any further help in explaining our proposed oil shale leasing program, please notify me.

Sincerely yours,

HOLLIS M. DOLE,  
*Assistant Secretary of the Interior.*

RESPONSES TO QUESTIONS RAISED BY SENATOR HANSEN CONCERNING THE DEPARTMENT OF THE INTERIOR'S PROPOSED OIL SHALE LEASING PROGRAM

*Question 1. What does the Administration and the Department plan to do if, in fact, there are no applications for leases in Utah and Wyoming?*

*Response.* If lands in one or more of the oil shale States are not nominated, it would be an indication that the oil shale resources of those States are not attractive for competitive leasing at the present time. Although not considered in the proposed program, the Department could select, on its own motion, specific lands for competitive leasing in a State where nominations were not submitted in order to be sure that present interest does not, in fact, exist.

*Question 2. If the Department does not receive any lease bids for oil shale development in Wyoming and Utah, do they envision going forward in the program and, in fact, leasing lands in Colorado?*

*Response.* The applications to core drill under our proposed prototype oil shale leasing program indicates interest in both Colorado and Utah oil shales. We have had some interest in Wyoming oil shales, but no applications for core drilling have been filed. If the program is implemented and we receive nominations of lands in Colorado, but none for lands in Wyoming or Utah, we would proceed with the competitive sale of two leases in Colorado.

*Question 3. If so, how does the Department envision stimulating interest in the oil shale lands of Wyoming and Utah?*

*Response.* If insufficient interest were shown by industry in competitive leasing of oil shale in one or more of the States, we would not schedule further lease sales until there was some demonstration of interest in oil shale development in these States such as nomination of lands for leasing, or some technological development occurred which would make the leasing climate more favorable.

The Department, through the Bureau of Mines, is seeking to develop a new extraction technology—in situ retorting—which may lead to development of the leaner and thinner oil shales which are not commercially attractive at the present time. Work to date has established the technical feasibility of the in situ approach, but much remains to be accomplished before this technique could be adopted for commercial application.

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U.S. DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
*Washington, D.C., December 6, 1971.*

Hon. HENRY M. JACKSON,  
*Chairman, Committee on Interior and Insular Affairs,*  
*U.S. Senate, Washington, D.C.*

DEAR MR. CHAIRMAN: We appreciated the opportunity to appear before your committee on November 15 to review the status of the Department's proposed oil shale program and to testify on S. 2510. Senator Moss and other members of the Committee were most gracious in listening to the Department's presentation and asked numerous cogent questions which helped to clarify our program and our concern with S. 2510.

As we promised at the hearing, we are transmitting herewith our response to the 15 questions posed to the Department in your November 5 letter, those raised by Senator Hansen in his letter to us of November 19, and an analysis of our proposed "Mineral Leasing Act of 1971," which was introduced in the Senate as S. 2726 on October 20, 1971.

The report transmitted with your November 5 letter entitled "Comparison of the Department of the Interior 1968 and 1971 Oil Shale Leasing Programs and



Lease Forms," was quite interesting. As requested, we have reviewed the section of the report beginning on page 30. That section discusses how potential oil shale developers might view the costs, economic and technical risks, and the impact of changes in the laws that govern oil shale leasing. It is not possible for us to generalize on these points since each potential bidder would be acting in the light of his own circumstances and would have his own data upon which to assess these factors. The basic issue contained in that section is whether our program will succeed or whether other alternative approaches to oil shale development need to be considered.

We are not, at this point in the planning for this program, in a position to predict industry response to a program which has not been implemented. Industry has, however, responded quite favorably to the opportunity to core drill on public lands. As detailed in their statements of November 15, those members of industry who testified have endorsed the proposed leasing program. These actions indicate, we believe, that the rationale used to develop our program is sound and, if implemented, the program would achieve its stated goals. Thus, consideration of methods to stimulate interest in oil shale development should await the outcome of our current leasing proposal.

It is true that the current program differs in a number of respects from the 1968 test leasing program. Undoubtedly, proponents of the 1968 program may disagree with those features of the current program which differ from the previous approach. We are most happy to consider all constructive suggestions on our program as it evolves, but hope to avoid a prolonged argument on the points of differences between the prior unsuccessful effort and the current one which has received a great deal of support and shows promise of success.

During the course of our testimony, a question was raised concerning the significance of the \$3.74 per barrel price for shale oil as compared to the price of Texas crudes. The comparison of the two supply sources is more complex than the discussion at the November 15 hearings would indicate. For the record, we would like to clarify this value.

The value to a refiner of any crude oil is determined mainly by its quality, the location of the refinery, and the costs of transportation. Due to partial upgrading prior to transportation, shale oil is expected to be about \$0.15 per barrel more valuable than Texas Gulf Coast crude. Pipeline transportation of Colorado shale oil to a refiner located in the Mid-Continent area would cost about \$0.38 per barrel while transportation and gathering charges from the Texas Gulf Coast would total about \$0.29 per barrel. To a Mid-Continent refiner, the cost of oil from the Gulf Coast would total \$3.97 per barrel; the sum of the posted price (\$3.68 per barrel) and the cost of transportation (\$0.29 per barrel). If this same refiner were to purchase shale oil at \$3.74 per barrel and transport it to his refinery, his total cost would equal \$4.12 per barrel. This oil, however, is \$0.15 per barrel more valuable than Texas crude due to its improved quality by upgrading. Adjusting for this quality differential, the refiner could afford to pay either \$3.74 per barrel for shale oil in Colorado or \$3.68 per barrel for Gulf Coast crude oil and produce final products of comparable value. Thus, at current prices and at production costs outlined in the Bureau of Mines publication "Mining and Conversion of Oil Shale in a Gas Combustion Retort", shale oil would yield a discounted cash-flow rate of return of 12 percent.

Thank you for this opportunity to further clarify our program. We look forward to a continuation of the constructive dialogue with your committee on the matter of oil shale development as well as other aspects of the Nation's energy needs and resources.

Sincerely yours,

HOLLIS M. DOLE,  
*Assistant Secretary of the Interior.*

#### "MINERAL LEASING ACT OF 1971"

*Section 1* contains the short title "Mineral Leasing Act of 1971."

*Section 2* contains a declaration of policy emphasising the need to balance the promotion of mineral development with protection of the environment.

*Section 3* contains definitions. Only a few require comment.

"Leasable lands" means all federally owned land (including acquired land) and lands in which the United States has reserved the minerals but conveyed the rest. It specifically excludes (1) parks, refuges and wildernesses unless otherwise



provided by law, (2) Indian lands, (3) naval petroleum and oil shale reserves and (4) OCS lands. It does not include public domain lands for purposes of Title V only.

"Oil and gas" includes "tar sands" to avoid a troublesome problem under existing law.

Title I contains general provisions applicable to all titles.

*Section 101* authorizes prospecting permits similar to those authorized under the Mining Law of 1971.

*Section 102* authorizes the issuance of leases as provided in Titles II, III, IV and V.

*Section 103* provides uniform rent of \$5 per acre.

*Section 104* requires consultation or consent of incorporated areas for leases of oil and gas and other minerals within their city limits.

*Section 105* requires competitive bidding for all leases.

*Section 106* requires consent of surface managing agency and conditions in leases to protect nonmineral values.

*Section 107* authorizes multiple leases on a single tract.

*Section 108* authorizes production of associated or related minerals in a single lease.

*Section 109* provides for environmental regulations similar to section 10 of the Mining Law.

*Section 110* authorizes bonds to enforce any requirement. (Requires bonds for reclamation).

*Section 111* contains penalties.

*Section 112* authorizes surface leases similar to section 9 of the Mining Law.

*Section 113* basically restates present law as to when acreage will not be chargeable against the limitations.

*Section 114* provides for limitations or assignment.

*Section 115* provides for suspension of operations or waiver of rent or royalties to promote conservation or development or to protect the environment. It is somewhat broader than existing law in this area.

*Section 116* follows existing law in giving the Secretary the right to water discovered while drilling under a Federal lease.

*Section 117* provides that all leases, even if in production, may be cancelled administratively. Existing law requires producing leases to be cancelled by court action only.

*Section 118* would extend to all leases and permits the present provisions applicable to oil and gas leases for automatic termination upon nonpayment of rentals. The provisions give the Secretary authority to reinstate leases under specified conditions.

*Section 119* follows existing law or disposition of revenues (37½% to all States but Alaska which gets 90%) but eliminates the payment to the reclamation fund.

*Section 120* would extend the principle of unitization to all minerals. Specific provisions governing unitization are not imposed by statute, as they are now with respect to oil and gas, but the Secretary would be given broad power of regulation.

*Section 121* provides for forfeiture of a lease where lessee enters into agreement to restrain trade.

*Section 122* preserves existing authority to grant pipe line rights-of-way.

*Section 123* repeals certain existing laws.

*Section 124* provides for regulations under the Administrative Procedures Act, which will apply to leases in effect when the regulations are issued.

*Title II* covers oil and gas leases

*Section 201* provides acreage limitations which, except for Alaska, are the same as the Mineral Leasing Act of 1920. No additional allowance is provided for the acquired lands which the proposed law would embrace.

*Section 202* provides a primary lease term of 5 years and a royalty of 12½%. The lease can be extended by production or by diligent drilling operations.

*Sections 203-205* are basically consistent with existing law.

*Title III* covers coal, oil shale, various compounds of calcium, magnesium, potassium and sodium, sulfur and other bedded minerals

*Section 301* provides acreage limitations.

*Section 302* provides a 20 year term extended by production plus rents, royalties and other conditions as the Secretary shall prescribe, readjustable at the end of 20 years and at 10 year intervals thereafter.

*Section 303* provides for lease renewals for 10 year periods.



*Title IV* covers disposal of "construction minerals" including sand, gravel, building stone, pumice, etc.

*Section 401* allows surface managing agency to dispose of, either by lease or sale.

*Section 402* authorizes Federal agencies, or State, local governments or non-profit organizations to obtain construction minerals without charge.

*Section 403* authorizes negotiated sales for certain purposes.

*Title V* covers disposal of "hard rock minerals" on acquired lands. These are the minerals which, on public domain land, are covered by the Mining Law of 1971

*Section 501* provides acreage limitations.

*Section 502* provides lease terms.

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#### RESPONSES TO QUESTIONS OF THE SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE CONCERNING THE DEPARTMENT OF THE INTERIOR PROPOSED OIL SHALE LEASING PROGRAM

*Question 1. It appears from the Program Statements, the economics of shale oil production have only slightly improved since 1968. In view of this, on what basis does the Department expect that under the prototype leasing program industry will make the substantial investments in the proposed leaseholds that would be necessary to achieve the goal of a commercially operating shale oil industry by 1980?*

*Response.* The response to the Department's proposed oil shale leasing program has been very encouraging. As detailed in our statement before the Committee on November 15, 1971, we have received applications to core drill at 22 different locations. The 11 industrial firms currently participating in the program will have committed over \$2 million if all of the locations are cored. We believe this interest reflects the increasing economic attractiveness of shale oil production (discussed in our Program Statement released June 29, 1971) and the now well-defined need to develop alternative liquid fuels from domestic sources.

However, we are not, at this time, in a position to predict industry response to a program that has not been implemented.

*Question 2. How will the Department of the Interior determine the refusal price of the bonus bid?*

*Response.* The Department would make an economic evaluation of the tracts offered for lease prior to the lease sale to determine the value of the leases at that time. These economic evaluations would consider the volume and quality of the recoverable resources, cost of production, value of product, and uncertainty of the estimates of these variables. The judgments necessary to relate these values to minimum bids would be similar to those now made for other leasable minerals.

*Question 3. Does the Department anticipate that substantial bonuses will be paid?*

*Response.* Pending resource evaluation and program implementation, it is not possible to anticipate the amount of any potential bid, and, consequently, whether it would be substantial. Interest in the program thus far leads us to conclude that conditions would be favorable for a successful sale.

*Question 4. If substantial bonus bids are not expected, on the grounds that additional high cost research and testing of processes will be required by the lessee, then would offering fewer leases produce the same result at a much lower cost in public resources? Would it be for all six leases nominated to have the same geologic conditions? (sic) Would all six leases be awarded if each lessee was planning to use similar technology?*

*Response.* In our view, the cost of research will not prevent the receipt of substantial bonuses. Many factors enter into the bidders determination of the amount of his bid.

With six leases in three states, identical geologic conditions will not exist at each location. The technologies developed by independent operators even on similar leases will differ in detail if not in principle. Every lessee may not be successful in developing an economic technology.

If we assume that all six leases would be issued and each lease embraced the maximum allowable acreage of 5,120 acres, the leased acreage would amount to



approximately 0.5 percent of the known oil shale lands of potential commercial value in Colorado, Utah and Wyoming.

*Question 5. Does the Department assume that not all six leases will be awarded (see Program Statement, Page V-1)?*

*Response.* Prior to lease nominations and evaluation, we are unable to respond to this question.

*Question 6. Why was the royalty payment set at 12 cents per ton of 30 gallon per ton shale? How was it determined? Also, why were the royalties on associated minerals reduced in early years in view of Department's recent actions on sodium leases in oil shale deposits?*

*Response.* The royalty rate of 12 cents per ton of mined 30 gallon per ton oil shale has been proposed to approximate the rates for other leasable minerals at the point of extraction of the resource from the ground. The gross value of the mined rock is calculated to range from 60 cents to one dollar per ton.

Because of complex start-up problems which must be met by a lessee in this new type of extractive industry, the royalties on associated minerals set forth in the proposed oil shale lease form were designed as an escalating incentive royalty. This type incentive has been applied in pioneering leases in the Wyoming trona area and elsewhere.

*Question 7. Why, after many years' use by the Department of an acceptable definition for oil shale and its products, is the accepted definition not used in the proposed lease form?*

*Response.* In the preliminary statement appearing before the proposed oil shale lease form in the Department's Program Statement, Appendix B, at 1, we state that "(d)efinitions, formulas, and other clarifying matter will be included in proposed leasing regulations." Those regulations are under study.

There is no "accepted definition" of oil shale and its products for oil shale lease forms or regulations. The original lease form and lease regulations promulgated in 1920 did not define the term "oil shale." The proposed oil shale leasing regulations for the 1968 leasing program were never adopted, and no oil shale lease was issued under that program.

In order that you might have some idea of our thinking in this regard, we expect to include the following traditional definition of "oil shale" in the Department's oil shale leasing regulations:

"Oil shale is a fine-grained sedimentary rock containing organic matter which was derived chiefly from aquatic organisms or waxy spores or pollen grains, which is only slightly soluble in ordinary petroleum solvents, and of which a large proportion is distillable into artificial petroleum. This term is applicable to any argillaceous, carbonate, or siliceous sedimentary rock which will yield oil upon destructive distillation."

We intend to include in any lease sale under the proposed program mineral substances found in association with oil shale. (see Program Statement, at B-1).

*Question 8. The very low cost of holding the lease in the early years, combined with the minimal production (or in-lieu payment) requirements for 20 years, appear to have been designed to encourage R & D. If so, what could a lessee learn in three years that would permit him to decide to give up the lease in that time and retain the balance of the original bonus? Alternatively, what could be learned within that time to permit a lessee to decide to retain the lease by paying the balance of the bonus?*

*Response.* The initial payment provisions are to encourage commercially viable oil shale development. We believe the installment payment of bonuses would also act to increase bonus bids as well as permit greater exploration and engineering studies in the first three years. In that period, the lessee could refine the information on the characteristics of the resource, perform detailed engineering studies, and evaluate the environmental hazards and the costs of their control. At the end of the three years the lessee would be in a position to make an informed decision on the economics of the operation. He could find development either economic or uneconomic. If the lessee decides to proceed, he must prepare and submit to the Department for approval his detailed plan of development and operations, including environmental controls.

The benefits of the initial three-year period to the Government and the public should not be minimized, since any detailed engineering studies or firm designs for environmental control would result in increased knowledge of the resource and of methods to control possible environmental effects of oil shale lease operations.



*Question 9. The production (or in-lieu payment) requirement at year 20 is so small that it is less than what has now (after 1968) been accepted by the Department (and most other experts) to be of a sub-economic plant size. Why was this particular production requirement selected?*

*Response.* The purpose of in-lieu payments is to make the costs sufficiently high to encourage active development of a commercial process. It is not the purpose of the in-lieu payment to match the royalty from a commercial plant and it is not the intent of the lease to specify the size of a commercial plant. Assuming a production rate of 3,500 tons of 30 gallon oil shale per day, the in-lieu payment starts at \$150,000 in year 11 and escalates to \$1,500,000 in year 20. It is over one million dollars per year from year 17 on. These are not trivial payments. In addition, if production in paying quantities is not established by the end of year 20, the lease would expire.

The royalty payments are graduated to give the developer time, in the early years, to prove his technology and environmental controls while preparing for commercial operations in the latter years of the lease.

For a further discussion of production incentives, see question 11.

*Question 10. If at the end of year 20 there is either no production or only small pilot operations, could the Secretary renegotiate the terms of the lease downward? If so, would this in effect allow the lessee potentially to retain the lease for another 20 years under even more favorable conditions?*

*Response.* The proposed oil shale lease provides that it would terminate if there is no production, or production in less than paying quantities, at the end of its 20 year term. The readjustment provision of the proposed oil shale lease, which is provided for by law, authorizes the Secretary to revise the terms either upward or downward at that time. However, we cannot predict what action the Department might take in the economic, environmental, and technologic situation which will exist some twenty or more years hence.

*Question 11. If the object of the new oil shale program is to provide incentives for a commercial industry, why are not reasonable but realistic performance requirements included in the lease form? Would it be possible, under the prototype leasing program for a lessee to retain the lands to beyond 1990 at relatively low costs without any significant shale oil production?*

*Response.* One objective of the current oil shale program is to provide incentives to develop a commercial technology, which will, in the normal course of events, be followed by commercial industry. There is no certainty, however, that any lessee is going to be successful in developing such a technology. Diligence and other performance requirements are included in Section 2(s) of the proposed lease form, and a minimum production (or in-lieu payment) requirement is included in Section 2(d). We believe these performance requirements are both reasonable and realistic.

The minimum cost of holding the hypothetical lease considered in our response to question 9 is \$8.4 million over a 20-year period, an average of \$1.2 million per year over the last five years. The bonus payment will be additional. This is not an insignificant amount to be paid for holding a lease that, if not developed, will yield no income and will expire at the end of the 20-year period.

*Question 12. How was the size of the "environmental bond" requirement determined? (At \$500 per acre, with a minimum of \$2,000, as little as four acres could be in use.)*

*Response.* The minimum rate for the bond of \$500 per acre is based on the estimated cost of reclaiming lands affected by oil shale development. The minimum total amount of \$2,000 is required under 43 CFR Part 23. During the first three years of the lease, detailed economic and engineering studies of reclamation practices by the lessee would enable the Department to evaluate the bonding level and adjust the bond so as to insure reclamation of the land. The adequacy of the bonds would be reviewed every 3 years and revised as needed.

*Question 13. A significant amount of environmental damage could be caused by air and water pollution arising at the retorting and semi-refining plants. Has this possibility been considered in determining the size of the bond required?*

*Response.* Land reclamation and related environmental considerations have been included in estimating the bond level (see response to question 12). An approved mining plan is required prior to commencing operations, and an operation



may be shut down for noncompliance with the lease provisions or for violations of Federal or State air and water quality laws. These same air and water quality laws also pertain to any pollution originating from the retorting and semi-refining operations. Where operations do not comply with the provisions of the air and water quality laws, the suspension of such operations would eliminate the pollution hazard while proper safeguards are being devised and installed.

*Question 14. A comparison of the environmental requirements of the 1968 and 1971 lease forms show a great many similarities. In view of the nearly 1 year delay since mid-1970 which was caused by the Department's concern about the environment, in what significant ways have the environmental safeguards been upgraded?*

*Response.* The protective requirements in the 1968 program were part of the basic data used in the development of those aspects of the current proposed program. Since that time, the National Environmental Policy Act has become law and the Council on Environmental Quality has been established. As a result, there has been a new definition of the obligations and responsibilities of the Federal Government and industry.

The one-year postponement of release of the program from June 1970 until June 1971 was occasioned by the need to assess the environmental impact of oil shale development and costs of environmental protection. It enabled an independent assessment by the three State panels of the environmental hazards and the practicability and costs of controlling such hazards. The three State reports, submitted as exhibits during the November 15 hearing, conclude that the environmental challenges can be dealt with economically and that the costs would approximate 7% of the total cost of an oil shale operation.

While the June 29 statement treats the environmental effects and the necessary controls from a general standpoint, we concluded that the impact must be further assessed for individual tracts so that protective provisions could be prescribed for each tract which may be proposed for leasing.

*Question 15. If developing a commercial oil shale industry is the objective of the new leasing program, could this be accomplished more readily if lessees were required to license technology developed in connection with research and operations under the leases, to others at reasonable rates?*

*Response.* Oil shale processing is not a unique operation where only one method is likely to be economic. With the development of several acceptable methods, competition among patentee-lessees would undoubtedly lead to reasonable licensing rates, particularly in light of the competition from other sources of petroleum and the maximum acreage limitation of 5,120 acres of oil shale lands allowed to any one person, association or corporation. Our purpose should be to create the conditions that would assure the development of several competing economic technologies. None of the mineral leasing laws provide for licensing requirements, and we are unaware of any instance in which the Department included such requirements in any lease issued under such laws. Such a requirement would be outside the scope of the Government's patent policy as contained in the President's "Memorandum, and Statement of Government Patent Policy," (36 FR 16887), which is keyed to Government-funded grants and contracts for the conduct of research and development.

Senator Moss. I am glad to hear of your optimism on the 1970 program now for leasing as announced. Why is this going to work any better than it did in 1968, when quite a similar program was announced and industry didn't come forward?

Mr. DOLE. I think, Mr. Chairman, that the answer to this is probably better planning and over a longer period of time. If you will recall, the 1968 program had quite a short fuse to it and industry was not able, within the time period allotted, to make the investigations which are needed for the large investments that will be required.

In our proposed prototype oil shale leasing program which we have been working on now for better than a year—we have kept industry informed of where we are, what we are doing and what the time schedule is, with the net result that they have had an opportunity to go in and look over the area and do drillings within a period of time



that they can evaluate, which was not available to them during the 1968 program.

Furthermore, Mr. Chairman, there are other reasons why I think this will produce results, whereas the 1968 program did not. Rather than having the department set up the areas to be leased ahead of time, we have announced to industry—you go out and look the area over, nominate tracts, then we will evaluate these tracts, put the environmental considerations to them and then we will let you know which tracts will be used. Then we have given them wider latitude.

If you recall, during the 1968 proposal, one tract was announced by the department, and the department did some drilling on it, and even from its own drilling it concluded this tract was not a viable tract, so it received no interest. Further, we have seen that other matters occurred during this time. I think things have taken place on the international scene that make it quite evident to industry that no longer can it disregard development of these energy resources.

There are many other things within the program, Mr. Chairman, and they will be analyzed and developed and submitted to you in response to the questions that were proposed by your consultant.

Senator Moss. The demands for energy certainly should create more incentive for development of these energy sources. Your objection on page 7, is that you believe "that S. 2510 which provides for extensive Government participation in energy development runs counter to the philosophy of the present Mining and Minerals Policy Act, which specifies that the Government's principal role is to encourage private enterprise to develop the Nation's mineral resources."

Now the basic thrust of S. 2510 is that the Federal Government participate with industry in developing new energy sources. Thereafter, as soon as the plant is built and one is working economically, the Federal Government disappears from the scene, and the corporation withdraws and there is no more activity.

Mr. DOLE. You are right there, Mr. Chairman. Your bill would require that the Federal Government would withdraw in the developmental stages. However, we feel that industry is capable and willing to assume the enormous costs that are involved. We feel that by putting this solely and largely upon the private sector that more people will become involved in this and that more rapid progress will be made because of the need of private industry to get a return on their investment.

I think that the idea of having Uncle Sam back all of these things—sometimes it is necessary—but in this instance we feel that it can be done within the private sector and thus we would be carrying out the will and wishes of Congress as displayed in the Mining and Minerals Policy Act.

Senator Moss. I recall reading a speech which you delivered before the National Energy Forum here, I think, on the 24th of September. I have one short quote from it:

If there is one thought I would like to leave with you, it is that the government, particularly the Federal Government, is deeply involved in the energy business and is slated to become even more so. It owns most of the energy resources at home and controls entry of those from abroad. It alone has the capability to underwrite the risks of the cost of developing such long range speculation.



Isn't that contrary to what you are talking about this morning, about leaving the development in the hands of the private industry?

Mr. DOLE. No, Mr. Chairman. At that point in my speech, I was referring to speculations like the breeder reactor and such. I call to your attention other energy resources and of the need to control entry of oil or other materials from abroad. We have such things as a liquid metal breeder reactor, which is going to require enormous amounts of money and we feel this is a proper place for Government to get in there.

We control 80 percent of the lands under which oil shale is found. We control all of the land not in State ownership on the continental margins of the Nation.

I don't believe there is any question that Government is going to become more and more involved in the energy picture.

In this situation, as far as oil shale is concerned, we feel very definitely that private enterprise can develop it, and because of the various admonitions by Congress we feel they should be allowed to do so.

Senator Moss. Isn't there a great deal of R. & D. to be done yet before oil shale can become a source of energy? I believe in that same speech you said with luck we may have a shale oil prototype plant in operation in the latter part of the 1970's, which may, in turn, permit a commercial plant to be built in the 1980's.

Aren't we quite a ways away yet?

Mr. DOLE. We are a long way down the road, Mr. Chairman. The industry has progressed in the R. & D. work up through development and through the pilot plant process. Now, whenever you go and make these jumps from the laboratory to the pilot plant, from the pilot plant to the demonstration plant, from the demonstration plant to commercial plant, there are many things, temperatures, pressures, and equipment that have to be proved out.

I can only recall one time when we went directly from the laboratory to a commercial size scale that it worked out, and that was in the development of ferro-nickel processes on a nickel mine out in Oregon.

Ordinarily, Mr. Chairman, there are many things that have to be revised, repaired, in going from one size scale to the other. And so, with the proper amount of expenditure of funds, very, very strong attention to this problem, we hope to be in a position to have viable commercial scale development by 1980.

Senator Moss. What factors will be involved in your environmental analysis on each site to be drilled that you have testified about this morning?

Mr. DOLE. What factors, Mr. Chairman?

Senator Moss. Yes, what factors?

Mr. DOLE. There will be the factor of returning the land to further use, of care of the water, the replanting, of minimum damage to the environment as far as bringing in a new industry into a presently barren area. The factors of population come into that area, of roads and other factors which I have not enumerated, but which will be considered in the environmental statement.

I am pleased that the States of Colorado, Utah, and Wyoming are working with us and they have large groups also that are concerned, and they are advising us and helping to develop this. I feel



this is going to be one of the best grounded, one of the most complete and studied impact statements ever put out.

Senator Moss. To what extent have environmentalists been heard from in this matter? Do you think they are going to be satisfied with the environmental statement of the kind you describe?

Mr. DOLE. Mr. Chairman, when we talk about environmentalists, I think we talk about whole ranges of groups and organizations. I am sure those with one philosophy will never be satisfied. I think, though, as far as our contacts with the environmentalist groups, we have been working with them and the person who has had the most contact is our oil shale coordinator, Mr. Stone, and I would like him to state what we have done with environmentalist groups.

Senator Moss. All right.

Mr. STONE. Mr. Chairman, in the three panels organized by the State committees, the environmental people were invited to participate in them, such as specialists, hydrologists, reclamation specialists. This participation has varied in each of the three Governors' panels to a differing degree.

In Colorado, Governor Love has reconstituted their State committee, formed it into four major panels, including the various areas, and have invited and have the participation of the well-known environmental experts from the Denver area, reaching out quite broadly, and they are participating with us in that effort.

As an organization, we would not cite any specific group as being in there, but the members that are represented are part of our well-known environmental groups.

Senator Moss. Are your environmental studies being made on the basis of retorting the rock and shale, or do they have to be with the in situ method?

Mr. STONE. They explore various methods, surface mining, underground mining, the results from overburden handling, and handling just the spent shale from an underground mine, the hydrologic problems involved, all of these factors are part of the study work.

Senator Moss. How does the Plowshare program fit into this over-all shale development program we are talking about?

Mr. DOLE. I gather from that, Mr. Chairman, you are referring particularly to the Rio Blanco nuclear stimulation project, which has been proposed in the Piceance Basin. That is a code name that has been given to this particular nuclear stimulation of natural gas formulations.

Senator Moss. That is to manufacture and make available natural gas by nuclear stimulation?

Mr. DOLE. Yes. In the area of the Rocky Mountains, Mr. Chairman, there are great quantities of natural gas that are available, but they are in very tight formation, they are not being drilled and we are not getting gas from it at the present time.

However, there have been a couple of shots in that area which indicate that fracturing by nuclear stimulation could make these gas supplies economic and thus enlarge our gas supply.

On Rio Blanco, which is the newest one for the stimulation of gas, the Atomic Energy Commission is putting forth a definition report. The Department of Interior's role in this is in an advisory



capacity and until the report is in and we have had an opportunity to look at it, we will not be in a position to comment on it.

