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HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE ENVIRONMENT

OF THE

COMMITTEE ON

INTERIOR AND INSULAR AFFAIRS

HOUSE OF REPRESENTATIVES

NINETY-THIRD CONGRESS

SECOND SESSION

ON

PROJECT INDEPENDENCE BLUEPRINT

HEARINGS HELD IN WASHINGTON, D.C.
NOVEMBER 21 AND 25, 1974

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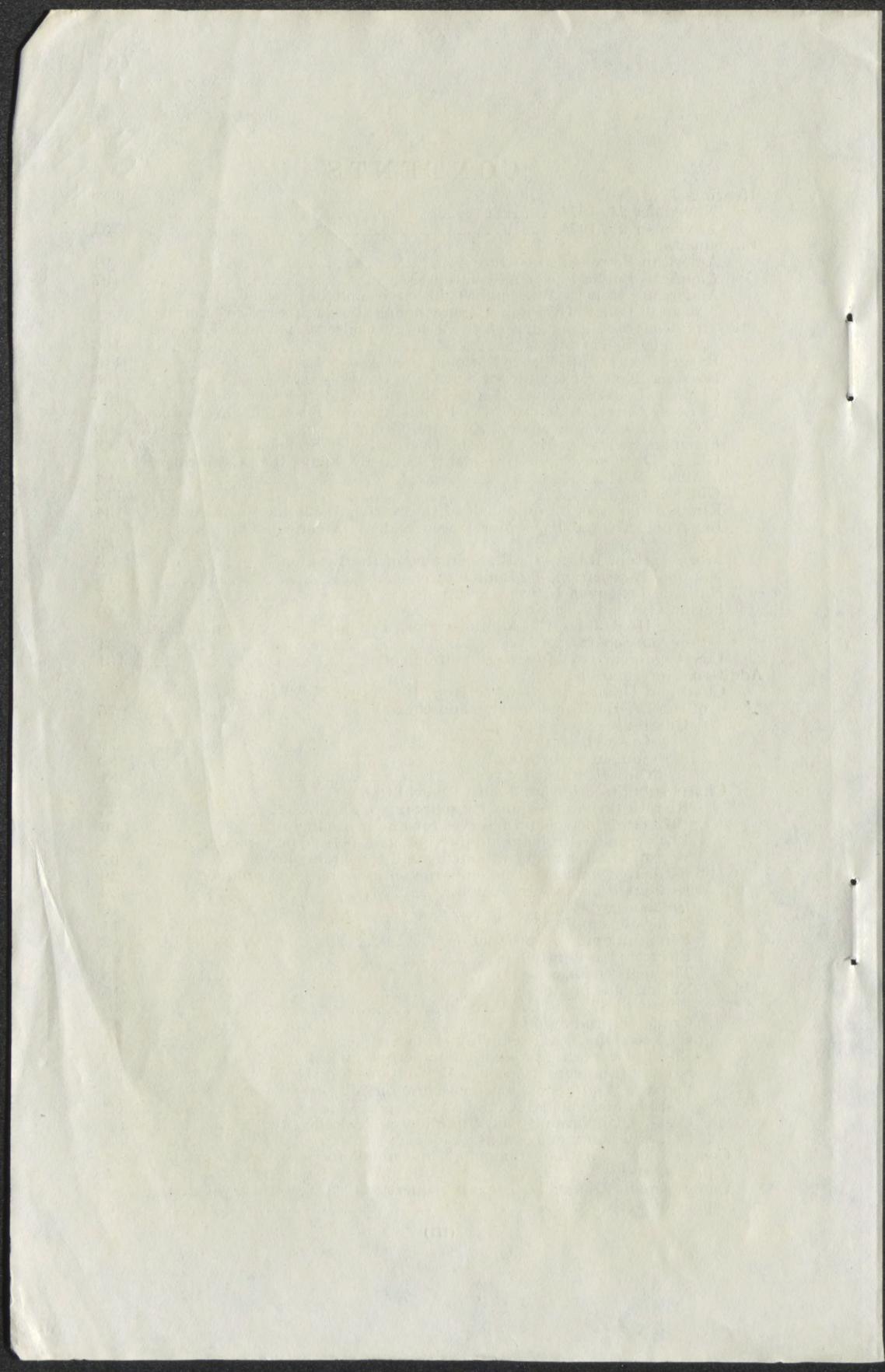
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PROJECT INDEPENDENCE BLUEPRINT

THURSDAY, NOVEMBER 21, 1974

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON THE ENVIRONMENT
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 1324, Longworth House Office Building, Hon. Morris K. Udall (chairman of the subcommittee) presiding.

Mr. BINGHAM. The Subcommittee on the Environment will be in order.

We are happy this morning to welcome the Secretary of the Interior and appreciate his giving us the time.

I am filling in at the moment for our chairman, Mr. Udall, who is tied up in the conference on the strip mining bill.

I will begin by reading the statement that he had prepared to open this meeting.

The release of the Project Independence Blueprint has confirmed what many members of this subcommittee have known for some time.

1. We are indeed in the depths of an energy crisis. U.S. production of natural gas has exceeded new additions to reserves in 5 of the last 6 years. U.S. crude oil production peaked in 1970, yet oil consumption has continued to rise. And increased energy prices have contributed substantially to the worst inflation this country has seen in two decades.

2. Energy problems will get worse before they get better. The blueprint tells us that between 1974 and 1977 there is almost nothing that can be done to prevent domestic oil production from declining or at best remaining constant. Yet oil consumption is expected to maintain its present pace or even rise again, depending on prices. So unless we take immediate steps to reduce oil consumption, and therefore imports, the United States will be more vulnerable to an embargo than ever before.

3. Yet there are ways to achieve near self-sufficiency by 1985. We don't need to continue to exploit our energy resources with such reckless abandon. The blueprint tells us that with continued \$11 oil import prices, insecure imports could be virtually eliminated either by an accelerated supply program or by effective long-term conservation measures. So the problem facing us in the long term is not a lack of options, but rather how to choose an acceptable set of production and conservation actions from among the many possible combinations available to us.

In our hearings today and Monday we intend to examine these findings and others in some depth in order to better understand which

broad policy directions the country should pursue. With assistance from administration witnesses we hope to consider the report's implications for four key policy issues:

1. Is energy self-sufficiency a goal the Nation should pursue? The report concludes that "while zero imports is achievable, it is simply not warranted economically or politically." We would like to evaluate this conclusion as well as examine the costs and tradeoffs involved in achieving lesser degrees of energy independence.

2. What is an appropriate balance between efforts to stimulate new domestic energy production and actions to slow down the rate of growth in energy use? This subcommittee has supported the former with its surface mining and nonnuclear energy research bills. To insure adequate emphasis on the latter, the subcommittee has also reported out a bill, H.R. 11343, which would set a national goal of 2 percent energy growth per year. We are therefore particularly interested in the report's findings in this area.

3. What actions should be taken concerning the management of Federal energy resources? The administration has previously proposed significant new leasing of the Outer Continental Shelf and other Federal energy resources. However, the report implies that leasing could proceed at many different rates depending on such factors as future energy needs and energy import policies. The subcommittee would like to determine whether the current leasing program is consistent with more moderate growth rates in energy use.

4. What is the role of energy price controls, if any, in a national energy policy. Decontrol of domestic energy prices has been proposed as a means for stimulating new energy productions. Others have opposed decontrol either as being too inflationary or as being of limited effectiveness. We are interested in whether the report has developed any new findings on this critical issue.

It is my hope that through these hearings on Project Independence we will learn more about the administration's plans for confronting the energy crisis as well as contribute to congressional understanding of this complex report.

The gentleman from California.

Mr. HOSMER. I think it is laudible that this committee in the previous Congress made a very comprehensive study of the Nation's energy situation. It set forth and predicted the very situation in which we find ourselves today, and pointed out some of the ways it could have been avoided. The work of this committee was totally ignored by the public and by the Congress.

More recently, the Ford Foundation report, also provided a framework for discussion of the Nation's energy problem. And now, 2 months later, we find ourselves in today's hearing with this report which again offers a smorgasbord of options, objectives, and alternatives.

But I would say, Mr. Chairman, that the time for choices, not only in the near range but also in the long range, is running short and that thus far even with a series of energy czars we still haven't witnessed much progress toward solidifying a national energy policy. Particularly, we still lack an identifiable methodology for establishing a long range energy policy which will be met with public acceptance and stimulate congressional action.

If indeed we are going to be able to formulate an energy policy—one which points the country toward ultimate solutions and avoids fractures and interferences in dealing with short-term problems—between now and 1985—a start will have to be made in outlining at the present time a policy which strikes toward precise objectives rather than zigs and zags with each turn of current events.

I think this report is contributory. I don't regard it in quite the terms that the statement implies. I note that the chairman's statement surfaces some of the prejudices for solutions that have been floating around this committee, such as H.R. 11343, which arbitrarily states a specific low energy growth rate for the future.

But, nevertheless, I will be interested in hearing what the Secretary has to tell us.

Thank you, Mr. Chairman.

Mr. UDALL. I thank my colleague for his comments.

In the interest of time, Secretary Morton, I think we will get to you.

STATEMENT OF HON. ROGERS C. B. MORTON, SECRETARY OF THE INTERIOR, ACCOMPANIED BY ERIC ZAUSNER, ASSISTANT ADMINISTRATOR, AND JACK CARLSON, ASSISTANT SECRETARY

Secretary MORTON. Thank you very much.

I am bringing Eric Zausner, and Assistant Secretary Jack Carlson.

Since the blueprint study came out of the Energy Agency, I think it would be helpful to have Eric here because he is familiar with it in detail, and also has some charts which might be helpful in answering your questions and shedding some light on some of the rather complex information that we will be talking about.

Mr. UDALL. We appreciate having him and the charts, and particularly you as a former member of this committee and one who has one of the toughest jobs in the country today dealing with this many faceted energy problem.

You may proceed.

Secretary MORTON. Thank you, Mr. Chairman, gentlemen of the committee.

I appreciate the opportunity to appear before this committee to discuss the recently released FEA study on Project Independence.

The study, or blueprint, as it has been called, is an analysis of the options we have to consider in order to achieve a balance of the supply and demand for domestic sources of energy with an acceptably low level of reliance on foreign energy sources.

The principal focus of the report is the next 10 years—that is, it presents the situation against which we will have to make policy choices to meet our energy needs until 1985. It gives us an analytical framework within which we can develop specific energy policy. With regard to the newer energy sources that will become available after 1985, the blueprint is the first building block in developing the further policy choices that will be required for the long term.

In my judgment, the blueprint is a living document, subject to continuing review and adjustments, but it is the most comprehensive and up-to-date analysis we have. On the basis of this report, and with additional economic, social, and environmental impact analysis, we can move with far greater confidence in formulating our energy future.

The study outlines three major policy directions:

- (1) A base case extending the current trend into the future;
- (2) an accelerated supply case, relying more or less on all-out development of energy resources; and
- (3) a conservation case, which concentrates on a reduction of demand.

Each of these is analyzed in terms of two alternative price structures: a world oil market level of \$7 per barrel and a world price of \$11 per barrel.

As you know, domestic energy demand in the last decade has been growing at a far greater rate than our ability to produce energy. In 1950, the United States was considered self-sufficient in energy but the situation has deteriorated considerably since that time. In the period from 1950 to 1970 our energy consumption increased at a rate of approximately 4 to 5 percent per year while production rates have been stabilizing and in some cases declining. Coal production, for example, is still at the level that it was in the 1940's and, in fact, is even less than it was in the 1920's. Crude oil production has been declining since 1970 and will continue to decline or at best remain constant for the next few years. Natural gas consumption has been exceeding the rate of new discoveries since the late 1960's. As a result, by 1973 our dependence on foreign oil had grown to over one-third of domestic petroleum consumption.

The Arab oil embargo of last winter dramatically demonstrated the Nation's vulnerability to insecure imports. The embargo not only alerted the American public as to the extent of our energy problem, but had a significant economic and social impact on the Nation. It is estimated that the embargo resulted in a \$20 billion drop in GNP and in unemployment of a half million people.

The "Blueprint" projections are that at \$11 a barrel world oil prices, domestic energy demand will grow at a substantially lower rate than it has in the past. The study estimates that demand will grow at about 2.7 percent per year between 1972 and 1985, consuming approximately 103 quadrillion Btu's, or quads, as compared to previous forecasts of over 115 quads.

Even at \$7 prices, total energy demand will grow at about 3.2 percent through 1985 reaching about 109 quads. At \$11 oil, if no major changes are implemented, reduced demand could lower imports to 3.3 million barrels a day by 1985; whereas at \$7 oil, under the same assumptions, imports would be over 12 million barrels a day. We can already observe the effect of higher oil prices on demand. Gasoline consumption in 1974 is about 5 percent less than the pre-embargo projection of 1973, although, of course, some of that reduction is the result of the slowdown in the economy.

Energy supply is severely constrained in the short-run and largely affected by world oil prices in the long-run. There is very little we can do to increase the domestic production of crude oil between now and 1977. Currently, the United States is producing about 8.6 million barrels of oil a day. By 1985, at \$7 world oil prices, production from the lower 48 States could decline to about 4 million barrels a day. Additional U.S. production by 1985 would have to be supplied by Alaska and the Outer Continental Shelf. If oil prices are at \$11, production from the lower 48 States would reach about 12.8 million barrels a day

by 1985 as more expensive secondary and tertiary recovery techniques come into use. Coal production will increase significantly and is expected to be over 1 billion tons per year by 1985; however, coal production is affected severely by the lack of demand. A very important point in the Project Independence study is that the 1 billion ton figure could perhaps be doubled if new methods were found to secure a market for the coal.

Another significant finding in the Project Independence study is the need for natural gas deregulation to achieve greater production of this increasingly scarce commodity. With continued natural gas price regulation, the production of gas will decrease to about 15 trillion cubic feet. With deregulation of new gas, this decline could not be halted, but an increase in production could be expected to a level of 24.6 trillion cubic feet by 1985. Since natural gas is such an important and clean source of energy, the relevance of this finding is evident.

In this regard, the blueprint confirms a fact which has been abundantly clear for some time now—a fact which has led us to give the highest priority to legislation to deregulate new gas prices.

While nuclear power is expected to grow from about 4 to 5 percent of total electric power generation to about 30 percent in 1985, other fuels such as synthetics, shale oil, geothermal, and solar energy which have large potential in the long term, are not expected to amount to significant supplies before 1985 due to technological, timing, and economic factors.

Achieving the base line case will necessitate strong actions to solve serious problems. It will mean, for example, increasing coal usage, but this requires the timely availability of air pollution control equipment. In addition, the financial problems of the electric utility industry have been particularly acute in the recent past, and it remains unclear whether market and regulatory forces will be adequate to correct this situation. Current manpower, equipment and material shortages are likely to persist in the short term and may adversely affect levels of production. For example, it now takes between 3 and 4 years from the time a walking dragline is ordered until one is delivered. Drilling and platform availability is also constrained.

Alternative actions that could be taken to accelerate domestic supply include Federal leasing and development in the Atlantic, Pacific and Alaskan Outer Continental Shelves and the tapping of the Naval Petroleum Reserves. We have already taken preliminary steps in this direction. Baseline environmental studies are underway in frontier areas and a tentative leasing schedule of 1975-78 was released last week at the Coastal Governor's OCS Conference. The tentative schedule calls for six lease sales per year through 1978. These areas along with Alaska onshore areas are the most promising for future domestic production in the Lower 48 States is declining and will probably continue to decline in the future. A strong program in all these areas could increase potential production to over 15 or 16 million barrels per day by 1985. Shale oil production could be increased to about a million barrels a day in 1985 if potential could be achieved and water and environmental constraints are overcome. And the only way to increase the role of nuclear power would be to accelerate powerplant construction.

By accelerating domestic supply, the United States could reach a position of energy self-sufficiency by 1985. That is, we could reach zero imports. While zero imports may sound attractive, we do not believe that it is a practical goal. Some imports are secure and are not subject to arbitrary cutoffs while others are useful to maintain traditional international trade relationships.

Energy conservation and accompanying deficiencies could reduce demand growth even further by 1985. We are now very seriously evaluating results of our voluntary energy conservation program and if this program does not prove adequate to reduce demand, additional mandatory actions will be proposed. Presently we are assessing a number of energy conservation proposals which could meaningfully reduce domestic demand. These proposals include a broad range of options and they will be studied very carefully. I would emphasize that before measures designed to either bring about energy conservation or increase supply can be introduced, their secondary effects on the economy and the wellbeing of all Americans must be thoroughly analyzed.

The Project Independence Report will be used to assess energy policy alternatives prior to the President's state of the Union message in January.

Currently, the Energy Resources Council is working with the other Federal agencies to outline and coordinate a series of special energy policy objectives for the United States and a number of detailed proposals designed to improve our short- and long-term energy situation. Each agency has been asked to review the report and provide suggested policy proposals to the ERC within 2 weeks. The ERC will develop a cohesive energy policy package, using the expertise of these Federal agencies. It will analyze not only the energy implications of various proposals, but their economic, social, and environmental impacts as well, determining the feasibility of each prior to the end of this year. The proposals will form the basis for an energy policy statement by the President when the next session of Congress begins.

As we face the difficult energy policy choices that lie ahead, reasonable men will differ on which choices best serve the national interest. I am firmly committed to seeking full public participation in the decisions that we must make.

Particularly, I expect to be meeting regularly with appropriate congressional groups to insure an open dialog about the best approaches to America's energy future.

The development of a national energy policy has gone through several cycles in the preceding months and years. Organizations, ideas, and people have changed. But with the Project Independence analysis completed and with a determination to develop a comprehensive policy, we are now moving in the right direction and I am convinced that we will put the Nation on the course to a desirable energy future.

Thank you very much for allowing me my statement, Mr. Chairman.

I will be glad to try and answer your questions.

Mr. UDALL. Thank you, Secretary Morton.

I particularly appreciate the approach and attitude reflected in your last couple of paragraphs. It has been obvious the country hasn't had a firm and cohesive energy policy. The Congress and executive

branch have been moving many times in opposite directions and we have had a number of changes in leadership. I think we owe it to the country, all of us, both the Congress and the executive, to get down and get going on this. That was the purpose of these hearings and the purpose of the blueprint, as you pointed out, and I like your statement that you intend to work with various congressional committees in this area.

There is intense interest this morning in your testimony as you can see by those present. I have tried to cover the subcommittee fairly over the months so that we don't penalize the junior members.

I think we will simply divide the time arbitrarily, fairly, and make sure everybody gets a shot at Secretary Morton and make sure everybody gets a chance to answer questions here.

I think with 12 colleagues and about 90 minutes—you can stay with us until 12?

Secretary MORTON. Yes, sir.

Mr. UDALL. That works out to about 7 or 8 minutes apiece.

We will proceed on that basis.

Let me take my time.

We have before us some legislation, before the full committee now, of which I am the author and which a number of those here have worked on, which is related to two things in the latter part of your statement. One, we propose to establish an energy policy council which could be the counterpart of CEQ, the Council of Economic Advisors, Council is doing. Our bill also would fix a target of energy growth, Council is doing. Our bills also would fix a target of energy growth—2 percent annual growth rate as against 4 or 5 as in the past.

Has your position changed on this legislation, the desirability of these two points, particularly?

Secretary MORTON. Number one, on the Council, I don't want to form too many layers of Government. I certainly feel we should develop an advisory group. I am studying the effectiveness of an advisory group in advising the combination of the ERDA organization, the Federal Energy Organization as well as other energy organizations such as Interior, Transportation, and the like.

My fear is if we create a CEQ for energy it will not be as effective as it should be because it will become a layer of Government, and I feel that that is not in the best interests of getting this job done.

The ERDA Act itself, as you know, created the Energy Resource Council. It is a within-Government council. I would hope that our objective advisory group could be totally without government, could be a group of citizens who without conflict of interest could objectively advise, and I don't believe that one created legislatively as this one would accomplish that goal.

As far as the 2 percent growth is concerned, it seems to me that we should not set a 2 percent or any percent growth arbitrarily at a given point in time. Three years from now or 4 years from now we might find that that is unacceptable.

I would point out to the committee, sir, that Germany consumes 43 percent less energy per capita than we do. Whether their way of life is 43 percent more unattractive than ours is I think open to question and argument. I am very apprehensive about trying to set growth goals because you never know what kind of effect they will have on the

economy or the society or whether in fact we should go the other way as far as energy is concerned after we solve our short-term dilemma.

Mr. UDALL. I wonder if you would comment on the argument that many made before our committee, and I know Senator Hollings came over and testified on it, saying there is great value in separating out those concerned with long-range economic policy or environmental policy from those who are administering the policy such as EPA. Does it bother you that you are cast in the role of not only being the man who is coordinating the formulation of long-range policy but you are also saddled with a lot of the day-to-day administration of the policy?

Secretary MORTON. Perhaps I view the role of the Energy Resources Council's Chairman differently than that has been viewed before. The term czar upsets me because certainly there is no place in this business for czarism. What I am trying to do is to bring the full impact of the Federal Government into being against the problem, coordinating the efforts of the line agencies and almost all of the line agencies of this Government have some impact and some contribution to make in terms of both the development side as well as the conservation side of the problem. I feel that the role is one of coordination.

Now, the long-term aspect of the problem, was addressed by the Congress in the establishment of the ERDA concept, the whole idea was to put the R. & D., which in itself is long term, that is both a short term, but definitely a long-term component into a single agency where it can be examined by the Congress and the public as to adequacy. As long as we are going in that direction I think the role of the Council Chairman is to make sure that these agencies first are adequately funded. And second, are working together and are not in a turf battle one with the other; and third, that there are no gaps in the pie that are being overlooked.

So I feel that the original structure and the Council Chairmanship is pretty well designed based on what actions the Congress have already done in creating of FEA and ERDA.

Mr. UDALL. Let me shift gears, and without getting you in trouble with the White House, I am talking theoretically and hypothetically, but in the event we have to go to mandatory measures to reduce automobile gasoline consumption, what kind of a scale of desirability of the various efforts that have been suggested, the gasoline tax, the horsepower tax, how do you come down if you were forced to go to one of these?

Secretary MORTON. I come down on the horsepower tax and the mileage proposition as being too late with too little. If you are talking about horsepower tax on new cars you are only talking about one-seventh of the fleet because the fleet only replaces itself about every 7 years.

As far as the mileage goals that we are setting, having a 20-mile-per-gallon fleet average by 1979 I think is a must. I think we must move in that direction. I hope we can do that without a horsepower tax, but a horsepower tax may be used to accomplish this.

But a horsepower tax in itself or the gains that will be made by the automobile industry will be felt so far out into the future that we may well have to take mandatory action such as an embargo that shows up in the form of a cap on imports or any other number of mandatory alternatives. I am not against these other proposals at this point, but I don't see them working fast enough to get the job done.

Mr. UDALL. The Chair recognizes Mr. Hosmer for about 7 minutes.

Mr. HOSMER. I would like to comment in more blunt terms than the Chairman. The Resources Council is composed of some Secretaries who seldom meet together and who have other responsibilities. I don't believe that you are ever going to get the long-range energy problems of this country adequately attended to until you set up a group of say five wise men who do have the interests you spoke of but who are unburdened by distractive administrative duties.

Now, you didn't mention nuclear fuel, but we will be facing an absolute shortage on that in about 1982. Does the gentleman have any comments on what you might want to do with that problem?

Secretary MORTON. I think what you are directing your remarks to is the enrichment capacity problem.

Mr. HOSMER. That is right.

Secretary MORTON. That has to be solved, as you know. The Atomic Energy Commission as it has been functioning has not solved the problem, and we are trying to, by reorganizing this effort and by the creation of ERDA, put together the kind of organization that can solve the problem.

Mr. HOSMER. What you are doing with that is taking a production activity and sticking it into a research and development agency.

Secretary MORTON. One of the problems here, of course, is our acceleration of the search for uranium.