In other words, we are not in position right now to comment until the Atomic Energy Commission, in its very thorough manner, defines this project. We will have an opportunity to comment on it at that time.

Senator Moss. Do you see any relationship or carryover that might fit into the oil shale development although this is for stimulation of natural gas?

Mr. DOLE. Yes. One of the ways that has been looked at for our oil shale resources is the *in situ* retorting. This is being examined in Wyoming right now. I think it is obvious that nuclear stimulation could be a method for the utilization of the oil shale resources. We have a lot of studying to do and it is a long way down the road, and in my opinion it would seem to me to be a second or third generation utilization of oil shale resources.

Senator Moss. Since you are optimistic that private industry is now ready to go ahead on governmental lands in this oil shale development, why hasn't private industry moved on privately held oil shale lands of which there is quite a large area?

Mr. DOLE. That is a very good question, Mr. Chairman, and I have considered this myself, at some length. About the only answer I come up with is that they must be assured, because the Federal Government does own so much of the land, better than 80 percent of it, that this land will be available for future development once they have made a capital investment on their own land, that the Government lands will be available under terms and conditions which they continue with the exploitation of their processes.

In other words, I feel that as soon as we do come up with this program, that it is going to be successful not only on Federal land, but on private land. But it is the Federal attitude for this and the Federal manner which it will be developed. That is very critical to their thinking.

I must say this is a conclusion drawn by me and I am not privy to any of the thinking by private enterprise, but your question certainly is a good one, and this is the way I have answered it for myself.

Senator Moss. The bill provides that any patent of any process developed must be made available to other members of the industry on license. I think your point of view was that this discouraged private development because they would want to keep any technique they developed.

If that is so, how are we going to keep it from sliding into the hands of a monopoly?

Mr. DOLE. Mr. Chairman, in answer to that I would say this: No. 1, we have the Department of Justice that has cognizance of the need for great competition within our private sector, and I am sure that you will agree with me, Mr. Chairman, that they are very assiduous in their promotion of competition. And No. 2 is I feel that the oil shale program has several approaches starting it. I know there are various private areas that are approaching it in different fashions.

Consequently, I think we are embarked upon a new energy development in a manner which allows for a great deal of innovation by



a great many people, and that it will not have the risk of becoming the monopoly that a lot of people fear.

I would add to this, also, Mr. Chairman, that one of our reasons for not going along with the patent requirements in your bill is that there has been no other mineral treated in this fashion, under the mineral leasing law. There were no patent requirements within this law and we see no need for changing it in this regard.

Senator Moss. If there is a need for developing this method of extracting oil from oil shale, if the private companies have been reluctant to this point, don't you think we ought to have a new departure and find some way of stimulating the development so then, after an industry has been developed, the private sector can go ahead with its production?

Mr. DOLE. I don't think what we need is a new departure, although you might say our prototype leasing plan is a departure from the way the Government has approached it in the past. I think all we have to do is make the opportunity available to private industry, under set rules and regulations that they know that they will be allowed to make a profit.

Mr. Chairman, I know I do not have to call to your attention, but I do want to reiterate, that the name of the game and the way we do business here in our country is under the private enterprise system. So, therefore, I think we should give it the broadest latitude in allowing it to work.

Senator Moss. I agree with that, except that private industry, whenever representatives talk to me about it, say if you will give us a higher depreciation allowance on it now, and allow us to write it off on our taxes, then private industry will go ahead. Then they are asking for Federal subsidy on this, the same as if we had them in a mixed corporation, going in for the R. & D.

Mr. DOLE. Mr. Chairman, in response to that I would say this. I am sure that the oil shale industry is no different than any other industry. I think they will try their best to get as much help as they can. We feel this is right down the nub. It could very well be that this proposal that we put forth is a little bit tight and it could well be that what you are talking about in your bill might very well come to pass in the years to come.

Right now, the indications, the signals we get from private industry are that they think it will work under our program and I think we ought to have the opportunity to go this way.

Senator Moss. I am sure we both want the same results. We want action, development of the technique and technology of oil shale extraction, which does two things. One, it must be economically viable and competitive with other sources of energy and secondly, it has environmental protection, so we won't cause damage to our environment in getting there.

The question is, how to get there the best way.

I will defer to my colleagues and see if they have any questions. Senator Anderson, do you have a question?

Senator ANDERSON. Thank you.

You had a reference to nuclear stimulation. What part of that is the nuclear proposal?



Mr. DOLE. Senator, I know of your long and distinguished career in working with the AEC as Chairman of the Joint Committee. This is not part of our proposal at the present time. We visualize at the present time, that oil shale probably will be developed either through regular mining methods—open pit mining or underground mining. Our work on *in situ* development of oil shale, we feel, is behind the present known methods of open pit mining and underground mining.

It could well be as we go further down the road that nuclear stimulation in the deep areas of the basin could be the way that we can extract that energy from the oil shale.

Senator ANDERSON. Do you know the Plowshare program?

Mr. DOLE. We are cognizant of the Plowshare program. We act in an advisory capacity to the AEC on this. We deal in many of their proposals as they relate to the environment. We feel the Plowshare program indeed is making a real contribution to the United States.

Senator ANDERSON. What about the tar sands?

Mr. DOLE. Yes; they are in Canada, Senator, and they form one of the largest untapped resources in the world. There is a corporation now extracting oil from this by regular mining methods. Nuclear stimulation in those deposits perhaps is not as viable as it is in the oil shales because they do not have the cover of ground to contain the explosion.

Senator ANDERSON. You listed three different States. What happened to New Mexico?

Mr. DOLE. Senator Anderson, this is one of the breaks of nature—you have your uranium deposits in New Mexico that are extremely good and we don't have any deposits up in Oregon, and I don't think that is fair either.

Senator ANDERSON. I am told there is an excellent possibility.

Mr. DOLE. As we go forward on the development of oil shale resources, perhaps we will obtain the technology to go to lower and lower grade deposits.

As you probably know, oil shale deposits are fairly widespread throughout the United States. I believe there are something on the order of 30 States in which oil shale deposits are found. However, the richest ones, highest grade ones, are found in the Colorado, Wyoming, Utah area, and it is an accident of nature just as all other mineral deposits are accidents of nature.

Senator ANDERSON. You are not going to forget the atomic development?

Mr. DOLE. No; we are not going to forget the atomic development, Senator. We feel that we do not have the technology or the know-how at the present time and we have to do a lot of work in this area and so I can assure you we are not forgetting it, but we feel it is further down the road than the present program that is put forth.

Senator ANDERSON. You said the name of the game is development. What about development in New Mexico?

Mr. DOLE. On that, Senator Anderson, I thoroughly agree 100 percent with you. I think if you will go back through my background long before I came to Government, my principal activity was to try to develop the resources of the West.

Senator ANDERSON. I didn't want you to lose that interest.

Mr. DOLE. I am not going to, sir.



Senator Moss. Senator Bellmon?

Senator BELLMON. Mr. Secretary, on page 6 of your statement you make reference to the administration's Mineral Leasing Act of 1971. Could you briefly outline the differences between the Administration Act and S. 2510?

Mr. DOLE. Senator Bellmon, I was distracted for a moment, and I did not get the full import of your question.

Senator BELLMON. The difference between the administration's Mineral Leasing Act and S. 2510, where are the differences?

Mr. DOLE. I refer this to Mr. Rigg.

Mr. RIGG. The Mineral Leasing Act revisions would bring the Mineral Leasing Act of 1920 in line with the concept under which we believe that the leases should be developed. In the case of oil shale, we would double the acreage, specifically define tar sands and we would require competitive bidding to knock out the type of lottery which now frequently accompanies noncompetitive bidding.

I will be happy to get you a copy of our discussion on the Mineral Leasing Act revision.

Mr. DOLE. Perhaps it would be desirable to put this in the record for you.

(The information referred to follows:)

U.S. DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
Washington, D.C., October 12, 1971.

HON. SPIRO T. AGNEW,  
*President of the Senate,*  
Washington, D.C.

DEAR MR. PRESIDENT: Enclosed is a draft bill "To reform the Mineral Leasing Laws."

We request that the bill be referred to the appropriate committee and that it be enacted.

The Mineral Leasing Act of February 25, 1920, as amended and supplemented (30 U.S.C. §§ 181-287), governs the disposition of oil, gas, coal, and certain other minerals on hundreds of millions of acres of public land. During the 51 years of its existence it has played a major role in the development of the Nation's mineral economy, has contributed needed funds for the schools and roads of the Federal Government to control in some measure the use of the public domain. Time, however, has revealed major deficiencies in the Act.

The Mineral Leasing Reform Act of 1971 would amend the existing mineral leasing laws in six major respects: (1) it would incorporate specific requirements to protect the environment; (2) it would substitute one general mineral leasing statute for the several different statutes now in existence; (3) it would concentrate greater responsibility for the leasing or sale of federally owned minerals in the Department of the Interior; (4) it would extend the leasing laws to mineral deposits in certain land not now subject to any form of disposition; (5) it would extend the leasing principle to certain minerals now covered by other disposal laws; and (6) it would extend the principle of competitive bidding. Each of these six changes is an important step in bringing the mineral leasing system into conformance with modern concepts of resources management.

(1) We feel that the protection of the environment should be a major concern of any legislation to reform the mineral leasing laws. The Administration has proposed the "Mined Area Protection Act of 1971" which has been introduced as S. 993, to encourage States to regulate the environmental aspects of mining on State and private land. The proposed "Mineral Leasing Act of 1971" contains a section which would apply parallel provisions to the public lands. It would require among others, that the operator file an operation plan with the Secretary for approval before he commences any activity which might cause a significant



disturbance of the environment. The plan would be in accord with regulations issued by the Secretary and designed to assure that the operation would not violate air and water quality standards and would control erosion, subsidence and other specified environmental damage. The regulations would require that reclamation be made an integral part of the operation, but would allow the operator maximum flexibility to determine the most economically feasible means of achieving the environmental objectives.

(2) The Mineral Leasing Act of 1920 applies only to public domain, i.e., land that was never in State or private ownership. Mineral leasing on lands acquired by the United States from State or private owners is covered by the Mineral Leasing Act for Acquired Lands passed in 1947 (30 U.S.C. 351-359). This distinction as to the disposition of minerals is based largely on an accident of history. Under the mining law of 1872 a distinction between public domain and acquired lands was necessary, because it was felt that lands which the United States has acquired for a specific purpose should not be available for private appropriation for mining.

However, where full discretion and control over the disposition of minerals is retained by the United States and where title to the deposits and the lands containing them is retained by the United States, there is no need for separate leasing systems for acquired lands and for public domain.

(3) The proposed bill would allow each surface managing agency to dispose of sand and gravel and other "construction minerals" on lands under its jurisdiction. It would also allow the General Services Administration to convey mineral deposits when it disposes of a full fee title to property declared excess under the Federal Property and Administrative Services Act of 1949. With those two exceptions the proposed bill would consolidate the responsibility for administering federally owned leasable minerals in the Department of the Interior. Within the Executive Branch the Department of the Interior has paramount competence and knowledge in the minerals field. The recognized expertise of the Geological Survey, the Bureau of Mines, and the Bureau of Land Management has led most Federal agencies to delegate minerals management of lands under their jurisdiction to the Department of the Interior. Efficiency and economy dictate that this practice be expanded where practicable.

The proposed bill recognizes that the surface managing agency has a strong interest in minerals extraction on its lands. Sections 105 and 108 make it clear that the surface administering agency must consent to any disposal and may require conditions to be included in the lease to protect the nonmineral interests in the land.

(4) Mineral deposits in certain Federal lands are at this time not available for leasing under any statute. A major omission at the present time is acquired lands set aside for military purposes. Only when mineral deposits in the acquired lands in a military reservation are being drained or threatened by drainage can the Secretary take protective action and lease them 40 Ops. Atty. Gen. 41 (1940). Similarly, deposits in both public domain and acquired lands within incorporated cities, towns, and villages are barred from leasing, except in cases of drainage. In many cases mineral development is possible without damage to private property. The proposed legislation would make deposits in all Federal lands leasable except the Outer Continental Shelf (which is subject to another statute), lands in national parks and monuments, national wildlife refuges and national wildernesses, lands in naval petroleum or oil shale reserves, and Indian lands. Lands in incorporated cities, towns, and villages could be leased for oil and gas only after consultation with local authorities and for other minerals only with the consent of such authorities.

(5) The proposal would place certain minerals presently subject to the location system under the Mining Law of 1872 or to sale under the Materials Act, under the Mineral Leasing System. The Mineral Leasing Act presently covers coal, oil and gas, tar sands, oil shale, phosphates, potassium, and sodium. It also covers sulphur but only in Louisiana and New Mexico. The proposed bill would (1) cover all minerals in acquired lands, including the so called "hard rock" minerals which are currently disposed of under a variety of special statutes, (2) define oil and gas to include all hydrocarbons except coal and oil shale thereby avoiding a difficulty in the present law of distinguishing between tar sands and oil and gas, (3) include sulphur in all States, (4) include certain compounds which are subject to controversy as to which law covers them, (5) add calcium and magnesium as leasable minerals, (6) create a category of "bedded



minerals" which gives the Secretary of the Interior discretion to provide for the leasing of minerals found in beds of mineable thickness rather than in lodes or veins, and (7) create a category of "construction minerals" which would include the so called "common varieties" of minerals now subject to sale under the Materials Act as well as uncommon varieties of those same minerals and certain other similar minerals which are used in construction. Such construction minerals would be subject to sale or lease at the option of the land administering agency. The bill also provides for the leasing of minerals, not otherwise subject to its provisions, when they are associated with, or related to, minerals subject to a lease.

(6) One of the most heavily criticized aspects of the present leasing system is the extent of noncompetitive leases awarded by "lottery". The Public Land Law Review Committee recommended an expansion of competitive bidding. The proposed bill would provide that, with minor exceptions, all leases would be issued competitively.

In addition to these six basic principles the proposed bill incorporates provisions to remedy a number of additional specific defects, which have appeared through the years in the existing leasing laws.

We regard this revision of the mineral leasing laws as a balanced approach to the problem of providing adequate exploration and development incentives, a uniform, clear, and workable system of disposal, a fair return to the public and adequate protection of the environment. All these factors are urgently needed. We strongly recommend, therefore, the enactment of the Mineral Leasing Act of 1971.

The Office of Management and Budget has advised that the enactment of this proposed bill would be in accord with the program of the President.

Sincerely yours,

ROGERS C. B. MORTON,  
*Secretary of the Interior.*

Senator BELLMON. It is my opinion that S. 2510 has a lot of the same thing in it. Is the main difference just the Government-private corporation?

Mr. DOLE. It is more than the private corporation. It has to do also with the way they treat licensing for development of technology. Those are the main areas, the size of the lease, the patent provision, environmental protection.

Senator BELLMON. Do you have any current estimate of what it will cost to produce a barrel of crude oil from oil shale?

Mr. DOLE. Yes, Senator. This Bureau of Mines technical progress report was published and came out just last Friday. It could very well be that you might want to refer to this. The title of this is "Mining and Conversion of Oil Shale, and the Gas Combustion Report." The abstract is very short, and I would like to read it to you. "Several systems have been proposed for the production of synthetic crude oil and oil shale. An economic analysis of one proposed system is presented in this paper. An oil shale complex that could produce 100 thousand barrels a day of a semirefined crude oil will require a capital investment of \$426,216,400. (I think that is refining it very much.) A selling price of \$3.74 per barrel of product will be necessary to maintain a discounted cash flow rate of 12 percent." That is the end of the abstract.

Senator BELLMON. Presently crude oil prices are what, \$3.40?

Mr. DOLE. Yes, around \$3.40.

Senator BELLMON. How would a private company justify a \$425 million investment when they are going to lose 25 cents on every barrel, or it would be more like 40 cents a barrel?

Mr. DOLE. Senator Bellmon, it will take several years before we are at a commercial size plant for oil shale. I think you will agree with me, Senator Bellmon, that when 80 percent of the free world's oil is



located in North Africa, and the Middle East, that the experience we have had in the past year indicates that the price that we have been paying for foreign oil is not going to be maintained.

Furthermore, by the development of oil shale resources a sufficient quantity of oil could be developed with which we would be at a competitive position with the Middle East, so that the rise in the prices of oil there will not become too burdensome to the people of the United States.

As you know, we peaked out in our development of oil reserves in about 1967, and we are not adding as much to our reserves as we are taking out at the present time. I think the development of this oil shale resource by many of the energy companies is good insurance that the price we will be charged for our oil in the future will not go above a certain amount.

Senator BELLMON. I agree with you, Mr. Secretary, that if we become a large leader or even substantially dependent on offshore supplies of crude oil, we are going to be paying a very high price for the oil.

By the way, when can a part of that statement you are referring to be made a part of the record?

Senator MOSS. Was that an exhibit?

Mr. DOLE. I would like to have it printed, Mr. Chairman. It is 11 pages in length.

Senator MOSS. It will be put in the record after your testimony.

Senator BELLMON. Already in this country, the economics in this country of oil and gas development are not good. During the last several months, when there was a 7-percent upward adjustment in crude oil prices by the companies, they are criticized by the administration.

Do you think the administration has had a change of heart now so they will allow the prices to get up so that oil shale might—

Mr. DOLE. Of course, Senator, one of the most difficult things facing the administration has been inflation, this is one of the most difficult things that we have before us right now, and certainly we are going to try to keep prices down as much as possible. But if you will recall, inasmuch as the chairman referred to one—if you will recall a speech I gave last fall, in which I brought out the price of energy is underpriced and it will never be any less than it is now, and it is bound to be more. So, I feel that regardless of how much we would like to see energy stay down, we no longer have the control to make it stay down.

I feel it is going up whether we want it to or not. As a matter of fact, I feel that the oil shale programs can very well work a salutary effect on keeping the price of energy within bounds.

Senator BELLMON. I think if we go on with the route we have taken, when we become dependent on oil from the Middle East and north Africa, we are going to see the cost of our energy escalate.

Is there anything that has been done in the administration's Mineral Leasing Act to encourage new techniques in the secondary recovery areas? Does the Department consider this an important area at all? There are literally billions of gallons of oil left in the ground that will never be recovered unless the Government provides research funds to develop better methods.



Mr. DOLE. Senator Bellmon, if we can increase the recovery of oil from underground by just 1 percent, we would add to our resources a total of 4 billion barrels of oil, and for every 1 percent above that, we would add another 4 billion barrels of oil.

We have a very modest effort within the Bureau of Mines research program on secondary recovery. In my opinion it is not as large as it should be and I would like to see greater emphasis on secondary recovery.

On the other hand, I will say this. I do not feel that industry itself has made the investment in secondary recovery methods that I feel are required and I would urge industry to put more effort into secondary recovery and I would conclude by saying that perhaps the increase in the price of energy will allow this, because in my opinion the leaving of this oil in the ground is a loss of this resource that belongs to the people and is one of the real bad things that we have done in the past years.

Senator BELLMON. How much money has the Interior Department spent, say, in the last year, or 5 years, on research and better recovery methods?

Mr. DOLE. I cannot tell you, Senator Bellmon, precisely. I can furnish that figure for the record. I feel it is only a few hundred thousand dollars a year.

Senator BELLMON. Few hundred thousand?

Mr. DOLE. Yes.

(The information requested follows:)

<i>Bureau of Mines research expenditures; secondary recovery of oil</i>	
Fiscal year:	<i>Funds, dollars</i>
1972 -----	\$569,000
1971 -----	686,000
1970 -----	637,000
1969 -----	604,000
1968 -----	584,000
Total -----	3,080,000

Senator BELLMON. We have, according to your estimate, at least 280 billion barrels of oil in the ground, that we are not going to recover by present techniques. Is this true?

Mr. DOLE. This is true.

Senator BELLMON. In the newspaper of last week there is a story by a reporter named "Hedley Burrell." I would like to read a couple of sections from this. It refers to a report from Senator Proxmire's Joint Economic Committee, in which it says there are deposits in the offshore areas of Alaska, south Alaska. I am not quoting directly—it says they may rival the amount of oil available on the North Slope. Then it gives reasons as to why they are not being developed.

I would like to have this story made a part of the record and ask you if you wish to comment on it and give any information to the committee that you may have about these developments in the southern areas of Alaska.

Senator Moss. Without objection, it may go into the record.



(The document referred to follows:)

[From the Washington Post, November 8, 1971]

# OIL FIND OFF SOUTHERN ALASKA SAID TO RIVAL THE NORTH SLOPE

(By Hedley Burrell)

Potential oil supplies off the coast of southern Alaska may be larger than the North Slope deposits, according to a report released yesterday by Sen. William Proxmire (D-Wis.).

The Interior Department has assessed the offshore potential, the report says, but has not made its findings public.

Industry sources confirmed that the offshore deposits may be enormous.

The Proxmire report—prepared for the senator's Joint Economic Committee by Martin Lobel, his legislative assistant and oil expert—says such deposits "might interfere with the North Slope pricing expected by the oil industry."

"You could get this oil out by tanker without a pipeline," Lobel said in an interview, "but of course, the industry wants to build one."

The industry wants to move the North Slope oil by pipeline to Valdez, Alaska, and then ship it by tanker. The offshore oil, says Lobel, could go all the way by tanker from an ice-free area and thus be cheaper to the U.S. consumer.

But after two years of delay and a large capital investment in leases, exploration and construction preparation, the oil companies are anxious to realize some return from marketed oil shipped via the pipeline at the earliest opportunity.

The Interior Department has yet to approve the trans-Alaska pipeline, which is under fire from conservation groups.

The Proxmire economic panel's Subcommittee on Priorities and Economy in Government plans hearings Nov. 22 to 24 on oil prices.

In his report for the committee, Lobel says the southern Alaska deposits, known as the Cordova Field, are subject to the same restriction as other offshore fields—no royalty bidding.

"It is not being considered despite its potential benefits, including the entry of smaller independents, supposedly because of the fire in Shell's offshore well," the report states.

Royalty bidding allows oil firms seeking drilling rights to offer the government a higher percentage of royalties rather than a large cash payment.

Since a large cash payment is avoided, smaller firms are able to bid, Lobel says.

The rationale for not allowing this in the offshore fields, Lobel says in his report, is that a small company could not have met the cost of fighting the type of blaze Shell had to battle in the Gulf of Mexico.

But Lobel says smaller firms could obtain insurance the same as the industry giants and their entry into the field would increase competition, reducing prices to the consumer.

His background study, an analysis of a report issued last April by the Office of Emergency Preparedness, is highly critical of the office's handling of crude oil and gasoline price increases.

The OEP, charged with keeping an eye on imports and price increases, has come up with an analysis of petroleum reserves and drilling and exploration expenditure based on unaudited data supplied by the industry, says the Lobel report.

"Despite the enormous economic, welfare and national security questions involved, the government has failed to collect data of its own.

"Without such data, no reliable analysis on which to base policy decisions is possible."

The Lobel study says that despite the lack of analysis, the OEP concluded not only that November, 1970, price increases were necessary but that future raises would be needed for national security reasons.

Mr. DOLE. Yes, Senator, I would like to comment on this. I recall the article. Where this information was obtained for Mr. Proxmire is a mystery to me. As a matter of fact, I don't know if it is a U.S.



Geological Survey report. I have asked Mr. Radlinski, the Acting Director of the Geological Survey, to contact Senator Proxmire to determine what report he is talking about.

As you know, Senator Bellmon, the only way you find oil is through the drill. There is no other way. Now, as geologists, we can say that the geological conditions look right for accumulation of oil in an area. We can say we have determined that there are structures that may contain oil. But the only way that oil is ever discovered is by drilling.

If it is on Government land then it means before it can be drilled it has to be leased. As you know, it has always been the objective to the U.S. Geological Survey to try to find out what the resources of our country are in order that we can develop them in an orderly fashion and in the best interest of all the people of the country.

Senator BELLMON. How many leases have been let in this area that the story refers to?

Mr. DOLE. Zero.

Senator BELLMON. How many wells have been drilled?

Mr. DOLE. Zero.

Senator BELLMON. Then where did the information come from?

Senator MOSS. That is what he said he would like to know.

Mr. DOLE. If I can coin a phrase, Senator Bellmon, it "beats the hell out of me."

Senator MOSS. Senator Baker, do you have any questions you want to ask?

Senator BAKER. Thank you, Mr. Senator. Thank you for allowing me to sit with the committee, and I notice we have a vote in progress now.

Mr. DOLE. Mr. Chairman, I am pleased to see Senator Baker here.

Senator MOSS. Senator Baker does sit with our committee on our general energy study we are making as a representative of the Public Works Committee. He does have great interest in this matter and contributes to our deliberations.

I had one or two more questions I would like to point out that S. 2510 doesn't deal solely with oil shale. It covers other possible sources of energy and although we have concentrated on oil shale here this morning, there are other things, such as solar energy and tar sand, with which we are concerned.

In considering the nuclear stimulation forecast, might this have some interconnection with oil shale, where gas and oil shale might appear in the same area?

Mr. DOLE. Yes, this is the concern, Mr. Chairman, on Rio Blanco. They are looking for the gas deposits which underlie the oil shale deposits, and I think the concern is that in the development of Rio Blanco, there could be damage to the oil shale deposits. This is the area we are interested in reviewing when the program definitions are submitted to us.

Senator MOSS. We appreciate your testimony and the very thorough documentation which you brought to substantiate the points you made in your testimony. I will be interested in getting your answers to these prepared questions.



The issue, as you stated in your speech that I referred to earlier, is simply, how can we best organize the inevitable Government participation so the private sector can do its job efficiently and that is what we are trying to measure here in these hearings, and before the committee.

Thank you, gentlemen, very much.

Mr. DOLE. Mr. Chairman, we have this 12-minute slide presentation, if you have the time. If not, we will volunteer to come up and show it to you and your colleagues individually or selectively at any time.

Senator MOSS. It will be interesting to see. We are going to have to recess for 10 or 12 minutes now to go vote, but maybe you can be ready to turn the lights out and put it on as soon as we come back.

Mr. DOLE. I am going to go back to the office, but I will leave some people here to do this, if you wish.

Senator MOSS. Thank you.

[Recess.]

Senator MOSS. The hearing will come to order.

We will now see the slides or film.

[Film presentation.]

Senator MOSS. Thank you. That is a good presentation, and it helps us understand a little better what the program is.

(The report referred to follows:)



MINING AND CONVERSION OF OIL SHALE  
IN A GAS COMBUSTION RETORT

by

Sidney Katell and Paul Wellman

Mineral Resources and Environmental Development,  
Morgantown, W. Va.

Bureau of Mines Oil Shale Program

Technical Progress Report - 44

October 1971

U.S. DEPARTMENT OF THE INTERIOR



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## MINING AND CONVERSION OF OIL SHALE IN A GAS COMBUSTION RETORT

by

Sidney Katell<sup>1</sup> and Paul Wellman<sup>2</sup>

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### ABSTRACT

Several systems have been proposed for the production of synthetic crude oil from oil shale. An economic analysis of one proposed system is presented in this paper.

An oil shale complex to produce 100,000 barrels per calendar day of semirefined crude oil will require a capital investment of \$426,216,400. This investment includes mining, retorting, intermediate pipelining, and partial refining.

A selling price of \$3.74 per barrel of product will be necessary to maintain a discounted cash-flow rate of 12 percent.

### INTRODUCTION

Although the physical exhaustion of petroleum resources appears to be many years away, the increasing demand for petroleum has led to concern for adequately meeting future demand. The conversion of oil shale to a synthetic crude oil, which can be accomplished by various systems under consideration, is one of the several alternative ways to supplement petroleum requirements.

An oil shale processing complex consisting of three mines, three retorting plants, and a prerefinery has been proposed for the production of 100,000 barrels per calendar day of semirefined oil. Included are the equipment and installation for mining and retorting in the Roan Creek area in Colorado and the pipelining of the gas and crude oil to the prerefinery in DeBeque, Colo. In addition, the cost of chemicals and catalyst, interest during construction (plants), interest during development (mine), startup expenses, and working capital have been taken into account. The complex is designed to process 174,820 tons per stream day or 157,335 tons per calendar day (CD) of raw oil shale assaying 30 gallons of oil per ton of shale. Figure 1 is a block diagram of the total complex.

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<sup>1</sup>Chief, Process Evaluation Group.

<sup>2</sup>Chemical engineer, Process Evaluation Group.



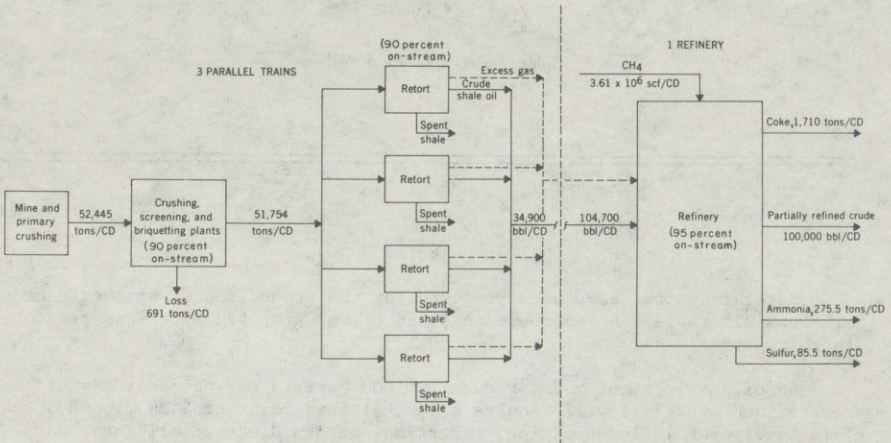


FIGURE 1. - General Block Diagram—Oil Shale Project, 100,000 Barrels per Calendar Day.

#### MINE DEVELOPMENT AND GENERAL MINING PLAN

Three mines will be operated to produce the required tonnage. At each mine, development will begin by driving three headings from the outcrop in the top bench of the minable section of the oil shale. These headings will be 30 feet wide by 31 feet high with 60-foot barriers between headings. One heading will be the main return airway, the center heading will be the belt haulage, and the right heading will be the intake airway and haulageway for men and supplies.

It is assumed that the development headings can be turned to the right at 600 feet and be clear of any weathering along the outcrop. The development headings will consist of three entries similar in size and functions to the main heading. The production panels will start operations as the development has advanced the required distance. It is estimated that 200 days will be required to open the first panel.

The mining plan is to mine the right side of the mine until the limits of mining are reached. The left side will be mined on the retreat. Under this system the mine will go into full production in the shortest possible time. It also means that the working area will be concentrated and better control of ventilation, haulage, and supervision will result.

Sufficient places will be provided to load tonnage. The crews will be equipped with a heading jumbo, scaling and bolting rig, bulldozer, front-end loader, and trucks.



The production panels are 1,860 feet by 1,020 feet and are mined using a 33-foot thick heading round and 28-foot bench round. The headings are 60 feet wide. Sixty-foot square pillars, regularly spaced, are left for support. A ramp will provide haulageway from the bench round to the main haulage level. Production panels will be equipped with a heading jumbo, a bench jumbo, scaling and bolting rigs, bulldozers, front-end loaders, and trucks.

The ore will be transported to portable crushers located at the mouth of the panel. These crushers will discharge onto a 60-inch belt that will carry the ore to the main haulage 60-inch belt.

The roof will be supported by roof bolts on 6-foot centers. Sixty-foot barriers will be left between panels and development on main headings.

Ventilation will be provided by 1 million cfm dual fans at the main portals. Direction of the airflow is controlled by crosscuts, regulators, and overcasts. Portable blowers with tubing provide secondary ventilation.

#### PRIMARY CRUSHING AND SCREENING PLANT

The run-of-mine shale is conveyed directly to the receiving hoppers at the crushing plant; one plant is provided for each of the three mines. The underground concrete hoppers are sized to provide 24-hour surge storage. The shale from the bottom of the hopper is conveyed to the primary-crusher feed bin at a rate of 58,272 tons per stream day or 2,428 tons per hour. A 90-percent onstream factor is assumed for the plants. Three conveyors, 48 inches wide and 200 feet long, are required. The shale is dumped into three parallel storage bins which are sized for 1/2-hour holdup. From the storage bins the shale is fed by magnetic vibratory feeders to the primary gyratory crushers where the size of the shale is reduced to minus 10.5 inches. The crushed shale is conveyed to underground surge bins (sized for 24-hour holdup).

The shale from the bottom of the surge bins is transported to the secondary crusher feed bins on 48-inch-wide belt conveyors.

#### SECONDARY AND TERTIARY CRUSHING AND SCREENING PLANTS

The shale at a rate of 58,272 tons per stream day is fed from the storage bins to three double hopper feed bins in the secondary crushing system. From each surge bin the shale is fed by two magnetic vibratory grizzly bar screens (six operating in parallel). The minus 4.5-inch material (47 percent of the total) falls through the screen to the product conveyor from the secondary crushers. The plus 4.5-inch material feeds to the secondary crushers (six crushers in parallel) and is crushed to minus 4.5 inches. The shale is then conveyed back under the screens, picking up the material that originally passed through the vibrating grizzlies, and is transported to tertiary crushing.

Three feed hoppers in tertiary crushing provide 20-minute holdup and receive the shale at a rate of 805 tons per hour for each hopper. Magnetic



vibratory feeders (6 in parallel) are used to feed the vibrating screens (6 in parallel); the minus 3-inch material is screened out and falls on the product conveyors from the tertiary crushers. The plus 3-inch material (35 percent of the total) then feeds to the tertiary crushers (6 in parallel) where it is reduced in size to minus 3 inches. The shale is then transported by the return conveyors, picking up the material that passed through the 3-inch screens, to the main conveyor and is conveyed to three surge storage hoppers (3-day holdup).

From the surge storage hoppers 57,600 tons per stream day of shale is fed to the splitter in the screen house. Sixty-five percent of the shale bypasses the screens and feeds directly to the surge bin for feed to the retorting plant. The double-deck screens (three in parallel plus one spare) remove the minus 1-inch material on the top screen and minus 3/16-inch material on the bottom screen. The screens are fed by vibratory feeders. The shale from the top of the screens feeds to the conveyor that transports the bypass to the retorting plant and the fines from the screens (2,256 tons per stream day) are conveyed to the briquetting plant.

The overall dust losses in the crushing and screening operations are estimated to be 1.32 percent of the shale handled. Half of this loss is assumed to occur in crushing and transporting and the balance in screening.

#### BRIQUETTING PLANT

The fines are conveyed to the briquetting surge bin No. 1 on a 20-inch belt conveyor. The fine shale is then fed by vibratory feeders to two parallel hammer mills where it is reduced in size to minus 14 mesh. From the mills the shale is conveyed to surge bin No. 2. A vibratory pan feeder is used to feed the milled shale to two parallel double-paddle horizontal mixers where it is mixed with crude shale oil (binder). From the mixers the material flows by gravity into the briquetting machines.

The briquettes are then sent by conveyor to surge bin No. 3 and are then conveyed back to the retort feed conveyor.

#### RETORTING PLANT

The three retorting plants, each consisting of four 56-foot diameter units, will be located in close proximity to the three mine locations. The retorts are scaled up from smaller unit data but are assumed operable to facilitate this study.

The shale from the 3-hour surge bins and the briquettes from the briquetting plant are fed to the retort feed hoppers (atop the retorts). Each of the plants uses one belt conveyor equipped with an automatic tripper to feed the retorts.



The retorts are equipped with Cameron and Jones<sup>3</sup> improved feeding and discharge mechanisms. The feeding and discharge mechanisms are described in detail ("Quarterly of the Colorado School of Mines," v. 60, No. 3, July 1965) in a paper presented to the Second Oil Shale Symposium.<sup>4</sup>

Each retort processes 14,376 tons per stream day of shale and briquettes and produces 9,693.5 barrels per stream day of crude shale oil, 86,242,000 standard cubic feet per day of excess low-Btu gas, and 11,160 tons per stream day of spent shale.

The shale bed in the retorts is maintained at a depth of approximately 18 feet. The fresh feed at the top of the unit is preheated by the off gases from the retort combustion zone. The shale, at a rate of 500 pounds per hour per square foot of cross sectional area, moves through the preheat zone of the retort. The combustors, located near the midpoint of the shale bed, use recycled low-Btu gas burned with air to provide the heat needed for retorting.

About 82 percent of the recycled gas is fed to the bottom of the retort and is utilized to cool the spent shale to about 200° F prior to discharge. The remainder of the recycled gas, together with the combustion air, is fed directly to the combustors.

The gases from the top of the retorts, with entrained crude shale oil, flow through rotoclones and electrostatic precipitators for separation of gases and oil. The crude is then pumped to storage tanks located at the retorting site. The low-Btu gas is compressed either for recycle or to supply other plant fuel requirements.

The spent shale is fed to a common conveyor belt for discharge into a canyon. The mines and retort plants are located to provide dry canyons for the spent shale disposal. It is assumed that mined out areas will be utilized as soon as they become available. The crude shale oil from the retorts, 116,322 barrels per stream day, flows by pipeline to the refinery storage tanks near DeBeque, Colo.

#### PREREFINERY

The crude oil from storage is charged to a distillation column. The crude is heated in a furnace enroute to distillation. The crude charge is decomposed into a heavy fraction and vapors, about 50 percent bottoms and 50 percent overhead. The residual heavy fraction from the bottom of the distillation column is fed to the coke drums. The overhead product is cooled and depropanized to yield a distillate product, 55,100 barrels per stream day. The uncondensed gases, consisting of C<sub>3</sub> and lighter gases, are utilized for plant fuel. The liquid hydrogenated product, 42° API, is pumped to storage.

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<sup>3</sup>Reference to specific makes or models of equipment is made to facilitate understanding and does not imply endorsement by the Bureau of Mines.

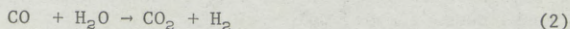
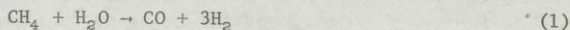
<sup>4</sup>Russell J. Cameron. Cameron and Jones Vertical Kiln for Oil Shale Retorting, Pp. 131-146.



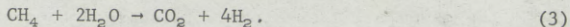
The bottoms from the distillation column are fed through a preheat furnace to the delayed coking units. The feed is preheated prior to being charged to the drums. The product from the top of the coker, the coker distillate, is cooled and depropanized and then, together with the distillation overheads, is charged to hydrogenation. The coke from the drums, 1,710 tons per calendar day, is stored for sale. The hydrocrackers operate at 835° F and 1,500 psig and produce a product containing about 45 volume percent material in the gasoline boiling range.

The gas streams from the hydrogenation, delayed coking, and distillation contain the sulfur and nitrogen available for recovery, the recoverable materials being in the form of hydrogen sulfide and ammonia. The streams are processed as follows: An ammonia-water wash is used to remove the hydrogen sulfide from the coker and distillation gases, and a water wash is used to extract the ammonia and hydrogen sulfide from the hydrogenation gas. The combined ammonia-hydrogen sulfide-water solution is then heated to 170° F to drive off the hydrogen sulfide which is scrubbed with sulfuric acid to remove traces of ammonia. The hydrogen sulfide is reacted with air in a Claus kiln to form sulfur (85.5 tons per calendar day) which is recovered as a hot liquid and stored for sale. The ammonia-water solution is pressurized to 230 psig and heated to 330° F to liberate the ammonia (275.5 tons per calendar day), which is cooled, condensed, and stored for sale in liquid form.

About 89 percent of the washed gas from the gas treating plant is steam reformed to produce the hydrogen needed for hydrocracking. The gas used for hydrogen generation is converted to produce 76 percent of the hydrogen theoretically available with complete conversion of the gas. A small amount of methane is purchased to augment the fuel supply. Using methane as an example (other hydrocarbons in the coker gas react in an analogous manner), the conversion involves the two following steps:



with the following overall result:



The first reaction takes place in tubes at 50 psig and 1,400° to 1,500° F using a nickel catalyst and an excess of steam. The endothermic heat of reaction is supplied by burning retort gas in the furnace surrounding the tubes. The hydrogen yield then is increased by catalytic water-gas shift conversion at 800° F as illustrated by equation 2. A hypersorber is used for hydrogen purification before compression and introduction to the hydrocracking unit. The hydrogen requirement is 1,662 standard cubic feet per barrel of product. Twenty-five percent excess hydrogen is produced to provide for surges and losses.



## CAPITAL INVESTMENT

Table 1 is a summary of the estimated total capital investment required to develop the mines and to install the equipment to process 174,820 tons per stream day of oil shale. Included are initial catalyst and chemicals, interest during construction, startup expense, and working capital. The total estimated capital investment is \$426,216,400.

TABLE 1. - Capital investment summary, 30-gallon shale

Mine:	
Initial investment.....	\$24,609,400
Present worth of deferred expense (discounted at 12 percent)..<	14,518,900
Retort plant:	
Retorting.....	115,381,100
Crushing and screening.....	12,316,000
Briquetting.....	1,582,000
Refinery.....	113,339,700
Utilities.....	41,469,400
Facilities.....	30,898,200
Total.....	354,114,700
Initial catalyst.....	9,517,700
Total plant cost.....	363,632,400
Interest during construction (plant).....	16,225,200
Interest during development (mine).....	561,700
Startup expense (plant).....	11,033,100
Subtotal for depreciation.....	391,452,400
Working capital.....	34,764,000
Total.....	426,216,400

Working capital requirements are detailed in table 2. Interest during construction assumes a two-year construction period. An allowance of \$11,033,100 is included for startup expenses.

TABLE 2. - Working capital, 30-gallon shale

Cash.....	30 CD operating cost..	\$6,952,800
Accounts receivable.....	90 CD operating cost..	20,858,400
Inventory.....	30 CD operating cost..	6,952,800
Total.....		<sup>1</sup> 34,764,000

<sup>1</sup>Includes \$5,944,100 for mine.

The cost of providing steam, power, cooling water, sanitary water, compressed air, etc., is included in plant utilities. The cost of administrative buildings, roads, fences, rolling stock, etc., is included in plant facilities. A summary of utility and facility costs is given in table 3.



TABLE 3. - Summary, utilities and facilities, 30-gallon shale

	Utilities	Facilities
Retorting plant:		
Generator.....	\$3,375,000	-
Turbine.....	8,160,000	-
Startup diesel generator set.....	1,080,000	-
Power distribution.....	4,125,000	-
Air compressor.....	3,582,000	-
Gas compressor.....	1,582,200	-
Steam generation and distribution.....	333,000	-
Site preparation, etc.....	-	\$1,500,000
Administration building.....	-	750,000
Subtotal.....	22,237,200	2,250,000
Refinery:		
Powerplant.....	9,100,000	-
Power distribution.....	3,850,000	-
Steam generation.....	5,200,000	-
Air compression plant.....	750,000	-
Telephone system.....	332,200	-
Warehouse.....	-	480,100
Maintenance and operating building.....	-	266,700
Central shops.....	-	3,683,600
Intermediate gathering system.....	-	1,945,000
Water treatment and distribution (includes cooling water).....	-	8,983,300
Condensate system.....	-	1,540,100
Laboratories.....	-	1,149,500
Operating unit buildings.....	-	2,937,600
Other refinery buildings.....	-	638,600
Refining site, roads, and fences.....	-	1,053,700
Sewage and refuse system.....	-	5,970,000
Subtotal.....	19,232,200	28,648,200
Total.....	41,469,400	30,898,200

## OPERATING COST

Table 4 is a summary of the estimated annual operating costs. Included in operating costs are labor, labor supervision, administration and general overhead, raw water charges, annual catalyst and chemicals, taxes, insurance, and depreciation. The annual operating cost is \$85,543,000 before credit for the byproducts and \$78,434,600 after credit.



TABLE 4. - Annual operating cost, 30-gallon shale

	Annual cost
Natural gas--3,610 Mscf/CD x 365 days/yr x \$0.25/Mscf.....	\$329,400
Charge for use of water (Colorado) 480 M gph x 8,760 hr/yr x \$0.026/M gal..	109,300
Annual catalyst and chemicals.....	5,335,000
Direct labor, plant.....	2,980,900
Direct labor, supervision plant.....	540,000
Direct labor, mine.....	5,282,500
Direct labor, supervision mine.....	378,000
Maintenance labor, plant.....	4,325,000
Maintenance labor, supervision plant.....	420,000
Maintenance labor, mine.....	1,526,300
Maintenance labor, supervision mine.....	315,000
Operating supplies, mine.....	10,102,400
Operating supplies, plant (20 percent of plant maintenance)....	1,814,000
Maintenance materials, plant (100 percent of maintenance labor).	4,325,000
Payroll overhead, mine (35 percent of payroll).....	2,625,600
Payroll overhead, plant (24 percent of payroll).....	2,066,500
Administration and general overhead, plant.....	1,235,900
Administration and general overhead, mine.....	1,293,800
Taxes (land valued at \$1,000/acre, 6 sq miles) at 68 mills per dollar of evaluation.....	261,100
Taxes on improvement at mine (at 68 mills per dollar on 1/3 the cost).....	557,800
Insurance, mine, 2 percent of investment.....	492,200
Taxes (retorting, crushing, and screening, and interplant pipelines) at 68 mills per dollar on 1/3 the cost.....	3,485,300
Insurance (retorting, crushing, and screening, and interplant pipelines) at 2 percent of investment.....	3,075,300
Taxes (refinery) at 68 mills per dollar on 1/3 the cost.....	3,870,000
Insurance (refinery) at 2 percent of investment.....	3,414,800
Depreciation.....	<u>25,381,900</u>
Annual operating cost.....	85,543,000

Cost/barrel of oil = \$85,543,000 ÷ \$36,500,000 = \$2.34

Cost/barrel of oil after byproduct credit =  $\frac{\$85,543,000 - \$7,108,400}{\$36,500,000}$   
= \$2.15

#### FINANCIAL ANALYSIS

Table 5 shows the method of determining financial analysis based on a 12-percent discounted cash-flow rate which takes into account the present value of capital expenditures (both before and after startup). The present value of the positive cash flow includes the effect of changes after depreciation is taken. A selling price of \$3.74 per barrel for the semirefined oil



10

(30-gallon shale) is required to balance the present value of the capital expenditure with the present value of the positive cash flow, using a 12-percent compound and discount factors and a 20-year life.

TABLE 5. - Financial analysis, 30-gallon shale

Year	Estimated capital investment	Positive cash flow, oil at \$3.74/bbl	Discount or compound factors, 12 percent	Present value investment	Present value cash flow	Federal income tax
-2	\$58,126,100	-	1.2544	\$72,913,400	-	-
-1	269,549,100	-	1.120	301,895,000	-	-
0	64,022,300	-	1.000	64,022,300	-	-
1	-	\$61,011,100	.893	-	\$54,482,900	\$22,446,200
2	-	61,011,100	.797	-	48,625,800	22,446,200
3	-	61,011,100	.712	-	43,439,900	22,446,200
4	-	61,011,100	.636	-	38,803,100	22,446,000
5	5,481,200	61,011,100	.567	3,107,800	34,593,300	22,446,200
6	-	61,011,100	.507	-	30,932,600	22,446,200
7	-	61,011,100	.452	-	27,577,000	22,446,200
8	-	61,011,100	.404	-	24,648,500	22,446,200
9	-	61,011,100	.361	-	22,025,000	22,446,200
10	32,403,200	61,011,100	.322	10,433,800	19,645,600	22,446,200
11	-	61,011,100	.287	-	17,510,200	22,446,200
12	-	61,011,100	.257	-	15,679,900	22,446,200
13	-	61,011,100	.229	-	13,971,500	22,446,200
14	-	61,011,100	.205	-	12,507,300	22,446,200
15	6,369,600	61,011,100	.183	1,165,600	11,165,000	22,446,200
16	-	61,011,100	.163	-	9,944,800	22,446,200
17	-	50,018,500	.146	-	7,302,700	33,438,800
18	3,111,600	50,018,500	.130	404,500	6,502,400	33,438,800
19	-	50,018,500	.116	-	5,802,100	33,438,800
20	-34,764,000	50,018,500	.104	-3,615,500	5,201,900	33,438,800
Total	-	-	-	450,326,900	450,361,500	-

Figure 2 illustrates the effect of varying the debt equity segment of the capital investment and the relationship of different values for the interest rate on the debt portion of the investment. This relationship is based on a selling price of \$3.74 per barrel for the semirefined oil.



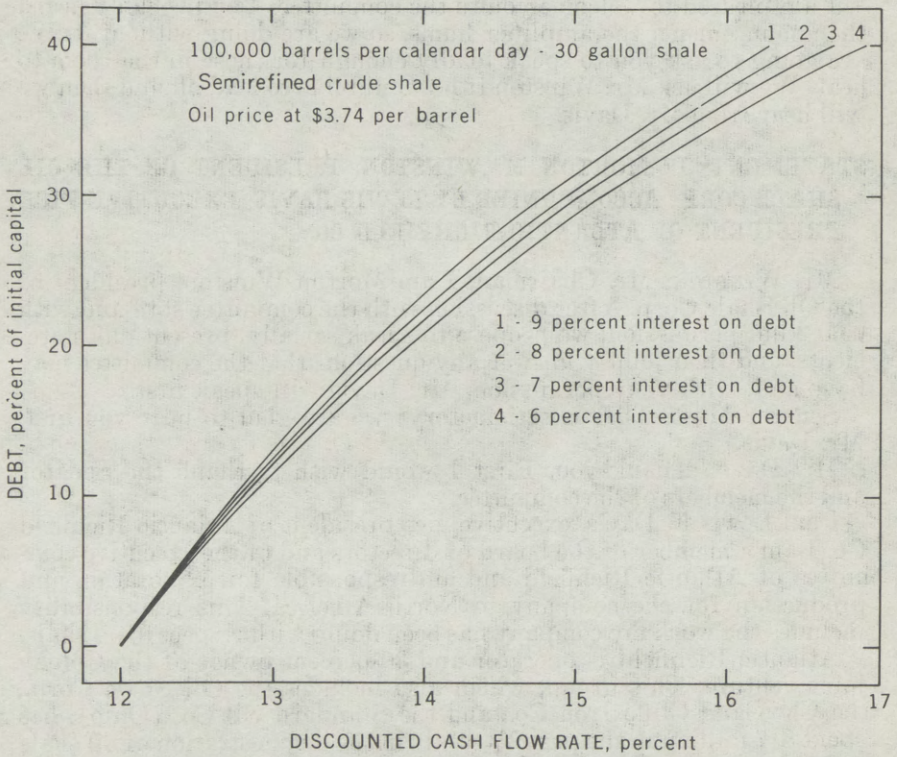


FIGURE 2. - The Effect of Debt-Equity Split on DCF at Various Interest Rates on Debt.



Senator Moss. Our next witnesses now will be Morton M. Winston, executive vice president of the Oil Shale Corp., and Lewis Davis, executive vice president of Atlantic Richfield Co. Will those two gentlemen please come forward?

I am pleased to welcome you to the committee. You probably heard the announcement; the amplifier hums, so we are doing without it. We are going to ask you to speak loudly enough for those in the room to hear. We will ask Mr. Winston if he would like to lead off and then we will hear from Mr. Davis.

**STATEMENT OF MORTON M. WINSTON, PRESIDENT OF THE OIL SHALE CORP., ACCOMPANIED BY LEWIS DAVIS, EXECUTIVE VICE PRESIDENT OF ATLANTIC RICHFIELD CO.**

Mr. WINSTON. Mr. Chairman, I am Morton Winston, president of the Oil Shale Corp. After discussion with the committee staff and with your kind permission, we propose to speak serially, present our statements, and then jointly answer any questions that the committee may have and, with your permission, Mr. Davis will speak first.

Senator Moss. That is satisfactory; we are glad to hear you first, Mr. Davis.

Mr. DAVIS. Thank you. First I would wish to thank the Senator and the members of the committee.

I am Lewis F. Davis, executive vice president of Atlantic Richfield Co. I am a member of the board of directors and of the executive committee of Atlantic Richfield and am responsible for exploration and production for the company in North America. This responsibility includes the work my company has been doing with respect to oil shale.

Atlantic Richfield is operator and 30-percent owner of the Colony joint venture. This group, which also includes the Oil Shale Corp., the Cleveland-Cliffs Iron Co., and the Standard Oil Co. (Ohio), has spent \$17 million in the past 21½ years in the demonstration of oil shale technology at a 1,000-ton-per-day plant and mine near Grand Junction, Colo. Atlantic Richfield and the Oil Shale Corp. have recently completed plans for the extension of this program through the expenditure of an additional \$6.5 million over the next 18 months. These substantial expenditures demonstrate the belief of Atlantic Richfield that the development of oil shale in the United States can be achieved in the near future, and we strongly support current efforts by the U.S. Government to provide industry with the necessary incentives to develop our Nation's oil shale reserves. It is apparent to us that in the long term, the United States will be faced with the necessity of developing alternative indigenous sources of energy or accepting dependence on foreign sources.

Atlantic Richfield approves and supports the declared objectives of S. 2510 "to bring into being the technology for commercial development of new energy sources as quickly as possible." However, we suggest that the development of a sound national fuels and energy policy must logically precede consideration of S. 2510. We feel that the feasibility of commercial development of oil shale reserves must be viewed as an integral part of the Nation's overall energy policy and should



not be dealt with in a vacuum. In addition, we do not believe that the application of S. 2510 to minable oil shale development is either necessary or desirable.

It is our position that satisfactory technology for the commercial mining and upgrading of oil shale is already in being and that production of synthetic crude oil from oil shale on a commercial scale will be achieved by private industry. Under these circumstances, we do not believe that there is any reason for the Government to create a Federal corporation to construct a demonstration facility or a full-scale commercial facility to manufacture and market petroleum products from oil shale.

Government aid and direct intervention in the development of atomic and space technology were provided since these programs were not primarily commercial in concept. In contrast, production of synthetic crude in significant volume is primarily dependent upon economics rather than new technology, and we feel that a true and convincing demonstration of the commercial feasibility of a large-scale synthetic oil operation can best be made by private industry rather than by a Government owned and managed corporation not subject to the constraints of competitive forces.

We believe that the Department of Interior's proposed oil shale leasing program is an essential first step in the development of our oil shale resources. Once this step has been taken and adequate incentives are provided to overcome the economic risk involved, the competitive nature of the industry will insure the optimum development and production of synthetic crude at the minimum economic and social costs to the Nation.

My company has recently initiated action looking toward participation in the forthcoming Federal oil shale lease sale. We have agreed to be operator of a core drilling program for one of the several groups which now seek land-use permits. The data obtained from these cores will be available to any company or individual that may choose to share in the costs. Atlantic Richfield strongly supports the Department of Interior's program for the development of the Nation's oil shale reserves. We feel that this program will increase the efforts being made by private industry to develop commercial operations by placing a significant resource base in the hands of additional competing companies.

We endorse Interior's plan to develop and promulgate definitive environmental criteria designed to achieve commercial production of synthetic crude with minimum adverse impact. No reliable evaluation of the economics of a first generation oil shale facility can be finalized until such environmental standards are known.

Colony's policy with respect to protection of the environment is fully described in a paper prepared by Atlantic Richfield personnel for the environmental quality conference for the extractive industries of the American Institute of Mining, Metallurgical and Petroleum Engineers, which was held in Washington, D.C., on June 7 to 9, 1971. Copies of this paper will be made available to the committee.

In summary, it is our position that S. 2510 is premature and not an appropriate method for investigating the feasibility of commercial development of oil shale resources. We believe that the program of



the Department of the Interior will be well received by industry and successful in accelerating the development of the Nation's oil shale reserves by private industry.

Senator Moss. Thank you for your statement and the attachment will also appear in the record as part of your testimony.

Now, Mr. Winston, if you would like to proceed, we will hear from you.

Mr. WINSTON. Thank you, Senator; we have submitted a written statement with certain exhibits, but I would like to summarize it rather more briefly orally, if you permit.

Senator Moss. I would be happy to have you do that. The entire statement and exhibits will go in the record in full.

Mr. WINSTON. Before turning briefly to the three subjects that are the subjects of this hearing, I would like to mention briefly who we are and most particularly amplify a little Mr. Davis' statements, the expenditures that have been made by the Colony group.

The earlier testimony this morning tended to raise the inference that private industry has done little or nothing with respect to oil shale development, and I think that that may be partly wrong.

We are a small publicly held corporation. Since 1955, but particularly since 1964 in the Colony venture, we, together with our colleague, have expended to date more than \$46 million. And by the time that program Mr. Davis referred to that is now underway between our companies is completed, that number will have risen to approximately \$55 million. Those costs refer only to the cost of technological development, not to acquisition of reserves which we have also made large expenditures on.

I think that is the best evidence that private industry has not sat still and that small companies, and we certainly are one, have been able to find a place in the program of development of these resources.

We join Atlantic and others in endorsing the Department's oil shale leasing program. We think it is wisely formulated and very carefully regulated, and that particularly as to companies who don't now have access to oil shale reserves, it will be a substantial stimulation of further efforts beyond our own in the development of oil shale technology.

In 1964, as I am sure you remember, then Secretary Udall, convened an oil shale advisory board to investigate many of the questions that are now, at a later and more advanced stage, still subject to investigation.

We appeared before that committee and we then urged a research and experiment leasing program separate and distinct from a conventional leasing program. We said that in such a program, under closely controlled circumstances, the Government would benefit.

In 1968 such a program was launched, unhappily not in accordance with criteria then consistent with general industry interest. We welcome the fact that since that time the Department has considerably revised and greatly improved its program and we endorse wholeheartedly the program now pending.

Particularly, what this program adds is substantial time for evaluation and substantial opportunity for industry to discover the nature of available reserves and to express its views on which tracts are desirable and feasible for development.



As to the environment, the program provides extensive protections and environmental safeguards and we wholly endorse them. We would add one caution, however, that it is absolutely necessary prior to the time that competitive bidding takes place there be reasonably detailed definitions of the environmental protection standards that will be applied generally to these leaseholds. The reason for that is, as Secretary Dole noted, the environmental cost now projected by the committees for the several States, range at 7 percent of the total capital cost. But 7 percent is significant, and significant changes in environmental requirements could change those numbers. If the program is to succeed, potential bidders, evaluating the value of the tract they want to bid on, must have a reasonable definition of what they can be expected to do. Therefore, the program which calls for further regulations to define environmental protection standards, needs that elaboration before the bidding takes place.