Mr. HOSMER. I am not talking about uranium ore but the industrial capacity of uranium enrichment which is about to be consumed in this country. In the meantime, we do have some overcapacity which might be used for free production purposes in order to make it possible for private industry rather than the Government to add the new production capacity that will be required after 1982.

Secretary MORTON. I can't argue with you on that. If we are going to have a light war generation and if it is going to come anywhere near the contribution that we project as its potential in the Blueprint study the problem of uranium enrichment in terms of the volumes that are going to be required to operate that generation have got to be solved and have got to be solved in the near term. I don't think there is any question about it. Certainly, I can't sit here as an expert in the field of uranium enrichment, but the commitment to do this job I can tell you is being firmly put together, and I am sure that the President in his budget consideration is going to have to consider the amount of money that is going to be required to do this.

Mr. HOSMER. I will say to the Secretary that he virtuously acknowledges he is not an expert, and I will say I don't know anyone in the executive branch of the Government in a policymaking position that is, and they are fumbling.

This 16 million by 1985 that you point out for shale production, could you do that with \$7 a barrel oil?

Secretary MORTON. I don't think you could in today's world. We may have to work out some device to insure the desirability of this operation from an investor point of view.

Mr. HOSMER. You recognize that the financial problems of the electric utility companies are acute; however, you say it remains unclear whether market and regulatory forces will be adequate to correct the situation. If they are not, what do you have in mind?

Secretary MORTON. We will have to come to the Congress with legislation that will override the deficiencies in the regulatory area, because they are primarily regulated, as you know, by State agencies. Rate is their problem today in terms of generating the cash and capital growth required to do what they have to do.

We have burdened them with additional capital costs beyond just the inflationary costs of the times, but with the necessity for the installation of rather sophisticated environmental equipment.

We cannot, in my opinion, let the utility industry in this country flounder for lack of money or earning power. We will have to come to Congress to get the kind of legislation that will insure that they are not paralyzed.

Mr. HOSMER. Could that possibly include investment tax credit extensions?

Secretary MORTON. It well may. But the point about that is it doesn't do any good unless you are earning some money. We may have to definitely open some legislation that directs itself directly toward the regulatory side.

Mr. HOSMER. Do you recommend the deregulation of the price of natural gas or are you talking just about new natural gas?

Secretary MORTON. The administration position is only talking about new gas, additional gas. However, as you know, there are a good many points of view in the Congress that deal with the deregulation of all natural gas.

Mr. HOSMER. You stated that \$11-a-barrel oil would considerably decrease the demand for oil. But if you don't have that by market action or by an arbitrary action of the Arabs, and if it is desirable to decrease the use of oil, why not just slap a heavy tax on gasoline at the pump and other petroleum energy uses?

Secretary MORTON. I would refer to my answer to the chairman that I think we have to arm the President in the next few days with a portfolio of alternatives so he can make a judgment as to what is the best way to go, and obviously we have to determine what impact this will have on employment and other factors in the economy.

We certainly want to minimize this effort in terms of its depressing effect on the economy. We went through the experience of the embargo costing us about \$20 billion in GNP and we want to be very careful that any self-imposed embargo or disincentive has a minimal effect on employment and the economy, and that is why it is not easy to pull one out of the air.

Mr. HOSMER. Does what you just said imply an approval for Senator Mansfield's proposal for a range of full powers in the hands of the President to be used upon his own discretion?

Secretary MORTON. I haven't had a chance to study the Mansfield proposal, and therefore it would be premature for me to comment on it. I am always apprehensive in trying to set up controls to try and get your way out of a situation.

I have always felt forces in the marketplace, providing they can operate without undue injustices, would be the way.

Mr. UDALL. Mr. Vigorito.

Mr. VIGORITO. Thank you, Mr. Chairman.

Mr. Secretary, it is nice to see you here today and hear your remarks.

You keep mentioning \$7-a-barrel oil, and I think as far as international prices are concerned, you might as well forget that. That is an exercise in futility. From now on we had better talk about oil prices at \$10 plus per barrel. I never again expect to see international oil selling for \$10 a barrel.

You mention oil production at \$11 a barrel in the lower 48 States could increase in 10 years. If I am not mistaken we are producing about 8.8 million barrels a day. That would mean—correct?

Secretary MORTON. That is about right, yes, sir.

Mr. VIGORITO. That would mean—well, 10 years, that is a 50-percent increase in domestic production within the 48 States. I don't see where that could possibly come from. Do you have any suggestions as to where that additional 50-percent increase is going to come from?

Secretary MORTON. Mr. Congressman, it is generally considered about 2 barrels of oil remain in the ground for every barrel that is extracted under normal procedures, that is without secondary and tertiary recovery. With that, which is an expensive way, but you can do it on today's \$11 basis, you would expect these increases to take place.

I think it might be interesting for the committee if Mr. Zausner went through this chart very quickly for you which deals with the question you raise.

Mr. ZAUSNER. You stated domestic production has been declining over the last few years. At the prices at \$4 or \$5 or \$6 a barrel we would expect the lower 48 States to decline to about 4 million barrels a day. The more expensive secondary and tertiary could take lower 48 onshore production and hold it fairly constant which would be quite a change within the last few years.

Most of the increases above that holding would essentially come from the areas where we haven't produced very much before.

Alaska, with completion of the TAPS pipeline and also perhaps looping that pipeline could produce 2½ million barrels a day by 1985. There is a potential for 200,000 to 300,000 barrels a day of production from oil shale and tar sands by 1985. Of course, offshore production in the business-as-usual case, which would come primarily from the Gulf of Mexico would roughly be another 2 million barrels a day. That is the basis for talking about roughly 13 million barrels a day in 1985.

But it is also important, I think, that that doesn't include the kind of actions we could take in addition to merely price effects to develop frontier areas. These are primarily on the lower 48 or Outer Continental Shelf areas, primarily the Atlantic and Pacific and Alaska and tapping naval petroleum reserves. They could produce another 3 to 4 to 5 million barrels a day on top of the 13 million barrels a day which could come from the traditional areas.

Mr. VIGORITO. You mention here that coal would get up to a billion tons by 1985. I believe today's production is around 600 million tons plus, 660 or something like that. That means that every year we have to increase production over the previous year between somewhere like 40 or 60 million tons a year. That is quite an increase. We have to work at it. It won't come easily. It will take a tremendous investment in machinery and equipment and trained manpower and opening up new mines and so forth.

What bothers me is you say production is affected severely by demand markets. You say lack of demand markets. Would you expand on that?

Secretary MORRON. Coal is a very systems-limited or demand-limited fuel. If you don't have the boilers to burn it there is nothing else you can do with it.

Coal production and the utility or the generation of electric power are so closely interrelated that you can almost consider it as a single effort.

In order to utilize a billion tons a year of coal, and we are talking about coal used for—under boilers as opposed to metallurgical coal, will obviously necessitate the development of a system of electric generating plants that can absorb that much. One of the restrictive problems is first, I think they have a technical problem in meeting the environmental standards. We are now proposing some amendments in the Clean Air Act to hopefully eliminate some of these technical matters. There are some legislative problems that the utilities industry have, and Congressman Hosmer brought this up.

We also, of course, have some financial problems that the utilities industry has got to overcome. Those are the constraints that they are talking about and those are the constraints that will make coal demand limited.

It would seem to me that it is so much in the best interests of the United States to convert as much of our electric power as we can from oil to other fuels, nuclear power and coal, that we should address ourselves immediately to overcoming these problems on the demand side.

Now, we have started, as you know, at a pretty good clip to increase coal production. There have been 100 mines opened and 75 deep mines and one of the constraints has been transportation. I found out yesterday every dark cloud has a silver lining. Because of the slowdown in the auto industry the delivery has been accelerated.

I hope that we will be able to overcome the legislative constraints so that the demand for coal will increase. We get back again to the uranium enrichment operation. So we meet that demand. This will also entail expansion of coal production. So if we can increase the utilization system, the additional production will follow, I am sure.

Mr. VIGORITO. Thank you, Mr. Secretary.

Thank you, Mr. Chairman.

Mr. UDALL. Mr. Ruppe.

Mr. RUPPE. Thank you, Mr. Chairman.

You have indicated we can reach a viable independence by 1985. You indicated that "These areas along with Alaska onshore areas are the most promising for future domestic production. Onshore production in the lower 48 States is declining and will probably continue to decline in the future. A strong program in all these areas could increase potential production to over 15 or 16 million barrels per day by 1985."

Do you foresee that this figure would actually be the daily rate of consumption in the country, or do you anticipate that Project Independence in fact won't be met and we will use at least 3 million barrels of oil imported from abroad. What does our oil production figure look like in 1985.

Secretary MORTON. Let me show you a chart that depicts that. We are predicting some growth.

Mr. RUPPE. If you produce 16 million barrels a day—today it is around 7—so either we won't reach Project Independence or we will have to cut down greatly on oil consumption or import oil from abroad or a combination of both.

Mr. ZAUSNER. When we refer to 16 million barrels a day production that does not include gas liquids.

Mr. RUPPE. That is on field?

Mr. ZAUSNER. It would still be roughly 2 million a day. In addition, that 16 would not include roughly the million a day of oil shale.

Mr. RUPPE. What do you think the consumption—

Mr. ZAUSNER. About 21 to 22 million barrels a day.

Mr. RUPPE. 21 million barrels. Using 17 now, do you foresee only a 4-million-barrel increase in the next 11 years?

Mr. ZAUSNER. That is at \$11 prices.

This year domestic consumption has been running below last year, and we expect at least for the next 2 years that consumption will not be up appreciably.

Mr. RUPPE. Do you anticipate importing the 3½ million barrels you referred to earlier? I think in the Secretary's statement you projected 3½ million barrels of imports and we will not be able to reach total Project Independence.

Mr. ZAUSNER. That is if we take no action and do not open up the frontier areas and develop the Alaskan reserves, the naval reserves. The number we have used with no new action is 13 million barrels a day, and if you take the 13 million barrels a day and 2 million natural gas liquids, the oil shale and other commodities, that gives you roughly the 3½ million barrels.

Mr. RUPPE. You anticipate by 1985 consumption will be 21 million barrels a day and it would be entirely developed through domestic sources and totally independent of foreign imports of oil?

Mr. ZAUSNER. It could be.

Mr. RUPPE. What is it going to be, sir?

Secretary MORTON. The point is the potential that you have. You will have to take an awful lot of action. You will have to drill, for example, in the frontier areas and discover oil in the frontier areas. This is one of the big ifs.

Mr. RUPPE. Are you saying by 1985 it is possible with all of the ifs to get to about 21 million barrels a day; am I correct? So then it depends on what action you take on the consumption side whether you can meet that 21 million barrels. Would you have to import in case that consumption figure rises above 21 million?

Secretary MORTON. I feel very strongly we will have to impose a new ethic on utilization of energy on this country. If we self-impose it, the consumption of gasoline, for example, in 1974 is below 1973. How these trends are going to go over the next couple of years because of certain other uncertainties in the economy, I think are very difficult to predict. But we will have to come out of the problem and we are dealing with a time frame here of 1985 about a new energy effort.

Mr. RUPPE. I thought it was Exxon president, Mr. Jamison, or one of the officials of Exxon who indicated that gasoline consumption

was rising. He felt gasoline consumption was fairly inelastic to price. It was a reference in the last few days to reports that gasoline consumption was rising.

Secretary MORTON. That may be in the short run. It goes up and down within a short cycle.

Our figures are pretty accurate that within the close of the year of 1974 it will show a decrease.

Mr. ZAUSNER. Even in the last several months demand has also been running below last year.

Mr. RUPPE. Going back up?

Mr. ZAUSNER. It is following the season trend but for the last several months that is pretty consistently been running below last year.

Mr. RUPPE. I also read the other day where Gulf or one of the other major companies had canceled a refinery construction project, and I think three or four other firms have canceled construction projects, due to uncertainty as to imports, lack of deepwater ports, legislation from the Congress, et cetera. What is your feeling toward the cancellation of these refineries. Is it a good idea or do you feel there is some type of national policy that would perhaps encourage this type of construction if it is indeed needed?

Secretary MORTON. The question is if it is indeed needed while they are undergoing a rather conservation program. These decisions are made on pure economic analysis that show an inadequate return on investment. If they were confident they would have a return on investment they would make the investment, I feel sure.

We are going through, and I think they recognize it, a period in which there will be a decline in the use of products that come out of these refineries because there is no other short-term fuel.

Mr. RUPPE. You are not concerned in the short term these projects are being canceled out?

Secretary MORTON. No, I think there will have to be some adjustment in the product facilities. I think if we see the refinery capacity of this country can't meet its demand in fairly near-term forecasts then I think we should get concerned.

But today our refinery capacity at today's level seasonally adjusted is certainly not running at 100 percent.

Mr. UDALL. The gentleman's time has expired.

Mr. Melcher.

Mr. MELCHER. Thank you, Mr. Chairman.

Mr. Secretary, about 10 months ago the Subcommittee on Public Lands heard testimony regarding Elk Hills to the effect there have been migration of some of the oil to the south, and therefore out of the reserve and to a private company, which I believe is Standard Oil of California. Navy authorities assured us that they felt the migration had been stopped and that Standard Oil of California was cooperating in every way not to take advantage of any of the migration of the oil.

But, however, there was also testimony from experts to the effect that any open oil field is seldom static, it doesn't necessarily remain in place, that is a tendency to seep or migrate away.

In view of that, are you prepared to accept the responsibility of submitting to the Congress, if so directed by Congress, a proposal to develop Elk Hills promptly within a matter of a few months—

Secretary MORTON. That is a proposal before the Congress for 2 months.

Mr. MELCHER. For production not by Standard Oil of California, who participate in a unitization contract for 21 or 22 percent of the oil, but by either the Government or by contract by Government to another company for development?

Secretary MORTON. You would have to make sure you were dealing with the highest bidder. I don't propose to selectively select a contractor to develop any resource unless I am sure that the public is getting the most out of that selection.

Mr. MELCHER. In other words, a plan in the public interest?

Secretary MORTON. Let me say this on Elk Hills. I am sure this committee has been involved in it but there is another committee in the House that is much more involved in it. I have struck out in any kind of development proposals for Elk Hills and that is where the legislation has rested.

Mr. MELCHER. It also rests in this committee.

Secretary MORTON. Hopefully then, you will report out the bill.

Mr. MELCHER. My second question involves a different subject entirely, but concerns your role in energy matters. Many of us here in Congress are particularly happy to see your emergence as the leading spokesman for the administration in the energy field. What would be your attitude of exporting of Western coal to Japan, bearing in mind this is low sulphur coal?

Secretary MORTON. Coal is our biggest single export for any one commodity, including everything, wheat, anything else you want to call it. I wish I could think of the figure offhand, but it is around \$2 billion a year, something in that area.

Now, our dilemma today is not a dilemma of supply. Our crisis today is a crisis of price and risk. The price crisis is causing a transfer of wealth from this country to the OPEC countries to the tune of \$23 to \$26 billion a year and we see no way in the short-term that that can be decreased substantially without having everything work that we have been talking about here earlier. So to suddenly decide to add \$2 billion to our trade deficit by cutting off Japan, would supply us with a good deal of steel, from which depends on that coal to be made, seems to me to be cutting off your nose to spite your face. I think we have coal reserves sufficient in this country to enjoy for many, many years a wholesome export of coal.

Mr. MELCHER. I wasn't referring to existing exports of coal. I was referring to low sulphur coal from the West. I don't know of any of that being exported at the present. I am talking about new export of low sulphur coal that is in short supply for our own utility companies.

Secretary MORTON. In that case, I think we should make sure that our own domestic needs are served universally before we increase our exports.

I thought you were talking about stopping the export of metallurgical coals which is one of our better export commodities.

I obviously believe we have a utility problem and that we must, until our nuclear generation really has a dominant position in the marketplace, we have got to protect our fossil fuel fired plants, and I obviously feel you shouldn't ship out from under them.

Mr. MELCHER. Protect ourselves first? Our own needs first?

Secretary MORTON. Yes, sir.

Mr. MELCHER. In defense of wheat farmers all over the United States, we export about 1 billion bushels a year and it is worth somewhere between \$4.50, \$5.50 a bushel, and that is worth about \$5½ billion of oil export.

Secretary MORTON. Some years we do and some years we don't.

Mr. MELCHER. I notice your statement on the lack of equipment such as pipe and walking draglines. Can you foresee a type of Government encouragement to provide this necessary and essential supply for energy development?

Secretary MORTON. We certainly can, and as you know, we have several mechanisms including the Defense Production Act which really in effect gives us the power to allocate materials for fabrication of these products.

Right now we only anticipate trouble in two areas, mobile and stationary rigs for the offshore. They are built in specialized yards. The capacity is not as easy to expand or is it as elastic as other commodities. The National Petroleum Council recently did a study which gives us an encouraging point of view as far as oil country goods are concerned, and hopefully we are going to come out of this thing without having to impose a lot of mandatory allocation type of regulations.

It is an amazing thing. Now, this change in the automobile production will have a very good effect on the fabrication of many of these items which have been very long-term in delivery.

Mr. MELCHER. I noted your comments in that area.

Thank you, Mr. Chairman.

Mr. UDALL. Congressman Dellenback.

Mr. DELLENBACK. Thank you, Mr. Chairman.

I note in your testimony, Mr. Secretary, you deal with the question of conservation, and I have a number of other things we might pursue a little bit. I would like to ask a couple of questions about what you say about it, because I note that you deal in terms of generalizations in your testimony.

The basic report itself has quite a chapter on energy conservation. The blueprint itself deals with certain concepts of new standards and subsidies and incentives and switching and prohibiting and encouraging and voluntary and mandatory.

I wonder if there is anything else you can tell us at this time as to how important you look on this energy conservation subject to be. One reason I ask this question is I think there is an entirely erroneous feeling that the concerns of the administration to date have not really been on conservation, that they have been on what we do with production and supply. This is not my understanding of your feelings, and I would be very interested in your giving us for the record what you feel.

Secretary MORTON. I have felt for a long time that the conservation job as far as the Federal Government, had to be an across-the-board effort. We had to pit the whole Federal Government against this problem. I think there is a great deal more going on than is realized, and perhaps we haven't been making enough noise about it.

Let's look across the board. The Department of Commerce has been meeting with industry and has developed a conservation program for business and industry on a per-unit-of-output basis, and actually we

have been able to reduce the energy per unit of output this year by about 7 percent. Their goal is 15 percent. They are about halfway to their short term over the next couple of years.

The goal for transportation, the most visible is lower the gasoline consumed per mile of the automobile fleet. We have collectively—Secretary Brineger and his people have collectively met with the oil industry and now we are meeting with them individually. In fact, I and other members of the administration are meeting with the Ford Co. to discuss this very thing to see what problems have to be overcome, but our definite goal is to get to a 20-mile-per-gallon fleet by 1979.

Because 35 percent of our energy is used in heating and cooling space in which we work and live and so forth this is another big area.

The Department of Housing and Urban Development is working on a program in this area to try and work with State agencies across the board, not only in retrofitting of buildings but in terms of new building codes that will provide a standard of insulation much higher than we have had.

So the conservation effort is pervasive. It is not centralized. It is not a propaganda effort. We are beginning to work with the States for a much more legitimate system of enforcing the 55-mile-an-hour limit.

We have a very broad program. I don't know how the Congress would react if we wanted to use the money for public education in this area.

Mr. DELLENBACK. That is very helpful. I know the chairman joins with me in feeling education is very important.

Secretary MORTON. If we don't change the energy ethic and reduce our energy per capita in this country through conservation and efficiency we will have trouble way into the next century, and it will be serious trouble and it will have a very detrimental effect on the way of life of the average American citizen.

Mr. DELLENBACK. On the idea of structure, Mr. Secretary, when we created ERDA, as you know, we created six subparts in the final breakdown—subparts dealing with fossil and nuclear and administration and other and one of those six subdepartments was conservation. Is it intended that that office do the real work and is that a pervasive reachout? Is there going to be a real conservation effort in ERDA as you reach forward in this?

Secretary MORTON. I think you should say efficiency effort, and I think it will be there, because ERDA will have the responsibility and the statutory mandate to bring the energy concepts of the future into being, and those energy concepts have got to be concepts that are far more efficient in terms of unit of work or unit of output that we are experiencing today. So the answer in that respect is absolutely yes.

Mr. DELLENBACK. And it will be under ERDA? I am thinking in terms of the structure. When the Congress went forward and created ERDA I think the Congress' intent was to give a concentrated cutting edge under the general authority, under your capacity because of what has been assigned to you, but I am looking at the question of it being fragmented or whether you really don't intend to have the effort headed up and concentrated in a single position to a substantial degree. I think people will misinterpret again, at least some of them, what you have said.

You talk in terms of the effort for efficiency and conservation being pervasive and spread out and letting it go out. That doesn't mean there isn't going to be a concentration under your agencies of the heading up of an effort even though it may mean a reaching into the Congress and the FPC and on and on and on. Do I misinterpret what we have created or how you intend to implement it?

Secretary MORTON. Far be it from me to try to peruse the congressional mind when they created ERDA, but we will make the best out of it.

I think what we have and the reason I definitely open the encouragement of ERDA is I think we will have an agency whose primary objectives reach beyond the next generation, and for this Government to do that is a very enlightened thing, and for a good many of us to be excited about.

Mr. UDALL. Thank you.

Mr. Bingham.

Mr. BINGHAM. A quick question on this \$7 and \$11 alternative. Why were these figures picked?

Mr. ZAUSNER. The \$11 approximated in terms of world oil. They were based on a world oil supply demand analysis. What seemed clear is that the Middle East producing countries can cut back supply to support prices. We feel \$11 in 1974 is probably the upper end of that range. We don't feel that a higher than \$11 price is very likely.

On the other hand, we think it is a real possibility and one we think the \$7 number normal. It is pretty much a lower boundary. We think, given the growth rates at something like \$7 and the production capabilities that are possible in the world, would suggest a price much lower than \$7 is not much of a likelihood in the next 10 years. So we wanted to contrast these two extremes so we could see the implications of those prices.

I think as the Secretary mentioned, the implications of \$4 difference is quite dramatic in the United States.

Mr. BINGHAM. I think the actual result is we will be talking anywhere in between.

Secretary MORTON. That is one of the problems of quantifying forecasts.

Mr. BINGHAM. But your forecasts are based on the two extremes.

Secretary MORTON. If you see the two walls you pretty well know the room you are in and you can make policy within that framework.

Mr. BINGHAM. You spoke of the possibility of legislation-directed to the regulatory process over the utilities in the States. Could you spell that out at all, what type of legislation you have in mind?

Secretary MORTON. Certainly at this point in time nothing has been drafted. I am deeply concerned that our utility industry, and these perhaps are questions that should be dealt with by the Federal Power Commission and not so much by the Secretary of Interior, but because the whole coal problem is so related, practically all of our coal is burned or the big end of it is burned by the utilities, that is which is not used in the metallurgical process. The capital growth in the utilities because of restrictions on rate has been such that they now do not have the cash or the credit to overcome the cost inflation and the additional costs that have been added because of environmental restrictions. What we may have to do is address that problem at the Federal

level. These rates are fixed, as you know, by local regulatory bodies, and if we abandon the historical reserves which we have always had, which have varied between 13 and 15 percent as far as electric power, in other words, between 13 and 15 percent additional capacity to take care of fluctuations, to provide for growth in industry and in our society, and if we abandon that, and if we decide to downgrade the service, I think we will be making a terrible mistake.

The easiest way to take remedial action is to take the earlier one before we get into a bad situation, and it could take legislation, and certainly I don't pretend to have any sort of bill spelled out, but I am warning the Congress that this is an area, and hopefully I am warning through the Congress the State regulatory agencies that this is an area we had better look at because our electric utility industry is vital.

Mr. BINGHAM. Judging from the situation in my District, and I am sure this is true elsewhere in the country, increased utility rates have already caused intolerable hardships. Now, don't we perhaps have to come to the point of view that we have adopted with regard to mass transit: that the delivery of electric power to domestic users is probably something that cannot be done on a self-sustaining basis?