Finally, as to 2510, I think what we have already said projects our conclusions. We have no comment to make because we are not competent to on 2510 as to other more difficult energy sources as to which little or no development has yet taken place. But private industry, including particularly ours and our group, has made large strides, and we join Mr. Davis in believing that oil shale technology is now fully in hand. Therefore, S. 2510 at this time seems inappropriate to further development in oil shale. It may well be appropriate in other areas as to which we are generally ignorant.

Finally, you expressed earlier concern about the possibility of decreased competitions, if technological development were to be left wholly to private sources, and, you thought 2510 would be likely to dull that anticompetitive effect. The technology of oil shale development is wholly owned and controlled by my company, it is not owned or controlled by a group. We have repeatedly publicly said, and I would say here again, that that technology is available on reasonable conditions to any company ready, willing, and able to make use of it in oil shale production and it will continue to be. We look to licensing, far from being a method of control of the industry, as a substantial source of revenue to our shareholders, who have supported a not very easy and costly development over many years.

Thank you.

Senator Moss. Thank you, Mr. Winston.

In saying that the technology goals at hand—just what is that technology? Is this the mining retort technique?

Mr. WINSTON. Yes.

Senator Moss. Doesn't that run into problems that you mentioned earlier; saying that lessees would have to know the environmental standards that might make a difference as to the economics. Isn't the retort—mining retort business fraught with great environmental problems? Either of you can respond.

Mr. DAVIS. We have done a great deal of work in the past 2 years on the retort and its effect on the environment and we believe that we have now solved all of the problems that would lead to adverse effects like air pollution or water pollution, things of that nature. We have an unavoidable problem that is incapable of solution that would be desired by some of the more radical environmentalists. That is when



this shale is retorted, it increases in volume to where you have 30 percent more than you would have had when you took it out of the mine. There will have to be shale deposits in nearby canyons. We have conducted extensive work on compacting the shale and reestablishing vegetation. You saw the pictures that the developer showed. Some of those were on our property and we are confident that after we finish disposing of this shale in the canyons and revegetating them, they will look better than they do today.

Senator Moss. The canyons will be filled up, is that correct?

Mr. DAVIS. No, sir; partially filled.

Mr. WINSTON. Senator, that slide presentation made it look a bit as if the Nation will be paved under shale residue. We have a property that has a surface of 8,000 acres. The production of the entire primary reserve of that property, which would be 50,000 barrels a day for close to 40 years, will less than fill one single canyon on that property and that is less than 8 percent of the geographical extent of that property. That is reasonably representative of the entire deposit at the southern edge of the basin which is essentially the oil shale land in private hands. We won't be filling the canyons.

Senator Moss. What about air pollution from retorting, how extensive will that be?

Mr. DAVIS. We have designed various types of scrubbers and separating devices and used them successfully on Parachute Field, and used them successfully to combat the air pollution which previously existed.

Senator Moss. What fuel do you use, oil that you get from oil shale?

Mr. DAVIS. In the experimental plant we are buying fuel in order to make the cost of operating the plant easier and eliminate unnecessary waste. On the larger plant we would burn fuel that would be the product of the plant itself.

Mr. WINSTON. Our air pollution control problem is relatively less than, say, a modern refinery policing their stacks and they are, I think you would agree, well policed and clean where they are properly designed.

Senator Moss. What volume of water is required in this technology we are talking about—of retorter?

Mr. DAVIS. It takes one and a half to three barrels of water for every barrel of product. We are not sure yet of a number that is more accurate than that.

Senator Moss. If we got up to 100,000 barrels or 1 million barrels point we talked about in the slides, we would be using a vast amount of water; is that correct?

Mr. DAVIS. You would be using several million barrels of water, that is correct. We have underway a study together with a number of other companies and the State of Colorado on the availables in the area and how much water can be assigned for an industry of this nature. While the study is not complete, we don't have any accurate numbers, we feel there will be water available for this million barrel a day industry that the Department described.

Senator Moss. What about water quality standards? What about percolating water, for instance, through the mines?

Mr. DAVIS. The water that dips down into the mine will be collected and treated and used in the process of wetting down the spent shale.



As the shale comes out of the retort of course, it is finely ground and we wet it with water before it gets to the atmosphere, and then additional water is added when we compact the shale and deposit it. Actually, the water we use, none of it reaches the stream, it is used to wet the shale or goes into the atmosphere as steam or vapor.

Senator Moss. Are you contemplating open pit mining or underground mining, or a combination of the two?

Mr. DAVIS. Our properties are suitable for underground mining, not open pit.

Senator Moss. Mr. Winston, you said in discussing the 1968 program that the 1971 was better because of time for evaluation and industry nomination of sites. Are those the differences between the two programs that seem to make this one desirable?

Mr. WINSTON. There are, of course, other differences and we have attached a brief appendix to our written statement that sets out all that we think really meaningful, that would add in addition to the matters you mentioned, which are essentially matters of time for gathering and digestion of information, the difference which is not immaterial in the method of payment of the bonus, so that a company, particularly one with no experience in this field, which might come in and bid and then discover, after it was successful, that it did not have the capability of completing a course of development, and I think I have indicated that we think that course of development entails expenditures something like those we made in the vicinity of \$50 million, would have the right to petition the Department to turn the leasehold back and be freed of what amounts to two-fifths of the commitment, and has a tendency to lower needless risk.

Senator Moss. Environmental standards are considerably higher in 1971 than they were in 1968?

Mr. WINSTON. Yes.

Senator Moss. So this would add somewhat to the speculative cost or calculated cost of developing a leasehold. Yet, in 1968 there was one taker, isn't that all, that made a bid?

Mr. WINSTON. That is correct, sir.

Senator Moss. And nobody else did.

Mr. WINSTON. Yes.

Senator Moss. Is there enough difference between these two to be optimistic about there being bids at this time?

Mr. WINSTON. My answer to that is we believe very definitely there is enough difference. There are a lot of differences. There are differences in the economic environment, there are differences in the general perception of the supply situation of the United States which this committee already has under detailed study. There are critical differences of time to evaluate and understand the leasehold before attempting to place dollar numbers on its present worth.

That bid in 1968, was submitted by us, and it was deliberately a token bid, and we said it would be materially increased provided we have the opportunity to go in and determine the degree of underground fracturing, the movement of waters and other matters.

There are already at least eight companies announced to be participating in drilling who do not own shale reserves and who were not involved in the last program.



Senator Moss. Isn't S. 2510 something of an inducement to get the bids in, because if private industry doesn't move the Federal Government appears to be ready to go?

Mr. WINSTON. A threat is always less effective than a promise, I think.

Senator Moss. It was reported at p. 16 of the May 1971 issue of "Oil and Gas Discoveries" that in your appearance before the New York analysis group in April of this year, you said it would cost TOSCO \$1.95 to produce a barrel of oil from shale. Why isn't it commercially productive, since you have private leaseholdings of considerable extent and value over \$100 million, I think?

Mr. WINSTON. Why is it not?

Senator Moss. Yes, you can provide oil now for \$1.95 a barrel?

Mr. WINSTON. Well, I believe what I said was we were in the final stages of a program and we presented our view then of the numbers and said we were in the process of fully confirming cost and engineering designs, and that is exactly what we are doing. My answer to your question is we expect to be economic and we think we are within a reasonable distance of having that definitive answer.

Senator Moss. Mr. Davis, is it your opinion that the provisions of S. 2510 will not hasten the development of oil shale industry, even though the technology is at hand?

Mr. DAVIS. I do not feel that there will be many companies that will desire to participate in the venture on the basis that is outlined in the bill; that is, it is a Government controlled and operated corporation and we would much prefer to do it on our own.

Senator Moss. Of course, Atlantic Richfield is a producer of liquid petroleum and we have some questions going on about secondary recovery, this morning. To what extent is your company devoting its resources to secondary recovery and liquid petroleum, as against the amount spent in oil shale research?

Mr. DAVIS. We began research activities on secondary recovery, about 30 years ago. We were the developers of the high pressure gas injection process, that was first used in the United States, in west Texas, in a field called block 31. By use of this invention we were able to double the recovery from this field and secure an additional 75 million barrels of oil. We have continued a large effort on secondary and tertiary processes throughout this area. Our annual research budget for this effort is considerably larger than the money we spent on the shale project.

Senator Moss. Considerably larger, you say, in secondary recovery?

Mr. DAVIS. Yes, over a period of time. We feel that this is a vital need and a number of the major companies have recently agreed to meet and talk to each other about their research in this area, with a view to making sure that effort as being extended is being done so as to get the maximum benefit from the research dollar.

I think we will eventually see some improvements in tertiary recoveries that will result in additional reserves. I am not able to give you a prediction of the amount, but I think they will be substantial, but at present the process is not in sight.

Senator Moss. Do you agree with the statements made by the Department that a prototype plant can be completed in the late 1970's



and commercial plant in the 1980's to produce oil from shale; I mean under the present program?

Mr. DAVIS. We are now engaged in our final test work at Parachute Creek. We plan to complete and shut down the plant we have there sometime after the first of the year. Then we will begin definitive energy cost estimates and design work so that hopefully by summer or fall of 1972 we will have reached a point where we can make a decision as to whether or not we will follow it with a full-scale 50,000-barrel-a-day plant. This plant will be a commercial plant in the sense it would make money, and though it might have some break in cost and an initial period of loss, it would still be put in with the idea of being a viable investment.

Senator Moss. If there were——

Mr. DAVIS. It would take 3 years to put it in. After 1975 or 1976, we would hope to have a commercial plant in operation.

Senator Moss. Wouldn't it be helpful, and perhaps accelerate this process somewhat, if you have a mixed governmental-private corporation with resources available and expertise and all of the rest to contribute to this?

Mr. DAVIS. Well, of course, everybody likes to have help when they are engaged in a difficult question, but the question is who. With help you sometimes get too much control and too much advice.

Senator Moss. You think you might be overadvised, if you have some Government help.

The Senator from Oklahoma, do you have any questions?

Senator BELLMON. Thank you, Mr. Chairman.

I have only a couple of questions. I would like to ask the witnesses if they have any opinion about when the different price relationships and different degrees of technological development will actually make the processing and production of oil shale competitive with the production of energy from other sources, in your judgment. You just said you could produce oil shale for \$1.95 a barrel. If that is the case you are already well in the ball game.

Mr. WINSTON. Senator Moss quoted an estimate we earlier made, which I think was subject to the completion of our work. Our underlying answer to your question would be that we believe shale oil production is now economic. That is to say, it will make money, subject to the completion of a field program now nearly done. One questions also how much money, Senator, and rate of return on the investment. In order to answer the question fully one would have to make certain assumptions about what it cost today in the United States to go out and starting from zero find a new daily barrel production. We think the costs we project compare very favorably with the enterprise in the United States today.

Mr. DAVIS. That \$1.95 does not include all of the cost. That was not intended to include capital costs, interest on investment, operating cost, and the whole ball of wax.

Mr. WINSTON. It was not an interest-based number. It was strictly an equity discounted net cashflow analysis that was offered and interest costs on customary leverage would raise that number substantially, as they would in any leverage capital investment.



Senator Moss. If the Senator would yield, I would like to quote the second sentence, which comes from the May 19, 1971, issue of Oil and Gas Discoveries. The second sentence reads:

Speaking for itself only TOSCO estimates that a premium quality refinery feedstock, selling for \$3.70 a barrel, can be produced at a cost of \$1.95 a barrel, including depreciation and amortization charges.

Mr. WINSTON. I am positive that whatever cost figure I gave did not include amortization. I am not familiar with the report in the press that you just read, and thus cannot now comment any further on that.

Senator BELLMON. Including all charges if you are going to make one of those \$426 million investments in a 100-barrel-a-day plant. How much would you need for each barrel of crude, based on the knowledge you now have?

Mr. DAVIS. I don't think we are ready to give a number like that.

Mr. WINSTON. We are not looking at a 100,000-barrel plant. Our costs are rather different than those of the Department. It would be extremely difficult to generalize an answer to that question.

Mr. DAVIS. At today's oil prices, the project would be classified as marginal.

Senator BELLMON. What are today's oil prices?

Mr. WINSTON. I can explain why it is difficult to answer you. First of all, this is a manufacturing enterprise. Synthetic crude oil is not the only alternative product. We have talked about a hydrotreated crude oil, produced in the field, and we are today examining and have not completed our examination of the direct production of a raw shale oil which is virtually low-sulfur fuel oil. If you look at that market and the cost of making that product, it is quite different from a synthetic oil. So those differences involve differentials of operating costs and differences of capital costs. This trying to evaluate for you what number is necessary, there are too many numbers to offer you a quick generalization.

Senator BELLMON. What I am trying to find out, if you can produce this oil shale for \$1.95, as you said, and we are not getting the job done and we are running out of energy at a rapid rate, and if we get a 100,000-barrel plant on stream, which is probably at least four times more than we will have in the next 5 or 10 years, it is going to be important as far as meeting our energy needs. We are going to be needing energy at the rate of 30 million barrels a day, and this kind of thing is significant.

Mr. WINSTON. What we are trying to say, is we are a few months away from the final answers to the questions you are asking us and when we are done we will have spent something approaching \$55 million to have those final answers. That kind of help is a little late for us. We have our money on the line, our commitments have been made, and the timing is very short. Nor are we spending our money without some confidence that we are right and those answers will be favorable answers.

Senator BELLMON. How much has been spent on the tar sand project?

Mr. DAVIS. I would say in excess of \$300 million.



Senator BELLMON. Are they making any money?

Mr. DAVIS. I have been told that they are now making money, that they have turned the corner and landed in the black.

Senator BELLMON. Do you think you will get any other kind of company to take this kind of risk in oil shale?

Mr. DAVIS. We have had preliminary conversations with several companies and we believe there will be enough interest that we can form a consortium of companies to put in this first plant.

Senator BELLMON. How large a plant?

Mr. DAVIS. About 50,000 barrels a day.

Senator BELLMON. How much will it cost?

Mr. DAVIS. Somewhere between \$200 and \$250 million.

Senator BELLMON. When do you feel the consortium might be able to get it into production?

Mr. DAVIS. Late 1975, early 1976. It takes 3 years to build this thing, but there is a considerable startup.

Senator BELLMON. How soon will the final decision be made as to whether or not the—

Mr. DAVIS. We anticipate making the decision in the third quarter of 1972.

Senator BELLMON. Third quarter of 1972, a year from now?

Mr. DAVIS. Slightly less than a year, Senator Bellmon.

Senator BELLMON. In the long run what percentage of the total crude oil need of this country, do your companies see coming from oil shale in 1975, 1978, under present rules and regulations.

Mr. DAVIS. You mean assuming that the Government lands are available for lease?

Senator BELLMON. Yes.

Mr. DAVIS. I guess that is just a question of how fast can you build plants and put them in.

Senator BELLMON. The question is how much are we going to under the present arrangement.

Mr. WINSTON. Assuming we have a plant onstream let us say by January 1, 1976, and it is operating, say, and assuming say \$200 million for 53,000 daily barrels, which is one set of numbers, you can just plain multiply, if you wanted 10 plants, they would then be an investment of something over \$2 billion.

Senator BELLMON. If I followed your testimony properly, the first 40,000-barrel plant you wouldn't decide to build it for a year then it will take more than 3 years to get it in operation if everything goes well.

Mr. WINSTON. Something less than that.

Senator BELLMON. This puts us up to 1976?

Mr. WINSTON. Yes.

Senator BELLMON. So it looks like there will be only one plant operating in the year 1980, under the present schedule.

Mr. DAVIS. Yes, but there might be a half dozen nearing completion.

Senator BELLMON. Giving us a total output of 300,000 barrels a day.



Mr. DAVIS. I don't think we ought to be under any illusions that we are going to have a rapid massive buildup in the synthetic fuels industry. It requires a great deal of money, equipment, engineering and it is truly a massive construction effort.

Senator BELLMON. I don't want to put words in our chairman's mouth, but I think you ought to see this matter from the viewpoint of the Members of Congress. Already in the city of Washington, already we know that our production of petroleum is exceeding the discovery of mineral reserves and we know the demand goes up year after year. And we also know as soon as there is no gas in the filling station and no electricity when you turn on the switch, Congress is going to be the one to get the heat for this.

We are concerned with helping the industry do the job that is not being done at the present time. And that you said is not going to be done. This is as you said, by 1980, 400,000 barrels a day is of little consequence. What the chairman and I are interested in is try to find some way to accelerate our need before we meet a critical shortage.

Mr. DAVIS. Of course, if we had the permission to bring the North Slope oil down into the United States, that will help us while we improve our method.

Senator BELLMON. If you get that, that won't solve a problem.

Mr. DAVIS. It certainly will help. I think we have an extremely serious problem in front of us and—but I don't quite understand how the Government corporation would solve it, because, as I read the bill, it provides for a demonstration plant or two nondemonstration plants and these are going to take 3 or 4 years to design and build and there will have to be a demonstration of feasibility, so that whether industry does it or the Government, it looks like to me we are facing the same kind of time delay, unless we want to mount some massive plan like the Manhattan project, where we say we are going to do it regardless of cost.

Senator MOSS. In saying that we now have the technology, and it is the retort technology, is there any research going on in other means of getting oil out of the shale? I am thinking of the talks we get periodically about in situ methods.

Mr. DAVIS. We have investigated a number of ideas ourselves and done some work ourselves. And the company we mentioned we merged with has also done research work in this area, and we are not very optimistic. This shale is, as you know, not very permeable. And the in situ processes that have worked today have involved reservoirs that did have quite a bit of velocity in front of the building.

Senator MOSS. Well, we surely appreciate your testimony—

Senator BELLMON. Mr. Chairman.

Senator MOSS. Senator Bellmon.

Senator BELLMON. In comments made in connection with the environment, you said you feel you can cope with these problems. Does this include the problem of avoiding the blowing of fine materials that are going to come out of the retort?

Mr. DAVIS. We described a wet scrubber that removed those materials from the atmosphere. They are removed from the effluent as it goes into the air.

Senator BELLMON. That is all I have.



(Questions by Senator Hansen and their answers by Mr. Davis follows:)

QUESTIONS SUBMITTED BY SENATOR HANSEN, ANSWERED BY LEWIS DAVIS,  
EXECUTIVE VICE PRESIDENT, ATLANTIC RICHFIELD CO.

Senator HANSEN. It seems to me we all have the same objective here. The Chairman is searching for ways to help develop sources of domestic synthetic fuels, particularly oil shale, to fill a forthcoming gap in our energy supply. You are actively engaged in research and development towards this objective. The Department of the Interior has launched their oil shale leasing program. What in your opinion can be done to insure that we can develop our oil shale resources to help fill the developing gap?

Mr. DAVIS. In my opinion Senator Hansen, there are two things that I think can be done which would have considerable effect upon the establishment of an oil shale industry.

One is to change the current Mineral Leasing Act of 1920, which restricts oil shale acreage holdings to 5,120 acres per lessee. The acreage holding limit should be increased, because we feel that it is vitally necessary for an operator to have the reserves necessary to justify this type of high risk capital investment.

Also action must be taken by government to create a favorable environment rather than the present hostile environment for oil shale development. In today's situation, we find we not only have all the tough technical problems of developing the transition from a prototype plant to a commercial plant, but we are periodically faced with unexpected obstacles and hurdles thrown at us under the guise of protecting the environment.

We are not seeking to escape our responsibilities to protect the environment in our operations. We have taken many steps already which we have researched. A copy of some of our environmental research and development in the environmental protection area was attached to my statement. What we are seeking is a reasonable, balanced and stable situation in which to operate under the present environmental protection policy. Local, State and Federal Governments must provide such a condition to permit an oil shale industry to be established by anyone.

Senator HANSEN. Mr. Davis, what do you think can be done to solve this problem?

Mr. DAVIS. The Department of the Interior attempted to help in this area in their oil shale leasing program by establishing credit to be charged against royalty payments for excessive environmental protection costs. It helps, but this in itself does not stabilize environmental protection demands. Environmental protection is desirable, necessary and acceptable but, when impractical environmental requirements are utilized solely to deter or eliminate development of energy resources, they should not be acceptable. Government agencies, regulatory bodies, and outside groups can now create so many unreasonable, impossible and excessive conditions and costs we consider it a hostile environment for the development of vitally needed energy resources. I think it is time for the industry to be given credit for what it is doing, rather than continuously creating a more hostile situation in which it has to operate.

Senator Moss. Thank you very much, gentlemen. You are in the business and therefore we are glad to hear from you and get your estimate on this matter we have before us.

Now, we have another vote on in the Senate. I think we might as well take our recess until 2 o'clock and then Mr. Cameron will be our witness at that time.

(Whereupon at 12:45 p.m. the hearing was recessed to reconvene at 2 p.m., the same day.)

(Mr. Winston's prepared statement follows:)

STATEMENT OF MORTON M. WINSTON, PRESIDENT, THE OIL SHALE CORP.

Mr. Chairman and Members of the Committee, my name is Morton M. Winston. I am the President of The Oil Shale Corporation. Our company is commonly known by the acronym TOSCO. At the outset, I would like to thank the Com-



mittee and the staff for providing us with this opportunity to appear and to put before you our views on the closely related subjects of this oil shale hearing. We will address ourselves principally to the following questions:

1. Is the public domain oil shale leasing program which has been commenced by the Department of the Interior a constructive and adequate program?
2. Have effective steps been provided in the oil shale leasing program or otherwise to ensure that the objectives of environmental integrity will be achieved?
3. Is it desirable to encourage the commercial development of oil shale and other additional energy sources?

Before offering you our views on these questions I would like to say very briefly what TOSCO is and what it has done and is doing in the field of oil shale development.

We are a publicly held corporation with more than 25,000 shareholders. From the time of TOSCO's incorporation in 1955 it has steadily pursued, first alone and then with substantial co-venturers, the development of proprietary systems for the mining and retorting of oil shale, the recovery of raw oil and gas, the upgrading of the liquid products to high-quality commercial fuels, and the disposition of the solid residues from those operations consistent with high standards of safety, restoration of the environment and even the improvement of esthetic values. These have in fact been our objectives since the present management became responsible for the company's affairs in 1960, long before environmental concern became a prime responsibility of corporate citizenship.

To date more than \$47 million has been expended by TOSCO and its associates in the course of development of oil shale mining and processing techniques, including the control and disposal of residues. When the Parachute Creek field program, now in its final phase, has been completed, total expenditures on technological development will exceed \$55 million.

We stress the size of these expenditures for technology solely to make it plain that the suggestion that private industry has shown no aggressive interest in oil shale development is misleading. As you undoubtedly know, others too have made substantial expenditures in the field demonstration of technology, including not only the Union Oil Company of California but also a group of substantial oil industry participants who joined together to lease and operate The Bureau of Mines Facilities at Anvil Points during the middle 1960s.

We look for reasonable returns to our shareholders from the free and open competition of our technology in the industrial marketplace under an open policy of licensing to all applicants upon reasonable terms and from the production of our substantial own reserves as well as, we trust, from competitively acquired federal leaseholds.

In 1970 we acquired an oil refinery in the San Joaquin Valley of Southern California to complement our continuing development efforts and to permit integration of our impending shale oil production in the classic industry pattern. We are also at work today on other applications of our technologies including upgrading of low-sulphur content western coals to provide an economic and environmentally satisfactory fuel source for the mid-west. But those matters are beyond the immediate scope of today's subjects.

So much for who we are. I would like now to turn to the three principal subjects of the Committee's interest today.

#### I. THE FEDERAL OIL SHALE LEASING PROGRAM

We believe that the Federal Oil Shale Leasing Program provides a wisely formulated and carefully regulated opportunity for industry to demonstrate its willingness to participate in the initiation of commercial production of shale oil and the low-sulphur fuels readily produced from it.

In 1964, Secretary of the Interior Stewart Udall convened an Oil Shale Advisory Board to consider the need for access to the federal oil shale reserves. We testified at length before the Board to outline our views of how a program might be formulated with fair incentives to industry and positive guarantees for the protection of the public interest in the value of the resources and of the environment. We strongly urged a limited program of "experimental" or "research" leasing to be carried out on a competitive basis and carefully regulated and monitored. We favored such a program because it would provide a development opportunity to those in the industry without adequate reserves, and would



provide a substantial base of data and information from initial commercial plant operations which we thought then and do think now is indispensable to the Government's regulation of further orderly development.

Unhappily the resulting 1968 program did not meet those criteria. It is gratifying, however, to note that in the intervening time the able staff of the Department has labored hard to generate a program which has done so. For your possible interest or reference we attach as Exhibit A a copy of the written statement submitted by us in 1964 on this subject. We also attach as Exhibit B a comparison of the 1968 leasing program and the present leasing program. This comparison shows that a number of significant improvements have been made in the present program.

In brief, we believe that the present Oil Shale Leasing Program is constructive and adequate as a prototype program. The effectiveness of the program in stimulating oil shale development has already been evidenced by the list of companies which are participating, directly or indirectly, in the core drilling program. At least eight are companies without significant private oil shale holdings, who but for this program would have had little incentive to invest in oil shale development.

We believe that a substantial period of time is required for industry to participate in the nomination process, to evaluate tracts that have been selected for bidding, and to assess the costs of complying with measures to protect the environment. The present program does, we think, provide adequate time for these purposes.

While the pending program seems well designed to bring about development, it is, wisely we think, restricted in scope. It contemplates a maximum of two leases in each state. If the maximum number of leases were to be issued for the maximum acreage, the total amount under lease would be only .5% of the total federally held oil shale acreage. The development of these leases will not represent a major alienation of national reserves. Such development, should, however, generate an important source of environmental and industrial data which will be invaluable in planning and implementing successor leasing programs. Indeed we think that experience with actual commercial production operations is an essential first step in the evolution of a sound national policy for oil shale.

## II. ENVIRONMENTAL INTEGRITY

We believe that the Federal Oil Shale Leasing Program will not only stimulate the development of an oil shale technology for commercial production but that it also provides effective safeguards for the public's interest in the protection of environmental values. We think the program can provide a precedent-setting example of cooperation between federal and state government agencies with industry and those representing environmentally oriented groups in the detailed examination of the various impacts of the proposed industrial activities upon ecosystems of the region prior to the commencement of significant development.

Although we wholeheartedly endorse the current program we would emphasize that because of the very substantial capital investment necessary for commercial production, it is essential to prospective lessees that they know in advance the magnitude of principal costs facing them, including environmental costs. We trust that detailed environmental guidelines will be available to potential lessees in advance of lease bidding, and that the lease terms will specify that production operations that are in compliance with the guidelines could not be jeopardized by subsequent administrative fiat aimed at a particular lease, establishing new and more onerous regulations. We do not suggest that production operations should not have to comply with subsequently enacted legislation or subsequently promulgated regulations of general applicability to industry. We are stressing only that individual lessees must know in advance of making substantial financial commitments what measures of particular applicability to their leases they must satisfy. We are hopeful that these measures can be defined prior to lease bidding.

We want to stress that our concern with what environmental protection measures may be required does not reflect any lack of available technology to protect the environment. Much of the work that I mentioned earlier has included measures to control air and water quality and to control the disposal of the residues from processing operations and the revegetation of disposal areas. We have the technological capacity for complying with whatever may be reasonably required in the areas of air and water pollution and disposal of residue and



revegetation of residue. I am speaking of course of oil shale operations as we believe they may occur within the foreseeable future, principally under-ground mining with above-ground retorting and related processing. Our suggestion is, however, that because different environmental measures have different costs and these costs are not insignificant, these measures should be defined in advance of substantial financial commitments by lessees or potential lessees. Reasonable certainty as to costs is essential to the success of the leasing program.

As already noted, the leasing program contemplates that before any large scale leasing is undertaken, the results of some actual commercial operations pursuant to the initial leasing will be in hand. At or prior to such time, we hope to have experience with commercial operations on privately held lands. Such operations will have generated substantial information about environmental and other considerations of an oil shale industry. We would be agreeable to cooperating with the Department of the Interior in utilizing that information in planning for a broader leasing program. Indeed, experience on private lands may accelerate, or enable the Department to accelerate, the planning for a broader leasing program.

In the context of both a broader leasing program and the limited one that is at hand, we suggest one significant improvement that could readily be achieved: the coordination within the federal government of the responsibility for environmental aspects of a shale oil industry. We trust that the benefits of such coordination are obvious to all concerned. We are of course aware that within the divisions of the Interior Department a substantial degree of coordination has already been achieved, and we believe that such coordination has already produced positive benefits. Efforts to such coordination should be expanded to include inter-agency coordination, with the Environmental Protection Agency, the Counsel on Environmental Quality, and others.

### III THE DESIRABILITY OF ENCOURAGING THE COMMERCIAL DEVELOPMENT OF OIL SHALE AND OTHER ADDITIONAL ENERGY SOURCES

We think that the nation's deepening energy supply dilemma, which this Committee and others already have under study, make it essential that the government act promptly and vigorously to encourage the development of oil shale and other additional energy sources.

This is, we believe, the basic policy expressed in S. 2510. But so far as oil shale is concerned, we are convinced that through privately financed and managed efforts the technology is already at hand to bring about commercial production.

Technological improvements which we expect will occur, are likely to grow out of actual commercial experience with technology that is at hand in the pending leasing program and otherwise.

We are not today prepared to address at length what should be done with respect to energy sources other than oil shale. We note, however, that this Committee is embarked upon a major study of energy questions and policy. We are confident that that study will make a significant contribution toward a determination of what further measures the government should take to satisfy the nation's energy needs.

Thank you.

#### APPENDIX A

The material referred to as Exhibit A was retained in the Committee files.

#### APPENDIX B

### COMPARISON OF 1968 FEDERAL OIL SHALE LEASING PROGRAM WITH PRESENT LEASING PROGRAM

#### I. SELECTION OF TRACTS FOR LEASE BIDDING

A. Selections of lease tracts in the 1968 program were made by the Department of the Interior at the outset of the program, with no consultation or coordination with, or opportunity for nominations by, industry.

Three tracts were selected, all in Colorado. A conscious effort was made to sample three "distinctly different" mining and processing possibilities, with the result that for any one process approach, only one specific tract was available.

One of the tracts was selected for open-pit mining. At the time the tract was announced, September 10, 1968, relatively little was known about it or even about



its general area, the northern edge of the Piceance Creek Basin near the White River. In Secretary Udall's words, "Precise geologic data on this site is unavailable." The Department undertook to drill a core hole on this tract and to make the data public, and estimated that the size of the tract would be set at about 2,000 acres (based upon expected core drilling results as to thickness and hydrocarbon content of the oil shale). No company drilled a core on this tract.

The results of the Department's core were not officially announced until December 29, 1968. As early as October 14, however, the Grand Junction Daily Sentinel reported that Interior had concluded that the tract had turned out to be "a gross disappointment", but that no alternate open-pit tract would be selected. In its October 29 press release, the Department said that "at depths where surface operations are expected to be practicable, the shale does not appear to be sufficiently rich to support mining operation at this time." In formally calling on November 4, for test lease bids, the Department set the size of this tract at 5,083 acres, and described it only as "potentially attractive for underground mining of multiple horizons."

The other two selected tracts comprised 1,255 acres and 5,120 acres respectively. As a practical matter, industry's consideration was confined to these 6,375 acres.

B. Selection of lease tracts in the current leasing program starts with an opportunity for industry to consider, by core drilling and lease nominations, a vastly larger area, with some specified exceptions such as the Naval Oil Shale Reserves and areas of recreational or historical significance. This area includes 16 million acres of oil shale lands, of which eleven million acres "are believed to contain oil shale of potential value for commercial development in the foreseeable future."<sup>1</sup>

This area includes Utah and Wyoming as well as Colorado. It includes lands covered by unpatented mining claims including one initiated prior to the Mineral Leasing Act of 1920, when oil shale was open to location pursuant to the mining acts. See, e.g., Program Statement, pp. III-16,-17; Solicitor's Opinion, "*Competitive Leasing of Oil Shale Lands Covered by Unpatented Mining Claims*," M-36839, October 28, 1971.

The current program contemplates a maximum of six leases, each up to 5,120 acres, two in each state. There is no required distribution among different techniques; all six could be appropriate for proven underground room-and-pillar mining.

The outlines of the current program were generally known as early as May 1970. Details were officially published at the end of June 1971. Industry has until January 31, 1972, to nominate tracts for lease bidding. See Program Statement, p. III-17; 36 Fed. Reg. 20996 (November 2, 1971).

## II. OPPORTUNITY TO CONDUCT INFORMATIONAL DRILLING PRIOR TO LEASE BIDDING

A. Since the 1968 leasing program started on September 10 with the announcement of the three tracts, there was no prior opportunity for industry to conduct informational core drilling on those tracts. The Secretary's press release of that date stated that "potential bidders will be permitted to drill a limited number of core holes on the sites between September 20 and November 15 under specified conditions to be published soon by publication in the Federal Register." A "Fact Sheet" referred to by the Secretary stated that no more than three core holes per tract and no more than one core hole per applicant would be permitted,<sup>2</sup> and that from September 13 on, applications would be granted in order of priority of filing. Drilling operations were to terminate no later than November 15, 1968.

Only two companies. The Oil Shale Corporation and Atlantic Richfield Company, effected the filing of permit applications prior to the opening of the Colorado Land Office at 10 AM September 13 (*i.e.*, prior to the closing of the Land Office on September 12), the initial deadline for priority. Land Office officials held a drawing on the 13th to determine priorities between these two companies. It was expected that the Geological Survey would control where cores

<sup>1</sup> See Program Statement for the Proposed Prototype Oil Shale Leasing Program, U.S. Department of the Interior, June 1971, p. II-1 (hereinafter "Program Statement"); Applications for Permits to Conduct Informational Core Drilling, 36 Fed. Reg. 12319 (June 30, 1971); Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program, Department of the Interior, June 1971, pp. IV.

<sup>2</sup> An applicant could, however, participate in cores drilled by other applicants.



would be drilled, and would select three sites per tract, from which the first in priority could select one.

Core drilling details did not appear in the Federal Register until September 14, a Saturday. These details were as announced in the Fact Sheet, except that the initial deadline for priority was stated as 10 AM September 16.

On September 20, no further applications having been filed, the Secretary revised the core drilling program so as to permit an applicant to drill one hole on each tract (but only one hole) and so as not to restrict the holes per tract to three applicants. Drilling operations were still to terminate, however, by the end of November 15. 33 Fed. Reg. 14241. Applications had to be filed by October 4.

In the Federal Register of October 12, the Department extended the filing deadline to October 18 and the drilling deadline to December 1, citing "increased interest in prelease drilling." It also then rescinded the limitations of one core per applicant per tract.

A total of six cores holes were drilled, one at the Government's expense on the "open pit" tract noted above, and five by companies. These companies encountered a shortage of drilling rigs. Although the published December 1 deadline for drilling operations did continue, with the permission of local federal officials, until virtually the bidding date itself, December 20, 1968.

Little time was available to assess potential bids between the time the core analyses became available and the bidding deadline. It did become clear during this interval, however, that there were substantial questions as to the mineability of the two "underground" tracts. On both tracts, water was encountered above and below mineable oil shale horizons; and severe fracturing or "rubble" was encountered above and below the mineable horizons. In addition, on one of these tracts fluid hydrocarbons in undetermined quantities were encountered. Further core drilling would have been required to determine whether these problems were manageable, but no further time was available.

B. The fact that the present program would include opportunity for core drilling was generally known by May 1970. Core drilling was officially authorized at the end of June 1971. See 36 Fed. Reg. 12319 (June 30, 1971); Program Statement, pp. III-4, -5, and Appendix A thereto. Applications for such drilling were authorized until June 30, 1973. No limitations were imposed as to the number of cores that could be drilled.

The current programs calls for selection of lease sites in 1972, with lease bidding at the end of 1972 and early in 1973. Interested persons can thus drill core holes before and after selection of lease sites.

While many companies are understood still to be studying where to drill core holes (and there is a large volume of public information that bears upon where further holes seem worthwhile), applications have already been filed, and permits issued, to drill more than four times as many holes as were drilled under permits in the 1968 program, and drilling is currently underway.

### III. OPPORTUNITY TO ASSESS RESULTS OF INFORMATIONAL DRILLING AND TO CONSIDER LEASE TERMS PRIOR TO LEASE BIDDING

A. In 1968 only a few weeks, at most, was available to assess the results of informational drilling, which was not even to begin until September 20, before the lease bidding, on December 20.

Not much more time was available to consider the lease terms. The royalty and patent provisions of the lease terms were first announced and published on September 30, 1968. The "mining and waste disposal terms" were announced on October 14, as was a revision of part of the terms that had been announced on September 30.

Both announcements referred to December 20 as a "tentative" date for the lease sales. On November 4 the Secretary issued a formal invitation for lease bids, and made the December 20 date definite.

Neither the September 30 nor the October 14 announcement invited public comment on the lease terms or otherwise suggested they were subject to revision. However, the Federal Register for Friday, December 13, 1968, one week prior to the sale date, contained a number of revisions of the lease terms. 33 Fed. Reg. 18523-18525.

B. The Program Statement of June 1971 included an entire "proposed oil shale lease" as Appendix B, and stated that "though it is expected the final lease form . . . will be along the same general lines as this draft lease, it should be



understood that any provision is subject to clarification and change." The Program Statement also indicated that final lease terms as well as final environmental control requirements would be announced in 1972 well before the scheduled lease bidding.

#### IV. BONUS REQUIREMENTS LIMITING ABILITY OF SMALL COMPANIES TO BID

A. The 1968 program in effect required initial bonus bids of at least 20 million dollars, payable in five equal annual installments starting in the seventh year of the lease. However, the bonus was not to be refundable in any circumstances, including relinquishment of the lease or inability to conduct actual mining operations.

Although the full bonus was not payable in full for several years, it had to be covered in full by a bond upon issuance of a lease. (Such bonds would have been very expensive for small companies.) Thus the bidding was open only to companies, if any, who could venture 20 million dollars or more at the outset.

B. As of the present, the current leasing program does not contain any specified minimum bonus amount, although the Department can reject bids.

Moreover, the full bonus amount need not necessarily be ventured at the outset. The bonus is payable in fixed equal annual installments beginning with issuance of the lease. If the Secretary accepts surrender or relinquishment of the lease prior to the end of the third year, the fourth and fifth installments would not be required.

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#### AFTERNOON SESSION

Senator Moss. The hearing will resume.

Mr. Cameron, will you come forward, please?

We are having troubles on timing. I thought I would be able to make this vote before we reconvened, but it has not come on, so we might as well get started. I may have to interrupt you somewhere along the line, but we are anxious to have your testimony here.

#### STATEMENT OF RUSSELL J. CAMERON, PRESIDENT, CAMERON ENGINEERS, INC., DENVER, COLO.

Mr. CAMERON. Thank you very much.

Senator Moss. You are president of Cameron Engineers in Denver; is that correct?

Mr. CAMERON. That is correct.

Senator Moss. Very good. We are glad to have you, Mr. Cameron.

Mr. CAMERON. Thank you very much, Mr. Chairman, for inviting me to appear again before this committee to present testimony on oil shale development.

While progress is being made in bringing this resource into beneficial use, the urgent need to add to our domestic energy supplies makes this hearing especially timely.

I intend to provide you with my appraisal of the present oil shale leasing proposal of the Department of the Interior, to comment on S. 2510, and to offer some suggestions for consideration by your committee to bring the development of oil shale and other domestic sources of synthetic fuels to realization with greater certainty.

Mr. Chairman, I believe the prototype oil shale leasing plan initiated by the Department of the Interior on July 29, 1971, has a reasonable prospect of success. Six informational drilling programs have been started in which at least a dozen private companies are participating.



Others are known to be considering their own drilling programs or buying-in to those already in progress.

My company, Cameron Engineers, has received authorization to drill up to six coreholes in the northwest part of the Piceance Basin in Colorado. Drilling is now going forward with two drilling rigs in operation around the clock. One corehole is essentially completed and hydrologic testing with the cooperation of the Geological Survey is now in progress. Core assays are being done—at our expense—by the Bureau of Mines laboratory at Laramie, Wyo. As you know, the Department of the Interior is entitled to receive, at no cost, the results of all coring and well testing and be provided with a one-quarter split of all cores recovered.

My firm is acting as contractor in this program for a three-company group composed of American Petrofina Co. of Texas, Marathon Oil Co. and Sun Oil. Another industrial concern has signified its intention to join the group.

In addition to conducting the drilling program, we are evaluating all data acquired with the objective of providing the group our recommendations for a lease nomination together with a conceptual plan for its development. We also will provide both our clients and the Department information on the environmental impact of the development of our recommended lease site. We expect to meet the January 31, 1972, deadline for nominations despite the short time available and the advent of winter conditions in the Piceance Basin.

Since filing our application for a special land use permit for core drilling on August 4, 1971, we have received excellent cooperation from the Bureau of Land Management and all other Federal, State, and local officials who have had responsibilities under the program, and there have been many. You will be glad to know that environmental monitoring and supervision has been strict but not unreasonably so. There should be no adverse effect on the environment of the area from our drilling program.

I would also like to commend Assistant Secretaries Dole and Loesch, Solicitor Melich, and in particular, Mr. Reid Stone, the Department's oil shale coordinator, and other members of the oil shale task force for their efforts to provide a workable leasing format. This has not been easy.

The limitations imposed by an obsolete 50-year-old statute, the Mineral Leasing Act of 1920, certainly diminish the effectiveness of the leasing program and conceivably could prevent it from succeeding. I was glad to learn this morning that the Interior Department had issued a decision that to a certain extent clarifies some of the confusion that has existed as to the rights of a lessee or a participant of a company in a group that has a lease. I am sure that will be helpful.

What concerns me most is the 5,120-acre limitation on lease size and the further limitation of a single lease per company regardless of the size of lease. Both provisions are statutory requirements under the 1920 act that must be modified to have an effective leasing program in the future and perhaps even to make the present effort successful.

Let me explain the reason for my concern. In 1920 when the present leasing act was put into effect, petroleum production in the United States was only 1 million barrels per day. A 5,120-acre oil shale lease



was more than sufficient for the largest conceivable shale oil plant. Today, our oil demand is more than 15 million barrels per day and by 1980 is expected to exceed 20 million. Our annual increase in demand at present is more than one-half million barrels daily.

A single 5,120-acre oil shale lease simply cannot support an economic unit of production of significant output in most parts of the Piceance Basin and few, if any, areas in Utah and Wyoming. Note the absence of any drilling applications in Wyoming and only a single application in Utah. Even where the oil shale zone is relatively thick and reserves sizable the geometry of mine development makes a 5,120-acre block marginal for an economic scale of production.

A further inhibition to leasing under the present program is the single lease limitation. This first lease may be a money loser because of the immature state of the technology and other factors that make pioneer ventures more risky than succeeding ones. An opportunity to obtain a second lease to recover potential losses from the first one is an important consideration.

Those who participate in the present prototype program in the absence of changes to the leasing act must do so with the expectation that changes will be made. If these limitations were removed before the sale date—December of 1972 is now predicted—I am certain there would be more competition for the tracts offered.

Mr. Chairman, I respectfully submit that on the evidence of the significant amount of interest being shown in the present limited prototype leasing program that private industry is indeed willing to take on the responsibility for oil shale development. For this reason I question the need for a Government-industry corporation such as is suggested by S. 2510.

In my opinion it would be more beneficial for this committee and the Congress to move promptly to enact a bill such as S. 2726, the proposed Mineral Leasing Act of 1971, which would correct the deficiencies noted above. I would even suggest the consideration of special legislation that would apply the oil shale provisions of S. 2726 to the present prototype leasing program since the complexities of enacting new legislation for all leasable minerals may be time consuming.

Now, I would like to leave oil shale for a moment and comment briefly on the overall energy situation. It is almost trite to say so, but this country runs on oil and gas. Today we use petroleum for more than 75 percent of our energy needs. As important as coal is in the generation of electric power, as vital as nuclear energy will become in the future, and as spectacular as the harnessing of falling water can be, the contribution of these energy sources to our needs is relatively small and necessarily will continue in this role for decades. In other words, we have no effective replacement for petroleum.

We have now reached a plateau in our ability to produce oil and gas. Reserves have been declining for several years. Imports have increased to the point that one-fourth of our oil comes from beyond our borders. The importation of gas from overseas has now begun. The situation is worsening rapidly. Oil imports have doubled in the past 10 years and will double again in this decade even if Alaskan oil begins to flow. By 1980 we also could be importing a significant part of our natural gas supply.



Can we proceed in the direction of further dependence on foreign energy sources? Security arguments dictate against it, but can we even afford the cost? Will our balance of payments stand a \$10 to \$15 billion burden for imported oil and gas? That I repeat, \$10 to \$15 billion. That is the prospect only a decade from now.

Why not reduce our consumption of energy? Why not cut out non-essential uses? Be more efficient in the conversion of oil, gas, and coal into electricity and motive power. Turn out the lights. We should do these things and we will. Even so, we will still be dependent on imported oil and gas for a critical part of our energy supply and the cost will be high.

The incredible part of this story is that it need not have happened. We have known for years the basic technology to make oil and gas from coal and oil shale. It is inconceivable that the conqueror of the atom and the Nation that sent men to the moon and back could not develop its largest energy sources. But we face an energy crisis that seems unavoidable because we have not done so.

Whatever we do now will be too late to prevent shortages of energy and disruptions to our economy. But we must act, and act promptly, to avoid more serious consequences—political blackmail, unacceptable pressures on the dollar, and an actual weakening of our productive ability.

Mr. Chairman, if the viewpoint I have expressed above is even approximately correct, we must be prepared to move promptly to encourage the commercial development of our coal, tar sand, and oil shale reserves as sources of petroleum products. We have processes to produce oil and gas from these sources that have been thoroughly tested on a small scale. Although improved methods are certain to evolve with large scale experience, I am confident that present technology can be the basis for commercial production now.

I am also convinced that private industry can do the job better, quicker, and at less cost than any joint effort of government and industry. But a hospitable economic ambient is required to attract the large amounts of capital that will be needed.

These early plants will likely be more costly than expected and may take years to reach reliable efficient levels of performance. The first project to produce synthetic oil from Canadian tar sands was expected to cost \$160 million when authorized in 1962. It is only now operating at designed rates of production after an investment of more than \$300 million.

Financial exposures of this magnitude in the fact of oil and gas prices that have been kept at artificially low levels by Government regulation have been the most single deterrent to initiating the commercial production of synthetic fuels in the United States. With these same uncertainties still present, Government must provide some sort of price stability for the pioneering phase of this new industry, if we are to have a privately financed synfuels industry in the foreseeable future.

The uranium purchase program under which Government assured a market for U<sub>3</sub>O<sub>8</sub> at a stable price, encouraged a privately financed exploration effort that within a very short time achieved the goals of the



uranium stockpile and present prices are even lower than those at the time the program started. I wonder if a similar concept might not be effective in stimulating the establishment of a synthetic fuels industry.

An appropriate agency of Government might purchase synthetic fuels made domestically from coal, oil shale or tar sands under long-term contracts at prices determined by competitive bidding. Contracts probably should be for a minimum of 10 years. As production began, Government would sell the synthetic fuel on an annual basis at prices determined by competitive sale. The Government actually would never take possession of the products.

Such competition would pit each synfuel source against the other as well as process against process. With each company or group risking its own capital a realistic evaluation of production methods and synfuel sources should result.

What might be the cost of such a program?

If the net difference in cost and sales price were \$1 per barrel, say \$5 for syncrude, \$4 for conventional oil, the 10-year cost to Government of establishing a 250,000 barrel a day synfuel industry would be less than \$1 billion. Mr. Chairman, I don't want to get into that argument of about how much shale oil might cost. I see what I have done here is establish a new figure for you to be confused about. I used the highest cost I have seen in publication as the cost for producing oil from oil shale; \$5 per barrel has been suggested by the recent NPC task force study, as a cost for shale oil from a pioneering plant.

I personally feel that shale oil production costs would be less than \$5 a barrel. But even if it were \$5 a barrel, then the \$4 per barrel figure I use there seems to be fairly well in line for these high quality synfuels.

If you recall, this morning Mr. Winston said their estimate today was about \$3.75 per barrel. When I take this \$1 per barrel difference as a potential cost to the Government, I think we are looking at the maximum cost that might have to be made up.

Of course, the thing that is rather intriguing about this is that if a plant or such a group of plants were to start in production around 1975 and 1976, and a contract of this nature would proceed for 10 years, I think it is entirely possible that the price at which Government could sell its oil, again at competitive sale on an annual basis, might soon exceed the cost that they were committed to pay under such a contract.

It would be considerably less if world crude oil prices increase as anticipated. Industry's investment would be on the order of \$1.5 to \$2 billion.

A \$1 billion payment by Government to establish a critically needed industry is a bargain by almost any measure. A synfuels industry could exert influence that would repay its cost many times over. Not the least of its benefits would be the creation of jobs and stimulation of the economy.

I hold no special brief for this particular suggestion. Any plan that will provide industry the incentive to invest private capital to start synfuel production on a commercial basis would be acceptable. The important thing is that we must act now.



I hope this committee and the Congress will take appropriate action. Senator Moss. Thank you, Mr. Cameron. I agree wholeheartedly with your sense of urgency that something be done forthwith, and I think my colleagues who have been here reflected this great concern we have, because as you say the energy crisis is already upon us, really.

There isn't time now to avoid some dislocation and some difficulties that are going to come our way when our energy demands climb beyond the point where we can reasonably meet them without resources.

Senator Bellmon mentioned the fact it was announced here in Washington there would be no new additional customers accepted for gas in the distribution area of Washington, D.C. because of the shortage of gas supply. So, we are beginning to get the pinch already. Even with the best estimates of speed, you are 3 or 4 years away from the building of the plant.

I am glad to have your suggestion. It is a variation, of course, to have the Federal Government bear a part of the underwriting cost and the burden of getting this industry underway. You turned around, by having the Federal Government guarantee to buy the production and thereby stimulate the investment of the private capital, whereas S. 2510 would have industry and Government both providing the capital and going forward together.

As you pointed out also, Mr. Cameron, the opinion of the Solicitor has answered some of our problems or at least clarified it a little bit.

I agree that would release some of the pressure, but still 5,120 acres is hardly enough to gamble a \$250 million plant on; is it?

Mr. CAMERON. In most places you couldn't build a \$250 million plant on 5,120 acres. By that, I mean you wouldn't have enough reserves to support the operation of such a plant.

Senator Moss. You urge us to move on with the revision of mining laws and I cosponsored a bill to do just that and I am for it, but I am still searching hard in this energy field. You will notice today we are talking about shale primarily, but we are looking for all other sources of new energy that might be developed.

Why do you feel that industry could do so much better on its own developing the technology and finding the answers to guarantee the market than it could if it were involved with the Government?

Mr. CAMERON. Mr. Chairman. I think some of the figures that were quoted this morning by Mr. Winston and Mr. Davis indicate that industry and certain companies have indeed been willing to spend a lot of money and have indeed gone a long ways toward developing this technology.

In past appearances before this committee I have brought you up to date on the problem that our company has been having in conjunction with the Brazilian Government that could develop a technology that could be used for shale oil production.

If you have a vote here—

Senator Moss. I have less than 5 minutes now. I have a vote.

Mr. CAMERON. I can complete this in less than 30 seconds. Industry has already developed a tremendous amount of the technology and know-how, and it has been this economic instability in the price that has caused them not to take this large risk.



Many industries in the past have had such help, such as uranium stockpiles; I guess the railroads had some help originally and other things. I am an ex-Government employee. I worked for the Bureau of Mines for 7 years. I guess I have some concern that Government and industry do well in the same harness. I think that putting an ox and mule in the same harness just doesn't work very well. I am not sure that this type of organization would be as efficient as holding out a carrot to industry and then taking a board and putting it on their behind.

This is generally the kind of thing that I would prefer to see rather than one of these cooperative ventures with both parties having different objectives and may not work as well together.

Senator Moss. Thank you very much, Mr. Cameron. We appreciate that. I have to get to the floor now very rapidly, and I believe we have wound this up. The record will be open for 30 days for additions. In case I have forgotten something, though, I will be back to close it down.

Thank you.

(Whereupon, at 2:45 p.m., the hearing was concluded.)



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## APPENDIX

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(Under authority previously granted, the following statements and communications were ordered printed:)

STATE OF COLORADO,  
EXECUTIVE CHAMBERS,  
Denver, November 15, 1971.

HON. HENRY M. JACKSON,  
*Chairman, Committee on Interior and Insular Affairs,  
U.S. Senate Office Building, Washington, D.C.*

DEAR SENATOR JACKSON: Please enter the following statement into the transcript of the November 15 Senate Interior and Insular Affairs Committee hearing on the proposed oil shale leasing program and Senate Bill 2510:

The State of Colorado has reviewed the proposed oil shale leasing program in considerable depth. Whereas, much of this program is based upon data prepared by the Colorado Committee on Oil Shale Environmental Problems, we strongly support the basic concepts and aims of the oil shale leasing program as stated in the program statement by the Department of Interior June 1971. We believe the leasing program to be fair to the prospective industry lessees, and to the rights of the lessor who essentially are the people of the entire United States. Although it is impossible at this time to envision the details of all of the environmental problems to be encountered in an oil shale development program, we believe that current research and the rules and regulations included in the leasing program will allow for an adequate solution to those problems.

At this time we are opposed to Senate Bill 2510, and to the federal government's forming a Federal Energies Corporation. We believe that private enterprise, under our current leasing program, would be the proper vehicle for oil shale development. The five million dollars suggested to fund the bill each year might better be spent in additional appropriations for oil shale and energy programs of the U.S. Bureau of Mines, the U.S. Geological Survey, state agencies involved in energy research, or research grants to private organizations. Total research objectives might better be met with less expenditure by allowing tax credits or depletion allowances for specific industrial energy research.

Sincerely,

JOHN A. LOVE, Governor.

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EXECUTIVE DEPARTMENT,  
Cheyenne, Wyo., November 15, 1971.

HON. HENRY M. JACKSON,  
*Chairman, Committee on Interior and Insular Affairs,  
U.S. Senate Office Building, Washington, D.C.*

DEAR SENATOR JACKSON: First, let me express my thanks to you for the opportunity to submit this brief statement on the proposed oil shale leasing program and the associated environmental studies in Wyoming.

Wyoming is an energy resource state with large deposits of oil, gas, uranium, coal and oil shale. We are very cognizant of the energy situation in the United States and the world and realize that all of these resources are going to be needed to meet these energy demands of the future. Significant developments have taken place in all of these energy resources in Wyoming except oil shale.

Wyoming was pleased to work with the United States Department of the Interior during 1970 in the development of a new oil shale leasing program. In February of 1971 Wyoming submitted to the United States Department of the Interior the report "Environmental and Economic Report on Wyoming Oil



Shale", along with similar reports submitted by the states of Colorado and Utah. We looked forward to the announcement of a new oil shale leasing program which would encourage private industry to initiate the steps necessary to develop a commercial oil shale industry in each of these three states.

The proposed prototype oil shale leasing program which was announced in June, 1971, appeared to be a step in the right direction for the initial development of the oil shale resources of Colorado, Utah and Wyoming. We in Wyoming are, frankly, disappointed by the total lack of response to the prototype oil shale leasing program in Wyoming to date.

We feel that among the reasons for a current lack of interest is the fact that a lease of 5,120 acres in Colorado, due to the thickness of the Colorado deposits, would provide considerably more resource, oil shale, than the same size lease in Wyoming. Thus, it appears that by limiting the size of the lease to 5,120 acres, Wyoming has been placed in a poor competitive position.

There also appears to be some question as to the ability of a company to amortize the large investment required in a reasonable period of time on a 5,120 acre lease in Wyoming.

Another problem with the prototype program is the tight time schedule. There are energy companies that have expressed interest in Wyoming oil shale, but are not in a position to select lease sites or file for drilling permits by the January 31, 1972, deadline. I hope that there will be some flexibility in this time schedule.

With respect to the environmental studies on oil shale in Wyoming, the Oil Shale Environmental Planning Committee is currently keeping abreast of new developments, but has not initiated any new studies and probably will not initiate any specific studies until such time as a specific area of interest has been selected by industry.

I would also like to offer a few comments on S. 2510. The basic technology on oil shale development is in the hands of private industry, with the possible exception of the in situ research being carried out by the United States Bureau of Mines in Laramie, Wyoming. The New Energy Sources Corporation appears to be in direct competition to industrial development of oil shale and could delay rather than encourage the development of oil shale by eliminating the competitive development of technology by private industry.

The joint problems of providing adequate energy for the United States and protecting the environment at the same time is going to require the full cooperation of the federal government, the state governments and private industry. But I am not convinced that this cooperation requires the formation of a new Government-Industry Corporation.

What is really needed are realistic development research programs in the field so that technical and environmental problems can truly be evaluated and solved in order that we can move into full-scale oil shale development in this decade.

With best wishes, I am

Sincerely yours,

STAN HATHAWAY, *Governor.*



COMPARISON OF THE DEPARTMENT OF THE INTERIOR <sup>1/</sup>  
 1968 AND 1971 OIL SHALE LEASING PROGRAMS AND LEASE FORMS

1. Name of Program

1968 - Oil Shale Test Lease Program <sup>2/</sup>

1971 - Prototype Oil Shale Leasing Program <sup>3/</sup>

2. Date of Sale

1968 - December 20, 1968 <sup>4/</sup>

1971 - Commencing in December 1972 and at two-week intervals <sup>5/</sup>

3. Term of Lease

Under both lease forms, 20 years and so long thereafter as production is maintained in paying quantities, subject to right of the government to readjust terms and conditions every 20 years <sup>6/</sup>

4. Number of Tracts, Acreage and Location

1968 - Three tracts in Piceance Creek Basin, Rio Blanco County, Colorado, selected for particular characteristic of shale and overburden, and each representing a different geologic setting, involving 1,255, 5,120 and 5,083 acres, respectively, or 11,458 acres in all. <sup>7/</sup>



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1971 - Up to six tracts, two each in Wyoming, Utah and Colorado, to be selected by a process involving industry nomination and review by Interior with aid of state oil shale advisory panels. Maximum acreage in each tract--5,120; total maximum acreage--30,720. Exact number of tracts and acreage cannot be determined until final decisions are made whether to proceed and which tracts to offer.<sup>8/</sup>

5. Exploratory Drilling

1968 - Under permit on the three tracts selected by the Department of the Interior for leasing to enable prospective bidders to obtain geologic information for bidding purposes. Permit holders required to allow others to participate pro rata in costs of drilling and in information received. Data developed to be supplied to the government.<sup>9/</sup>

1971 - Under permit on publicly owned oil shale lands in Wyoming, Utah and Colorado, to facilitate nominations and site selections and to obtain geologic data and other information to determine environmental control methods to be applied. Permit holders required to



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allow others to participate pro rata in costs of drilling and in information received. Data developed to be supplied to the government. <sup>10/</sup>

6. Method of Competitive Leasing

Competitive bonus bidding with rentals and royalties in each case. <sup>11/</sup>

7. Lease Provisions

A. Definitions

The 1968 Lease Form defines "oil shale and its products" and other terms appearing in the lease. <sup>12/</sup>

The 1971 Lease Form contains no definitions of terms used. <sup>13/</sup> Page B-1 of Appendix B states that definitions of oil shale and its products will be incorporated in the leasing regulations now being developed.