Secretary MORTON. Well, I don't know how—it is going to cost whether it costs at the meter or whether it costs on the tax form if you are talking about doing it through a government-owned utility versus privately owned utility. I don't think the government-owned utilities can generate electricity and do it any cheaper.

Mr. BINGHAM. Not necessarily that, but it seems to me somewhere along the line you can't pass on, granted all the factors, the need for capital in the utility industry, et cetera, it seems to me likely the domestic consumer will not be in a position to pay for it all.

Secretary MORTON. What is the alternative?

Mr. BINGHAM. You can make it a charge on the budget just as you do with mass transit today.

Secretary MORTON. Well, these are operating problems. I don't think you can disguise this cost. There is no way you can put blinders on the people. I think whether they pay for it at the meter or whether they pay for it on the tax form, it is going to cost. Now, the best thing we can do is increase supply, and when we increase supply and get production up, then we should have and can back out this political surcharged, high priced residual oil by the institution of domestic fuels, we certainly ought to be able to bring the price of electricity down, but as soon as you bring it down to a certain point, you will suddenly have another big spurt in growth because the demand goes up.

We have to find a place in the middle. I agree with you, I think the burden of the electric bills has become very, very difficult. It is a real, real problem. The best thing we can do is produce more abundant fuel to bring the fuel prices down.

Mr. BINGHAM. I would like to ask you to comment briefly on one of your earlier statements. You speak of the fact that decisions have yet to be made and the President will be making these in January. Yet in regard to leasing it seems there has been a firm policy to lease 10 million acres per year. Where is that 10 million acres to be located?

Secretary MORTON. That 10 million acres is pretty well delineated to be in the frontier areas as well as the Gulf of Mexico. We have institutionalized ourselves as to the amount of acres we can lease and go

through all the procedures that are necessary. I don't think we are now wedded to 10 million acres. What we are wedded to do is to find out where the oil is and where it is not. There may be a little reduction in the number of acres that are leased because there is no point in leasing vast, vast areas if there is no oil there. So we have to lease on a very selective basis as we go into the frontier areas and they can't be made until all the environmental procedures are complied with. We have a case before the Supreme Court dealing with the sovereignty of the Atlantic.

I met with a group from the Pacific Coast yesterday who are very much opposed to any leasing in the Pacific. These could very well prevail. The Governor of New Jersey took a pretty hard line against moving into the Atlantic. Well, everybody wants more oil, but not in front of my front door, so we have to go through, I think, a longer series of both public input as well as environmental study before the environmental decisions can be made. But if we don't start getting the baseline data and accumulating the criteria, we will never get there.

Mr. BINGHAM. Could I have permission to submit additional questions to the Secretary?

Mr. UDALL. We will put them together, and I know the Secretary will be happy to supply additional answers. I thought we might get a hearing record here that might be of use.

I have some questions submitted by Congressman Leggett for your interest.

Mr. Steelman.

Mr. STEELMAN. Thank you, Mr. Chairman.

Good to have you back before us, Mr. Secretary.

I think a lot of us in Congress think that monetary restriction doesn't seem to have the effect it should have regarding inflation. It has been my observation regarding food, steel, timber, communications, and oil that there is not enough competition in the marketplace to allow conventional free market forces to work. The paper this morning carried news about the Justice Department and A.T. & T. This is perhaps one example of monopoly. In the oil area, it seems to me there may be far too much domination in the market but too few producers.

Do you think there is adequate competition in the oil industry.

Secretary MORTON. Certainly if you look at several indicators you would conclude there is competition. One is the OCS bidding. In the bidding for tracts, their interest has been very competitive and resulted in a very, very substantial return to the Government of the United States. There is no way you could say these assets are being liquidated too cheap. One was sold recently for \$219 million and after drilling a few holes in it it is dusty.

Another aspect is that they are seeing some premium selling at the gas pump. We are seeing a real sales effort. So I feel—and there is a far more bigger independent sector than you think. Most of the oil is discovered on land by the small independent and wildcat people. The only monopoly that really exists in the oil industry is the OPEC countries. It is an international cartel and it is a tough one. They have been the first people and the only people who have ever been able to do anything like hold us up for price. If you will look at the history for energy prices you will see they have been only a fraction of what

they have been in Italy and Germany and Europe. This is part of our dilemma. With prices having been what they have been, I would say the oil industry is very competitive.

Mr. STEELMAN. I don't think there is any question about there being strong competition among the wildcatters and so forth.

My question is do you see any need for antitrust action against the majors, particularly those that dominate the retail business?

Secretary MORTON. Let me say this about the need for antitrust action. I will be candid. That is out of my field, and I have no idea, for example, that there was antitrust proceedings against the telephone company. The only thing I can say to you candidly is that we are getting a very competitive action on every lease or action that the Department is taking that gives the oil companies and the oil wildcatters an opportunity to explore and produce. I really don't feel competent to say whether there is any collusion or conspiracy or anything else going on because I have not seen it, but I have not been looking for it.

Mr. STEIGER. Would the gentleman yield for one question?

Mr. STEELMAN. Let's discuss the oil shale business that transpired this last year. First, the top five bidders, as I recall, were all majors for the simple reason that the capital requirements were so immense that small operators couldn't compete. My question is in the OCS bid, do we find the same situation, the majors dominating the bidding.

Secretary MORTON. No. Most of the major bidders included the independents. The independents have been able to piggyback their way into the amount they have wanted to in the OCS and have since indicated their bids and have been able to participate along with the majors.

You get to the other side of this coin, and I guess the Teapot Dome is a little bit in my memory. I will not be the guy that sits on a give-away or Christmas tree type of approach to the public lands. Right now, the prices are good, the situation is somewhat competitive, we are selling dry holes for millions of dollars. That is a pretty good business, and I think it is competitive.

Mr. STEIGER. I wonder, Mr. Secretary, has your office ever considered in confronting the OPEC monopoly problem, have you considered the nationalizing of the oil industry or a portion of it in order to be competitive. I have heard this propounded and your reaction would be helpful.

Secretary MORTON. You mean to develop some troops to confront them or—

Mr. STEIGER. No, nationalizing our domestic production in order to be able to compete.

Secretary MORTON. I think we are dealing with apples and oranges. No, we have not considered nationalizing the oil industry to compete with an international cartel.

Mr. STEIGER. Or for any other reason have you considered nationalizing?

Secretary MORTON. I am very much opposed to it. There is no reason for me to do it.

Incidentally, Mr. Steiger, I am delighted to see you here. It was touch and go there.

Mr. UDALL. Mrs. Burke.

Mrs. BURKE. Thank you very much.

Mr. Secretary, this has been very informative.

I would like to pursue a couple of things about the OCS leases, and I am very delighted you did meet with the people from the Pacific coast yesterday.

About what percentage of those 10 million acres do you estimate would be in the Pacific?

Secretary MORTON. This was an annual figure that would be on an annual basis. I think on the long pull, if oil is discovered you would find a fairly substantial amount in the Pacific, particularly the Gulf of Alaska where the geological structures are spread over a very large area.

As far as the lower California areas it is much more restrictive.

The answer to your question, I would give anything to be able to answer your question because we don't know whether there is oil or not.

Mrs. BURKE. There are areas where they have substantiated there has been some oil and some production with some risk, with some real risk and also danger. What is the plan in those high risk areas, and specifically the lower California area?

Secretary MORTON. I think that is an excellent question, because what we are trying to do is improve the technology to minimize the risk. We are encouraged by the technology. We had a disastrous hurricane in the Gulf of Mexico recently. The coke valves and the technology across the board worked. I think we have learned a lot from the spills and risks and the unfortunate incidents we have had. It is kind of like aviation. We have constantly been able to improve the technology of producing oil in the marine environment so that we not only produce it more efficiently so that we are improving and reducing the risk of environmental pollution.

I would point out the comparison between offshore production and shipping favors offshore production, rather than shipping particularly on an uncontrollable basis. One of the nice things about our Alaskan proposal is that that shipping will be on a controlled basis, under the Jones Act, it is intracoastal. It will be thoroughly controlled from the design of the ship all the way to the operation of the ship. That is one of the things, of course, that we are doing in connection with that. But the general technology and the research that is going on to improve through the Conservation Division of the Geological Survey to improve this is moving forward very well and each year we are doing a better job.

Mrs. BURKE. I recognize technology is increasing, but specifically in that area, where it is certainly our impression that leasing is imminent, I just want to get some assurance from you that it is not imminent or if it is, to what extent it is imminent. If it is imminent, what do you anticipate acreagewise and what requirement do you anticipate in technology before those leases could be implemented?

Secretary MORTON. Let me go through the procedure, and I will do it very quickly. First we accumulate all the geological data available, both in private hands and in the government to determine whether it is desirable to move into that area. The second thing we do is begin to develop an overall programmatical data, the marine biological data, the Seismic data, everything that we can in terms of the whole pro-

gram. Then after that, the next part of the procedure before any decision is made to lease whatsoever, we have to see if there is a desire on the part of the industry to really go in there and what areas, based on their own findings that they want to go. Once that is done, then we separate out from that any tracts that we feel for many reasons impinge upon wildlife or an area of critical concern. Then we begin the long process of the development of the EIS, the environmental impact statement, have public hearings, go through all of the review processes available before a review process is made. We will meet with the delegations. We meet with the State people, talk to Governors, talk to legislators, talk to their environmental groups and we begin to finally get down to where a decision will be made to go or not to go. The only amount of acreage I think in the Pacific that is under consideration at this time to go through that long process is about, something in the neighborhood of 1½ million acres.

Mr. UDALL. I regret blowing the whistle.

Mrs. BURKE. I just wanted to ask if the industry is interested.

Secretary MORTON. There are some that are and some that are not. We have, of course, the sanctuary experience in the Santa Barbara Channel where the decision was made not to move ahead. There was a tremendous amount of money used up. We have not refunded that money. We have reached the point where something has to give as far as that area is concerned. We are trying to evaluate the interest that industry has, and certainly we will get with you, and I would like to discuss it. There are some real problems, I know, but there are also some real problems about California's energy.

One of the problems is Elk Hills; can we make Elk Hills available to the California public?

Mr. UDALL. Mr. Cronin.

Mr. CRONIN. I am not next.

Mr. UDALL. Mr. Towell.

Mr. TOWELL. I was here to hear your statement read.

Mr. Secretary, it was a pleasure to hear your statement this morning.

I noticed in one area you said that, while the goal of zero imports would sound practical, you do not believe it would be a practical goal. You say we have some sources of imports not subject to arbitrary cutoff. That may be true, but I find even in the more or less secure area of imports they seem to be subject to people arbitrarily raising the price at any given moment. In effect that can be a cutoff if you want to triple or quadruple price, and that becomes a cutoff.

I am concerned. Perhaps we would have more leverage if we had a goal of zero imports, if we had that goal in mind.

Secretary MORTON. If you have that goal in mind you are turning your back on the world marketplace. There have been about 1 trillion barrels of oil discovered throughout the world up to this time. We should encourage these reserves. Obviously if it is in our interest, in 1983, 1984, 1985, to supplement our domestic production with foreign oil for economic reasons, for world relations reasons, for helping some of these countries, we should not turn our back on it. I think for us to start isolating ourselves from the world market entirely would not encourage the development of reserves outside the Middle East and we should encourage the development of reserves outside of the Middle East.

Mr. TOWELL. I certainly agree with you. I don't think we should be turning our back or isolating ourselves but at the same time that we would be building in some leverage and then we would not be under the complete thumb of any group in the East.

One other question. We talked about the possible monopoly of the major oil interests in this country.

Do you have the figures on the refining capacities of the independents; what percent has that been?

Secretary MORTON. About 15 percent is refined by independent refineries.

Mr. TOWELL. Thank you.

I think my colleague from Texas has a question.

Mr. STEELMAN. Mr. Secretary, your report includes the best economic way of handling a shortfall from the conservation side. What mandatory proposal would you consider?

Secretary MORTON. We are considering the whole cafeteria. We are considering the proposition of putting a cap on imports. We are considering the effects of taxation at various levels on crude oil and various levels in the energy chain. We are considering, an entitlements program at the present time which would be a controlled program, and we are considering the whole gamut of possibilities, of rationing. That is to include everything when you look at them all. You can ration by inconvenience, which occurred when the embargo was imposed. You can ration by a ticket system. You can get at this through allocation and imposition of a cap on imports. There are a good many ways you can do it. We are trying to determine what the economic effect and the administrative burden and the effect on society of each one of these proposals so when the President does make up his mind, he has a pretty good idea.

Mr. STEELMAN. Is the gas tax a possibility?

Secretary MORTON. I think so. The President would have to reverse himself if he did it, but I don't necessarily feel it is the best way to go, because that is a very depressing effect. You take that much of the economy and in a time of downgrading economy you might find that you are doing some harm and costing more jobs than is necessary to get this job done. But it was a thing we had to study and I think we studied it very adequately and the big problem is how do you put that back in an equitable fashion. Nobody ever came up with a good solution.

Mr. STEELMAN. I yield.

Mr. TOWELL. I yield.

Mr. UDALL. Thank you.

Mr. JONES.

Mr. JONES. In a few days the Ways and Means Committee would do away with the oil depletion allowance. You talk about production being influenced by economic incentives and you talk about the uncertainty of the depletion allowance and tax rates might constrain domestic resources. Tell us your opinion concerning the Ways and Means provisions.

Secretary MORTON. I think price overrides the depletion allowance and doing away with the depletion allowance providing there is an exception of the small independent producers at about the 3,000 barrel daily level. I think the price consideration today is more important.

and the industry—at least the majors, at these prices can get the capital it requires and can earn a fair return on investment without depletion allowances.

Mr. JONES. Do you think Congress should be taking any steps of a disincentive nature, for example, of the foreign tax credit?

Secretary MORTON. Yes, I definitely do. I think they go hand-in-hand with—

Mr. JONES. What would you suggest?

Secretary MORTON. Well, I would defer really to Secretary Simon on how you do this, because it is really an economic question, and let me put it in simple terms, we have had for a long time a real incentive for this industry to move abroad and that is exactly what has caused our dilemma and these big incentives have primarily been earned in their operations abroad and they have contributed to that as a matter of national policy. I think it should be more profitable for any basic industry of the United States to operate here providing there is a domestic resource for their operation.

So I would think the tax credit has to be looked at, the whole gamut of things, the deduction that you have for the taxes that are paid in other countries has to be looked at, but I don't believe I would be able to pinpoint the exact ways and means of doing this. I think it will have to be done by careful economic analysis to make sure we are doing it right.

Mr. JONES. You talk about the capital investments that will be needed in short-term, \$500 billion, \$470 billion, something like that. Do you feel that will be adequate to make Project Independence somewhat successful and how do you square these lower capital requirements with the Chase Manhattan estimates?

Mr. ZAUSNER. There have been several different estimates made, and the numbers in the blueprint are close to the National Academy of Sciences although the Chase Manhattan is not. Second, I think the number reflects much lower growth rate and demand. As you can imagine, every percentage can be hundreds of millions of dollars alone. So I think the number reflects that reduced demand growth rate.

The question is not the number of the dollar amount in the aggregate, but the capability to attract.

As the Secretary has indicated, the key problem is that of that \$450 billion needed, fully \$300 billion is for the utility sector and that is a sector in which we have questioned their capability to attract that money given their current financial situation.

Mr. JONES. You mentioned secondary and tertiary recovery may give us about 2 million barrels a day.

Secretary MORTON. Potentially.

Mr. JONES. Does that mean you will put significantly more R. & D. money into the Bureau of Mines?

Secretary MORTON. We would put it in tertiary recovery. I think the best thing we can do is take secondary and tertiary oil out of the old oil classification and put it in a new classification, and I think this will attract the kind of R. & D. money to really move this program ahead much faster than the Government effort will be.

But the answer is yes. We will be adding in this area.

Mr. JONES. One final question. In your statement concerning demand, you touched on the delivery system. Where do you feel a coal slurry pipeline fits into the use of coal.

Secretary MORTON. I think where you have a flow of coal from an area that would be assured over a certain amount of time and the utilization at the end of that line over a considerable period of time, it does not have to be flexible. The thing about the railroad transportation is it is flexible. When you have the production at the point over-guaranteed and the system at the other end for doing it, then I think coal pipeline is a good way to go.

Mr. JONES. Do you have any information coal slurry pipelines will put other modes of transportation out of business?

Secretary MORTON. I don't think this is a good fear. If we worry about who we will be putting out of business rather than who we put in business we will be in trouble. I just don't visualize it.

Mr. JONES. If everything goes well and Project Independence is successful by 1985, have you projected what this would do to oil price structure?

Mr. ZAUSNER. The problem is supply and demand. The problem is such that you would expect the oil prices would be below \$11 right now and they are not. If we would reduce 5 or 7 or 10 million, that would free additional pressure on the world price. So if the direction is correct as our indications—but it is a question of what those pressures will ultimately result in as a kind of tradeoff between economics and politics.

Mr. JONES. What we are really going for is a negotiating tool to stabilize price, not only self-sufficiency?

Mr. UDALL. Mr. Cronin.

Mr. CRONIN. Thank you, Mr. Secretary.

With the seconds we have left, Mr. Secretary, I would like to get your reactions. Many of the problems we meet are things that require short-term investments based on today's circumstances. You use 3 years' lead drag time, 3 or 4 years is the length of construction time for refinery and total time with permit, you are looking 5 to 8 years, and many of the existing refineries in the United States are inefficient. They are not maximizing the end production and it is fair to say domestic refinery capacity can only handle so much and if we are to increase domestic production or if we are to diminish imports of refined products, then we will have to increase our own domestic refining products. If we have this as a need, and we also recognize that \$11 a barrel delivered price, construction of a new refinery is not economically feasible in today's prices. It is logical to have a move along the lines of the Government guaranteed price of something around the vicinity of \$7 to provide the incentive to produce these plants?

Secretary MORTON. I think you are asking a question in the bigger context, is it the policy of the Government to put a floor under energy prices? The same question could very well be framed to deal with the oil shale problem. The same question could be framed to deal with the utilities problem. I think there is great risk in committing the Government to a floor price when our effort is to reduce consumption and get the price down.

Eric may well want to get into the more specific economic analysis questions here for what the prospect is for a refinery under today's situation, but we are importing about 4 million barrels of oil a day that goes into the American refinery system and it is operating at about 80- to 85-percent capacity.

Mr. CRONIN. We are also employing offshore refineries that were built in recent years, and as we get into the lessening gap of refining produced on gallons returned and the price of crude we then put a—we have an out-of-whack situation there where some of the most efficient refineries are foreign and some of the least are some of our old domestic refineries.

Secretary MORTON. That is true not only with oil but certainly with steel and other products. We are paying for a few sins of the past. We may see a demand by the OPEC countries to integrate downstream, to say to themselves, well, not only are we going to sell crude oil, but we will refine it. They are making their deals. This, then, becomes an international negotiating problem.

Mr. CRONIN. Then the question is, what good does it do us to produce all the crude we need if the OPEC nations still have the refining capacity to process that?

Secretary MORTON. I don't have any reason to believe our refining capacity will grow as fast as our production.

Mr. CRONIN. Not at \$11, because it doesn't return anything on the investment. The only way you can produce an economic feasible refinery is \$7 and \$8.10, anything above \$8.10 is—

Secretary MORTON. I don't follow that.

Mr. CRONIN. We have gone through some economic analyses and if you were to take crude coming in at the \$11 figure the return on the investment and the selling price you would receive for the retail price for the product produced would not give you enough to cover the cost of that refinery. It would give you a negative return on investment.

Secretary MORTON. Well, I can't believe any more than electric power generation is going to be operated at a capital loss, that the refining industry will operate at a capital loss, that the prices will adjust to this loss.

Mr. CRONIN. Here if you have only 15 percent of the refining production run by independents and the rest run by integrated oil companies, the integrated oil company, and still produce a profit if they control everything from production to refining to retail distribution.

Secretary MORTON. I believe certainly there is enough competition for capital and when they get out of this inventory situation we will be on a much thinner profit structure than in this last bonanza, and I can't visualize the kind of monopoly you are talking about that will prevent independent refiners.

There are several independent operators trying to build refineries now, one in New England.

Mr. CRONIN. That is running into this problem right now.

Mr. ZAUSNER. We have roughly 15 million barrels of domestic refining capacity and are importing about 3 million barrels a day of crude to have some refineries running at anywhere near a point of capacity utilization. There has been quite a dramatic shift over the last year away from refined products. With domestic production declining and in not what they call new grass roots refineries there has been a shift, so that domestic refined products are down over a million barrels.

Mr. UDALL. In all fairness to the Secretary and to Mr. Bauman, we will have to move on.

Mr. BAUMAN. And the last shall be last, Mr. Chairman.

Mr. UDALL. Wait until next year.

Mr. BAUMAN. I want to ask the Secretary, or actually address an appeal to him regarding his statements in recent weeks dealing with offshore leasing and the Coastal Zone Management Act.

I would like to ask you, Mr. Secretary, and your Department, perhaps, to moderate what I think is the stand you have taken regarding the Coastal Zone Management Act and the proposed leasing schedule announced by your Department. It appears to me, representing a coastal area with which you are very familiar, that your Department might at least give the affected States time to go through the process of adopting coastal zone management plans to regulate the impact of the massive change which will occur if these leases go into effect and oil is found. I think you, probably more than anyone else in your Department, know the great concern which exists in my district about this.

Secretary MORTON. How much time do you need?

Mr. BAUMAN. I suspect 18 months to 3 years.

Secretary MORTON. You will have 3 to 8 years. I think your point, of course, is well taken. We have considered this. Remember, these decisions have not been made. There are many opportunities the States will have to really articulate their problems and become involved in the decisionmaking process. Somewhere you have got to start. The President has asked the Bureau of the Budget to put additional money, I think \$3 billion to be made to the States for the planning activity that goes with this. I would remind the States, too, that there is very little they can tell as to the size of the impact that any onshore results from offshore drilling will be determined. It takes, in the first place, if there is no oil there, the impact will be fairly light. If there is oil there it is over a big area and you don't know where it is going to be. For example, if the oil were in the northern part of the Maryland coast it well then could be taken right on into the refinery and tank farm facilities that already exist near Wilmington, Del. without being seen or surfaced. It might go into the refining circuits of Newark or Philadelphia. They will have from 3 to 5 to 7 years in which to become involved in this process.

I think if the thing looks catastrophic when we begin to put together the environmental impact statements and get some input from the States, if there really is a substantive problem then the decision can be modified or the program ranged because we are not operating on a specific schedule. We are beginning to put together all of the preliminary work which I described to Mrs. Burke that will result in making a decision.

I have no desire whatsoever to overrule or use the power of the Federal Government to discourage or to stop the States from doing the kind of job in land use planning that I think they have to do in carrying out their own responsibility to themselves.

Mr. BAUMAN. Mr. Secretary, one last question.

You mentioned the increased technology to provide safety. Will the leases that the Department requires of the companies require specifically this kind of technology?

Secretary MORTON. Absolutely. Absolutely. We have a statutory responsibility. It is carried out by Assistant Secretary Carlson's area of the Department and specifically by the Geological Survey. There is a whole division in that Department and Bureau that this is all they do is monitor. We put intelligence requirements and regulations which they all know in advance.

Incidentally, the pollution from oil being extracted from the bottom of the sea is far less than the pollution of oil being shipped into the United States by ships.

Mr. BAUMAN. Thank you.

Mr. UDALL. Thank you, Mr. Secretary. You have been most useful and helpful to the committee.

The committee stands adjourned.

[Whereupon, at 12:10 p.m., the subcommittee was adjourned, subject to the call of the Chair.]

PROJECT INDEPENDENCE BLUEPRINT

MONDAY, NOVEMBER 25, 1974

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON THE ENVIRONMENT
ON THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:10 a.m., in room 1324, Longworth House Office Building, Hon. Morris K. Udall (chairman of the subcommittee) presiding.

Mr. UDALL. The subcommittee will be in session.

We are honored to have this morning Hon. John C. Sawhill, Administrator of the Federal Energy Administration, who is before us to discuss the Project Independent Blueprint.

I think you know my admiration and respect for the difficult job you have done over the months that you have served us, and I am sorry you will be relinquishing your post with the difficult job before us.

Mr. HOSMER. Will the gentleman yield?

I couldn't agree more with what the gentleman has said respecting the witness.

Mr. UDALL. I thank the gentleman for that comment.

I see you have your prepared statement here. We will put it in the record and you may summarize it as you see fit. We will allocate the remaining time for what I hope will be an interesting dialog here between the subcommittee members who are very much interested in this subject.

STATEMENT OF DR. JOHN C. SAWHILL, ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATOR

Mr. SAWHILL. Thank you, Mr. Chairman.

Rather than reading my statement, I would like to use some charts which I have on the Vugraph.

Mr. UDALL. Without objection, we will put your prepared statement in the record and you may proceed.

[Prepared statement follows:]

STATEMENT OF HON. JOHN C. SAWHILL, ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATION

Thank you for the opportunity to appear before this committee to discuss FEA's Project Independence Report. This report is the result of a massive inter-agency effort lead by the Federal Energy Administration and involving over 500 professionals. We believe it is the most comprehensive energy analysis ever performed.

While the report itself does not recommend specific policy actions, we hope that this analysis will place the Nation's energy alternatives and their impacts in perspective, and focus public debate on the real issues and choices we face.

We felt that to recommend specific policy proposals without adequate debate on the difficult tradeoffs that must be made would result in a replay of the endless discussion without action which has characterized U.S. energy policy for the past several years. The problem in the past seems to have been that the public, the Congress, and the Executive Branch have focused arguments on particular measures, instead of a total National energy policy. We hope this report can correct this situation and feel that it represents a framework within which to evaluate the individual issues. In today's testimony, I would like to review the background and findings of the Project Independence Report. As you know the Nation's energy use has been growing at a rapid rate in the last 20-25 years.

Our rate of growth in energy demand has been 4-5 percent during this time period. In 1970, the United States was using about 70 quadrillion Btu's of energy each year as compared to about 20 quadrillion Btu's in 1940. Coal use, which peaked about 1920, is below the levels that it was 25 to 30 years ago. Domestic petroleum has increased rapidly, but so have imports, and we now are importing about 6 million barrels a day. Nuclear power which was expected to be the major source of energy in the future is only now surpassing firewood as an energy source. The root of the problem is fairly clear.

The Middle East nations have the greatest portion of world crude petroleum reserves. In fact, the Middle East has more crude petroleum reserves than the rest of the world combined. While some nation's import almost all of their oil, such as Japan and many of the European countries, the United States imports roughly 30 percent of the petroleum it uses.

The Middle East, on the other hand, exports over 20 million barrels a day while it consumes only $\frac{1}{2}$ million barrels a day. The Arab oil embargo last winter had a major effect on the Nation's economy and on our perception of the energy problem. The embargo caused a one-time decline in Gross National Product of about 10-20 billion dollars. While all of this reduction cannot be traced to energy, the energy crisis certainly had a major impact to reduce economic activity. While the United States is now importing about 6 million barrels a day, FEA estimates that imports could be reduced to 3.3 million barrels a day in 1985 if the price of oil is about \$11 a barrel.

This decline in imports would occur from a reduced demand for energy and increased production from sources that are economic at higher prices, and even if no major Federal policy actions are taken. At \$7 a barrel, however, imports would be over 12 million barrels a day. The import situation in the rest of the world would not vary quite as much with respect to price. For example, Japan's imports would be relatively constant as the price varies from \$4 to \$11 a barrel. We estimate that the demand for imports would be about 30 million barrels a day at \$11 oil, 45 million barrels a day at \$7 oil, and over 65 million barrels a day at \$4 oil. This compares to an estimate of production capacity of about 50 million barrels a day from the oil producing nations of the world. This indicates that world oil price is likely to be closer to \$7 a barrel than to \$4 or \$11 a barrel.

The FEA forecasts a growth in energy demand from about 72 quadrillion Btu's (quads) in 1972, to about 103 quads at \$11 oil, and 109 quads at \$7 oil. These estimates correspond to growth rates of about 2.7 percent and 3.2 percent, respectively and compare to earlier forecasts by the Department of Interior of about a 3.7 percent growth rate, and by the National Petroleum Council which projected as much as 145 quads of consumption.

FEA's forecast shows not only that an important shift in imports would occur as the price of oil varies, but that an important shift between fuels that are used would also occur. As the price of oil increases, we would expect that more coal would be used, since coal would be cheaper than expensive imported oil. In addition, as the price of oil increases, our domestic supply of oil would also increase, demand would be reduced, and imports would decline. At either price of oil, nuclear power is expected to grow substantially between now and 1985; but not at the previously projected rate.

The production of crude oil will shift by 1985, from the onshore lower 48 fields to offshore and Alaska. Crude oil production peaked in 1970 and has been declining ever since, and we estimate that production will continue to decline until at least 1976 or 1977, before increasing as a result of development in newer fields. If the price of oil is at \$7 a barrel, onshore lower 48 production could decline to less than 5 million barrels a day by 1985. Even at \$11 a barrel, this production would be less than its current levels, with the increase coming mainly from tertiary recovery, tar sands, and heavier crude oil.

The sources of electricity generation will also vary considerably as the price of oil changes. The major shift is between coal and residual oil, with oil being more predominant at \$4 a barrel and coal having much greater use at \$11 a barrel. Nuclear power will grow from about 3 to 30 percent of electricity generation by 1985; natural gas will decline as it is shifted to more important uses; and hydro-power and geothermal power will increase some, but not substantially.

It is important to look at the market for coal since coal is basically limited by demand and not the supply that can be produced at any particular price. As indicated earlier, coal will grow substantially in the electricity sector between now and 1985, and with oil and gas both being reduced in electric generation, the only way to increase the percentage of coal to produce electricity would be to reduce nuclear power. On the other hand, coal will maintain a small share of the fuel used in the industrial sector and could possibly be increased by providing incentives to switch from oil and natural gas to coal. Thus, the two main ways to increase the use of coal are to increase its use in the industrial sector and to increase the overall share of the electrical sector. To achieve these goals would require reduced uncertainty about the environmental acceptability of coal.

One of the most important policy actions that could be undertaken relates to the price of natural gas. If natural gas remains regulated at 42¢ per thousand cubic feet we estimate that production would decline from the current 22 trillion cubic feet per year to about 15 trillion cubic feet by 1985. This decline of about 40 percent would represent a significant reduction in natural gas production. If the price is deregulated, natural gas production would hold constant or increase slightly.

In summary, at \$11 oil, the import gap would be closed to about 3.3 million barrels a day, but would widen no matter what the price of oil in the next few years. The situation is dramatically different at \$7 a barrel oil, because consumption increases and production decreases and we would be importing almost 50 percent of our petroleum needs.

My testimony to this point concerns itself primarily with what we call the Base Case, or the case in which no major new Federal actions are taken to increase supply or reduce demand. Among the actions that could be taken to accelerate the domestic supply are development of oil and gas in the Atlantic, Pacific and Alaskan Outer Continental Shelves and in the Naval Petroleum Reserves; deregulation of natural gas prices; increased shale oil production; and accelerating nuclear power plant construction.

To conserve energy, the main areas of attack would be the automobile, where standards could be set to improve automotive efficiency or incentives could be provided to reduce the number of miles traveled; financial incentives could be provided for improved thermal efficiency in existing homes and offices; or minimum thermal standards could be established for new buildings. To further reduce dependence on oil and gas, actions could be taken to switch to coal or coal-fired electric power.

Under the base case in 1985, crude oil production could rise to about 12.8 million barrels a day in 1985. Most of the increases in production would come from Alaska and the Outer Continental Shelf. Under the accelerated supply case, production could rise to about 16 million barrels a day in 1985, with major increases coming from a million barrels a day of shale oil, Atlantic and Pacific OCS development, and greater development in Alaska and the Naval Petroleum Reserves. It is interesting to note that production of the lower 48 would be less in the Accelerated Supply Case than in the Base Case because some of the more expensive lower 48 oil would be replaced with the OCS or Alaskan oil.

Coal consumption could grow from 525 million tons (excluding exports), to over a billion tons in 1985 in the Base Case and over 900 million tons in the Accelerated Supply Case. Accelerated Supply consumes less coal than Business-As-Usual, since under Accelerated Supply less expensive oil is available for use and nuclear power plant construction is accelerated. The \$7 oil case uses less coal than the \$11 oil situation since less expensive oil can be used.

While synthetic fuels and shale oil are promising long term sources of energy, even under the Accelerated Supply Case at \$11 oil, we do not project more than about 1.25 million barrels a day of oil produced from shale, coal gasification, and coal liquefaction. This does not mean, however, that these sources should be forgotten since in the long run they could be very important.

In its analysis, FEA reviewed a number of important resource constraints that could affect energy. While there were short-term constraints of manpower, water, materials and equipment, the most important long-term constraints are in materials and equipment. Even under assumptions of accelerated availability

of certain equipment, fixed and mobile platforms will still be more than 30 percent short. Since this equipment is important to offshore development programs, quick action is needed to avoid very serious constraints. Other constraints could occur in drilling rigs, oil country tubular goods and steel products. Water availability may also be constrained in some of the coal and oil shale areas. It is expected that enough capital will be available in the aggregate to support energy investments, although the utility sector in particular will have serious problems in achieving its desired capital flows.

In summary, by accelerating domestic supply, at \$11 oil, we could reduce imports to zero by 1985. While zero imports is possible, we do not believe it is a realistic goal since some imports are from secure sources and we can protect ourselves against the severe impacts from small disruptions of supply.

It is important to look at a number of the conservation options that we analyzed. The conservation options which achieve the greatest savings in the long-run are fuel standards, disincentives to automobile travel, thermal standards and some industrial conservation measures. In the short-run, however, all of these incentives can provide significant savings and in general, conservation has greater short-term effects than increased supply actions.

Conservation measures can reduce imports to about 1.2 million barrels a day, by 1985, at \$11 oil. While conservation saves the equivalent of over 5 million barrels a day if all of these mandatory actions were taken, all the savings are not related to oil and some would save coal, electricity and nuclear power.

It is important to remember that the effect of increasing energy costs is felt most severely by low-income groups. Whereas wage earners with incomes above \$15,000 a year spend only about 5 percent of their after-tax income on energy, those earning under \$5,000 a year spend over 10 percent of their income on energy. Thus, we should carefully weigh the impact of increased energy prices on certain consumer groups.

Another option to reducing our vulnerability is the provision of emergency storage of petroleum. As storage is available for use, the GNP costs of an embargo decline considerably. Since a storage program is not very costly, the long term storage development would be cost effective. However, storage takes time to build, we are most vulnerable in the short-term and purchasing oil for storage could have the effect of maintaining the higher cartel prices.

Among the major policy implications we see are:

The United States could become self-sufficient by 1985, if the price of oil is \$11 per barrel and a number of major supply or conservation actions are taken. But zero imports is not a practical goal.

Any domestic energy policy must be designed to resolve uncertainties and could include actions such as exploration in frontier areas.

Accelerating domestic supply, while economic, has some environmental and social drawbacks and may be constrained by equipment shortages.

Although cost effective, a storage program will take time to implement when our vulnerability is highest and could act to sustain cartel prices.

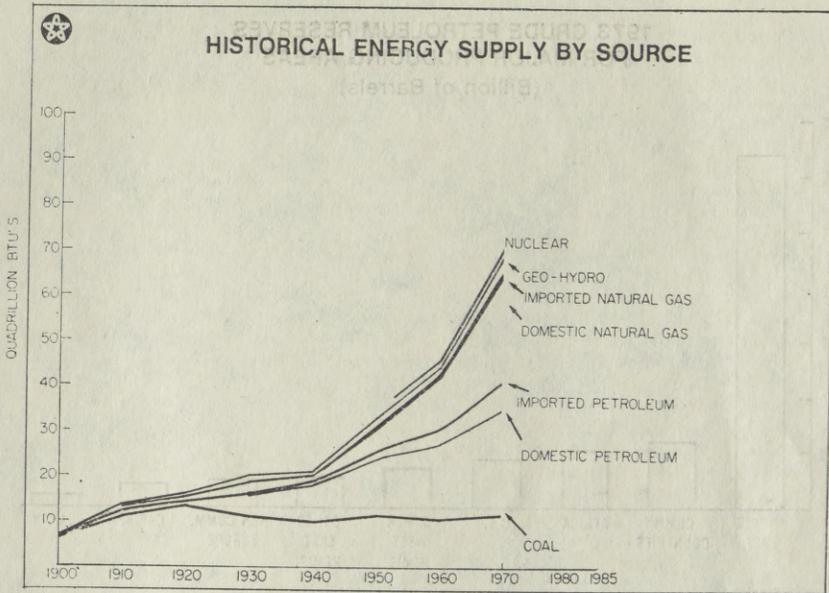
Conservation has positive environmental effects, but requires intervention and regulation of previously free market areas and results in increased nonmarket costs due to more limited choices and changed lifestyles.

The policy process which is now in effect in the Administration will turn the results of the Project Independence Report into a series of major policy objectives and specific policy proposals to the Congress early next year. The time for writing reports is over. The time to move positively to resolve our energy problems in the short-term and in the future is now.

Mr. SAWHILL. I think you will see the meaning to the statement as we go along.

As you know, this was a massive report that we put together, an interagency effort involving over 500 professionals from almost every energy-related agency in the Government. While it does not recommend specific policy actions, it does place the Nation's energy alternatives, their impact and perspective, so that the public may focus debate on some of the real issues and some of the difficult tradeoffs we will have to make.

As you will see at the end of the presentation, I have some conclusions which I have drawn, at least, from the Project Independent Blueprint which I would like to share with you.

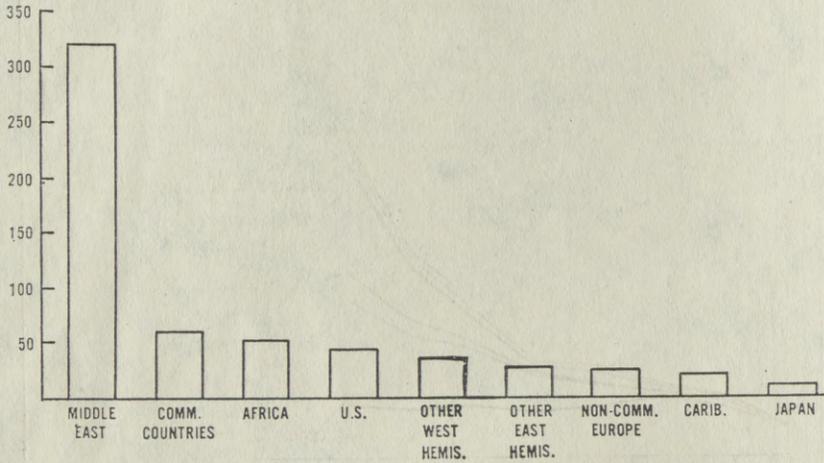


The first few charts that I will be showing you summarize information which you are somewhat familiar with that it might be well to look at in perspective. On the first chart, U.S. energy demand from 1900 to 1970. Coal, which is the green bar at the bottom of the chart, has been relatively flat over this period. Actually that has declined. Domestic petroleum has increased rapidly, but beyond the year 1970 it will begin to decline.

Imported petroleum is playing a more important role and will do so in the future. Natural gas has also increased rapidly, and nuclear energy, which held great promise for us, has not quite lived up to that promise, and I think we see that it is only producing today a very small amount of the Nation's energy supply, and therefore, if we must take steps, I believe to expand the role of nuclear, we will get into that later.

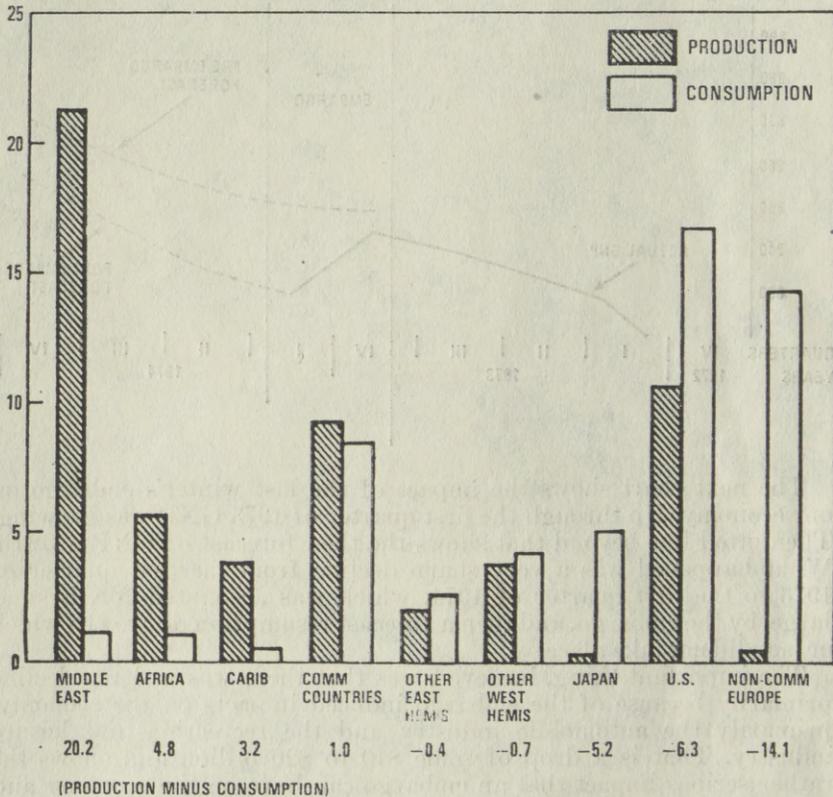
The other interesting thing on this chart is to notice the change in the growth rate of energy demand. Up to 1940, it grew at a fairly slow rate, picked up substantially between 1940 and 1960 and in the post-1960 era the chart begins to increase its slope even more sharply showing how rapidly we have increased our demand for energy in the last 10 years on into the early 1970's as well. GNP actually in that period had about the same rate of growth, which leads me to the conclusion that we cut our growth rate of energy demand without sacrificing the gross national product.

1973 CRUDE PETROLEUM RESERVES
FOR MAJOR PRODUCING AREAS
(Billion of Barrels)



On the next chart, we show the situation you are of course, aware of, and that is the tremendous dominance of the Middle East in the world petroleum reserve. As you can see, Middle Eastern reserves as shown on that chart are about 325 billion barrels completely dwarfing all other areas. While we talk about significant new finds in the North Slope and in Mexico and in Indonesia and other parts of the world, I think this dramatically points out that if we are in fact to expand the use of petroleum in the world, it will have to come from the Middle East.

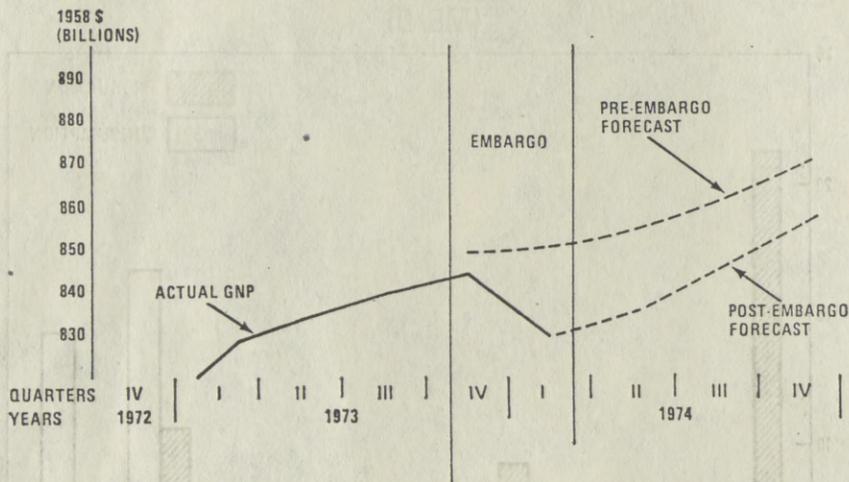
1973 CRUDE PETROLEUM PRODUCTION AND
 PETROLEUM PRODUCT CONSUMPTION FOR MAJOR
 PRODUCING AND CONSUMING AREAS
 (MB/D)



On the next chart the relationship between reserves and consumption is shown. Here, the Middle East, which has the bulk of the world's reserves, actually only consumes a very small portion of the oil utilized in the world. Where at the other end you see noncommunities, Europe with the nonconsumption in the yellow dwarfing the reserves in that part of the world, and even in the United States, of course—not reserves but products—even in the United States consumption is significantly ahead of production, which accounts for our current growth dependence on other nations for our imports. Japan is in somewhat the same situation.

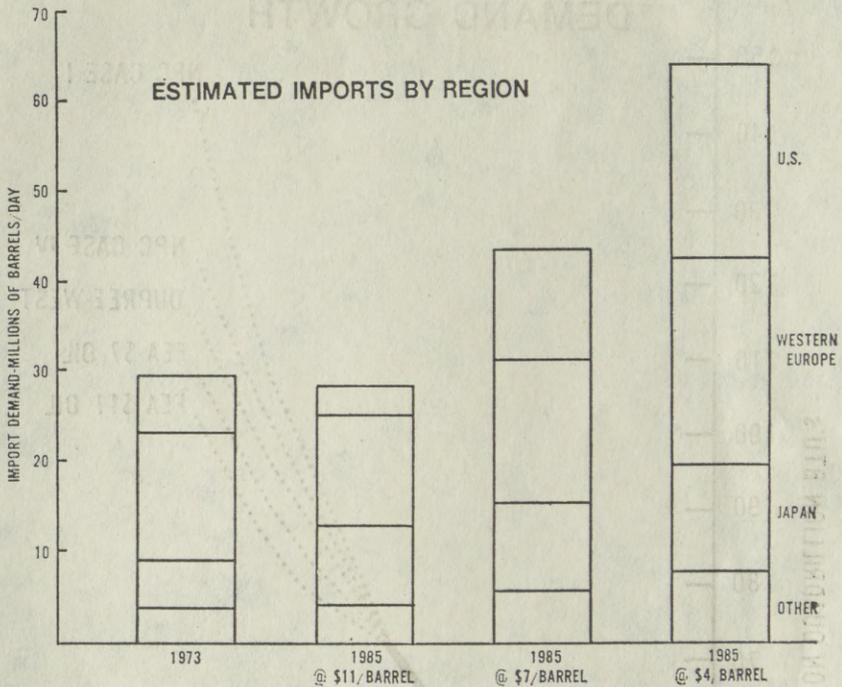
On the fourth bar from the right the Communist countries have production slightly exceeding consumption.

ESTIMATED IMPACT OF THE EMBARGO ON GROSS NATIONAL PRODUCT



The next chart shows the impact of the last winter's embargo on our economy. Up through the first quarter of 1973 GNP was growing. The dotted line beyond that shows the then forecast of GNP growth. What happened was a very sharp decline from the first quarter of 1973 to the first quarter of 1974, which was accounted for, by and large, by the embargo, and then a forecast resumption of growth which in fact did not take place.

The important thing, however, was that there was a sharp decline primarily because of the embargo induced impacts on the economy, primarily the automobile industry and the recreation and leisure industry. That is a drop of some \$10 to \$20 billion and shows the rather serious impact that an embargo can have on the economy and why we need to protect ourselves against future embargos.