B. Bonus

1968 - Not payable for first seven years. Payable in five equal annual installments beginning on the seventh anniversary date of the lease (the first day of the year eight) and ending on the eleventh anniversary date (the first day of year twelve).



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If lease is terminated prior to full payment of the bonus, balance of bonus is payable on date of termination. Production royalties (but not minimum royalties) paid during the first 11 years of the lease, to be credited against the bonus up to \$30 million for Tract 1, up to \$20 million for Tract 2, and up to \$25 million for Tract 3.<sup>14/</sup>

1971 - Payable in five annual installments, the first to be paid at the time of the sale and the remaining four to be equal in amount and to be paid on the first through the fourth anniversary dates. In the event the lease is surrendered or relinquished prior to the third anniversary date, the last two installments of the bonus are waived.<sup>15/</sup>

C. Rentals

As required by law,<sup>16/</sup> under both lease forms, fifty cents per acre per annum, to be credited against royalties accruing for the year for which paid.<sup>17/</sup>



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D. Royalties1968 - Minimum (Non-Production) Royalty Payment Required

None for first eight years. Beginning with year nine, \$50.00 per acre on Tract 1, \$10.00 per acre on Tract 2, \$20.00 per acre on Tract 3 per month, in lieu of a production royalty for each month in which the production royalty would have come to a smaller amount.<sup>18/</sup>

Production Royalty Rates - Oil Shale

Fourteen cents per ton on 30-gallon shale, increasing or decreasing one cent per ton for each gallon of increase or decrease in shale oil content, but not less than four cents per ton. The royalty rate also increases or decreases in the same percentage as the average value of crude oil and crude shale oil produced in Colorado, Utah and Wyoming increases or decreases. For in situ, the royalty on shale oil recovered is 12-1/2 percent.<sup>19/</sup> The royalty in each case is somewhat below the 12-1/2 percent royalty payable under federal oil and gas leases on public lands in the west.<sup>20/</sup>

Production Royalty Rates - Minerals Other Than Oil Shale

Five percent of gross value.<sup>21/</sup>



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Royalty Credits

All production royalties (but not minimum, i.e., non-production royalties) received during the first 11 years are credited against the bonus, to an amount not exceeding \$30 million for Tract 1, \$20 million for Tract 2, and \$25 million for Tract 3.<sup>22/</sup>

1971 - Minimum Royalty Payment Required in Lieu of Mining or In Situ Processing

None required for first five calendar years of the lease. Beginning with sixth calendar year, \$1.00 per acre increasing by \$1.00 per acre each year to \$5.00 per acre for year ten. Beginning with year eleven, the royalty value of the production rate of, for the example given in the lease form, 3,500 tons of 30-gallon shale per day, increasing by 3,500 tons per day for each succeeding year through year twenty, reaching a production rate of 35,000 tons per day in that year.<sup>23/</sup>

Production Royalty Rate - Oil Shale

Twelve cents per ton on 30-gallon shale, subject to upward or downward adjustment (but not to less than four cents per ton of oil shale) in relation to



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increases or decreases in shale oil content and crude values as in the case of the 1968 Lease Form. <sup>24/</sup>

Production Royalty Rates - Minerals Other Than Oil Shale

Three percent of gross value for first 10 years, 4 percent years eleven through fifteen, 5 percent years sixteen through twenty (end of primary lease term). <sup>25/</sup>

Royalty Credits

If Secretary concludes that there are involved in complying with environmental requirements, "extraordinary costs" (1) not within the contemplation of the parties when the mining plan is adopted and (2) in excess of the amount of the environmental performance bond, he may allow a credit against royalties in order to offset such costs. <sup>26/</sup> The environmental performance bond is to be not less than \$500.00 per acre for land to be affected in any three-year period and not less in total than \$2,000.00. <sup>27/</sup>

E. Production Requirements

1968 - If by beginning of year twelve, the lessee has not produced an average of 40,000 barrels of shale oil per day on Tract 1, 25,000 barrels per day on Tract 2,



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or 35,000 per day on Tract 3, over the preceding three calendar years, the lease is subject to cancellation.<sup>28/</sup> The performance requirement can be extended for a period equal to a delay (but not to exceed three years) occasioned by unforeseen causes without the fault or negligence of the lessee.<sup>29/</sup>

1971 - There is no production requirement. Lessee has option, beginning with calendar year six, of either (a) producing lease minerals to a royalty value of \$1.00 per acre, increasing by \$1.00 per acre each year until calendar year ten, when a royalty value of \$5.00 per acre is reached, or (b) paying an amount equivalent to such royalty values in lieu of any production.<sup>30/</sup>

Beginning with calendar year eleven, the lessee has the option (for the example given in the Lease Form) of either (a) producing 3,500 tons of 30-gallon oil shale per day or (b) of paying an amount equivalent to the royalty value of such production in lieu of production.<sup>31</sup> The requirement for production or payment of an amount equivalent to the royalty value of such production in lieu of production increases each year by 3,500 tons per day to and including the twentieth year, when the requirement is production of 35,000



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tons of oil shale per day or, in lieu thereof, an amount equivalent to the royalty value of production of 35,000 tons of oil shale per day.<sup>32/</sup>

F. Environment

1968 - Specific requirements incorporated in lease, including compliance with all applicable federal, state and local air and water quality standards.<sup>33/</sup>

The United States and lessee not less often than at five-year intervals to jointly review advances in conservation and reclamation technology and to determine whether existing environmental requirements should be modified taking into account costs as well as benefits of such improved technology.<sup>34/</sup>

Bond required to be sufficiently large to assure compliance. Amount of bond to be determined at time of approval of mining plan.<sup>35/</sup>

Mining plan required to be filed and approved before mining commences. Plan is to contain the specific procedures by which environmental conditions are to be met. Department has right to modify or reject plan.<sup>36/</sup>

Department has right to suspend operation to assure compliance with environmental requirements or with



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the government's orders or instructions relative thereto.<sup>37/</sup>

In the event lessee is required to cease operations by reason of failure to comply with safety or environmental requirements, the lessee is to pay liquidated damages for each day of shutdown equal to the average daily royalty paid over the last 12 months or the daily royalty payable on the mining of 50,000 tons of 30-gallon oil shale, whichever is the larger, until action is taken by the lessee to secure compliance.<sup>38/</sup>

1971 - There are to be incorporated in each lease stipulations of the general requirements developed by the government in accordance with 43 CFR § 23.5.<sup>39/</sup>

Lessee must comply with all applicable federal, state and local water and air quality standards.<sup>40/</sup>

Mining plan required, approved in accordance with 43 CFR Part 23, and lessee required to comply with shutdown and other requirements.<sup>41/</sup>

Bond of not less than \$500.00 per acre affected during each three-year period of operation but



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in no event less than \$2,000.00, to be conditioned upon faithful compliance with the regulations in 43 CFR Part 23, the environmental provisions of the lease and the environmental provisions of the mining plan.<sup>42/</sup> Lessee to avoid unnecessary damage to forage, timber, crops and improvements. United States may prescribe remedial measures in event of damage.<sup>43/</sup>

G. Patents

1968 - Lessee to grant licenses at reasonable royalty rates to any invention or discovery relative to treatment and recovery of oil shale, shale oil (other than refining) or minerals (other than oil or gas, and coal and asphaltic materials) falling under the lease made in first five years of lease or prior to initiation by Department of the Interior of a general commercial shale leasing program, whichever is the earlier. No license need be granted prior to the expiration of the period referred to in the preceding sentence. Lessee to submit a report showing the information, results and data developed during that period.<sup>44/</sup>

1971 - No comparable provision.



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#### ANALYSIS OF DIFFERENCES

There are three principal areas of differences between the 1968 and 1971 programs. These lie in (a) production and payment aspects, (b) environmental control provisions, and (c) treatment of inventions and discoveries. Each will be examined, following which some observations are made concerning their relationship to the objectives of the program.

Before examining these differences, it is desirable to consider the extent to which the two programs are in agreement on assumptions as to technology and economics of oil shale production.

To the extent that these two programs start from comparable assumptions as to technology costs, differences in lease terms will tend to reflect either differences in objectives or differences of opinion as to how given policy objectives on which there is agreement can best be achieved. On the other hand, substantial differences over the state of the technology or the economics of producing shale oil would heavily influence the objectives of a leasing program, thus complicating the task of comparison and analysis.



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The two programs are in fundamental agreement on technology and economics. Only modest advances in mining, or in in-situ or above-ground retorting technology are assumed or noted in the 1971 Program Statement<sup>45/</sup> and its accompanying draft of environmental impact statement.<sup>46/</sup>

As for oil shale economics, the 1971 Program Statement assumes that there has been some improvement relative to natural crude oil economics since the 1968 analysis. On page VI-19 of the 1971 Program Statement, it is pointed out that while costs for the "improved first generation" retorting plan increased about 45 cents per barrel between 1966 and 1970, this increase was balanced by a similar rise in the price of crude oil. The increased depreciation tax allowance of 15 cents per barrel resulting from the change in the point of application of the depletion allowance brought about by the Tax Reform Act of 1969<sup>47/</sup> is noted and the conclusion is reached that "the economic viability of shale oil production has been enhanced when compared to crude petroleum".<sup>48/</sup>

The 1971 Program Statement reaches the conclusion that "each of the supplemental sources [i.e., coal, oil shale and tar sand] is nearly competitive economically with crude oil using processes currently known but not yet commercially proved."<sup>49/</sup>



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By way of comparison, in respect of oil shale the 1968 Report concludes that the first shale oil plant would be marginally attractive at a 12-percent discounted cash flow if the shale itself is provided free of charge but notes that because of the high technological and other risks involved, a higher discounted cash flow might be desired by an investor.<sup>50/</sup>

Thus, the two reports are in fundamental agreement that economic feasibility, even with the shale itself provided free of charge, has not yet been reached but that the prognosis is good once the technological advances expected to be attained in the operation of a first generation plant have been achieved.

Against this background, the differences in the 1968 and the 1971 Lease Forms will be analyzed.

#### 1. Production and Payment

##### (a) The 1968 Program

The 1968 Lease Form requires the lessee, by the twelfth year, to have maintained substantially full-scale production consistent with characteristics of the leased site, over the three preceding years, or risk losing his lease.<sup>51/</sup> An extension



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of time of not more than three years is provided for failure to meet this requirement due to unavoidable causes (including failure of the technological processes) occurring without the fault or negligence of the lessee.<sup>52/</sup> Otherwise, the production requirement is absolute. The production requirement is 40,000 barrels per day for Tract 1, 25,000 barrels per day for Tract 2, and 35,000 barrels per day on Tract 3. Using the cost estimates of the 1968 Report for a 35,000 barrel per day of semi-refined shale oil plant would involve a capital investment of \$138 million in plant, including investment in mining and annual operating costs of \$26,800,000.00.<sup>53/</sup>

This requirement in the 1968 Lease Form provided a disincentive against holding the leased land without actual and substantial development of the oil shale resource.

The 1968 Lease Form defers bonus payments until commencement of year eight<sup>54/</sup> and permits application against the bonus of production royalties for the first years, up to a specified maximum for each tract.<sup>55/</sup> The delayed bonus was explained in the 1968 Report as being intended to permit the lessee time to construct his plant and mine without having to



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discount his bid for the unproductive early years. The royalty offset permitted a bidder to offer a higher bonus if he expected to be in commercial operation but it made it unprofitable to hold the land for speculative purposes.<sup>56/</sup>

The 1968 Report suggested that initial investment requirements could be substantially reduced were a developer to undertake initially construction of a single, 5,000 barrel-per-day test module rather than a full-scale plant and mine immediately. Such a module, it was postulated, would permit mining, retorting and semi-refining on a sufficient scale to permit more confident cost estimates, to improve technology and to prove the technology of a full-scale retort.<sup>57/</sup> At the same time much of the investment in such a module could be recovered since it could be designed in such a way as to form a unit of the subsequently constructed full-scale mine and plant. If no unusual difficulties were encountered, such a preliminary program could be completed with sufficient time being allowed to construct the full-size facility meeting the production requirement and to gain the benefit of the royalty credit,<sup>58/</sup> before the eighth year when minimum royalties commence.



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The production and deferred bonus royalty offset features of the 1968 Lease Form were foreshadowed by the February 1965 report of the Oil Shale Advisory Board.<sup>59/</sup> The Board unanimously stated that one of the objectives of the Federal oil shale policy should be:

"4. To prevent speculative use of leased Federal lands to the detriment of oil shale development."

One of the alternative courses suggested by the Board was that:

"(2) The Federal government should open for private leasing upon application or on government's own initiative a few commercial-size tracts of competitive bidding, with firm performance requirements that would make it impossible for a company to hold the land indefinitely without developing it. Lease terms would provide for a Research stage for those companies not yet ready for full scale development, with performance measured in dollar outlay. By offering a small selection of nominated lands in increments (much as is done now in the case of the off-shore lands in the Gulf of Mexico), land values and conservation hazards would become known as the industry grows. This approach aims to rely principally 4/ on private initiative as a means for proceeding with needed research and the development of an oil shale industry." (Footnote omitted) 60/

Mr. Mock, a member of the Board who was later to serve on the Public Land Law Review Commission, recommended that the leases:

"(d) Require certain developments for each unit on increasingly stringent terms so as to minimize speculative holdings. Each unit should be considered separately." 61/



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(b) The 1971 Program

The 1971 Program does not include production or investment requirements. These were cited by the Chairman of the Council of Economic Advisers as among the "critical differences" between the 1968 and the 1971 programs.<sup>62/</sup> Instead, it allows the lessee to choose between production and in lieu payments at levels lower than under the 1968 Lease Form and permits a lessee to relinquish the leasehold at his discretion by no later than the third anniversary date with no further obligation to pay the remaining installment of the bonus.<sup>63/</sup>

Assuming a leasehold of the full 5,120 acres permitted by law, rental for the first five years would amount to \$12,800.00<sup>64/</sup> and the \$1.00 per-acre initial payment called for by the 1971 Lease Form<sup>65/</sup> would in year six amount to \$5,120.00. By year ten, when the in lieu payment is \$5.00 per acre,<sup>66/</sup> (\$25,600.00 for a full 5,120 acres) the cumulative in lieu payment for a 5,120-acre leasehold over years six through ten would total \$76,800.00. Adding the first five-year rental payments (\$12,800.00) give a total cost for the first 10 years of \$89,600.00.

Beginning with year eleven, the in lieu payment would be computed on the basis of royalties that would have been payable on



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a stipulated production.<sup>67/</sup> The production stipulated is 3,500 tons of 30-gallon shale per day, a quantity from which, at a recovery efficiency of 100 percent, 2,500 barrels of shale oil per day could be produced.

Since the production rate (and the in lieu equivalent payment option) increases by an annual rate of 3,500 tons per day for each succeeding year through year twenty, by the twentieth year the lessee would have the choice of either having in operation a 25,000-barrel-per-day plant and paying the royalty thereon or in lieu of production of paying an amount equivalent to the royalty on production from such a plant.

In dollar amounts these in lieu payments would begin at about \$151,200.00 in year eleven and increase by the same amount each year (on the basis of 360 production days per year) to \$1,512,000.00 in year twenty.

It follows that a lessee under the 1971 Program could hold a leasehold of 5,120 acres of 30-gallon shale without production by making payments (in addition to the bonus) totaling \$8,316,000.00 over years eleven through twenty.

To hold the leasehold without production for the entire 20 years would (in addition to the bonus) cost less than \$8,500,000.00, or an average of less than \$425,000.00 per year, or about \$83.00 per acre per year. It is doubtful that in lieu payments on such a modest scale



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will either "spur development" or "avoid long delays before development", the two purposes ascribed to the in lieu payments by the 1971 Program Statement.<sup>68/</sup> The production rate upon which they are based (3,500 tons per day beginning in year eleven, rising to 35,000 tons per day in year twenty, which could serve a plant with a capacity of 25,000 barrels of shale oil per day) are likewise minimal. The production rate for year eleven is only three times the capacity of the Union Oil Company pilot plant (1,200 tons per day) and only three and one-half times the capacity of the Tosco pilot plant (1,000 tons per day). These pilot plants functioned in the 1950's and the 1960's.

In the evaluation of the state of technology and economics in the 1968 Report, a plant of 35,000 barrels per day semi-refined, (40,000 crude) was selected for the base case.<sup>69/</sup> Among the comments received from industry on the report was that the size of the lease was too small to support a plant size sufficiently large to be economic. Industry judged this to be in the order of 100,000 barrels per day.<sup>70/</sup>

The 1971 Program Statement (pages V-2 and V-3) assumes that after one year of operation at the 10,000 barrel-per-day level, each of the plants would then be increased to a size



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capable of producing 50,000 barrels per day. That assumption, along with industry comments on the 1968 Report, would appear to make the requirement of only 25,000 barrels-per-day production for the twentieth year of the 1971 Lease Form (a production rate which would not be called for until 1993) unrealistic in terms of an economic commercial oil shale development.

## 2. Environmental Controls

Both the 1968 Program and the 1971 Program contemplate strict environmental controls. The 1971 Program Statement emphasizes that environmental considerations may well control the final decision on whether to proceed with the prototype leasing program.<sup>71/</sup>

The 1968 Lease Form specifies the environmental requirements to be met, provides for a bond and requires approval of a mining plan which contains the specific procedures by which the specified general environmental requirements are to be met.<sup>72/</sup> In accordance with current Interior Department practice<sup>73/</sup> and regulations,<sup>74/</sup> the specific environmental requirements to be met by the lessee under each lease to be issued under the 1971 Program are to be formulated upon the basis of a technical examination to be made in relation to the particular



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site to be offered for lease. The Department's press release of June 29, 1971, characterizes these stipulations as being "especially tailored for the site and the anticipated problems involved."

The 1968 Lease Form's environmental provisions have been described as being "Strict open ended requirements with many unknowns." The same source described the 1971 Program environmental provisions as "Strict requirements which will be defined in the lease."<sup>75/</sup>

However, the 1968 and the 1971 environmental stipulations appear to be comparable both with respect to the detail specified. It would seem to follow, therefore, that bidders would apply the same discount factor under both lease forms. The 1968 provisions were themselves "tailor made" for the sites involved, having been developed by a departmental task force specifically for the three tracts offered for lease.<sup>76/</sup> Moreover, the 1968 provisions appear to be comparable to representative Interior Department "general requirements" for environmental protection formulated in accordance with the procedures in 43 CFR § 23.5.<sup>77/</sup>



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There are, however, two substantive differences between the lease forms which involve environmental considerations.

First, the 1968 Lease Form provides for liquidated damages (representing lost royalties) to be paid to the government in the event the lessee is required to suspend operations by reason of failure to comply with the environmental stipulations or with air or water pollution control laws and regulations.<sup>78/</sup> There is no counterpart in the 1971 Lease Form.

Second, the 1971 Lease Form authorizes the offset of extraordinary environmental costs against royalties (royalty credits) in the event the Secretary determines that compliance with the environmental requirements of the lease entails extraordinary costs.<sup>79/</sup> There is no counterpart in the 1968 Lease Form.

The 1971 Program Statement explains the purpose of the royalty credit provision as follows:

"The royalty credit provision is designed to achieve the maximum possible environmental integrity while allowing an oil shale industry to achieve commercial stature and thereby bring oil from oil shale into the nation's energy supply. The provision has been devised specifically and only for inclusion in the six prototype leases provided for in the planning program and only as an effort to



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promote the development of a presently nonexistent industry. There is no intention to include such a provision in any later oil shale leasing efforts, nor in leases covering other minerals which are utilized in established industries." 80/

With substantial mining and production, it is anticipated in both the 1968 Report and the 1971 Program Statement that considerable reductions in production costs would result. It could well be, under such conditions, that economically feasible solutions might be found to "extraordinary environmental hazards", should any be encountered. Therefore, if the six prototype leases to be issued under the 1971 Program (during the course of which considerable cost reductions might not be achievable) were to require a substantial commitment to actual production, the royalty credit for these leases would appear to be reasonable. On the other hand, unless the lessee actually undertakes substantial efforts in development, the objective sought to be achieved by the royalty credit cannot be accomplished and it will not contribute toward achievement of the prototype program's goal, which is:

"The goal of the Department of the Interior's proposed prototype leasing program is to provide a new source of energy for the Nation by stimulating the timely development of commercial oil shale technology by private enterprise, and to do so in a manner that will assure the minimum possible impact on the present environment while providing for the future restoration of the immediate and surrounding area." 81/



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The 1968 Lease Form did not provide a royalty offset for unanticipated extraordinary environmental costs. Its inclusion would have been consistent with the objectives of the 1968 Program. The 1968 Lease Form did, however, contain an environmental provision that would appear to be a useful device to secure an upgrading in conservation and reclamation to accord with technological advances occurring subsequent to lease issuance. The reference here is to the provision of the 1968 Lease Form which provided for periodic review to determine the desirability of modifying the conservation and reclamation requirements to take technological improvements into account.<sup>82/</sup>

### 3. Inventions and Discoveries

Under both programs, inventions and discoveries made by the lessee remain his property. They do not become the property of the government. However, the 1968 Lease Form<sup>83/</sup> provided for the lessee to grant nonexclusive licenses on a reasonable royalty basis upon request of any responsible applicant for any invention or discovery made within either the first five years of the lease or prior to the initiation by the government of a general program of oil shale leasing, whichever is the earlier. The requirement did not apply to inventions or discoveries relating to conversion of shale oil



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to a pipeline pumpable product and no license could be required to be granted prior to either the expiration of the first five years of the lease or the initiation of a general oil shale leasing program, whichever first occurred.

Such a limited license provision is consistent with the concept of initial, limited lease programs, such as the 1968 and 1971 programs, as steps in the development of a viable, widespread commercial oil shale industry, particularly since lessees will be afforded the opportunity for a considerable "head start" in the utilization of federal oil shale lands. The absence of a comparable provision in the 1971 Lease Form presents a question as to the effectiveness of the program in stimulating development of a widespread commercial oil shale program if technological breakthroughs are made by a lessee or lessees under the 1971 Program.

#### Conclusion

The 1968 Program elicited little interest among bidders and attracted only nominal bids.<sup>84/</sup> This result was foreseen in the 1968 Report which stated:

"A major finding of this study is that it has been economic and technologic factors rather than the availability of land that have held back shale-oil development. There are large blocks of private lands, with clear title, that are particularly well suited for the most advanced oil-shale technology. Without title clarification, Government ownership of land of this type in the Piceance Creek Basin is limited (about 1 percent) in blocks large enough for production leasing,



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excluding the Naval oil-shale reserve. Nearly 20 percent of the oil-shale lands in the Piceance Creek Basin are in private ownership, but such ownerships may not be by those firms having the technology, financial resources, and need for commercial production.

"This study indicated that the value of the resource in place now is small, and will remain so until new technology has been developed and proved. Industry, if it purchases the resource subject to the development of improved technology in the future, probably would discount its bid at the rates it uses for alternate delayed return investment opportunities. Since this could reduce the bonus bids, the Government should alienate little of its holdings until improved technology is developed or shown to be available by bids of appropriate size." 85/

Why then was the 1968 test lease program proposed? The answer, as stated in the 1968 Report, was:

"There may be proprietary technology available that could make test leasing desirable for both thick and thin shale formations. Because the Government owns much of the thick, deep beds of the Piceance Basin, those with advanced technology to exploit this type of deposit might not be able to use their knowledge for commercial production without leases being offered. Moreover, some firms do not have sufficient oil-shale holdings and may wish to initiate a commercial venture using conventional technology in the thinner shale beds. ...." 86/

In commenting on the lack of bidding interest at the December 1968 sale, the then Secretary of the Interior stated:

"Industry apparently did not feel as confident as we did that what is needed at this time is construction of a first-generation commercial sized plant."

\* \* \* \* \*



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"Probably the principal conclusion to be drawn from the lack of bidding interest is that industry apparently doubts that technology has reached the stage where it would be prepared to undertake the large scale investment necessary for commercial development."

"Other factors may also have played some part in industry's decision not to bid at the lease sale," Udall continued. Among other factors that have been mentioned, he added, are whether domestic price levels for crude oil will remain substantially higher than the world market price; the recent Alaskan oil discoveries; problems associated with mining on the particular tracts offered in the shale sale; tax considerations; and the Mineral Leasing Act's prohibition against the holding of more than one oil shale lease by any one company, and the Act's limitation of leases to no more than 5,1200 acres each."<sup>87/</sup>

Of the other factors mentioned by the Secretary in 1968, price and tax considerations no longer appear to be inhibiting factors,<sup>88/</sup> and Alaskan oil will satisfy only a small fraction of the nation's petroleum requirements.<sup>89/</sup> However, the limitations of the Mineral Leasing Act remain as potentially serious problems.

The 1971 Program has a somewhat different purpose than the 1968 Test Lease Program. The objectives of the 1968 Program were to determine if proprietary technology unknown to the government was available or if industry, with the technology known to the government, was willing to take the economic risks



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inherent in actual construction of a first-generation commercial size plant under lease terms allowing both time and financial incentives for necessary start-up and development activities. The 1971 Program has as its purpose the stimulation of private investment in commercial oil shale development. The goal of the program is thus described:

"The goal of the Department of the Interior's proposed prototype leasing program is to provide a new source of energy for the Nation by stimulating the timely development of commercial oil shale technology by private enterprise, and to do so in a manner that will assure the minimum possible impact on the present environment while providing for the future restoration of the immediate and surrounding area."

As has been noted earlier, the 1971 Program is based on substantially the same technology and oil shale economics that underlay the 1968 Report. The omission of any production requirement from the 1971 Program, the fact that a leasehold thereunder can be held without production for payments (in addition to the bonus) amounting to an average of \$83.00 per acre per year over the first 20 years of the lease and the provision for a royalty credit for extraordinary environmental costs in the event development is actually undertaken by a lessee, all appear to be designed to remove what the 1971 Program Statement refers to as the "economic constraints" of the 1968 Test Lease Program.<sup>90/</sup>



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In sum, the 1971 prototype leasing program offers an opportunity to private industry to obtain and hold up to six leaseholds for at least 20 years at a total land cost of about \$8.5 million each, plus the bonus, with the scope and pace of research and development within that time frame to be determined by each lessee.

It remains to be seen whether the 1971 Program will actually achieve its goal of stimulating the timely development of commercial oil shale technology.<sup>91/</sup> The factors which would appear to have an important bearing on the probabilities of success of the program will be briefly discussed.

There is a substantial amount of shale land in private ownership having characteristics which make it suitable for first-generation technology.<sup>92/</sup> This would seem to indicate that companies which already have a position in oil shale land might have little incentive to add to their costs by the amount of the bonus and the annual rental and in lieu payments required. Moreover, each such company in deciding whether and what to bid would have to take into consideration the fact that its eligibility for oil shale leases in the future, when land of better shale quality or improved technology, or both, might make leasing more attractive, will depend on the willingness of Congress to change the law.<sup>93/</sup>



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The problem posed by the marginal economics of a first-generation plant also presents questions as to the attractiveness of the program to companies that do not have privately owned shale lands at their disposal.

Such companies, if they mean to move forward with first-generation plants, would face the necessity of making capital investments of well above \$200 million in each plant and mine.<sup>94/</sup> The royalty credit in the event of extraordinary environmental costs should be helpful in encouraging such investment. However, such companies would have to weigh their future ineligibility for another lease (unless Congress changes the law) against the possibility that development of their leaseholds might not be economically viable.

Unless a bidder has technology which he regards as almost a sure thing both technically and as a matter of economics, he would probably prefer to confine himself to research (or to simply hold the lands) rather than, at least at a relatively early time, risking the heavy investment in mine and plant construction required by actual development. Particularly would this appear to be the case considering the possibility that either a research breakthrough or, at the very least, significant improvements in technology might result from the expenditure of research dollars by himself or



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others interested in oil shale development. In that event, assuming that the new technology were to be available to him, later development of the leasehold would be both less risky and more rewarding.

The fact that the lessee would be committed to pay a bonus over the first five years of the lease is not in itself necessarily an incentive to early development even were the bonus to be substantial. In economic terms, the question facing an investor is not what to do about costs already sunk-- i.e., the bonus. The relevant questions are the investment alternatives offering the greatest return on capital currently available for investment and the added problems posed by the legal limitation to but one lease.