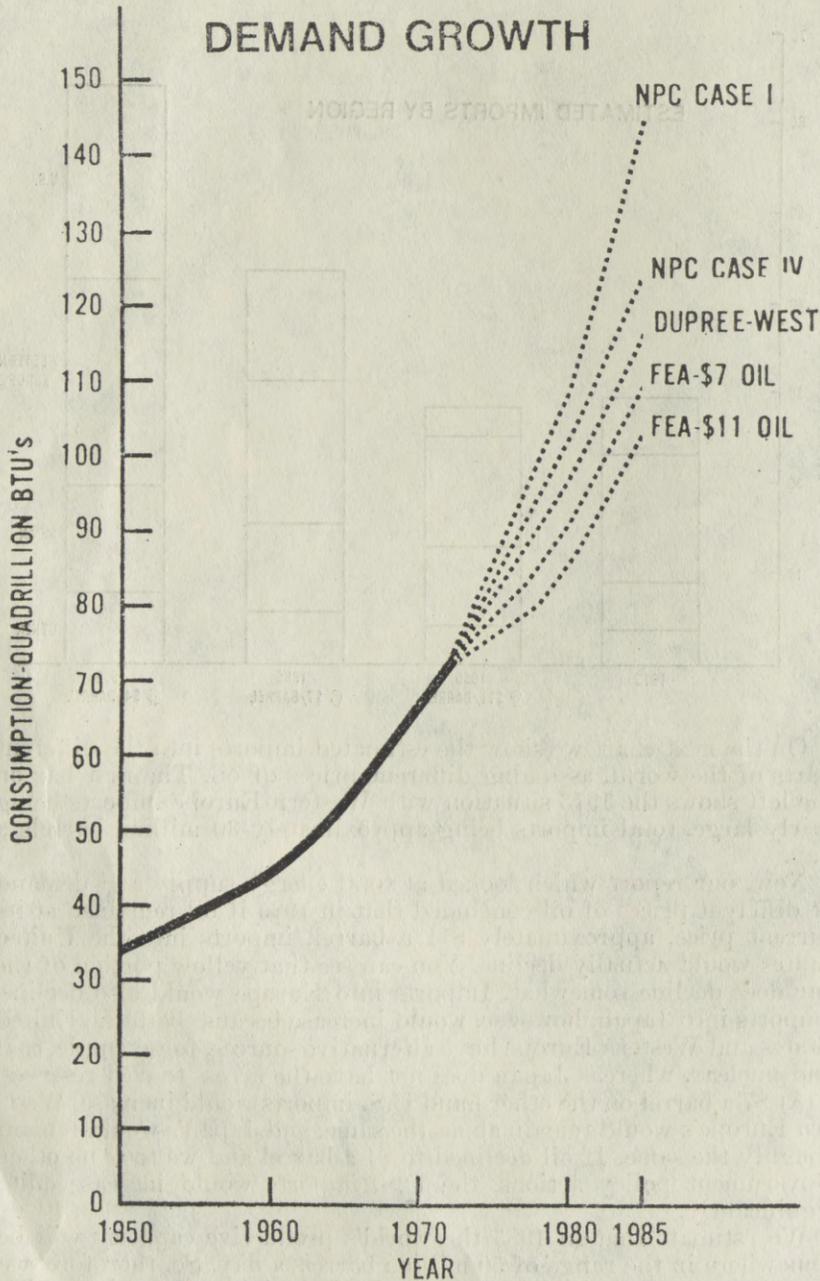


On the next chart we show the estimated imports into the different parts of the world, assuming different prices of oil. The first bar on the left shows the 1973 situation with Western Europe imports being fairly large, total imports being approximately 30 million barrels a day.

Now, our report which looked at total energy supply and demand at different prices of oil concluded that in 1985 if oil remained at its current price, approximately \$11 a barrel, imports into the United States would actually decline. You can see that yellow portion of the bar does decline somewhat. Imports into Europe would also decline. Imports into Japan, however, would increase because both the United States and Western Europe have alternative sources, for example, coal and nuclear, whereas Japan does not have the access to coal reserves.

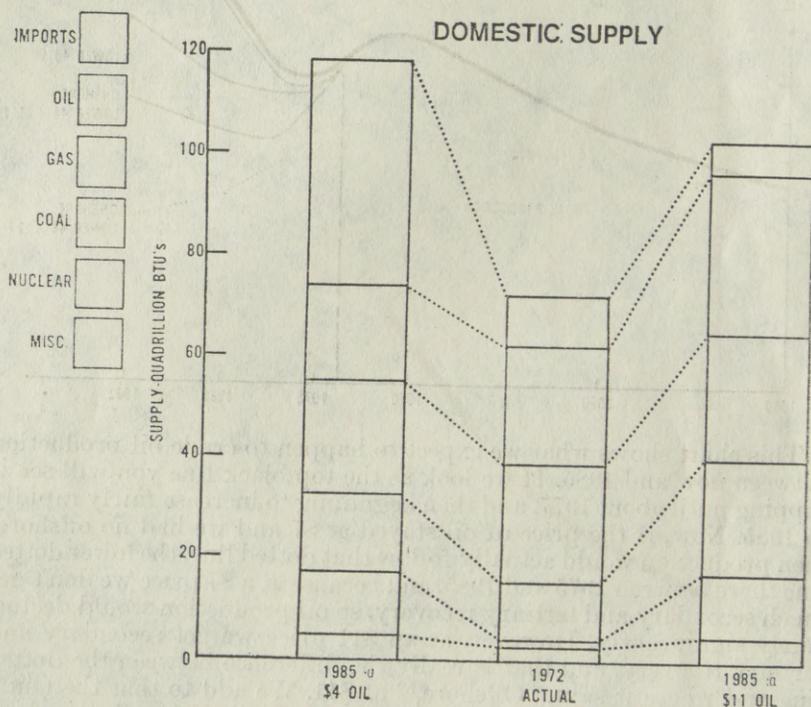
At \$7 a barrel on the other hand U.S. imports would increase, Western Europe's would remain about the same, and Japan's would remain roughly the same. If oil declined to \$4 a barrel and we took no other Government policy actions, the U.S. imports would increase quite significantly.

We estimate that in 1985 the world's productive capacity will be somewhere in the range of 50 million barrels a day. So, therefore, we would be surprised if the price remained as high as \$11 a barrel because we show imports of only 30 million barrels a day in the \$11 barrel bar. With productive capacity at 50 million barrels a day you have a fairly wide gap there. So we think the price will be somewhere between \$7 and \$11 a barrel and that is why our further analysis that I will be discussing with you, looks at world oil prices of both \$7 and \$11 a barrel. These, incidentally, are 1974 dollars. So naturally if we experience inflation they will go up relative to other prices.



The next chart shows one of the interesting things about the Project Independence report assessment, and that is that our estimate of demand growth is significantly lower than previous forecasts. At \$11 a barrel we estimate that the United States will consume roughly 115 quadrillion Btu's of energy, at \$7 closer to 110. These forecasts com-

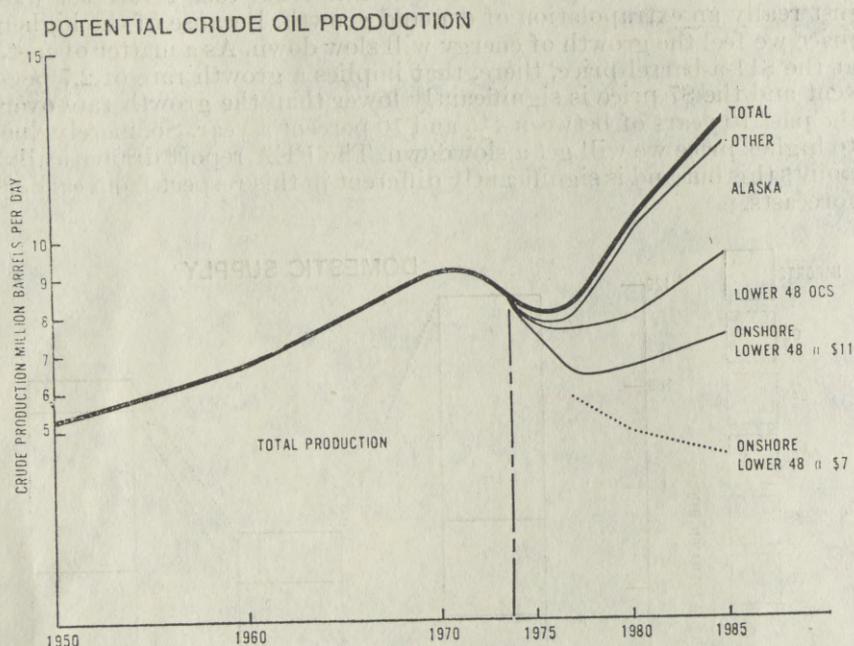
pare with the Duprey West forecast done by the Department of the Interior, which is somewhat higher than the National Petroleum Council's, which is even higher than that. The NPC case-1 forecast was just really an extrapolation of demand growth. Because of the higher price we feel the growth of energy will slow down. As a matter of fact, at the \$11-a-barrel price, there, that implies a growth rate of 2.7 percent and the \$7 price is significantly lower than the growth rate over the past 10 years of between 4½ and 10 percent a year. So, merely due to higher price we will get a slowdown. The FEA report dramatically points this out and is significantly different in this respect from earlier forecasts.



The next chart shows what will actually happen to domestic supply for different sources of energy, depending on price. We show the 1972 actual in the middle, the \$11 oil on the right and the \$4 on the left. At \$11 you can see our imports will decrease slightly. Our domestic oil supplies would increase somewhat. Our use of gas would stay about the same. Our use of coal would increase at \$11 oil because coal would be substituted for oil and nuclear energy would grow very rapidly.

Looking now at the bar on the left, the \$4 bar, imports increased very dramatically, domestic production declines because at the \$4 price there isn't sufficient incentive to bring forth secondary and tertiary recovery. Gas supplies are relatively the same, pretty much unaffected by the price of oil. Coal actually does not increase as rapidly at \$4 as it does at \$11 because it is more economical to substitute oil for coal, and nuclear

grows about the same in either case. We are looking for a fairly dramatic growth in nuclear energy almost irrespective of what happens to the price of oil.



This chart shows what we expect to happen to crude oil production between now and 1985. If we look at the top black line you will see it dipping until about 1977, and then beginning to increase fairly rapidly to 1985. Now, if the price of oil stayed at \$7 and we had no offshore, then production would actually follow that dotted line, the lower dotted line there between 1975 and 1985, and because at a \$7 price we don't get much secondary and tertiary recovery, so oil production would decline fairly significantly. However, at an \$11 price we get secondary and tertiary recovery, and that is really the difference between the dotted line and where it says, "Offshore," at \$11. We add to that the Outer Continental Shelf, Alaska, and other, which is oil shale to bring about that fairly dramatic turnaround in oil production.

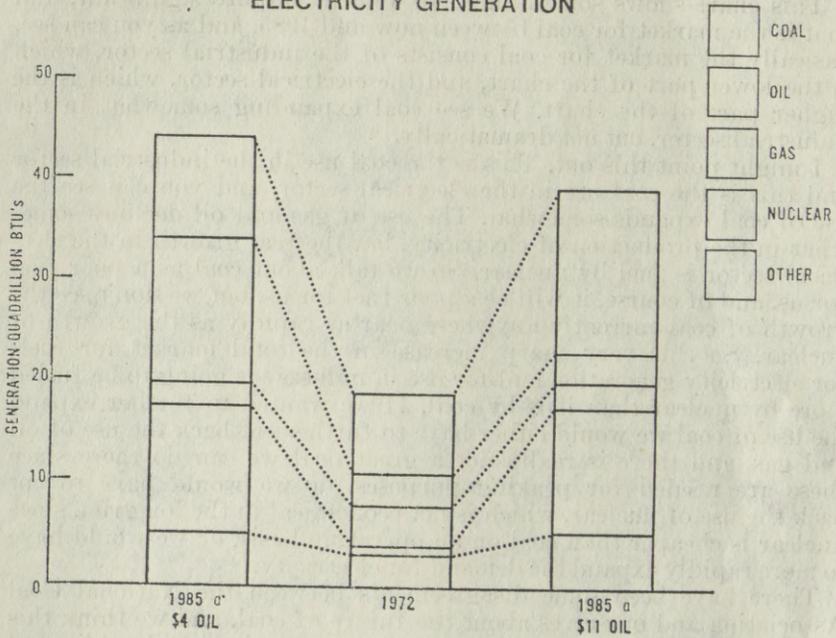
This is quite a shift from a past trend, so we thought it important to try to point out the components of that shift, and they are Alaska secondary and tertiary recovery made possible by the higher price and some standard production from the Outer Continental Shelf in this country, although this chart does not include anything from the Atlantic Outer Continental Shelf. It is primarily the Gulf of Mexico.

Incidentally, while I am going through this you might interrupt me—

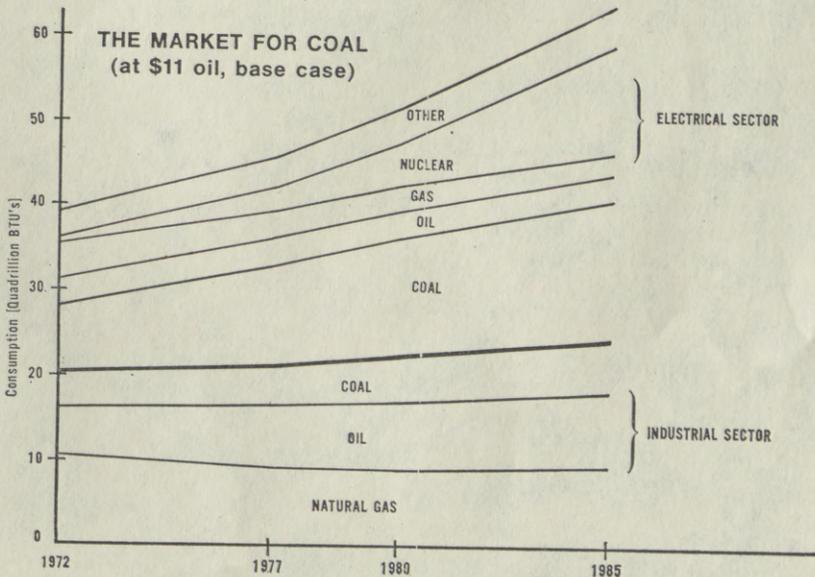
Mr. UDALL. It might be better to go through.

Mr. SAWHILL. All right.

ELECTRICITY GENERATION



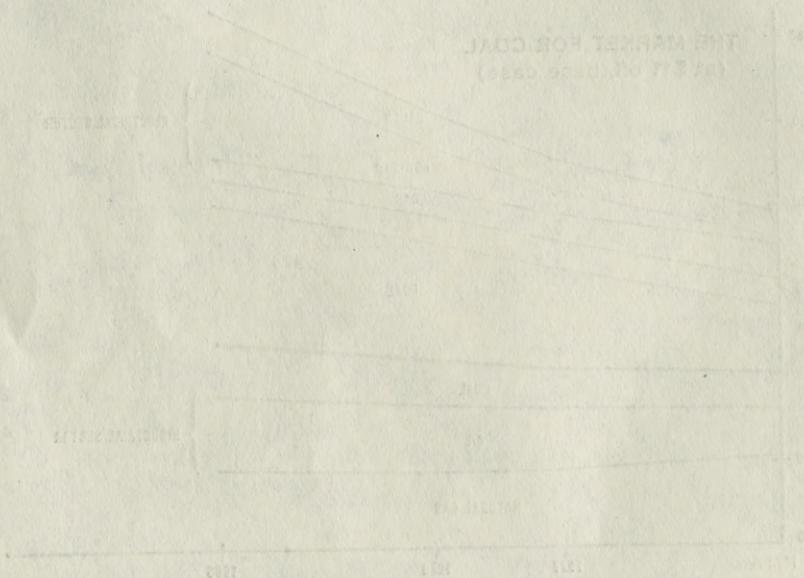
The next chart, this chart shows the source of electricity generation at \$11 and \$4 oil, and as you can see, coal will expand fairly rapidly as a course of electrical generation at \$11 oil because it will be economical to substitute it. Oil and gas will be fairly insignificant at \$11. They will maintain about the current position, although become a lower percentage. Nuclear, as I showed previously, will increase fairly dramatically. As \$4 oil becomes much more important because it is cheaper relative to coal than, of course, is \$11 oil.



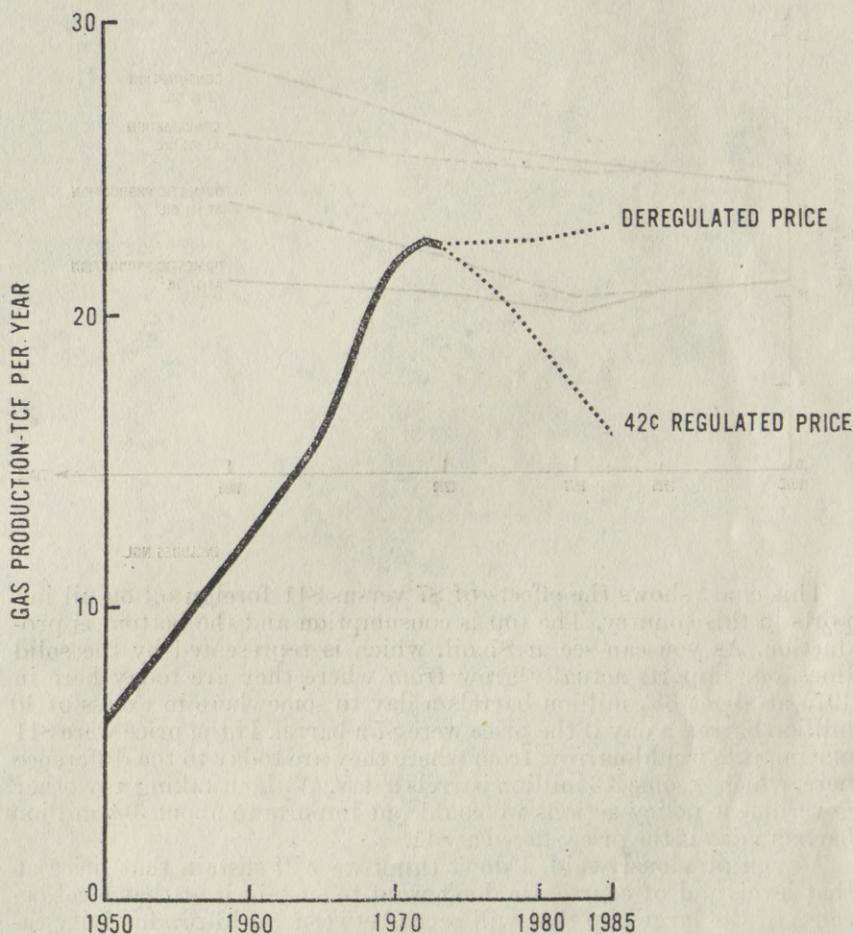
This chart shows something that we feel is quite significant, and that is the market for coal between now and 1985, and as you can see, basically the market for coal consists of the industrial sector, which is the lower part of the chart, and the electrical sector, which is the higher part of the chart. We see coal expanding somewhat in the industrial sector, but not dramatically.

I might point this out. This is the coal use in the industrial sector and this is the coal use in the electrical sector, and you can see the use of coal expands somewhat. The use of gas and oil declines somewhat in the production of electricity, but the real growth in the electrical sector is fuel by nuclear. So we talk about coal as a poor fuel for us, and of course, it will be a poor fuel for us, but we don't see the growth of coal currently anywhere near as rapidly as the growth of nuclear. So this very sharp increase in the total market for fuels for electricity generation and for use in industry is going to be fueled more by nuclear than it is by coal. If we wanted to further expand the use of coal we would either have to further cut back the use of oil and gas, and there is really not a great deal we can do there since these are needed for peaking purposes, or we would have to cut back the use of nuclear, which is not economical in the long run, since nuclear is cheaper than coal on an operating basis, or we would have to more rapidly expand the demand for electricity.

There have been some disagreements between the National Coal Association and ourselves about the future of coal, and we think this chart shows that really you are not going to get that much additional usage of coal without a greater expansion in the use of electricity or without trading it off for nuclear, which I don't think would be a sensible public policy.



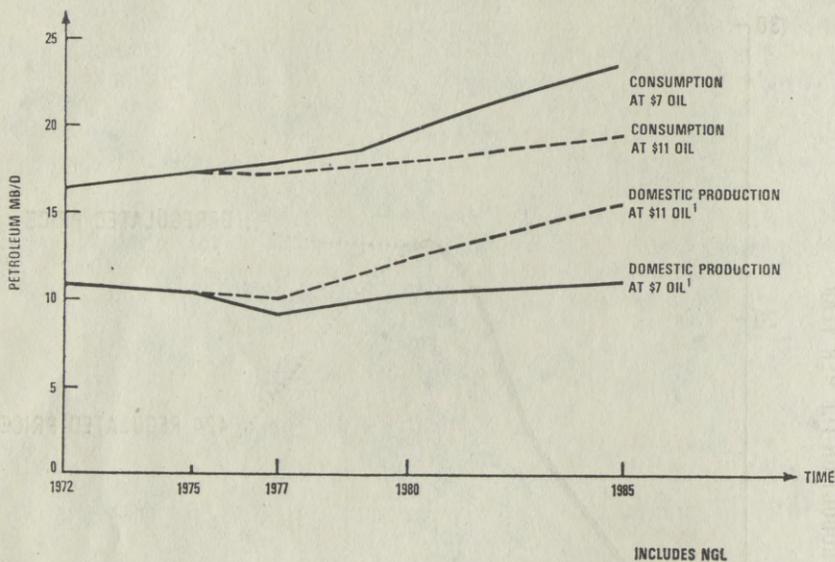
NATURAL GAS PRODUCTION



This is quite an interesting chart. It is addressed to natural gas, and it shows what would happen if we kept the current 42-cent regulated price, that there would be some decline in natural gas usage. On the other hand, if we deregulated the price of natural gas, and incidentally this implies a price of about 80 cents per MCF, we would actually see a flattening out in natural gas production. This is contrary to some previous estimates that if we deregulated the price of natural gas we would see a sharp increase. All we see that a deregulation would do would be to supply that production that is there in that red triangle.

Because of the decline in natural gas reserves in this country we don't see a very sharp increase in production which some previous forecasters have implied would come about as a result of deregulation.

EFFECTS OF \$7 VS \$11 FOREIGN OIL



This chart shows the effects of \$7 versus \$11 foreign oil on oil imports in this country. The top is consumption and the bottom is production. As you can see at \$7 oil, which is represented by the solid lines, our imports actually grew from where they are today here in 1975 at about 6½ million barrels a day to somewhere in excess of 10 million barrels a day if the price were \$7 a barrel. If the price were \$11 our imports would narrow from where they are today to the difference here, which is some 3.3 million barrels a day. Without taking any other government policy actions we could put imports to about 3½ million barrels a day if the price stayed at \$11.

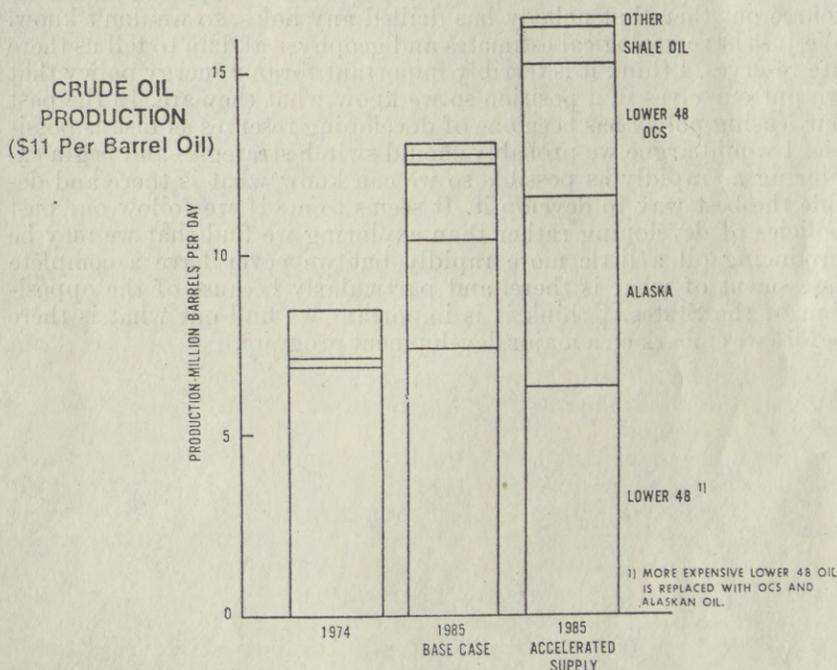
As you previously said, I don't think we will sustain that price at that level, and of course, we don't want to sustain it at that level because of the large gap that will occur between world productivity capacity and world usage at the \$11 a barrel.