Only if a lessee can obtain a lease on high-quality shale land at a bonus bid which heavily discounts the risk factors, would bidding appear to be warranted even to obtain a leasehold for research or speculative purposes. But the very factor which might render the lease attractive to an investor, i.e., a heavily discounted bonus bid reflecting the high risks involved, would tend to make such leasing unattractive from the government's point of view. The question the government must face in that event is whether it should alienate for at least 20 years, high-quality oil shale land at heavily discounted



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bonus bids with no commitment on the part of the lessees to invest meaningful sums in either construction or research.

The premise of the proposed prototype oil shale leasing program is that, if the environmental questions can be satisfactorily resolved, there is a need for the development of a commercial shale oil industry as a part of the national energy mix. Development of such an industry, if undertaken now, would, according to the 1971 Program Statement, result in some commercial development by 1980 with a great potential thereafter.<sup>95/</sup> The Committee will no doubt examine this premise and the contribution that a viable commercial shale oil industry can make in the national interest.

Assuming that the Committee's inquiry substantiates the need and importance in the national interest of undertaking at this time to stimulate development of a commercial shale oil industry, the Committee must focus on whether the proposed prototype leasing program will significantly contribute to that objective. There must be taken into consideration the fact that if the 1971 program does not achieve its stimulative goal, additional delays will result from the very effort to carry that program through.



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If it is in the national interest that shale oil development go forward at this time, the question to be resolved would appear to be the determination of the best alternative means to that end.

There are a number of alternatives covering the spectrum ranging from the government's construction of the first full-scale plant to a government commitment to purchase the output of the first commercial size privately financed plant at a guaranteed price. Within those outer limits there are a number of other alternatives which could be explored, and which do not require either that the private participant sacrifice his eligibility for a future lease or that the government lease shale land for minimal returns.

A variety of arrangements are possible by means of cooperative agreements pursuant to the Public Land Administration Act.<sup>96/</sup>

Another alternative is suggested by legislation along the lines of S. 2510.



FOOTNOTES

1/ The 1968 program evolved from recommendations made in the Department of the Interior's May 1968 report entitled "Prospects for Oil Shale Development, Colorado, Utah and Wyoming", hereinafter referred to as "1968 Report". The 1971 program is set out in the report entitled "Program Statement for the Proposed Prototype Oil Shale Leasing Program, U.S. Department of the Interior, June 1971", hereinafter referred to as "1971 Program Statement". The lease form developed for the 1968 program is "Oil Shale Lease Form No. 1, Rev. - December 10, 1968 (33 F.R. 16156; 33 F.R. 18523) and is hereinafter referred to as "1968 Lease Form" or by the reference "1968". The proposed lease form for the 1971 program is "Form 3170-1 (June 1971)" which appears at page 134 of Appendix B of the 1971 Program Statement. That lease form is hereinafter referred to as "1971 Lease Form" or by the reference "1971".

2/ 1968 Report, 129. Interior Press Release, November 4, 1968.

3/ 1971 Report, i. Interior Press Release, June 29, 1971.

4/ Interior Press Release, November 4, 1968.

5/ If the proposed program appears feasible after an evaluation of data developed from drilling and consideration of a final environmental statement. Final decision whether to proceed is not to be made before mid-summer of 1972. 1971 Report, ii, III-17-18, Interior Press Release, June 29, 1971.

6/ Section 21 of the Mineral Leasing Act as amended (30 U.S.C. § 251) subjects "royalties" to readjustment by the Secretary of the Interior "at the end of each twenty-year period". Under the 1968 Lease Form (Section 4(d)), the first 20-year period for purposes of royalty readjustment was to have commenced with January 1 of the year in which the lessee first produced a daily average of 40,000 barrels on Tract 1, 25,000 barrels on Tract 2, or 35,000 barrels on Tract 3. Under the 1971 Lease Form (Section 3(d)), the 20-year period will run from the date of the lease.



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7/ Notice of Invitation for Bids, October 31, 1968, 33 F.R. 16154, 16155, November 5, 1968.

8/ 1971 Program Statement, III-1, III-18 Interior Press Release, June 20, 1971.

9/ Oil Shale, Prelease Drilling Permits, September 12, 1968, 33 F.R. 13042, September 14, 1968, as amended on September 18, 1968, 33 F.R. 14241, September 20, 1968, and on October 10, 1968, 33 F.R. 15264, October 12, 1968.

10/ 1971 Program Statement, Appendix A, A-1.

11/ 1968 Program--Notice of Invitation for Bids, 33 F.R. 16154; Interior Press Release, November 7, 1968. 1971 Program--1971 Program Statement, III-6; Interior Press Release, June 29, 1971.

12/ 1968 Lease Form, Sec. 2(b)-(h).

13/ 1971 Program Statement, Appendix B-1, states that "Definitions of oil shale and its products as used in the proposed lease form will be incorporated in the leasing regulations now being formulated."

14/ 1968 Lease Form, Secs. 3(d), 3(c)(5).

15/ 1971 Lease Form, Secs. 2(r)(1) and (2).. Under this provision, as noted in the text, the requirement for equality in the amount of the bonus installments does not apply to the initial installment. Under the 1971 Lease Form, therefore, the down payment on the bonus might be fixed at a low or nominal amount in which event, if a lessee were to surrender the lease on or before the third anniversary date, his total bonus payments would be smaller. However, failure to specify in the 1971 Lease Form that all five installments are to be equal in amount may have been inadvertent since page III-7 of the 1971 Program Statement refers to the bonus being paid in "five equal installments".

16/ Section 21, Mineral Leasing Act of February 25, 1920, as amended; 15 U.S.C. § 241.

17/ 1968 Lease Form, Sec. 2(b); 1971 Lease Form, Sec. 2(b).

18/ 1968 Lease Form, Sec. 3(c)(6).

19/ 1968 Lease Form, Sec. 3(c)(1).



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20/ Interior Press Release, December 27, 1968.

21/ 1968 Lease Form, Sec. 3(c)(2).

22/ 1968 Lease Form, Sec. 3(c)(5).

23/ 1971 Lease Form, Sec. 2(d)(2) and (4).

24/ 1971 Lease Form, Sec. 2(c)(1) and (2).

25/ According to 1971 Program Statement, Appendix B-1 and 2. However, no provision therefor is included in the 1971 Lease Form.

26/ 1971 Lease Form, Sec. 2(c)(3)(iv).

27/ 1971 Lease Form, Sec. 5(e).

28/ 1968 Lease Form, Sec. 4(e).

29/ Ibid.

30/ 1971 Lease Form, Secs. 2(d)(1) and (2).

31/ 1971 Lease Form, Secs. 2(d)(3) and (4).

32/ Ibid.

33/ 1968 Lease Form, Secs. 7(a)-(f) and (i).

34/ 1968 Lease Form, Sec. 7(g).

35/ 1968 Lease Form, Sec. 7(h).

36/ 1968 Lease Form, Sec. 7(j).

37/ 1968 Lease Form, Sec. 7(k).

38/ 1968 Lease Form, Sec. 7(l).

39/ 1971 Lease Form, Sec. 5(a).

40/ 1971 Lease Form, Sec. 5(b).



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41/ 1971 Lease Form, Sec. 5(c) and (d).

42/ 1971 Lease Form, Sec. 5(e).

43/ 1971 Lease Form, Sec. 5(f).

44/ 1971 Lease Form, Sec. 16.

45/ This can be seen by a comparison of Figure 8 at page 47 of the 1968 Report with the figure on page B-11 of the 1971 Environmental Impact Statement. This shows that additional new information has been gained during this period on some aspects of in-situ processing (fracturing methods, retorting in both chimneys and in-information, and in-product recovery). However, even with these advances in-situ is still rated by the 1971 report as being less advanced than above-ground retorting. Above-ground retorting technology is shown, on page B-11 of the 1971 Impact Statement, not to have advanced significantly between the 1968 and 1971 reports. Nor has mining technology.

46/ Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program, U.S. Department of the Interior, June 1971.

47/ Sec. 501, Act of December 30, 1969 (P.L. 91-172, 83 Stat. 487).

48/ 1971 Program Statement, VI-20.

49/ Ibid., VI-19.

50/ 1968 Report, 77. See also Appendix B. Both 12 percent and 20-percent discounted cash flow calculations were made for the 1968 Report. The reasons were stated at page B-4 as follows: "The 20 percent discounted cash flow (DCF) rate of return after taxes was selected since: (1) The technology to be used in the first plants has been extrapolated beyond existing data; (2) industry believes that the first investments in a new product line require this amount of return, and (3) the first plants are expected to be obsolete in a very short period of time. The initial shale oil plant at each new stage of technology would require this rate. A 12 percent DCF rate has been taken as the return after taxes required on capital in proven mining and manufacturing endeavors.<sup>1/</sup> The second and subsequent plants in each technology would require the expectation of this rate of return." (footnote omitted)



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51/ 1968 Lease Form, Sec. 4(e).

52/ Ibid.

53/ 1968 Report, 65.

54/ 1968 Lease Form, Sec. 3(b).

55/ Ibid., Sec. 2(c)(5).

56/ 1968 Report, 130.

57/ Ibid., 78.

58/ 1968 Lease Form, Secs. 3(c)(5) and 4(e).

59/ The Oil Shale Advisory Board was an ad hoc advisory group appointed June 30, 1964 by the Secretary of the Interior to identify and evaluate major public policy questions associated with the development of oil shale deposits on federally owned lands. Joseph L. Fisher was Chairman and Orlo E. Childs, Milo Perkins, John Kenneth Galbraith, Benjamin V. Cohen and H. Byron Mock were the other members.

60/ Interim Report of the Oil Shale Advisory Board, 7.

61/ Ibid., 32.

62/ Letter to Senator Gordon Allott from Honorable Paul W. McCracken, August 6, 1971, appearing in "Hearings before the Committee on Interior and Insular Affairs, United States Senate" entitled "The President's Energy Message", Serial No. 92-1, June 15, 1971, 82-84. See also, letter from Kingsley V. Schroeder, Vice President-Production, Sunoco Division, Sun Oil Company, to the Department of the Interior, dated December 18, 1968, stating "the main reasons" for Sun's reluctance to bid at the December 1968 oil shale lease sale. Two of the reasons given were: (1) Unless a company is prepared to make an immediate and substantial commitment to shale oil production, the terms of the lease seem to us to introduce an unnecessary element of risk and severely limit profit potential. (4) The leases can be continued beyond the eleventh year only upon the attainment of an average production of 25,000 to 40,000 barrels of shale oil per day (depending on tracts involved) over the preceding three year period; otherwise they are subject to cancellation.



## Footnotes - Page 6

- 63/ 1971 Lease Form, Secs. 2(d), 2(c)(1)(iv) and 2(r).
- 64/ On the basis of fifty cents per acre per year and no royalties against which to offset. See 1971 Lease Form, Sec. 2(b).
- 65/ 1971 Lease Form, Sec. 2(d)(2).
- 66/ Ibid.
- 67/ Ibid., Sec. 2(d)(4).
- 68/ 1971 Program Statement, III-8.
- 69/ 1968 Report, Appendix B.
- 70/ Letters from Cameron and Jones, Continental Oil Company, Getty Oil Company, Rocky Mountain Oil and Gas Association and Mobil Oil Corporation to the Secretary of the Interior, dated, respectively, August 19, 1968, August 22, 1968, August 21, 1968, August 27, 1968, and August 29, 1968.
- 71/ 1971 Program Statement, ii; Interior Press Release, June 29, 1971.
- 72/ 1968 Lease Form, Secs. 7(h) and (j).
- 73/ Bureau of Land Management Manual, Part 3509.
- 74/ 43 CFR § 23.5.
- 75/ Letter to Senator Gordon Allott from Honorable Paul W. McCracken, cited n. 62, supra.
- 76/ Interior Press Releases, September 30, 1968 and October 14, 1968.
- 77/ See e.g., Bureau of Land Management Manual, Part 3509, Illustration 2; Notice of Competitive Coal Lease Offering, Peabody Sale M-10179, published in the Forsyth Independent, Forsyth, Montana, January 28, February 4, 11, 18, 1971; 1971 Program Statement, A-3-8.
- 78/ 1968 Lease Form, Sec. 7(1).
- 79/ 1971 Lease Form, Sec. 2(c)(3)(iv).
- 80/ 1971 Program Statement, B-2.



## Footnotes - Page 7

81/ Ibid., I-2.

82/ 1968 Lease Form, Sec. 7(g).

83/ Ibid., Sec. 16.

84/ Interior Press Release, December 27, 1968.

85/ 1968 Report, 125-126.

86/ Ibid., 129.

87/ Interior Press Release, December 27, 1968.

88/ The change in the point of application of the depletion allowance brought about by the Tax Reform Act of 1969 appears to have resolved the tax problem. There is a widespread belief in industry and governmental circles that domestic oil prices must and will rise. See, e.g., Oil and Gas Journal, September 20, 1971, page 61; Interview with Honorable Edward E. David, Jr., President's Science Adviser, U.S. News and World Report, October 18, 1971, page 53; Speech by Honorable Hollis M. Dole, Assistant Secretary of the Interior, before American Association of Oilwell Servicing Contractors, New Orleans, Louisiana, February 11, 1971; Hershey, "Financing in Oil", New York Times, October 24, 1971, page 16.

89/ 1971 Program Statement, VI-13.

90/ Ibid., III-1.

91/ See, 1971 Program Statement, I-2. The 1971 Program Statement assumes, on the basis of "the most optimistic projections" that of the six installments in operation in the 1973-1983 period, some will be on private lands. In other words, the 1971 Program Statement assumes that not all of the six proposed prototype federal leases will actually materialize. See, 1971 Program Statement, V-1-3.

92/ 1968 Report, 125. The 1971 Program Statement assumes that at least some of the first developments will be on private land. See, n. 91, supra.

93/ 43 U.S.C. § 241 prohibits the granting of more than one oil shale lease "under this section" to any one person, association or corporation, with an exception not here material. See, "The Oil Shale Policy Problem", Department of the Interior, July 7, 1964, at 25.



## Footnotes - Page 8

94/ 1971 Program Statement, V-9.

95/ Ibid., VI-20.

96/ 43 U.S.C. §§ 1361-1364 (74 Stat. 506). Sections 1362 and 1363 read as follows:

§ 1362 The Secretary of the Interior may conduct investigations, studies, and experiments, on his own initiative or in cooperation with others, involving the improvement, management, use, and protection of the public lands and their resources under his jurisdiction.

§ 1363 The Secretary of the Interior may enter into cooperative agreements involving the improvement, management, use, and protection of the public lands and their resources under his jurisdiction. The provisions of this section shall apply only in those cases where the making of cooperative agreements for such purposes is neither expressly authorized nor expressly prohibited by other provisions of law.

See, also the discussion in the 1968 Report, at 126-127.



## STATEMENT OF AMERICAN PUBLIC POWER ASSOCIATION

American Public Power Association, a national trade organization representing over 1,400 local publicly owned electric utilities in 47 States, Guam, Puerto Rico, and the Virgin Islands, is interested in the role of oil shale in a national fuels and energy policy, S. 2510 that would create a New Energy Sources Corporation, and the proposed oil shale leasing program.

APPA is concerned about the development of oil shale because it can provide a fuel to operate power plants. Approximately 900 publicly-owned electric utilities generate all or part of their power requirements. Some of these systems, plus the remainder of the Nation's over 2,000 publicly-owned electric utilities, purchase power at wholesale from bulk suppliers who might employ shale oil as a fuel.

It is our belief that adequate safeguards should be provided in the development of this great national resource so that public interests are fully protected. Eighty per cent of oil shale resources are on lands owned by the government of the people of the United States; these resources should be developed in their best interest.

## OIL SHALE AND NATIONAL FUELS AND ENERGY POLICY

The lack of national direction in the development and use of fuels and energy has long been the subject of discussion. At the 1971 APPA annual conference, APPA members adopted a resolution supporting legislation that would establish a national energy policy and calling for an investigation into the basic fuels industry. A copy of that resolution is attached to this statement.

Any national policy aimed at supplying adequate amounts of energy to the American people at the lowest possible cost—both environmentally and economically—must take into account the very large role the natural resources contained in oil shale will play.

Because of the magnitude of oil shale reserves, the development of this natural resource has the potential to change the energy picture for future years. It has been estimated that oil shale deposits in the three states of Colorado, Wyoming and Utah contain as much as two trillion barrels of oil. In addition, these same reserves contain a wealth of sodium minerals such as dawsonite and nahcolite.

*Oil shale, environment and electricity*

According to the latest available figures, 55% of all pollution from sulfur oxides comes from power plants. Because of this, many local and state governments as well as the Federal Environmental Protection Agency have imposed sulfur emissions standards for existing and new power plants. Other localities, in an effort to control sulfur oxide polluters, have passed laws limiting the sulfur contents of fuels used to generate electricity.

In Jacksonville, Florida, for example, the city council recently approved an ordinance requiring the city's electric authority to use fuel with a sulfur content no greater than 1 percent at its generating plants. Unfortunately, low sulfur fuel is short in supply as well as expensive. It would have been necessary for the utility to increase its rates and, since this happened during the wage-price freeze, the city council had to exempt the electric authority from the provisions of the ordinance.

Shale oil has an extremely low sulfur content—about .50 percent by weight. The development of this resource could therefore be extremely valuable for use in power plants. It could be used to satisfy part of the demand for residual fuel oil which is expected to increase to 170 million barrels by 1980. This represents nearly a 98% increase from 1962 in power plant usage of residual fuel oil. (It should be noted that these estimates, supplied by the FPC, take into account a decrease in the cost of nuclear power and coal but a continuation of present fuel oil prices. If oil prices were to decrease then the demand for it would increase.)

Another environmental benefit of oil shale is found in the use of nahcolite. Experiments have shown that this sodium compound can be used to reduce the sulfur content of stack gases. Furthermore, it is cheaper than the normally used sodium bicarbonate and more effective in sulfur removal than limestone. Nahcolite can also be used to neutralize acid mine water.



*Oil shale, energy and concentration*

Any national energy policy that purports to be effective must deal with economic concentration in the fuels industry. If large "energy companies" are allowed to control natural resources, actions in the public interest will be replaced by those for the corporate well-being, which may or may not be inconsistent with the public interest.

Economic concentration and monopoly trends in the fuels industry have been well documented. A recent study commissioned jointly by APPA and the National Rural Electric Cooperative Association discussed economic trends among coal, oil and natural gas companies. Briefly, the results indicated that there is a great concentration in individual fuels and that there is a trend towards "energy companies." An example of the latter is the merger of Continental Oil and Consolidation Coal Companies. These types of companies may be effectively eliminating interfuel competition.

If one examines the interests of the 25 largest oil companies as of early 1970, the amount of concentration in the fuels industry is readily illustrated. Of those 25, all have natural gas holdings, 18 have oil shale positions, 11 have coal, 18 have uranium and 7 have tar sands. Furthermore, there is evidence that "energy companies" are simultaneously acquiring rights to Federal water resources in the West for use in developing natural resources and generating electricity.

The trend toward concentration and monopoly of the fuels industry is evident. APPA believes that a national energy policy should make provisions to alter the existing situation and that this could be accomplished by introducing new energy sources and fuels such as shale oil into the market. Care should be taken to provide protection so that the existing situation in the fuels industry is not perpetuated.

Because of its competitive potential with crude oil, shale oil could precipitate a revision of unjustifiable import controls. Its substitutability for other fuels should insure a freer market mechanism determining fuel costs. It is estimated that once technology is perfected, one barrel of shale oil can be sold for less than \$2.00 whereas one barrel of residual fuel oil costs about \$3.50. Ultimately, lower fuel costs can be passed on to the consumer in the form of lower electric bills.

Emphasis on environmental concerns and the rising cost and shortages of fuels have made clear the need for unified national direction in using our limited energy resources. This presents both an opportunity and a danger. The private interests which presently dominate our fuel resources must not be permitted to shape policies for development of shale oil resources: if they are, we fear that the result will be an intensification of the already formidable anticompetitive forces at work in the present national fuels market.

NEW ENERGY SOURCES CORPORATION

APPA has long recognized the need for research and development of new energy sources. Attached is a portion of APPA's "Statement of National Power Policy". It enumerates the beliefs that not only do we need to develop new energy sources and methods but we must also improve upon the current ones.

With respect to oil shale, the 1967 APPA Annual Convention approved the following resolution:

Whereas, competition among alternative fuels has a beneficial impact in lowering the cost of operating thermal generating plants, and

Whereas, concentration of control over an energy source tends to decrease competition and leads to monopoly situations which are adverse to the interests of consumers, and

Whereas, oil shale deposits on Federal lands represent a great untapped source of potential fuel, availability and control of which could profoundly influence the energy market: Now, Therefore, be it

*Resolved*, That the American Public Power Association urges that the Federal government expand its efforts to develop economically competitive techniques of processing oil from shale rock, build demonstration plants as cost yardsticks for private industry, and lease Federal oil shale land only with strong protection against private monopoly and speculation.

APPA believes that the Federal government should conduct research and development aimed at developing oil shale. For whatever reasons, it is evident that large oil companies have been reluctant to find a feasible method in spite of their holdings in oil shale lands. Additionally, the Federal government is likely



to consider environmental aspects of oil shale development more completely than private enterprise.

APPA concurs, therefore, with the policy set forth in S. 2510—that the Federal government should bring into being “the technology for commercial development of new energy sources as quickly as possible by establishing a Government-industry program jointly managed and funded to demonstrate commercial methods of producing energy” from various new sources. However, we suggest modification of the following operational aspects of the New Energy Sources Corporation (NESC) as proposed in S. 2510:

1. *Section 2(a)* prescribes that four of NESC's board members shall be appointed by the President after he receives recommendations from “any private entity or entities” which have entered into contracts with the corporation. APPA objects to the use of “private” as this implies that only privately owned companies can participate in NESC's activities. In fact, section 2(d) makes it clear that contractual arrangements can be with either a public or private organization. APPA therefore recommends that, in describing the make-up of the Board of Directors, it should be made clear that the industry members can be from either the public or private sector.

More generally, however, we question the requirement that industry representatives *per se* be appointed to the Board. Perhaps an arrangement similar to the Tennessee Valley Authority Board of Directors is more desirable. The members of that body are all appointed by the President from the general public; their terms are for nine years so that hopefully they will be removed from political pressures. Also, this type of governing board would afford a better protection against big industry's domination of NESC—by industries with which it should have an arms length relationship. It would be entirely appropriate, then, for representatives of all sectors of the industry to sit on technical and advisory panels.

2. *In section 3*, the enumeration of projects to be undertaken by NESC may not be the best way to encourage development of new energy sources. The legislation specifies that four projects—“at least two” oil shale, one tar sands and one solar energy development—shall be conducted under NESC auspices. There have been a number of other potential new energy sources and generation methods identified and, although the Board has the authority to select other new processes for demonstration, it is doubtful, given limited funds, that there would be much chance of money being designated for anything other than the four specified projects. APPA believes it would be in the public interest to allow the Board of NESC some leeway in its choice of projects.

We would like to commend to the attention of the Subcommittee members the operational approach of the Federal Power Research and Development Act, which was introduced earlier this year by Senator Magnuson as an amendment to the Power Plant Siting Act. A copy of the bill is attached. The governing board of the trust fund created by this legislation is given a general mandate to follow in choosing projects to be undertaken rather than a more detailed approach as provided in S. 2510.

3. *Section 4(1)*, dealing with disposal of energy resources from the demonstration projects, does not have a provision granting preference to public agencies and cooperatives. APPA believes such a provision is necessary for the preservation of competition in the energy industry.

Historically, public agencies have been given preference in the disposal of energy from Federal water projects since the Reclamation Act of 1906. That law provides that surplus water from irrigation projects could be used to generate power and stipulates that, in order to prevent monopolization by private corporations, preference would be given for municipal use of the power. Since 1906 numerous laws related to energy have incorporated a preference provision. Notable among these are the Federal Water Power Act, the Flood Control Act of 1944, the Tennessee Valley Authority Act, the Bonneville Project Act and, most recently, the Atomic Energy Act.

The language of the Bonneville Power Act makes it clear why the preference clause is needed. It states that preference is extended to “public bodies and cooperatives” in order “to insure that the facilities for the generation of electric energy . . . shall be operated for the benefit of the general public, and particularly domestic and rural consumers.” Furthermore, the provision is included “in order to encourage the widest possible use of all electric energy that can be generated and marketed . . . and to prevent the monopolization thereof by limited groups.”



It is for this last reason stated in the Bonneville Act—to prevent monopoly—that APPA believes it is necessary to include a preference clause in S. 2510. The dangers of monopoly exist whenever it is possible for large corporations having access to abundant supplies of capital to place bids for the purpose of restricting access to new sources of competition. Such a danger is likely to become a reality under a law which fails to recognize that the public interest requires some safeguards against the development of such a situation. APPA views the preference clause as such a protection and a means of preserving the economic possibility of competition in what could otherwise be an industry dominated by investor owned companies.

4. Section 7 of the legislation requires NESC to dispose of physical facilities "when the commercial demonstration of a new technology has been accomplished." APPA suggests that this measure should be modified to follow provisions of the Federal Surplus Property Act. This statute requires that public agencies be given preference in the sale of Federal surplus property.

However, a more desirable action is the elimination of this section completely. APPA believes NESC should have discretion to retain control over the demonstration plants and continue to sell the energy or energy resource produced from them. The price charged by the Corporation would presumably provide a "Federal yardstick" for private industry to follow.

5. Section 8 provides for cooperation among agencies on a rather limited basis. APPA suggests that the scope of this cooperation be extended to include inter-agency projects. For instance, NESC and the Atomic Energy Commission might want to undertake a fusion project. Perhaps the Environmental Protection Agency would want to work with NESC in its oil shale demonstration projects because of the value of mineral by-products for pollution control.

#### PROTOTYPE OIL SHALE LEASING PROGRAM

APPA believes that any oil shale leasing program should be undertaken only with strong protection against monopoly and speculation. The most recently proposed program of the Department of Interior makes some necessary modifications of the 1968 proposal that strengthen those safeguards. However, APPA suggests that the following recommendations be incorporated into the leasing program:

1. Rather than strict competitive bidding, preference should be granted non-profit and consumer-owned organizations. The Department should encourage small companies, singly or jointly, to enter into leasing.

2. Patents on mining techniques developed on Federal lands or with Federal oil shale should be public knowledge and available for use upon payment of a reasonable royalty to the patent holder.

3. Federal lands should not be leased to companies that hold sufficient oil shale land to develop the resource but have not done so.

4. The Federal government should recapture leased oil shale land if development is not begun within a reasonable period of time. Leased land should also be recaptured if optimum development is not attempted or achieved within a reasonable period of time.

5. A royalty policy should be established giving a fair return to both the Federal government and the state governments involved. Returns should not be diminished by establishing any depletion allowance or credits for necessary environmental devices used in developing oil shale or associated minerals.

6. Because of the immense environmental problems associated with the mining and refining of oil shale, no lessee should be allowed to proceed in developing Federal lands without adequate assurance that applicable air and water quality standards will be met and that provisions for disposal of waste materials and protection of wildlife are sufficient.

We believe that the incorporation of these recommendations into the oil shale leasing program are necessary to insure the development of this vast resource in the public interest.

In summary, due to the potentially competitive nature and environmental desirability of new energy sources, research and development should proceed as quickly as possible. The American Public Power Association believes that this can be best be achieved by a joint-industry-government program of research and development, Federal demonstration plants, and strong anti-monopoly and anti-speculation provisions in any leasing or contract program.



## LEGISLATION RELATING TO SUPPLY AND PRICING OF FUELS

Whereas, the nation's electric utilities and the consumers they serve are continuing to experience shortages of fuel for the generation of electricity and are having to pay increasing prices for such fuels, and

Whereas, there is evidence that the increasing concentration of ownership of the nation's energy resources by a few large concerns has lessened meaningful competition, and contributed to higher prices and shortages of fuels used for the generation of electric power, and

Whereas, there is currently no national policy on the production and utilization of the nation's finite supplies of basic fuel resources, and

Whereas, remedies available under the antitrust laws of the United States and other regulatory acts could stop the growth of concentration in the fuels industry and lead to adequate supplies of fuels for generation of electricity at reasonable prices: Now, therefore, be it

*Resolved*, That the American Public Power Association supports legislation which (1) would lead to an in-depth investigation of the price and supply problems in the production and sale of the nation's basic energy resources, such as coal, gas, oil, and uranium, (2) would establish a national energy policy on the utilization of such energy resources, and (3) promote vigorous enforcement of the antitrust laws and various regulatory acts to stop the growth of monopoly in the production and sale of basic energy resources; and be it further

*Resolved*, That the American Public Power Association endorses enactment of the following bills by the 92nd Congress:

(1) S. Res. 45, authorizing the Senate Committee on Interior and Insular Affairs to undertake a study of national fuels and energy policy and to report its findings, together with recommendations for legislation to the Senate by September 1, 1972.

(2) H. Con. Res. 266, directing the Federal Trade Commission to make a two-year antitrust investigation and study of companies engaged in the production or sale of coal, gas and uranium.