The other thing this chart shows is that regardless of whether the price is \$11 or \$7, production actually declines between 1975 and roughly 1977. So there is very little we can do in the next few years to avoid expanding our imports unless we take steps other than just letting the price mechanism work.

So far we have been talking about the situation as it would exist with different prices. Now we would like to explore some alternative strategy for increasing energy supplies and for reducing energy demand and then show the impact of these strategies on supply and demand. This is the real value in the report. It gives us a tool that we can now use to estimate the impact of different policy actions on future levels of oil imports and on future usages of all fuels.

First, we will talk about an accelerated supply strategy involving developing oil and gas in the Atlantic and Pacific Outer Continental Shelf and Naval Petroleum Reserves No. 4 as well as 1, complete deregulation of natural gas prices, increased shale oil production and accelerating nuclear powerplant construction. If we did all four of these things we would show how that would affect the supply of energy.

Now we will look at a package of energy conservation measures such as setting standards for improved automobile efficiency, providing incentives to reduce miles traveled, providing financial incentives for improved thermal efficiency in existing homes and offices and providing minimum thermal standards for new buildings. We will look at this package and show what impact they have on energy demand. These aren't all the supply and demand measures we could think of but they are representative of the major steps the Government could take.



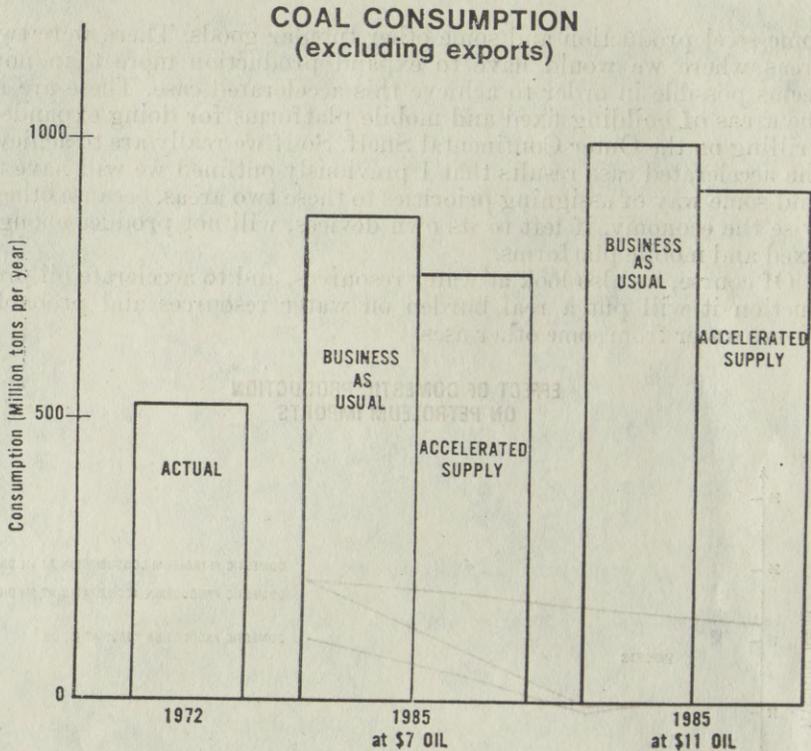
So first talking about supply. This shows what would happen to crude oil production if we did accelerate supply by expanding leasing on the Atlantic Outer Continental Shelf, the Pacific and Gulf of Alaska, the middle bar is the base case, the left hand side is the current situation and the right hand bar shows what would happen in an accelerated case. As you can see, the red, which is the Alaska production, expands significantly in the base case and even more significantly in the accelerated supply case because we are putting another Alaska pipeline in and losing more land up there and gaining more production.

The original bar is the Outer Continental Shelf and that also expands because we would be doing a lot more drilling and development of the Atlantic and Pacific Outer Continental Shelf. The tan bar is shale oil which on an accelerated strategy would also expand significantly.

Interesting enough, the blue, the production from the lower 48, declines in the accelerated supply case, because it becomes cheaper to put resources into Alaska and the Outer Continental Shelf than to continue to drill on land in the lower 48.

Overall, however, production does increase from about 13½ to 14 million barrels a day up to about 17 million barrels a day. This, of course, is at the \$11 price. That would be the impact of accelerated measures on the oil and gas production.

I must just stop here for a second and comment on my own view of the Outer Continental Shelf, and it is that we have we think a resource out there but nobody has drilled any holes, so we don't know. We just have geological estimates and geophysical data to tell us there are reserves. I think it is terribly important for our energy policy that we put ourselves in a position so we know what they are. In the past our leasing policy has been one of developing reserves as fast as possible. I would argue we probably should switch strategies and begin exploring as rapidly as possible so we can know what is there and decide the best way to develop it. It seems to me if we follow our past policies of developing rather than exploring we find that we may be producing oil a little more rapidly but we never have a complete assessment of what is there, and particularly because of the opposition of the States, I think it is important we find out what is there before we embark on a major development program.



This shows what would happen to coal consumption in the accelerated case. As you can see, because we are accelerating the production of oil, coal consumption actually declines. At the \$7 price it declines about the same as it does at the \$11 price, although in both cases it is above the yellow bar of 600 million tons a year, which is current consumption of coal.

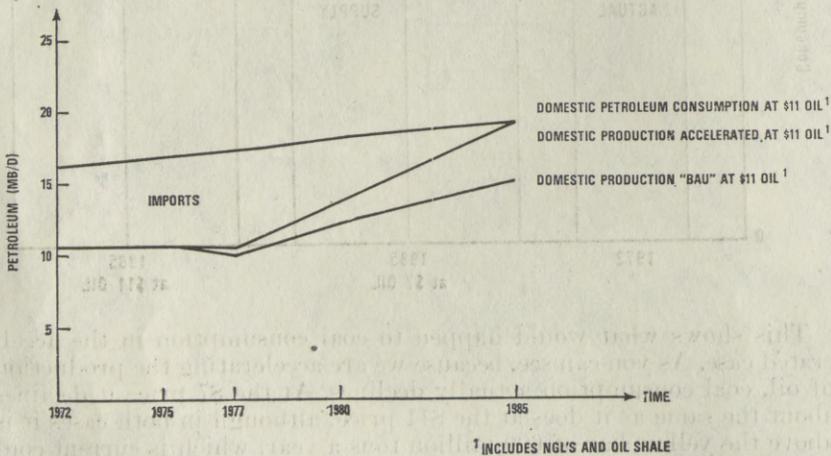
Next chart shows what happens to synthetic fuels, and as you can see, in the accelerated case, we expand shale oil and coal gasification somewhat more rapidly up to about 1 million barrels a day, but in any event it is only a very small portion of the total, and that is the point of this chart. Even with an accelerated rate development of coal, gasification, and shale oil, it won't account for a very significant portion of our total production between now and 1985.

One of the things we did was, after we looked at the accelerated supply strategy, we said to ourselves, can we do this. Does our economy have the manpower, the water resources, the materials, and the productivity capacity to enable us to achieve this accelerated production. What we found was that there were several areas where we would be close to maximum production if we tried to accelerate as rapidly as was implied by the accelerated case. These included drilling rigs and

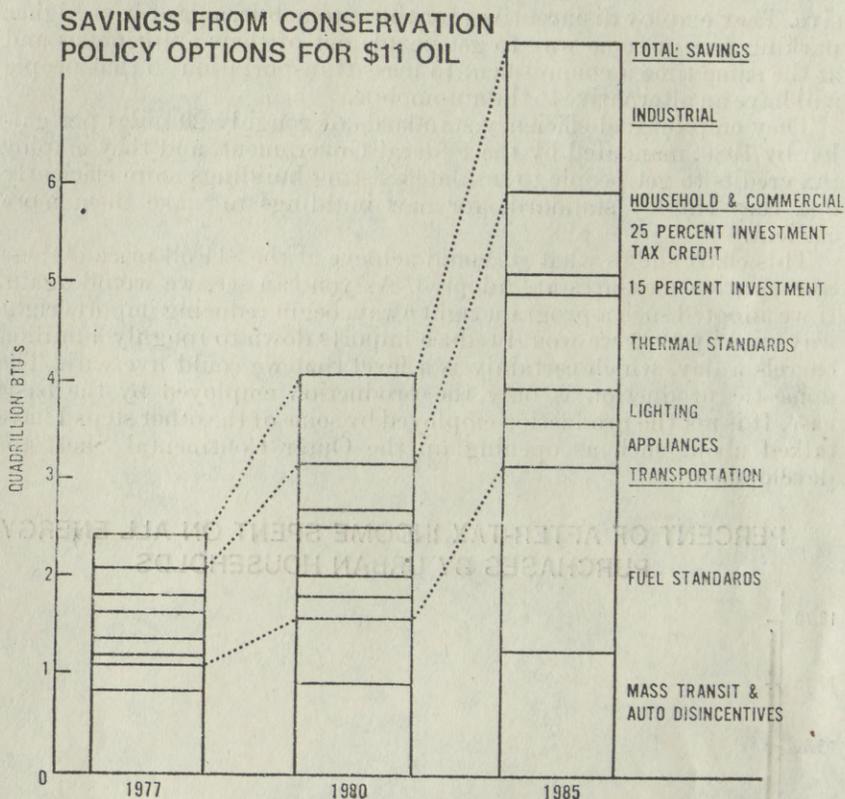
some steel production and some other tubular goods. There were two areas where we would have to expand production more than now seems possible in order to achieve this accelerated case. These are in the areas of building fixed and mobile platforms for doing expanded drilling on the Outer Continental Shelf. So if we really are to achieve the accelerated case results that I previously outlined we will have to find some way of assigning priorities to these two areas, because otherwise the economy, if left to its own devices, will not produce enough fixed and mobile platforms.

Of course, we also look at water resources, and to accelerate oil production it will put a real burden on water resources and probably divert water from some other uses.

EFFECT OF DOMESTIC PRODUCTION ON PETROLEUM IMPORTS



Next chart. This is somewhat similar to a chart I showed earlier. As you recall, at the \$11 price I said that demand and supply at \$11 would reduce imports to about 3½ million barrels a day. But in this chart with the accelerated supply steps shown here by the original line, you can see that we actually can bring supply and demand back into complete balance. In other words, we could achieve zero imports if we did all of the steps employed in the accelerated supply case. I, myself, don't feel that that is an appropriate measure to take, but it does show what we could do if we decided to adopt all of the steps indicated in the accelerated supply case.



Now, we turn from our supply strategy, or looking at a supply strategy to conservation. This chart shows the kinds of savings that we could get from energy conservation, assuming that oil was selling for \$11 a barrel, and there are a couple of things I think important to note here. The first is that big savings come from two areas, the automobile and buildings. Second, to achieve savings quickly we have got to provide disincentives to automobile transportation and expand mass transit.

A third point is that, unlike the accelerated supply case where we don't get any additional production until beyond 1977, here in the case of reducing demand we can actually achieve some significant results right away by 1977.

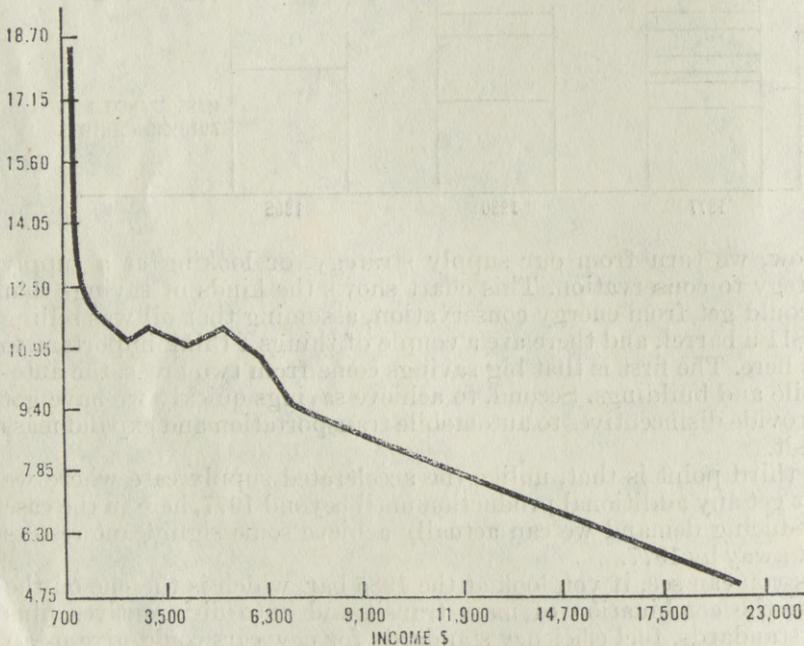
As you can see, if you look at the 1985 bar, which is the one on the right, the combination of mass transit and auto disincentives plus fuel standards, fuel efficiency standards for new cars could give us an excess of 3 quadrillion Btu's of savings. We can add on to that improved efficiency of lighting, thermal standards for new buildings, and a tax credit for existing buildings. You see that we achieve an additional 3 or 4 quadrillion Btu's of saving and the yellow block at the top is what we could get through the industry sector through the development of better industry processes.

We think the savings that can be achieved here are quite impressive. They employ disincentives for the automobile, a gas tax or higher parking fees or some way to get people out of their automobiles and at the same time a commitment to mass transportation so that people will have an alternative to the automobile.

They employ fuel efficiency standards of roughly 20 miles per gallon by 1980, mandated by the Federal Government, and they employ tax credits to get people to insulate existing buildings more efficiently and they employ standards for new buildings to make them more efficient.

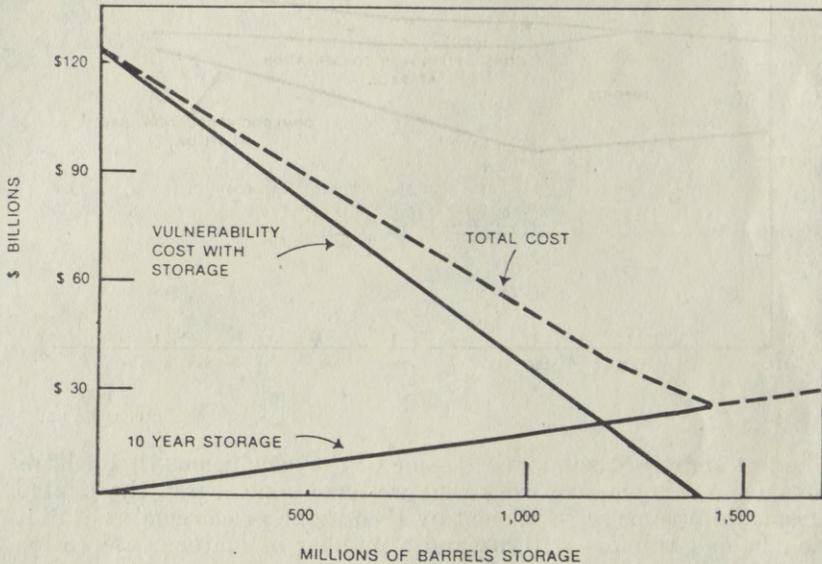
This chart shows what we could achieve at the \$11 oil price if these conservation measures are adopted. As you can see, we would again, if we adopted such a program right away, begin reducing imports right way, and by 1985 we would reduce imports down to roughly a million barrels a day, which certainly is a level that we could live with. The domestic production is only the production employed by the basic case. It is not the production employed by some of the other steps I have talked about such as opening up the Outer Continental Shelf for development.

PERCENT OF AFTER-TAX INCOME SPENT ON ALL ENERGY PURCHASES BY URBAN HOUSEHOLDS



The next chart shows something that we often forget when we talk about energy, and that is the impact of higher energy prices on income groups. As you can see, if you look at the percent of after-tax income spent on energy by urban households and looking from \$3,500 on up you can see the relatively high percentage in excess of 10 percent of income spent on energy by very low income households, declining fairly sharply to a very low portion of income by higher income households. Employing any energy policy has to provide some measures, either through the welfare system or some kind of negative income tax to try to level that line out.

COSTS OF VULNERABILITY AS A FUNCTION OF STOCKPILE SIZE



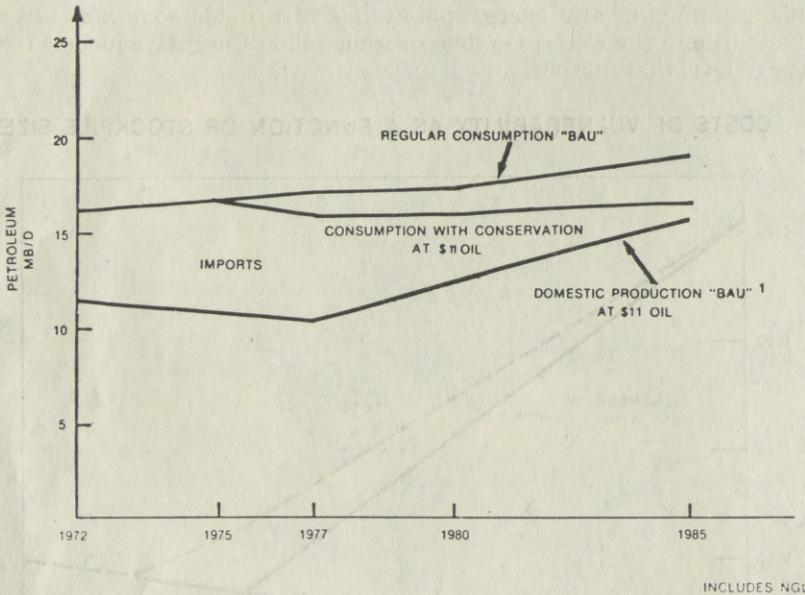
This shows another strategy that we looked at, not as an alternative, but as a supplement to the accelerated supply and reduced demand, and that is storage. As you can see, the blue line shows the cost of vulnerability with storage and what that implies is the more storage you have the less vulnerable you are. If you only have a little bit of storage and you get out oil for a year it will be very expensive because of the decline in the gross national product that you would experience. On the other hand, that green line at the bottom shows the cost of storage which is primarily the interest cost that you have stored.

I think what this shows is that storage is very cost effective, that the additional storage doesn't cost as much as the savings in reducing our vulnerability until you get somewhere over a billion barrels of storage.

The only problem with the storage program is that in order to expand or to create oil and storage we would have to go out and buy it somewhere, presumably on the world markets, so at the very time when it is terribly important for us to get the price of oil down because the devastating effect high oil prices are having on the world's economy we would be out there buying oil which would tend to keep that price up.

My own conclusion is that right now is probably not the time to go into a massive storage program. We would start a program, make sure we have the technology developed to store oil, but I wouldn't recommend a massive storage program right now because I think that would run counter to our efforts to try to get oil prices down.

CONSERVATION MANAGEMENT



The last chart just summarizes some of the conclusions that I have drawn from this massive work that we have done. First, the United States could become self-sufficient by 1985 if the price remains at \$11, which I don't think it will do, and a number of major conservation practices are taken.

I conclude that zero imports is probably not a practical goal. We can still import oil from countries which are relatively safe. If we do reduce our imports significantly it is clear to me that this will have the effect of bringing world oil prices down and we don't want to shut ourselves completely out of the world market because of the effects that these imports may, in fact, end up being cheaper than our own domestic products, and we don't want to put ourselves in a position where our industry has to run on high cost supplies completely.

The second conclusion, any domestic energy policy must be designed to resolve uncertainties and could include actions such as exploration in frontier areas. This is what I previously mentioned, and that is that I believe we should move quickly to explore but not necessarily develop the Outer Continental Shelf. Let's find out what is there and then come forth with a development strategy which will protect the environment, consider the appropriate interest of the States and at least once we know these reserves are there they will be in a position, like Great Britain is now, with some leverage over the oil producing nations.

Third, accelerating domestic supplies, while economic, has some environmental and social drawbacks and maybe constrained by equipment shortages. I discussed the equipment shortages earlier.

I might point out in connection with this point that last summer we had public hearings on Project Independence all around the country. I was quite impressed when I went out into the Western States about the deep concern many people had in that area about developing too rapidly, developing supplies prior to the development of appropriate community services. For example, I talked to a number of people out in States like Colorado and Montana and Wyoming, and they talked to me about the fact that they needed educational systems and transportation systems and sanitary systems in place before they could see a huge influx of population and the rapid development of their resources. We have community development work and still environmental problems.

The fourth point is that although cost effective, a storage program will take time to implement when our vulnerability is highest and could act to sustain cartel prices.

Finally, conservation has positive environmental effects, but requires intervention and regulation in previously free market areas and results in increased nonmarket costs due to more limited choices and changed life styles. So that while I am a champion of conservation, as is pretty well known, it is obvious that it does have some drawbacks in the sense that it does limit our choices. If we regulate the automobile industry and say the sales weighted average of cars in 1980 has to be 20 miles per gallon, this limits the choice of people to buy a gas guzzler. In all fairness I have to point that out, too, I suppose.

That pretty much concludes my presentation, and I will be happy to answer any questions.

Mr. UDALL. Thank you, Mr. Sawhill. It is, of course, a very vital subject to all of us.

We only have a little over an hour and a number of members have questions. I will divide that time so that each member will have 6 or 7 minutes, and following the previously announced rule, we will call on members in order of their appearance this morning.

Let me ask you first on my own time here a couple of questions if I may.

What projections in your studies and conclusions were based on the facts as you knew them and as various Federal agencies knew them last summer? I was disturbed and troubled by the news reports over the weekend that Canada, which we have always looked at as a very secure supplier of oil and which is now supplying us 900,000 to a million barrels a day, that Mr. McDonald announced over the weekend that Canada would reduce it to 650,000 barrels and will make a 100,000 barrel cut on January 1. What if anything does this development do to your projections and conclusions?

Mr. SAWHILL. We anticipated that. We did not anticipate quite as sharp a drop next year, but roughly we anticipated a phaseout, because I have had conversations with Minister McDonald over the past several months and he has been telegraphing the fact they are going to do this.

Mr. UDALL. I noticed on a number of your charts that projections included some component from shale oil over the next decade, couple of decades.

Mr. SAWHILL. Yes.

Mr. UDALL. Yet, in the last few weeks have seen two different developments that to me cause some doubt on those projections. One is the announcement that the company had a very large—

Mr. SAWHILL. Colony, I think.

Mr. UDALL. Colorado closed it down as uneconomic.

The other was a study which suggested that by the time you drill and tunnel to get the shale, by the time you use energy to crush it and energy to retort it and then to dispose of the waste shale, you may end up with a barrel of oil, but you may have spent more energy to get that barrel than contained in that barrel. How would you respond to those?

Mr. SAWHILL. Well, we only assume 250,000 barrels a day by 1985. I think with Colony closing down its project it will get somewhere in that range.

Our accelerated case assumes about a million barrels a day and would imply some kind of Government subsidy program, and if we did I am sure we could get Colony back in business again.

My only concern about shale is that we shouldn't move too rapidly until we have a better understanding of the environmental impacts; and second, until we further develop the technology. It seems to me with the present state of technology we have a technology which requires a great usage of water which is not very well equipped to handle the wastes.

So I don't think with present technology we will gain much beyond 250,000 barrels a day. If we are off as much as 50 or 100,000 barrels it will not effect our overall figures.

Mr. STEELMAN. Will the chairman yield?

Mr. UDALL. Yes.

Mr. STEELMAN. These are based on a \$11 price?

Mr. SAWHILL. Yes.

Mr. STEELMAN. Didn't Colony say it would have to be \$15 before it is economically feasible?

Mr. SAWHILL. It may have been somewhere in that range.

Mr. UDALL. It seems to me that makes the case for this bill that Mr. Dellenback and Mr. Hosmer—

Mr. SAWHILL. Yes, I would certainly agree because until we get into such a process for extracting oil from shale we won't see much.

Mr. UDALL. One of the provisions that would apply to the Colony situation was the ability of the administrator to guarantee a price of x barrels of production so the company could go ahead and learn some things without going busted.

Mr. SAWHILL. Yes. I think that is a sensible thing to do. I don't think we should support the whole oil shale industry.

Mr. UDALL. Right.

I like your emphasis on conservation. It seems to me we will have to go that road and very strictly and very vigorously.

One other piece of legislation we have been trying to get out here is the energy conservation bill which would set as a goal, an annual energy growth rate of 2 percent as against $4\frac{1}{2}$ to 5 percent as we

have had in the past. The great benefits of that I have been arguing is it gives us 30 or 35 years energy doubling time as against the 12 or 13 or 14 years that past history would indicate our doubling time. That is an enormous difference in the impact on the capital markets and the ability of energy industries to adjust and adapt. I don't know whether we will be able to do anything this year or not.

Mr. HOSMER. Whoever "we" is, it does not include me. I oppose some arbitrary, fixed percentage of reduction in the energy growth rate.

Mr. UDALL. I gather the gentleman from California would not be included.

Mr. SAWHILL. I would comment on this. At the \$7 price we show growth 3.2 at 112.7. If you overlay on that \$11 price the conservation measures I describe you could get down to a growth rate of 2.2 percent.

Mr. UDALL. Which is a growth rate that not "we", but "I" think is good.

Mr. Hosmer.

Mr. HOSMER. In the emphasis you have placed on exploring the Outer Continental Shelf, I assume that you have in mind some vast Government exploratory program?

Mr. SAWHILL. Well, I don't know if you need to get the Government directly involved in exploration, but I certainly think the leasing incentive should be revised so you get a lot of exploratory wells drilled quickly so we know what's there. I think that is the important thing.

Mr. HOSMER. How would you do this? What techniques would you adopt?

Mr. SAWHILL. Well, you could have the Government go out there and in addition to accounting for reconnaissance physics it could account for core whole samples, for example, and maybe even account for the drilling of a few exploratory wells.

Mr. HOSMER. Well, if someone wants to drill a well every 20 miles throughout the United States and take core samplings and so forth, but when you are drilling on the Outer Continental Shelf you just can't count entirely on core samples. You have to put in a well to get any sensible estimate.

Mr. SAWHILL. For example, you could make a precondition for companies to make leases that they—we have to know what reserves are there and until we do we won't be in a very good position to formulate our policy. Everything I have shown you this morning is based on some assumptions about reserves.

Mr. HOSMER. The only thing I can think of to implement your idea without getting the Government into the project would essentially be in the leasing program. The Government could stipulate that one can only lease in specific areas and establish a pattern by which the Government could solicit information from private enterprise.

Mr. SAWHILL. After all, these are public lands, and I would make that information available across the industry.

Mr. HOSMER. You did mention one other matter that I wanted to touch on. In all these cases of extrapolations, the results are just as good as the assumptions. Would you describe the methodology and any other information about these assumptions that might contribute to our understanding?

Mr. SAWHILL. I am not saying this to be facetious, but we have 15 volumes this size that document the study. This is a very complex study involving a very striate model of the energy industry in this country broken down on a regional basis. I have given you the assumptions we made on price to get the assumptions on existing oil fields. We get field by field to get estimates about what the decline rate would be of different prices. We went on a State-by-State basis and got estimates from State officials and the coal industries on what coal would be produced at different prices. We had the atomic energy work with us on nuclear and we came out a little more conservative than we have.

In addition, all the assumptions we developed we reviewed widely with people in the industry and other consultants and Government experts.

Mr. HOSMER. This won't be based on some econometric department at Princeton or some place?

Mr. SAWHILL. No, certainly not, MIT.

Mr. UDALL. We will have no anti-academic or anti-scholastical thoughts expressed here today.

Mr. HOSMER. No, we had enough of that in New Hampshire.

Mr. UDALL. At the close of the hearing Mr. Hosmer will lead us in a few bars of "Hail to the Chief."

Mr. JONES.

Mr. JONES. Thank you, Mr. Chairman.

Mr. Sawhill, I am particularly concerned about two areas, one, capital requirements necessary both in short-term and long-term solutions to the energy problem and, two, consumer price.

First of all, the price. I gather that you would charge and you think it is in the national interest to keep the oil prices at a minimum of \$7 a barrel?

Mr. SAWHILL. No; all I am saying I don't think the price will go below \$7 a barrel because at about that price world production and consumption seems to come into balance.

Mr. JONES. As I understand the world demand is 56 million barrels a day and mainly the OPEC countries are withholding from the market about 6 or 8 million barrels a day which is not being produced.

Mr. SAWHILL. That is about right, yes. I think your demand figure is a little high.

Mr. JONES. Well, 53 to 57.

Mr. SAWHILL. I think in the range of 48.

Mr. JONES. In any event, this production is withheld by the OPEC cartel, which would imply to increase that production and lower that price you need some sort of consumption—

Mr. SAWHILL. I certainly think the consumption countries have to get much closer together than they have in the past.

Mr. JONES. Do you have any idea how to break the OPEC cartel?

Mr. SAWHILL. My one idea kind of got shot down, and that is that the United States had to take the leadership in its reduction of the consumption of oil and then convince the consuming nations to join with it in reducing consumption. If you look at waste to reduce consumption in the short range you have to think about gasoline, and if you are going to reduce consumption of gasoline there are two ways, either reduce supplies by rationing or you can have a higher tax which will also have the same effect.

Mr. JONES. Is there any value from a national standpoint for this Government to encourage a private oil company cartel in dealing with the OPEC countries? In other words, private oil companies producing in these countries?

Mr. SAWHILL. Encourage the private oil companies to do what?

Mr. JONES. To become a cartel as a balance against the OPEC countries themselves?

Mr. SAWHILL. No; it seems to me that in Saudi Arabia, for example, you already have the four leading companies acting together in one company in Aramco. I don't think that is the answer. I think maybe the answer is to get the Government somewhat more involved in the whole process.

Mr. JONES. Let me switch to the capital requirements, I think your report calls for 350 or 400 million—

Mr. SAWHILL. 450.

Mr. JONES [continuing]. Capital requirements in short range, and I think John Winger of Chase Manhattan said about 1.4 trillion capital requirements.

Mr. SAWHILL. We think he is wrong, obviously.

Mr. JONES. The question I have has to do with changing tax policies by Congress, specifically the depletion allowance. Will that in your judgment hinder the raising of capital in the short range?

Mr. SAWHILL. Not in the aggregate; no.

Mr. JONES. As I understand, the depletion allowance is primarily used by producers to explore most of our domestic—

Mr. SAWHILL. That is a little bit of a misconception. They do most of the onshore but not offshore where the big capital is spent. That \$450 billion, 75, 80 percent of it is utility, not the oil industry or coal industry.

Mr. JONES. Do you have any information there will be a shift of capital from oil when you take away a depletion allowance on oil and other minerals, do you have any information that some companies will shift their capital?

Mr. SAWHILL. At today's prices for oil, no.

Mr. JONES. Which would indicate that the policy would be to keep today's oil prices at a proper level?

Mr. SAWHILL. Well, I don't think that is a policy we are going to have much impact on. The price of oil will be determined by the cartel, not by supply and demand conditions in this country.

Mr. JONES. I guess what I am getting at, is it any better—the consumer will pay one way or the other—is it any better to have him pay through the tax incentive process or through the product he purchases?

Mr. SAWHILL. I think it is better to have him pay through the product, myself.

Mr. JONES. Now, on the deregulation of natural gas, could you expand a little bit more on why you think that there will not be an increase in price of natural gas?

Mr. SAWHILL. We went around to reservoir engineers, we looked at natural gas reserves that might be available at different price levels and we didn't feel that a higher price would bring on any more than the amount that I have indicated. In the accelerated case, now, when you deregulate all natural gas prices you might get somewhere more, but even there it is not a significant figure.

Mr. JONES. What is your recommendation to Congress?

Mr. SAWHILL. That we deregulate just new gas.

Mr. JONES. On coal, do you think enactment of coal slurry pipeline legislation would in any way alter your statistics?

Mr. SAWHILL. No; it would take so long to get the ability and become effective that it wouldn't alter our figures.

Mr. JONES. Just one final thing. You indicate there is going to be a decline in domestic production over the next 3 years regardless of what policies are adopted.

Mr. SAWHILL. Yes.

Mr. JONES. Would you expand on that as to the reasons why?

Mr. SAWHILL. Just because our fields are very old and they are declining very rapidly. No matter—we are not finding new oil at a rate sufficiently rapid to replace that declining production.

Mr. JONES. On alternative sources of energy, are you satisfied that we have made enough of a commitment to capital needs for such things as solar power, geothermal, and what have you?

Mr. SAWHILL. Yes; I think so. We have to keep expanding. We are expending \$50 million in this fiscal year alone for solar, for example. It is still at the stage where we are trying to figure out how to do it where it is economically feasible. Once we get solar to the point where it makes sense to build demonstration plants then we can expand it, but I don't think we should expend any more money this year.

Mr. UDALL. The time of the gentleman has expired.

Mr. RUPPE. Mr. Chairman.

Mr. UDALL. Mr. Ruppe, you are recognized.

Mr. RUPPE. Thank you very much.

I certainly enjoyed your testimony, Mr. Sawhill, and the candor in which you state your views.

It is a rewarding experience for those who have listened to you.

You have indicated varying amounts of energy at certain prices and various percentages of growth. How does that affect our gross national product? Does it vary in accordance to how our energy growth moves?

Mr. SAWHILL. Yes; as I recall, and we did look into this pretty carefully. At the \$11 price of oil the growth rate would be half a percent less than at the \$7 a barrel price of oil. So we did analyze that. It is clear that lower oil prices are better for us than higher oil prices because they result in higher gross national product.

Mr. RUPPE. But getting down to the energy figures themselves, is there a corollation between the rate of energy growth—you have indicated it could be 2½ to 4 percent—and the growth of GNP? Does that as a corollary automatically indicate our GNP will be affected to the same degree?

Mr. SAWHILL. No, I don't think so, not for the foreseeable future. The two have been parallel. But we waste so much energy. If we shifted resources from wasting energy in space heating to producing insulation that wouldn't slow down our GNP growth but result in a shift. If we made more buses and fewer automobiles or consumed less gasoline this wouldn't result in a higher—

Mr. RUPPE. You are not pessimistic on that score.

Mr. SAWHILL. No, I have met with the six major paper, steel, cement, aluminum, petrochemicals and one or two others, and there are significant things they can do to reduce the growth rate in energy consump-

tion. As a matter of fact, we have gotten them all committed to reducing by varying percentages the productivity of their use of energy, in other words, the amount of Btu's they use per unit of output. They can do this through process changes and that won't slow down our GNP growth.

Mr. RUPPE. You have indicated the use of coal will probably double.

Mr. SAWHILL. Close to double.

Mr. RUPPE. By 1985. You also indicated that at certain stages because of particular facets in your model that the consumption of coal may not rise all that much. Would it at any time be desirable to go back to major utility users and major industry and regulate the utilization of those firms and companies of coal and oil, recognizing no matter what the price factors are we have 200 or 300 years of coal and a very definite amount of oil available to us? Do you think we should have a policy of getting major industry out of the oil and gas consumption business.

Mr. SAWHILL. We have a bill which gives the administrator of FEA the right to direct switchovers. I think we may have to come back to you at some point and ask for additional or modified powers under that bill. But I think we have the basic legislation in place.

The real problems are the environmental has always associated with burning coal. While from an energy standpoint it would be desirable to switch everybody to coal for the reasons you outline, we obviously can't do that and tolerate the increased amount of sulfur and sulfates in the atmosphere. It is kind of a balancing act, if you will.

Mr. RUPPE. Do you think if we don't turn to a larger utilization of coal by the turn of the century that we will have to turn to oil?

Mr. SAWHILL. Oil is certainly declining as a resource, but there are alternatives to extricate coal under utility and industrial powers, and that is to convert coal to cleaner burning fuels; and second, of course, nuclear power will be expanded rapidly and I would advocate that.

Mr. RUPPE. I think you did indicate no matter what the price natural gas production is likely not to expand.

Mr. SAWHILL. Right, we don't expect it to expand.

Mr. RUPPE. We have major industries and utilities utilizing natural gas as a primary fuel element. It seems to me quite a terrible wasteful utilization. We ought to use your bill or some other FEA policy to compel that change.

Mr. SAWHILL. Yes, we have the basic legislation in place to do that right now, but the industry problem will be tough for us, because 50 percent of American industry is fueled by natural gas and that is not slowly anymore but fairly rapidly being curtailed. My own home State of Maryland estimates 10,000 people could be out of work this winter.

Mr. RUPPE. Is a lot of research money being spent to broaden the use of coal to get the contaminants out?

Mr. SAWHILL. About \$425,000 this year. I think with the development of the ERA legislation and the new ERA thrust on possible fuel research that this will improve.

Mr. RUPPE. Final area of questioning. My automobile friends in Michigan appreciate your call for an extension of mileage per gallon and they, I expect, would like to undertake it voluntarily. They have a complaint that at the present time they don't have enough time to

sit down and think about extending mileage in view of the fact that emission standards are such an ever-moving set of goals they spend all their research time chasing ever-changing emission standards. They never have time to sit down and determine how to make them more economical to operate.

Mr. SAWHILL. I think that is a little bit of a smokescreen myself. There is no question the standards are changing, that they probably should be made stable for some period of time. I have testified in the past that I think the administrator of EPA ought to be given the discretionary right to set the NOX standard.

My own fairly tertiary analysis is that we have stabilized them for the next couple of years and it is only in 1978 they will start moving again. I agree that should be part of the total package, and I think Russell Train will agree with that.

Mr. UDALL. Mr. Foley.

Mr. FOLEY. I would like to join with Mr. Ruppe in commending you for the candor of your responses.

Further, I want to touch on a difficult subject, the gasoline tax increase.

We have had, as I recall, roughly a 50- to 80-percent increase in retail gasoline prices in the last 2 years.

Mr. SAWHILL. Yes, from about 33 to 25 cents or so.

Mr. FOLEY. Has the effect of that increase resulted in a remarkable drop in consumption of gasoline?

Mr. SAWHILL. Well, it has shown some reduction, and the amazing thing is that gasoline used to increase at 6 to 7 percent a year, and instead of that increase we have actually had some tailing off in gasoline consumption.

Mr. FOLEY. Were any of your proposals to reduce the consumption of gasoline based on the increases in gasoline tax, or do you feel that the higher retail prices would themselves be a sufficient deterrent to increasing demand for gasoline? Do European studies offer any other answers or solutions?

Mr. SAWHILL. Yes, I—

Mr. FOLEY. I know that the demand for gasoline is somewhat inelastic.

Mr. SAWHILL. It is quite inelastic. More inelastic in the short range than the 2 to 3 year period. Over that time you can trade your car in for a smaller more efficient car. But it is inelastic. I wouldn't pretend it isn't.

Mr. FOLEY. Is your support for increased gasoline tax based on shifts in the preference toward higher mileage automobiles or just tail off use?

Mr. SAWHILL. Both.

Mr. FOLEY. Both?

Mr. SAWHILL. Yes, you see, the tax we propose was a refundable tax so that lower income groups would get the tax back and have the structure of making our tax structure more progressive. So we had to offset savings we would get from a higher price with the fact we would be giving some people more income and there might be a tendency on their part to consume more gasoline. Nevertheless the package was designed to save a million barrels a day did have a tax.

Mr. FOLEY. In order for the conservation of gasoline to be significant or even noticeable wouldn't the tax have to be substantial?

Mr. SAWHILL. In the first year we estimate 25,000 barrels a day for each penny increase. Ten percent tax would be 250,000 barrels a day.

Of course, the other advantage is to the extent you don't refund it or to use certain income groups that you can use the revenues for research and development programs and for funding of public transportation.

Mr. FOLEY. I don't think anyone quarrels with the fact it would be a rather dramatic revenue raising device, particularly if it were a sharp increase. I was more concerned about the direct conservation value.

Mr. SAWHILL. That is more significant conservation value than almost any other measure. For example, comparing to fuel efficiency standards that is a much more significant impact, because with fuel efficiency only impact those cars bought in any given year. Whereas, a gas tax influences the whole automobile fleet.

Another measure was providing tax credit for people to insulate their homes. That is a good idea but it doesn't give you as much as a gasoline tax.

A third measure was providing thermal standards for new buildings. Again, you only save what you would use in heating new buildings.

Mr. FOLEY. What is our current—

Mr. SAWHILL. Maybe if I could just say one more thing. I wish I had the table comparing our gasoline tax to the facts initially, Germany, Great Britain, Mexico, those last two countries have raised their tax very sharply in the past 2 years. Our tax is very small and when we try to show leadership in the area of conservation and say we will cut back with only a 12 percent tax we don't have much credibility.

Mr. FOLEY. I was recently a participant at the World Food Conference. If my memory serves me I think they pay \$1.80 a gallon initially. And yet I didn't notice that this inhibited travel or transportation in Italy.

Mr. SAWHILL. Actually, if you look at the figures on gas consumption per person initially they are much, much lower than in this country.

Mr. FOLEY. In terms of the storage and supply situation, what is our current gasoline supply?

Mr. SAWHILL. Roughly 225 million barrels of gasoline in inventory right now. I don't have the exact figure. It is very good relative to what it was at this time last year.

Mr. UDALL. What is that in today's—

Mr. SAWHILL. We consume about 6 million barrels a day, so it would be about 2 days, no more than that—40-day supply.

Mr. FOLEY. Do you have detailed estimates on the cost of increased storage?

Mr. SAWHILL. Yes; we can make that available to you.

Mr. FOLEY. Granting your argument that it would be stimulating to price if we were to go into the market and purchase large quantities of gasoline for storage, do you not feel we be considered some gradual buildup of stocks?

Mr. SAWHILL. Yes; my only concern was not do it too rapidly.

Mr. FOLEY. Not massive.

Mr. SAWHILL. Right.

Mr. UDALL. Mr. Dellenback.

Mr. DELLENBACK. Thank you, Mr. Chairman.

Mr. Sawhill, could you give us a brief word on this proposed intervention that we saw written up in the Post a week or so ago on gasoline. You are quoted to express hope there will be some sort of a major breakthrough. Is there anything to this or—

Mr. SAWHILL. We don't have the kind of expertise at FEA that really enables us to evaluate something like this. We do have a man who is an automotive engineer. He looked at some of the tests as some other people did. He saw the car got a very significant gain an identical car with a standard engine in it. The theory behind the thing is that it vaporizes gasoline and takes the heavy molecules out and puts the heavy molecules into the cylinder. It seems to make sense.

Mr. DELLENBACK. You haven't tested it extensively or you can't add anything?

Mr. SAWHILL. No; I can't add much. That is to go through the regular EPA study.

Mr. DELLENBACK. You were quoted as having said Russell Train would expedite his consideration.

Mr. SAWHILL. Yes; and I have encouraged the inventors of this engine to take it through the EPA testing center out in Ann Harbor.

Mr. HOSMER. Russell Industries had some type of invention, didn't they?

Mr. SAWHILL. I am not familiar.

Mr. DELLENBACK. I am pleased with what you had to say about conservation, because while we put Mr. Hosmer down as doubtful, we agree very strongly that we have to work it out so it doesn't injure the rest of the economy.

Mr. SAWHILL. Well, I don't think it will. For example, if we give a tax credit for the insulation of homes this will stimulate an industry. One way to set automobile standards would be to give a tax credit for people to buy smaller more efficient cars and a tax penalty if they bought larger less efficient cars. This would be a stimulant to the automobile industry.

Mr. DELLENBACK. I couldn't agree with you more. It is desirable from several standpoints that everything be done to increase efficiency, because when you speak of conservation, I don't think in terms of a cutdown. I read you as saying do those things under the spur of conservation which will be stimulating.

Mr. SAWHILL. Exactly.

Mr. DELLENBACK. I couldn't agree with you more, and I think your emphasis is an extremely important one.

You touched earlier on the question of nuclear power, and said that you would make further comment on it. Is there anything you could give us in addition as to why the impact is so late and what the future of nuclear power is specifically, what we need to do?

Mr. SAWHILL. Well, I really can't add much to Mr. Hosmer's fund of knowledge in this field, and I don't pretend to be as expert as he is.

My impression is there have been very, very long lead times in bringing nuclear plants on line, partly because of construction delays, li-

censing and siting delays, creating to some extent by Government regulating policy. We have supported a bill to expedite siting. I think if we can cut down these delays we should be able to accelerate nuclear development.

Mr. DELLENBACK. Without going into specific detail, do you have any conclusions about the safety of nuclear power?

Mr. SAWHILL. I was quite impressed with the Rasmussen study by a professor at MIT the chances of a reactor accident, and frankly, they are very, very small, much smaller than the chances of a highway accident or being struck by lightning.

I think the only two areas I still have concerns about are the disposal of waste and the sabotage problem. I think we certainly should be able to lick the latter and I think there is quite a bit of work underway to work on the former.

Mr. DELLENBACK. Part of the testimony you have given deals with additional domestic supplies from Alaska, and I believe you mentioned additional pipeline? Is there such a plan actually underway within the Government, at the same time we are putting one underway?

Mr. SAWHILL. Well, we are really just trying to assess the need for it and also having some preliminary negotiations with the Canadians on the alternative routes, whether through Canada—

Mr. DELLENBACK. Have they shown more interest in Canada than a year or so ago?

Mr. SAWHILL. My understanding is yes. We had a man present at the negotiations and I think there is receptivity.

Mr. DELLENBACK. Would the installation of such additional pipeline be predicated upon finding additional reserves or do you suggest we go ahead with that kind of thing without waiting for additional proven reserves?

Mr. SAWHILL. Well, I think for oil we would want to determine additional reserves. For gas I think we already know there are additional reserves there that would justify the building of a pipeline.

Mr. DELLENBACK. So far as oil is concerned, you feel at the present time the proven reserves should come in the pipeline.

Mr. SAWHILL. What I suggest in oil is find some way of exploring naval reserve No. 4, and if that has the potential it seems to it could warrant a pipeline.

Mr. DELLENBACK. This committee has had extensive testimony over what is proven and what the expectations are, at least the optimistic hopes of what we might find.

Mr. SAWHILL. I feel the same about PET 4 as the Outer Continental Shelf. We need to do some drilling.

Mr. DELLENBACK. In your testimony you spoke in terms of shifting the emphasis from intensified increase in production to intensification of exploration so if we adopted this method, we would not know what it is we actually have. Where do you see such exploration on an intensified basis other than the Outer Continental Shelf?

Mr. SAWHILL. In PET 4.

Mr. DELLENBACK. Don't you have any other area in the lower 48 or elsewhere where there are possible resources we should be intensifying our exploration?

Mr. SAWHILL. None that I know of, and I haven't met—

Mr. UDALL. Including the gulf of Alaska?

Mr. SAWHILL. Yes.

Mr. DELLENBACK. Any more exploration in OCS?

Mr. SAWHILL. Maybe there is a little exploration needed.

Mr. DELLENBACK. It is my understanding that it was the same massive exploration as PET 4.

Mr. SAWHILL. No.

Mr. DELLENBACK. What about the two areas you think we should be concentrating our exploration in, PET 4 and the Outer Continental Shelf?

Mr. SAWHILL. Yes.

Mr. DELLENBACK. In the OCS, you are in favor of this kind of exploration?