(3) H.R. 4731, amending the Clayton Act to preserve competition among suppliers of coal, oil, and uranium by requiring divestiture of coal and uranium assets by oil companies.

(4) H. Res. 327, creating select committee in House of Representatives to study energy and fuels problems.

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RESEARCH AND DEVELOPMENT

Research and development have given us a technological society which today possesses an energy capacity capable of producing approximately 320 mechanical-electrical horsepower hours per capita per day. (One horsepower is the work performed in lifting a 99 pound weight a height of four feet, 5,000 times.) Future research and development can increase this substitution of energy for labor to the benefit of all citizens.

Present and prospective studies can also show ways to better manage our power production and pollution. By use of systems approaches, recycling of waste, and employment of new energy techniques we can come closer to our dual objective of low-cost electricity and a high-quality environment.

APPA believes that:

1. Technology for undergrounding of transmission lines should be stimulated to more rapidly solve technical and economic problems. Application of this technique could be a major aid in resolving environmental and esthetic problems in the electric utility industry.

2. Research and development is needed to create the means of disposing of liquid and gaseous effluents discharged by electric power facilities in a way which will decrease any adverse effect on the environment and will increase their use for beneficial purposes. There should also be expanded work on economic employment of by-products of combustion, such as sulfur and fly-ash.

3. Availability of economic methods of gasification of coal would enhance our fuel picture, and research and development efforts in this area should be advanced and accelerated.

4. Magnetohydrodynamics (MHD) offers the promise of improved efficiency, lower fuel costs, and alleviation of thermal pollution in future central station power plants using fossil fuels. A significant research and development program,



backed by Federal funds and followed up by pilot plants, is needed to bring this concept of fruition.

5. Widespread use of electric vehicles and rapid transit systems would radically reduce the dangers of air pollution. Active encouragement should be given to the perfecting of practical projects, their demonstration in actual operation, and their introduction on a commercial basis.

6. Large-scale regional desalting-power plants could become a major source of supplemental water in some regions of the United States. Means should be developed to convey both end products to areas of need, with preference accorded public agencies and non-profit organizations, and to employ multiple-purpose management concepts for maximum development of useful by-products.

7. To finance adequately research and development in the public interest, the Federal government should annually assess each electric utility in the United States a reasonable sum on a kilowatt-hour sales basis with the resultant funds to be expended on projects selected by a cooperative government-industry management group.

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STATEMENT OF M. A. WRIGHT, CHAIRMAN OF THE BOARD, HUMBLE OIL & REFINING Co., DECEMBER 10, 1971

The United States has entered a period in which the increasing demand for energy is outpacing the growth of domestic energy supplies. It is vital to the security of the United States that all reasonable steps be taken to increase the availability of these supplies. Priority should be given to accelerating the development of current domestic energy sources such as oil, natural gas, coal, and nuclear and also to those new energy sources which have potential for early commercialization such as oil shale.

Because of a conviction that oil shale will become an important future source of energy, Humble has had an active interest in oil shale development for a number of years. During the mid-1960's Humble participated with five other oil companies in the operation of the Bureau of Mines research facility at Anvil Points. The company has also conducted in-house research on the upgrading of the raw oil shale product. In addition, Humble has acquired ownership of some private shale lands; however, this acreage is scattered and is not amenable to development unless it can be consolidated or exchanged for other shale lands.

Humble supports the formulation of a policy for orderly development of oil shale as proposed by President Nixon in his message on energy, and welcomes the interest and support of the Senate Interior Committee in achieving this objective. Before commenting on the prototype oil shale leasing program proposed by the Department of the Interior and on Senate Bill 2510, it would be appropriate to mention several factors which have an important bearing on the development of oil shale.

#### FACTORS INFLUENCING OIL SHALE DEVELOPMENT

The commercial development of oil shale resources has been hindered by unattractive economics and the limited availability of oil shale lands, 80 percent of which are controlled by the federal government. These factors must be overcome if the potential of this resource is to be realized.

Oil shale technology has advanced to the point where mining, retorting, and upgrading of the raw product are physically feasible but not at costs which will permit shale oil to compete with other energy sources, notably crude and natural gas, at today's prices. As a favorable economic climate develops, we are confident that private industry will invest in the commercial development of oil shale, assuming that shale lands are available. However, it must be recognized that future market prices for energy supplies and the timetable for commercialization of oil shale, as well as other new sources of energy, are very sensitive to government policy actions.

If the establishment of a viable oil shale industry is to be accelerated, as it should be, special consideration must be given to the problem of the "pioneer" commercial plants. Any plant which pioneers new technology invariably incurs greater than normal risk of economic success. The acreage limitations contained in the Mineral Leasing Act of 1920 further aggravate this pioneer plant problem,



especially for those companies without sizable private oil shale holdings. This Act limits any one company or individual to only one federal oil shale lease having a maximum of 5,120 acres. Over a large part of federal shale lands, this amount of acreage would support only a single plant producing about 50,000 barrels per day or less. It is unlikely that any company would want to pioneer a full-scale plant of this size (which could require an investment of about \$250 million in a very high risk venture) if it could not use the knowledge gained to build and operate additional plants. With a change in this legislation, the probability that significant levels of shale oil production will be developed from federal shale reserves would be improved. The Administration's bill to reform the mineral leasing laws, S. 2726, provides for increasing the acreage limitation to 10,240 acres per state per company. This change would be a step toward a more realistic limitation, but we suggest that in addition any acreage which is under active development or production be removed from chargeability against maximum allowed federal acreage holdings.

The exchange of privately owned oil shale lands for federal lands of comparable value would allow owners of fragmented acreage to consolidate their holdings into a workable tract for development. The Secretary of the Interior has authority to make such exchanges and an exchange program should be encouraged.

Environmental uncertainties are also evident in the development of oil shale. The disposal of the spent shale is a fundamental problem. The environmental requirements can have a significant impact upon the cost of synthetic crude oil produced from shale. Criteria for disposal of the spent rock and also for air and water quality standards need to be clarified at an early date.

#### PROTOTYPE OIL SHALE LEASING PROGRAM

The prototype leasing program proposed by the Department of the Interior represents a constructive step toward the development of the nation's oil shale resources. Implementation of the program should go a long way toward clarifying the environmental uncertainties surrounding oil shale development. However, in the absence of legislation to remove or modify the current acreage limitations in federal oil shale lease holdings, the response to the prototype program may be limited, and the program may, therefore, fail to achieve fully its objectives. In this regard, it should be noted that interest exhibited in the core drilling phase of the program reflects a desire to develop basic geologic information. Whether a significant number of companies will actually bid on leases in the second phase and even more importantly whether significant production will be developed on leases which may be granted is still uncertain.

#### SENATE BILL 2510

Senate Bill 2510 would establish a joint government-industry corporation for the development of new energy sources including oil shale. While this bill has the commendable objective of accelerating development of new energy sources, the establishment of such a corporation is neither necessary or desirable in order to achieve this objective. In the case of oil shale, the technology which the bill seeks to bring into being is already basically available. It would not be desirable for the federal government to involve itself in the ownership or in the direct management of commercial energy resource development. Instead, the government's role as outlined in the Mining and Minerals Policy Act of 1970 should be to foster and encourage commercial development by private enterprise through appropriate policies and actions. It is difficult to see why a private investor would want to participate in the corporation which would be established under S. 2510 as presently drafted since investors would not retain any equity in the assets of the corporation after its dissolution nor the rights to patents or proprietary technology developed by the corporation. More importantly, direct government participation in commercial operations which private industry is capable of conducting is contrary to the basic tenets of our free competitive system.

#### SUMMARY

In summary, the following points should be emphasized :

1. A national energy policy should be formulated which provides an economic and political framework conducive to development of domestic energy supply.
2. Legislation should be passed to remove existing acreage limitations on the



leasing of federal oil shale lands and to declare the intent of the federal government to make oil shale leases available on a continuing basis.

3. Exchange of privately owned oil shale lands for federal lands should be encouraged.

4. Without some of the modifications mentioned above, the Interior Department prototype leasing program may meet with only limited success.

5. S. 2510 would involve the government in commercial operation which can and should be conducted by private business and is not consistent with the free competitive system.

HON. FRANK E. MOSS,

*Interior and Insular Affairs Committee:*

To make myself crystal clear:

1. I am a firm believer in the Free Enterprise System.

2. My statement before the above Committee shows fifteen (15) items for Free Enterprise.

3. This same statement shows one (1) item which is relative to the alternative route and shows it can be a success as, quote, "The Tennessee Valley Authority."

4. I am a scientist of the Massachusetts Institute of Technology, Class of 1922, or War Class of 1918. I majored in Mining & Metallurgy.

5. Myself and associate, John H. Morgan, Sr., are responsible for the Big Piney Oil & Gas Field, from which some 100,000,000 cubic feet of Natural Gas per day is being taken.

6. Over the past forty years we have been spending our own money to do the job of developing our own ideas.

7. I believe our record is as good as anyone's before this Committee and should be considered so.

8. We are easy to get along with, try us.

Respectfully submitted.

JUSTHEIM PETROLEUM CO.

CLARENCE I. JUSTHEIM.

JUSTHEIM PETROLEUM CO.

HON. FRANK E. MOSS,

*Interior and Insular Affairs Committee:*

1. German Industrial Company of the United States of great magnitude would like to match dollars with the Interior and Insular Affairs Committee to the extent of \$25 million or more each to develop the patent idea of Justheim Petroleum Company for in-situ distillation and hydrogenation of carbonaceous materials for the production of liquid gasoline and pipeline gas.

2. This industrial company would like the United States, through the Interior Department, to contribute the necessary lands, oil shale and tar sands, for this purpose.

3. This industrial company has Justheim's United States patents which can be the protection for the development of this idea of in-situ distillation and hydrogenation of these carbonaceous materials.

4. The patents which this industrial company has and desires the development thereof are for the purpose of cooperating with the United States Government for the non-pollution of the atmosphere and the desires of the United States Government for the ecology of its countryside.

5. The reason for Senator Moss doing this great job of bringing Senate Bill 2510 before the United States Congress is because of the fact that we are in a very serious natural gas shortage and unless something is done now to alleviate this situation by the synthetic production of pipeline gas, we will, by the year 1975, be short 2.2 billion cubic feet of natural gas per day on the West Coast alone.

6. Irrespective of industry's oil shale lands, the U.S. Government has approximately two trillion barrels of shale oil in its oil shale lands, which, according to the Institute of Gas Technology, contains 13,440 trillion cubic feet of pipeline gas. It is the synthetic pipeline gas which we hope to be able to produce economically by Justheim Petroleum Company patents and the getting together amicably with the United States Government through its Interior Department, by the Senate Bill 2510 introduced by Senator Frank E. Moss and the development monies of the United States matched by this great industry from this German American company.



7. I might say here, for the record, that I have tried every oil company that could muster the necessary capital to do the job with no avail.

8. The industry would like to know what happens to the patents as the development takes place. In other words, we are protected by the patents under the claims which are granted, such as any form of heat sources either Nuclear or Fossil Fuel Heat. We are protected by exchange of heat from the Nuclear or the Fossil Fuel Heat, and we are protected with other claims also, and with all of this protection, we have In-Situ protection as well. What the industry would like to know, relative to all of this, is, do we retain our patents protection one hundred percent, under this development, or would this have to be agreed upon?

9. Industry would like to know as the development takes place and patentable improvements become discovered, how is it divided?

10. Industry would like to know if this development work is carried on in secret, as it must be, to protect industry's investment?

11. As I mentioned above, it is difficult to get industry to sign up with the government for development, and, accordingly, when industry is willing to work with the government, dollar for dollar, industry should be recompensed to accomplish this economic process. In reality, this should be, because of the fact that the government has worked for 50 years and hasn't come up with an economic process to date, and industry is paying its share now, dollar for dollar, and the government finally will be able to use all of the work from the exploration on the production of its two trillion barrels of Shale Oil, and industry will only be able to use the exploration work on a small amount of acreage donated to industry for the development and exploration. There should be a fair arrangement between the government and industry, on the end point of two trillion potential barrels of Shale Oil, the Patents, experience of the Oil Companies, and the government in the laboratories and the field.

12. Also, now that anti-pollution of the atmosphere and ecology have now become the definite topics of the day, and the President asking for these items to be carried out, it would seem that in-situ treatment of Oil Shale would have to be the flow sheet, rather than mining of the Oil Shale.

13. Pollution, ecology and economics would have to be charged to mining of the Oil Shale.

14. In other words, with in-situ there is no pollution of the atmosphere and regarding the ecology, there are no chargeables. Regarding the economics, it should be in favor of in-situ as there is no lifting costs or fine grinding costs, or costs of returning the fine grinding to the earth.

15. The above is a beautiful picture between free enterprise, the government and the state, all working together. When this picture isn't adhered to, we have the problems regarding Oil Shale which aren't being met.

16. There is the alternative to all of this. The U.S. Government could develop the In-Situ distillation and hydrogenation of the Oil Shale:

(a) In other words, the government would then find it necessary to develop an Oil Shale industry themselves.

(b) The U.S. government, owning approximately two trillion potential barrels of shale oil, could then take care of the high energy demand which is confronting us now.

(c) With this development, similar to Tennessee Valley Authority, we would then have the power crisis under control.

(d) This would be an ideal situation for the government to be in, if they are going to do this themselves, because then all the people would participate in all the profits and there would be no cry of "give away."

(e) In this manner the whole idea would be a success. Industry should know this because the best brains in the country would be hired to do the job, by the government, as the best brains were hired to get on the moon. All of this being brought about by the natural gas shortage crisis.

Respectfully submitted.

CLARENCE I. JUSTHEIM.

STATEMENT OF JOHN H. MORGAN, JR., PRESIDENT, UTAH RESOURCES INTERNATIONAL, INC.

Gentlemen, I am John H. Morgan, Jr., President of Utah Resources International, Inc., and appearing for and on behalf of this company, and representing several Utah oil shale lessees. I appreciate very much the opportunity of appearing before your Committee. I might also mention that I have been working



closely with the Honorable Calvin L. Rampton, Governor of Utah, and Congressman Sherman P. Lloyd, the Board of State Lands, the Department of Natural Resources, Mr. Gordon Harmsten and others toward the development of a great oil shale industry. I also speak as one having dedicated a great deal of time, effort and money to the development of our Utah Resources, and particularly our hydrocarbon resources, including oil shale. We (my father, Mr. J. H. Morgan, Sr., Mr. Clarence Justheim and myself), who are the principal owners of Utah Resources International, Inc., have also worked very closely with the oil industry in attracting some of the major oil companies to the development of our great hydrocarbon resources, including oil shale. Beginning in 1963, we successfully negotiated contracts covering substantial blocks of lands in Utah with Shell Oil Company, Gulf Oil Corporation, Pan American Petroleum Corporation (Standard Oil Company of Indiana), Husky Oil Company and others, and have continued to work closely with these companies, with the belief that through a cooperative effort, we can finally build a great oil shale and bituminous sands industry in our State.

#### ARE WE HEADED IN THE RIGHT DIRECTION AND ARE WE GOING FAST ENOUGH?

It is said: "Where there is no Vision, the People Perish." And in the oil business, we must have vision, or we will perish. And Abraham Lincoln said: "If we could first know where we are, and whither we are tending, we could better judge what to do and how to do it."

We must ask ourselves, where we are, and which way we are tending? Then we must ask ourselves: Are we going fast enough?

The American Oil Industry has proven itself to be one of the greatest examples of successful Free Enterprise that we can possibly find anywhere in the world. In times of war and in times of peace, the American Oil Industry has performed magnificently. And yet, as we look at the production figures for oil and gas in America, and in the Free World, and then look at the projected consumption figures for America and the Free World, we know that our energy demands are reaching fantastic proportions. Yet our ability to find new reserves of both oil and gas is not unlimited. As a matter of fact, the figures will reveal that our energy demands, in both oil and gas, far exceed the rate at which we are finding new sources of supply here in America and in those parts of the world where we can really count on the validity of a contract, and the support of that government.

The American Oil Companies have shown great skill and ability in working with and dealing with foreign countries in gaining initial oil and gas concessions from these countries. Typically, the American Oil Companies go in and take the initial risk and successfully develop large oil reserves. And after all the difficult part of it has been accomplished, the pattern has been that these foreign countries begin raising their royalty rates, so that it becomes difficult to make a reasonable profit. And they continue squeezing until they force the American Oil Companies out of their country, and nationalize the industry. It seems we are just playing their game. And all of the tremendous ability and scientific know-how and economic resources and negotiating skill really don't amount to much—if we get kicked out.

There is one other important point which must not be overlooked. The Middle East countries contain the greatest regular oil reserves in the world. And, of course, the American Oil Companies are heavily involved in the exploration and development of this oil. Yet, the pattern seems almost obvious that the Russian influence is growing almost daily in this part of the world. What is it that attracts the Russians to this Area? Is it that they love the people so much that they are just attracted to them? There is only one reason for his great attraction. This is because of the great oil fields in this Middle East Area. The Russians play a deadly game. They know that in any ultimate show-down with the Free World, they are going to be in a position to control that Middle East Oil. Because they know it is oil that fuels a nation. And it is oil that wins a war.

South America, of course, is one of the largest sources of oil for American import. But how stable are the South American countries? In any show-down between communism and the free world, could we count on Venezuela, Peru, Ecuador, Colombia, etc.? Or are we kidding ourselves?

The question that we must ask ourselves is this: How dependent upon foreign oil should we become? What should be our allocation of priorities in terms of investment in foreign countries to develop oil and gas reserves which could be expropriated almost without notice, and thus deprive America of oil which we have come to rely upon with such peaceful security?



Certainly, we have an obligation and a great responsibility to double our efforts to try to explore for, and find new domestic oil and gas reserves. And incidentally, our gas reserves are dangerously low in terms of the projected demand and the projected supply of gas, even over the next 5 years. El Paso Natural Gas Company, one of the greatest gas transmission companies in the world, has a 3 year "deliverability life" for its system. In other words, El Paso can supply its present customers for only three more years, and unless El Paso can somehow come up with new huge supplies of natural gas, the present customers will find their services will begin to terminate, as the gas supply picture for El Paso becomes more critical. And yet, El Paso is in better shape than many of the gas transmission and distribution companies. As a matter of fact, the Federal Power Commission has conducted a thorough study into the situation, as it applies to the Western United States, and the FPC Report is that the West will be 70% dependent upon foreign sources of gas by the year 1980. This means that we will depend upon liquefied gas, which is not cheap, in order to meet our fantastic gas requirements over the years, unless we can somehow find new sources of domestic gas supplies.

S. 2510 SHOWS A RECOGNITION OF PROBLEMS AND TRIES TO PROVIDE SOME ANSWERS TO THE PROBLEMS

What does all of this have to do with S. 2510, a Bill to establish a government-industry corporation to develop an oil shale and tar sands industry from our vast oil shale reserves, and also solar energy resources? It has a great deal to do with it, because the success of this Bill, or a similar Bill, will help solve this great energy problem which is before our Country today. In fact, this energy problem confronts the entire free world—and entire world—today. We can put our head in the sand, and try to tell ourselves there is no problem. But we would not be facing up to the facts of life, if we were to do this. At least, S. 2510 is a step to see if we can help find these answers, and we certainly commend Senator Moss and Senator Jackson and others who are trying to come to grips with the problems we have before us. Truly, it offers us a great challenge and also a great opportunity. We must also say that we are grateful we have a President who recognizes this energy problem—and crisis—and President Nixon has spelled the problem out very well in his June 4 Energy Message.

THE RESERVES OF OIL AND GAS IN THE OIL SHALE AND BITUMINOUS SANDS ARE VAST AND WARRANT INVESTIGATION, INVESTMENT AND PRODUCTION

It does seem a little ironic to see these great American Oil Companies going through the jungles and the arctic regions and the deserts, and encountering every imaginable obstacle in the finding of oil and gas supplies—oftentimes in countries where you just can't count upon the validity of a contract—when we have right in our own backyard, in a perfectly accessible area, billions of barrels of oil and trillions of cubic feet of pipeline gas, lying idle—all tied up in our oil shale reserves. In the Uintah Basin of eastern Utah, based upon the core holes drilled and reported on to the USGS and Bureau of Mines, we have in some areas as much as 500,000,000 barrels of oil in the oil shale in a square mile, and an equivalent of some 2.7 trillion cubic feet of pipeline gas in this same area. What does it require to bring this oil and gas to the surface, and find its way into great productivity, and in a great, energy-hungry country?

We have a formula by which we believe we can help bring about the production of these great reserves which are presently lying idle. After all, we have the genius of the American Oil Industry to concentrate upon these reserves. Perhaps we have the capital requirements to do the job, or we can provide a Plan to get the capital requirements. We really have the incentive to do it, because of the fantastic demand. But it even requires something else. In our judgment, it requires a tremendous cooperative effort, involving Free Enterprise, the federal government, and the State—all working together to obtain this objective of developing a great oil shale industry. We believe it can be done.

S 2510 really provides the initiative for the development of a great oil shale industry to come from the federal government, with free enterprise playing kind of a secondary role in its development. We are convinced that Free Enterprise would rather play a greater role than this. And if anything, Free Enterprise would rather play the dominant role. Still, it must be recognized that free enterprise has not really asserted itself in this development, or projected development. But



we are convinced that Free Enterprise will recognize this great challenge which is before them, and will work cooperatively toward developing a great industry.

#### GREATER PARTICIPATION BY FREE ENTERPRISE IS VITAL

May I suggest an approach which might have more appeal to Free Enterprise, and yet which would have tremendous value and make good sense to the federal government and state government? Again, the key to the success of this program is a great cooperative effort involving Free Enterprise, the federal and state governments—all working together to achieve a great goal. The suggestion would be that for all those Free Enterprise Companies who would be willing to do so, to join together in raising an initial minimum sum of money to be dedicated to the development of a great oil shale industry. This minimum amount would be \$5,000,000. Then the federal government, under the appropriate terms of this Bill or an amended Bill, would lend \$5,000,000 to this Corporated Entity, giving this corporation an initial capitalization of \$10,000,000.

#### REAL ANSWER LIES IN COOPERATIVE EFFORT

Through this cooperative approach—which is a fundamental part of this project, this corporate entity would have the full utilization of the research facilities of the Bureau of Mines and USGS, which would be a tremendous asset. The Corporation, itself, would be run by representatives from government, chosen by the President, and also by representatives of Free Enterprise, as this Bill provides. This corporation could call upon the private research know-how and facilities of the Free Enterprise Companies involved. Here, again, this will require a tremendous cooperative effort, and a recognition that we must work together, if we are to achieve a great development. And the State can also play a major role. In Utah, for instance, we truly have great research personnel and facilities. We have some of the finest scientists in the country or in the world. And we have already done a great amount of research work directed toward the development and recovery of these hydrocarbons. We are certain Colorado and Wyoming have similar contributions which can be made.

What a challenge this would be to Free Enterprise, the federal and state governments! The test of the good faith of Free Enterprise would be whether they would invest this initial \$5,000,000. We have good reason to believe they would. It would be a continuing cooperative effort, involving Free Enterprise and the Federal Government. And also the State government. Because the State has a great deal to add, as will be pointed out in this Statement.

The terms of the loan would be that it would be paid back, with interest, out of production from the oil shale and/or the tar sands.

Why should this approach have appeal to the federal government—all the people? You see, the federal government owns some 80% of the lands under which these vast reserves are located—estimated to contain some 2 trillion barrels. If Free Enterprise were to come in—with a government loan—to develop these vast reserves, at no cost to the government, the government would not only get its loan back: but the government would experience tremendous income—for education and otherwise—just from the royalties which would be received from such development. In fact, it would be a huge income from the production of some 500,000 barrels of oil per day, and a billion cubic feet of pipeline gas per day—which is our goal. In this way, of course, we would become more self-sufficient in our oil requirements, so that we wouldn't rely so heavily upon foreign sources of oil—which are so undependable, and subject to so many conditions over which we have no control.

Certainly, we have come to the point in America, that we must work together in a cooperative way, to achieve great things. And this has really been the genius of the American Free Enterprise System.

#### UTAH RESOURCES ARE TREMENDOUS

May I express a word about the State of Utah? Utah is fortunate in that Utah has been successful in selecting a certain amount of State Land in the heart of the oil shale reserves. The federal government, of course, owns the great majority of the land. The State of Utah, and particularly the Governor of Utah, has indicated a willingness to work cooperatively with Free Enterprise and the federal government in a way to help develop such a great industry in our State.



In fact, he has shown great leadership in this effort. After all, the royalties go to the schools of Utah, and we are in great need of support for education in our State. But the State is willing to grant special incentives for developing an oil shale industry in the way of research, rental and special royalty provisions, to encourage such development in Utah. Furthermore, the University of Utah, in its Fuels Engineering Department, and Dr. George Hill, Dean of the College of Mines and Mineral Industries, and Mr. Howard Ritzma, head of the Utah Geological and Mineralogical Survey for geology, have already contributed tremendously, and would make a much greater effort to help develop a successful oil shale and tar sands and coal industry, for the production of oil and gas, to meet these great demands. I would like to commend the Utah Geological and Mineralogical Survey, and its Director, Dr. William P. Hewitt, for the tremendous work they have done in researching, evaluating, reporting and mapping the complete geological picture in Utah, particularly with respect to the hydrocarbons of our State.

It is true the great bulk of the large oil shale reserves in Utah are located at depths ranging to 7,000 feet. But this may be a blessing in disguise. Because these depths make it possible to recover the oil from the oil shale "in situ", through the use of great heat and pressure injections. The Bureau of Mines has already done a great deal of research in "in situ" recovery. Except that it has been done only on a very small scale, through the use of butane burners to create the necessary heat to recover the oil from the shale. Shell Oil Company has also been heavily engaged in this kind of oil recovery and research. Mr. Clarence Justheim, my partner and associate, who is a graduate from the Massachusetts Institute of Technology in metallurgical engineering, has made a great contribution to this approach. Our idea is to put this program together on a sufficiently large scale that the economics of such recovery can be established. And if it is done on a sufficiently large scale, the economics will be much greater. The idea would be to build this industry gradually. But eventually, our goal is to produce 500,000 barrels of oil per day and 2 billion cubic feet of pipeline gas per day. These are large figures. But the reserves are there. It is a matter of getting them out economically.

#### PRESIDENT NIXON OIL POLICY COMMITTEE RECOGNIZES PROBLEM

I have been successful in getting two separate meetings with General George Lincoln, Director of the Office of Emergency Preparedness, and also Chairman of President Nixon's Oil Policy Committee. In this capacity, General Lincoln is charged with the responsibility of making sure that America has sufficient oil and gas available to meet the regular energy requirements for our country. But even of more importance, to meet the energy security requirements for our country—so that in times of emergency, we will have sufficient oil and gas to meet whatever the situation demands. When I explained to General Lincoln the facts regarding Utah's oil shale reserves, and how they are located, etc., and the proposal to recover these reserves "in situ", he suggested this kind of an approach might have a great deal of merit, and he gave us great encouragement to move ahead as rapidly as possible to develop such an industry. One important aspect, he suggested, was that the pollution and environment problems might be largely contained, under the "in situ" program because we would convert the shale to oil and gas in the ground, and recover them at the surface through the production holes. And he suggested we contact the Office of Environmental Quality, and explain our program to them. We did this, and had an excellent reception for this approach.

#### DEPARTMENT OF INTERIOR PLAN GOOD BUT DOES NOT PROVIDE REAL PLAN OF DEVELOPMENT

The Department of Interior has already initiated a leasing program for oil shale, wherein it is anticipated that each state—Utah, Wyoming and Colorado—will gain an opportunity to secure two leases each of no more than 5,120 acres from the federal government, some time in late 1972.

This is a good beginning. But it doesn't really solve the problems which confront the country today. The real problem before the American people is to find a good, solid, dependable source of domestic oil and gas to meet our huge energy demands. This approach isn't dynamic enough, in our judgment. It doesn't provide a real plan for development.



The Interior Department approach gives the oil companies an opportunity to go out and drill to determine where, and how much oil shale is in reserve. But this doesn't even really lead to a lease. And gives no preference to a lease at all.

We already know a great deal about the great reserves which are located in Utah, Colorado and Wyoming, from the coring and drilling already accomplished. We do know these reserves are all lying idle, and there is no real plan for their development.

In our judgment, the development should not be done by the federal government, except as a last resort. Rather, it should be a cooperative effort, with Free Enterprise leading the way. But with the federal and state governments pitching in all the way.

A federal loan, as we proposed, to match the investment of Free Enterprise, would give the initiative and incentive to move ahead. Our goal is the development of a 500,000 barrels of oil per day industry, and one billion cubic feet per day of pipeline gas from these vast reserves. The approach we have proposed we submit, can be the vehicle by which these goals can be obtained.

#### CONCLUSION

We commend this Committee and its Chairman for the vision and the determination which they have demonstrated in recognizing the energy problems we have in our Country, and to make sure that we are not caught unprepared as a country in meeting our energy requirements and the security requirements of our country, now and in the years to come. But we must have a Plan—a Plan which will appeal to Free Enterprise, the Government and the State. We respectfully submit that the Plan proposed herein would meet with the approval and support of Free Enterprise, the Federal and State governments.

Again, may I thank you for the opportunity to appear before you and present this Statement.

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