Mr. SAWHILL. Yes.

Mr. DELLENBACK. Do you think our exploration and technology are sound enough?

Mr. SAWHILL. Yes.

Mr. DELLENBACK. Even the——

Mr. SAWHILL. Once we find out what's there then we can assess whether we really do have the protection needed to get ahead and develop the fields.

Mr. DELLENBACK. So the intensification of exploration that you are suggesting we really move ahead on would be the whole Outer Continental Shelf and doing so without emphasizing on——

Mr. SAWHILL. Yes.

Mr. DELLENBACK. I would ask you with apprehension about one more area—Have you done any extensive projects as to the effect on GNP and the country in the event of a reimposition of another embargo?

Mr. SAWHILL. We estimated the last one cost us \$10 to \$30 billion. If we had another one it would at least cost us that much.

Mr. DELLENBACK. Is our import picture about the same?

Mr. SAWHILL. Yes.

Mr. DELLENBACK. We have not yet passed——

Mr. SAWHILL. No, because the higher prices has discouraged consumption.

Mr. DELLENBACK. The impact economically would depend on the legislation and so forth?

Mr. SAWHILL. Yes. We are in somewhat better shape. We try to estimate the economic impact of different legislations and size of embargoes, but because of the fact we have created the FEA and an organization in place to operate an allocation program we are in better shape than we were last winter when we had to start the agency.

Mr. DELLENBACK. Are we getting better information?

Mr. SAWHILL. Yes, we are getting much better information from the industry.

Mr. DELLENBACK. The governmental agencies have a much better grasp?

Mr. SAWHILL. Yes, we publish every month a Monthly Energy Review, a very comprehensive set of statistics, electric utilities and oil and gas and coal and so forth, not only showing what is happening but what will happen in the future.

Mr. UDALL. The gentleman's time has expired.

Mr. Bingham.

Mr. BINGHAM. Thank you, Mr. Chairman.

I would like to say that I, too, admire your frankness, and while it may have cost you your job, you performed a public service, nonetheless, and I think if we had more of this kind of frankness to the public and the Congress we would be far better off.

Pursuing the development of the OCS, what is your comment about the directly reiterated statement that the administration stands for an immediate 10 million acres leasing program?

Mr. SAWHILL. I think they backed off that 10-million-acre goal. Frankly, in a recent statement I have seen less emphasis on the 10 million acres than on getting started.

Mr. BINGHAM. Who would do the exploration under your proposal?

Mr. SAWHILL. That is to be done—you know, it can't be done by the Government because the Government doesn't have drilling crews and rigs. The only question is have the Government account for the exploration or whether the Government sets up fairly rigid regulations under which the industry does the exploration.

Mr. BINGHAM. Just a couple of specific questions on your statement.

In the middle of page 2 you have a statement, domestic petroleum has increased rapidly.

Mr. SAWHILL. We showed a chart.

Mr. BINGHAM. Production is in conflict with other segments.

Mr. SAWHILL. It was until 1970. This statement was designed to be read in connection with some charts.

Domestic petroleum is the tan part. Up to 1970 it was increased rapidly and then again to turn down.

Mr. BINGHAM. Well, I still don't understand that in relation to some of the other charts we have had that shows—that just takes it to 1970, does it?

Mr. SAWHILL. Yes.

Mr. BINGHAM. Has it leveled off since then?

Mr. SAWHILL. Yes, I will show you another chart which shows what has happened subsequent to 1970.

Mr. BINGHAM. I don't want to take the time.

Mr. SAWHILL. Let me just show you this, because this is kind of an interesting chart. You see, up until 1970 this black line was increasing and then again to decline and will continue to decline we think until about 1977 or 1978. This shows why we then expect it to turn up again, some from oil shale, some from Alaska, some from the Outer Continental Shelf, the Gulf of Mexico primarily. This will come from secondary and tertiary recovery if we have a \$11 price instead of a \$7 price.

Mr. BINGHAM. Thank you.

Now, on page three near the bottom, after the statement about Japan's imports remaining relatively constant if the price is from \$4 to \$11 a barrel, the next statement, does that deal with worldwide imports?

Mr. SAWHILL. Yes.

Mr. BINGHAM. So that there is a very great variation there worldwide?

Mr. SAWHILL. Yes. We had another chart that showed that and one of the points of that chart was that Japan would have roughly the

same level of imports almost irregardless of points because they had no alternatives whereas the United States with coal and nuclear would probably switch to those.

Mr. BINGHAM. You referred to the conservation package. What are the elements?

Mr. SAWHILL. There would be some way to provide disincentives to automobile gas like a gas tax, a refundable tax to lower income groups.

Second, and to the extent that all the revenues weren't needed for refunding, there will be funds available for mass transportation. There would be fuel efficiency standard which would require the automobile companies to have a 2-mile-per-gallon weighted average of their sales by 1980.

Third, there would be a tax credit for people to install insulation in their homes and also for commercial buildings, and finally thermal standards for new buildings.

Mr. BINGHAM. What would be the arguments used, laying the tax aside for a moment, what were the arguments used against that package, why the administration shouldn't go to that right away?

Mr. SAWHILL. Well, maybe they haven't yet made a final decision. I think the arguments used against efficiency standards are that it represents a further interference with industry.

Mr. BINGHAM. On the tax you say that it would be refundable. How would you handle the problem, say, of a person who has to commute 30 or 40 miles a day to his job but may not be in a lower income category?

Mr. SAWHILL. I should think we should probably try to encourage those people to carpool, for example, or to use a more efficient car. The amount of refunding would be enough for anyone to drive 10,000 miles per year in a car with 20 miles per gallon without suffering any tax penalty. It is only the driving beyond that that would be penalized.

Mr. BINGHAM. Would the refunding depend on the amount of use?

Mr. SAWHILL. No, a flat refund to everybody.

Mr. BINGHAM. How does that tie in with low income?

Mr. SAWHILL. Well, the lower income groups tend to drive less and use public transportation more. They would be getting a refund of a tax they never pay. They would get an inflation dividend of 100 financed by a gas tax.

Mr. BINGHAM. You wouldn't then be tying your refunding to some sort of a means tax.

Mr. SAWHILL. No, a straight across the board.

I noticed in the paper the other day that Charles Walker suggested a scheme I think perhaps even better than mine that would try to refund by refusing payroll tax, social security tax, and using that as a device for shifting the tax burden as opposed to the refunding scheme as we have suggested. I think his idea is a little better than ours.

Mr. BINGHAM. My impression is that the administration has made no effort over the last year to enforce the 55-mile speed limit. That it is universally ignored.

Mr. SAWHILL. The actual enforcement comes at the State level as opposed to the Federal level.

Mr. BINGHAM. There is no talk about it, no effort that I can discern to persuade the States to enforce it. This is directly inverse to the position taken during the embargo. The speed limit was quite well observed then.

Mr. SAWHILL. To the extent that you can bring pressure, I have sent telegrams and written letters to the Governors asking them to enforce the thing. The next step would be to withhold highway funds from those States that aren't enforcing it.

Mr. UDALL. The gentleman's time has expired.

Mr. STEELMAN.

Mr. STEELMAN. In your summary you say that we are dependent for 35 percent of our needs on imports and that the embargo effected a 14-percent drop. Is that the difference between what we got from the Arab countries and the other members of the OPEC cartel?

Mr. SAWHILL. That is correct.

Mr. STEELMAN. The tax bill, as I recall, takes away the 100-percent writeoff for any royalty payments to foreign governments by U.S. major oil companies.

Mr. SAWHILL. Yes.

Mr. STEELMAN. I have questioned oil company executives about this and the response was if you do that, it will mean higher prices in this country. What is your response?

Mr. SAWHILL. I don't have the exact number, but I don't think it will have a significant impact on prices, but I should explain that to you because that is a good question. I don't know the answer.

Mr. STEELMAN. On page 4 of the summary you make the point that world prices are determining U.S. energy prices. We have had an increase from about \$3 a barrel to \$11.50 a barrel over the last 18 months.

Mr. SAWHILL. Yes.

Mr. STEELMAN. This obviously does not include any increased cost of production, it is just an arbitrary figure set by the OPEC cartel.

Mr. SAWHILL. Yes.

Mr. STEELMAN. Do you see the need in this country for any anti-trust action against U.S. majors?

Mr. SAWHILL. We really did not as part of this report have time to study the structure of the industry and to get into questions of anti-trust. I am not a lawyer, so I probably can't give you a very informed comment on that subject.

Mr. STEELMAN. Have you seen the level of competition at the retail level necessary to affect stable prices?

Mr. SAWHILL. I think at the retail level there is pretty good competition. I think the question is at the refining level and the producer level. When you have 250,000 gas stations in this country, most individually owned or leased, you have a pretty good competitive situation.

Mr. STEELMAN. Their prices are determined largely by this—

Mr. SAWHILL. That is what I say. The gas stations compete with each other. What you really have to concern yourself with are the refineries themselves competing with each other. That is the area where we have to look at competition. The FTC has embarked on a pretty major study of the competition and I am sure we will see results of that pretty soon.

Mr. STEELMAN. You say in your statement that even with the Mexican find and maximum U.S. production that we could not approach the production level in the Middle East; is that correct?

Mr. SAWHILL. Right.

Mr. STEELMAN. Well, from what I read, I thought the Mexican find was important.

Mr. SAWHILL. It is important, but we are talking about reserves, speculating that reserves could be in the range of 20 billion barrels.

Mr. STEELMAN. I thought I read that the Mexican find was projected to outstrip the whole Persian Gulf.

Mr. SAWHILL. Oh, no. There is a lot of misinformation about that.

Mr. STEELMAN. So it is not significant?

Mr. SAWHILL. It is significant, but 20 billion barrels is half of the remaining U.S. reserve but it is not significant compared to the Middle East reserve. It is about the size of our north slope.

Mr. STEELMAN. All right. Your projections are all made irrespective of whatever changes there might be in tax policy, the depletion allowance, and taking away—

Mr. SAWHILL. I don't think the depletion allowance is going to have that much impact.

Mr. STEELMAN. So the argument always made by those in the oil business that the depletion allowance is a major incentive to new business is a smokescreen?

Mr. SAWHILL. We have had the depletion allowance and our reserves have not increased that rapidly and production has declined in 1970.

Mr. STEELMAN. So you think price is a better incentive?

Mr. SAWHILL. Yes.

Mr. STEELMAN. I raised earlier this matter of the price per barrel on the shale production. Colony, I am virtually certain, made the statement in its official announcement they would have to have a \$15 price before it would be economically feasible. You projected an \$11 price would produce 250,000 barrels per day.

Mr. SAWHILL. Yes.

Mr. STEELMAN. If your projections are based on an \$11 price and Colony says they can't keep their operation going for anything less than \$15 a barrel, it is pretty important.

Mr. SAWHILL. Colony is only one company, No. 1. I think we are trying to make a play for Government subsidy.

Mr. STEELMAN. Colony is one company that has been on the cutting edge of this whole shale development project and they were using the cheapest mining methods. My point is I hope you will look into it because the discrepancy is very significant.

Mr. SAWHILL. We are talking about 1974 dollars and to the extent that inflation continues that \$11 price is going to become a \$15 price.

Mr. STEELMAN. In your job, you had occasion, I am sure, to observe what the effects of various factors have been on our diminishing supply and increased demand. They involve both environmental and energy considerations. Every time we take up a bill here in the committee, somebody charges that the environmental movement is responsible for the energy crisis.

Mr. SAWHILL. I don't agree with that.

Mr. STEELMAN. On a scale of 1 to 10 you would rate it what?

Mr. SAWHILL. One. I don't think that has been the real problem. If we are trying to blame the environmentalists we are creating a scapegoat that isn't there. Our energy problem is a Government problem, that we consume energy very wastefully. The environmentalists recognized very early we have had to cut down. To some extent they have contributed.

Mr. HOSMER. That was the past, the future is in a different time frame and so forth, is it not?

Mr. SAWHILL. Yes, sir.

I just think we waste words for trying to blame environmentalists for what has caused the energy problem.

Mr. STEELMAN. All of us, in going back to our districts are hit with this contention that the oil crisis was created by the majors holding supplies to get the price up. I know it is hard. It is an inexact science at best to know what the reserves are. But do you see any attempts to contrive a crisis in order to get prices up?

Mr. SAWHILL. No; we did not.

Mr. STEELMAN. It was brought about primarily by the embargo?

Mr. SAWHILL. The immediate prices last winter, yes. The longer term problem was caused by our demand growing more rapidly than our supplies.

Mr. STEELMAN. You found no evidence supporting or any other artificial means?

Mr. SAWHILL. No; except on a very, very small scale.

Mr. STEELMAN. No further questions, Mr. Chairman.

Mr. UDALL. Mr. Cronin.

Mr. CRONIN. I have read through your testimony, Mr. Sawhill. I think it is certainly complete material for us to consider at this point in time.

You mention in coal in your testimony that it is a question of demand. Mr. Steelman has also brought up the question of ecology. I wonder how elastic that is. In my area of New England and in Massachusetts our utilities have been trying to burn coal now for a year and a half and cannot through environmental regulations. The New England area unlike any other section of the country has no coal producing its electricity. How many other areas of the country are there that affect the elasticity of demand the way we have it in New England?

Mr. SAWHILL. The New England regulations, as I recall aren't that much more stringent as in any other major urban areas. What has happened, you get utilities in other parts of the country with access to lower sulfur coal or shifted to nuclear energy to a greater extent than New England. After all, when residual oil was cheap it made sense for them to do that, so it became very dependent on residual oil.

Mr. CRONIN. They have a situation now even with low sulfur coal it would not be allowed to be burned, not because of the sulfur content but because of the ash content.

Mr. SAWHILL. There are precipitators that can eliminate that content if they make the capital expenditures necessary to do it.

Mr. CRONIN. This has been a subject of debate and I am wondering how many other sections of the country are affected by that?

On oil, if we bring in domestic supplies, which I certainly hope we will do over the short run, and I am certainly providing encouragement to bring that on, are we also going to move domestic refining capacity?

Mr. SAWHILL. Yes.

Mr. CRONIN. With that taking 4 to 6 years just to construct, can you see any way we can be providing some incentive to get that underway now?

Mr. SAWHILL. We in the FEA have tried to provide incentive to the extent that our allocation program makes supplies available to new refineries as they are built. I dedicated the first new refinery which ground was broken in this country over the last several years a few months ago.

Mr. CRONIN. It seems in recent weeks we have seen cancellation of proposed refineries.

Mr. SAWHILL. Mobil canceled one.

Mr. CRONIN. I understand Exxon has also.

Mr. SAWHILL. They may have. I am not aware.

Mr. CRONIN. Their public return for this is the instability of price and the guarantee of supply.

Mr. SAWHILL. I think the real reason is that they are using this as a way of trying to get the mandatory crude oil allocation program lifted. Obviously, what we are doing under this program is taking supplies in major oil companies and giving it to some of the smaller refineries. We have been criticized. I don't see how I could exercise my responsibility under the law because that is what they say to do.

Mr. CRONIN. By the same token, if the FTC decides to match up the majors so they are no longer integrated and each segment has to support itself, if you lifted these allocations I think it would be fair to say there would be no refinery expansion unless you had allocations; is that a fair statement?

Mr. SAWHILL. Let's put it this way. To the extent that in our allocation program we guarantee new refineries they will have access to supplies this provides incentives.

Mr. CRONIN. You mentioned storage in your testimony, and the long-term cost effectiveness of substantial storage, yet isn't it true that total storage in the United States has been declining rather rapidly in the last couple of years and wouldn't it make some sense to provide some incentives to increase storage?

Mr. SAWHILL. We are really talking not about inventories, but strategic storage in the event of an embargo, and we have never had any that, so that inventories may have declined some, although I don't think there has been much. They have been pretty stable.

Mr. CRONIN. They had a lot of World War II storage utilized around Boston and Newport, and now this in some cases has been replaced by new construction because it was in very attractive sites and the New England storage does not even come close to meeting its demand at this point in time. While the demand is increasing the storage is going down.

Mr. SAWHILL. Well, New England probably just needs additional storage for adequate inventory supplies.

Mr. CRONIN. My last point is I did not see you mention solar power at all in your testimony. Do you foresee any advantage to utilizing solar power, for example, to provide hot water for homes?

Mr. SAWHILL. Yes, I see cooling and providing hot water. That technology is available to us today. Several States have provided an exemption on the property tax with people who will enhance their homes with solar furnaces and I would encourage that. The relevativity is solar station power. It costs 50 times as much to generate a kilowatt of electricity through solar power as through conventional means.

Mr. CRONIN. Just the straight forward uses, such as providing hot water, won't that provide a substantial saving in oil that we could provide hot water for all our homes?

Mr. SAWHILL. Yes, it would.

Mr. CRONIN. Thank you, Mr. Chairman.

Mr. HOSMER. I just wanted to make clear for the record, Mr. Chairman, that I am not opposed—in fact, I am actually in favor of a reduction in the energy growth rate of this country. I oppose strongly, however, the selection by uninformed politicians or elected officials of some arbitrary growth rate, established by law, which may or may not bear any reasonable relations to the facts. That is why I oppose this piece of legislation before us which does precisely that.

Mr. SAWHILL. I think that was the essence of my testimony on that same bill.

Mr. HOSMER. Thank you.

Mr. BINGHAM. Mr. Ruppe.

Mr. RUPPE. Thank you very much.

Dr. Sawhill, am I correct in listening to your testimony on inquiries today that you foresee major reductions coming from perhaps a curtailment in automobile usage or a directive that the industry develop a 20-mile-per-gallon engine? It seems your thrust is directed more toward the automobile industry than the reduction by the industry sector of the country.

Mr. SAWHILL. Well, that is really where it is used, in the automobile. That is the major share of our oil consumption, right there.

I would also favor providing tax credits for people to insulate their homes which would reduce the consumption of heating oil in their homes and I would favor reducing consumption of oil in industry both by directing companies to switch from oil to coal and by encouraging them to install more energy-efficient industrial processes.

Mr. RUPPE. How would I answer the concerns expressed by my own rural constituency in terms of their shock over a proposed 10- or 15- or 20-cents-per-gallon hike. Some actually commute as high as 90 miles both ways and that tax gasoline hike, it would seem to me, for the commuter in the rural area, would be a terrific expense no matter how much he car pools. At the same time we subsidize metropolitan systems to the tune of many hundred million dollars a year. It would seem to me you would be putting a tremendous economic burden on the rural economy if you will, and using much of that funding to subsidize urban mass transit systems.

Mr. SAWHILL. I didn't say urban. I just said better mass transportation.

Mr. RUPPE. There has never been much in the way of public transportation in the rural areas.

Mr. SAWHILL. There will clearly be shifts that come about as a result of higher energy prices. Whether or not they have gasoline tax, the price has already gone from 32 to 50 cents. We have had a 20-percent increase which has impacted this area you are describing. So a further increase will cause, obviously, some further shifts, but we are going to have shifts, I think, toward people moving back closer to their places of business and back to the cities.

Mr. RUPPE. Well, let me think that one over for a moment.

What you are saying, it will be nuisance for people around the city, but you suggest getting away from the use of the automobile and into mass transit. What will be the economic effect? The cost of the capital system started off at \$1 billion, is now estimated at \$4½ billion and the gentleman from the appropriations suggested \$5 billion as the cost to complete it.

Mr. SAWHILL. It will be a lot cheaper than automobiles.

Mr. RUPPE. When you consider the advance subsidy—

Mr. SAWHILL. Look at the subsidies for the highway system. Compared to the subsidies for the highways it is very small.

Mr. RUPPE. Don't the highways pay their own way through gas taxes?

Mr. SAWHILL. I am suggesting using the gas tax. It is true that some people in northern Michigan will pay it and suburban Maryland and downtown Washington. I think you are drawing the thinking a little bit too starkly when you say the rural person in northern Michigan is going to finance the subway for Washington.

Mr. RUPPE. You can raise taxes for incremental use and pleasure driving, but for it to be politically acceptable you can't raise the cost of commuting for the rural individual who has no other choice of transportation.

Mr. SAWHILL. I understand that there is a burden there, yet I also understand we are probably going to have to change our lifestyles in this country if we are to reduce our consumption of energy. How do we solve this problem?

Mr. RUPPE. I was going to ask you because I think you are the authority. We should come up with a tax credit or tax reduction for the person who can legitimately show he is driving to work and no other transportation is available.

Thank you, Mr. Chairman.

Mr. BINGHAM. Before we adjourn I would like to underline what you have said about the need to change our lifestyle in this country. I don't think that the American people are beginning to perceive the ways we will have to change our lifestyles from an energy-wasteful one to one that is directed toward the conservation of energy.

Mr. SAWHILL. I agree, but it was that very kind of thing that cost me my job.

Mr. BINGHAM. Just a couple questions on natural gas.

In your chart No. 1, if I read it correctly, as of 1970, natural gas was supplying about the same amount of energy as domestic petroleum supplied?

Mr. SAWHILL. Roughly.

Mr. BINGHAM. Of that, how much is domestic use, household use?

Mr. SAWHILL. My recollection is it is about evenly split between residential and industry, but I might be wrong.

Mr. BINGHAM. If you were to deregulate new natural gas, how quickly and drastically would that affect the householder's bill for natural gas for cooking and eating?

Mr. SAWHILL. It is a little hard to estimate where the price would go, but roughly we estimate that it would raise the average household bill by \$10 to \$20 a year.

Mr. HOSMER. Didn't you use 80 cents a thousand cubic feet?

Mr. SAWHILL. I was using the 80-cent figure by saying we didn't think it would go any higher than 80 cents.

Mr. HOSMER. The gas would be there, if you could pay for it?

Mr. BINGHAM. Of course, that figure would have to be drastically modified for people who are heating their houses, would it not? Probably for someone who uses it only for cooking and hot water, \$10 to \$40 a year.

Mr. SAWHILL. I was thinking an average for all homes, natural gas completely for space heating, somewhat lower obviously for the people just using it for a stove. But I think this \$10 to \$20, maybe \$30 for the other individual—we are only talking about 5 percent of the supplies being regulated.

Mr. BINGHAM. But that 5 percent would surely grow, would it not?

Mr. SAWHILL. Yes; 5 percent per year.

Mr. CRONIN. We have seen the case made in the Northeast, Mr. Chairman, that it would actually lower the price to the consumer, because in areas of the country now becoming more and more dependent upon liquefied imported natural gas, just to meet existing demands and prevented from any future growth in natural gas, the imported LNG cost the consumer in the past much more than the deregulated gas costs every consumer in America.

Mr. BINGHAM. How much impact would water power sites have, particularly Dickey-Lincoln in New England, on our situation?

Mr. SAWHILL. I don't really have the answer to your question.

Mr. BINGHAM. I want to thank you very much for your testimony.

[Whereupon at 12:05 p.m. the subcommittee was adjourned.]

[Additional information and statements for the record follow:]

[Questions of Chairman Udall, Congressmen Bingham and Leggett, with answers supplied by the Department follow:]

QUESTIONS FROM CHAIRMAN UDALL TO SECRETARY ROGERS C. B. MORTON, PLUS ANSWERS

Question. 1.a. What are the Interior Department's most recent statistics concerning the number and acreage of nonproducing oil and gas leases both on on-shore public lands and on the Outer Continental Shelf? How do these compare with the figures for producing leases?

Answer. Offshore leases are classified into three categories:

1. Producing leases
2. Leases on which a producible well has been drilled, but the lease is not as productive as yet (shut-in leases)
3. Leases which have not had a commercial discovery (nonproducing leases)

Contiguous State	Producing lease		Shut-in leases		Nonproducing leases		Total	
	Number	Acreage	Number	Acreage	Number	Acreage	Number	Acreage
Alabama.....	0	0	0	0	13	74,106	13	74,106
California.....	3	13,155	16	80,074	49	253,579	68	74,106
Florida.....	0	0	0	0	62	357,120	62	357,120
Louisiana.....	544	2,098,574	132	604,375	372	1,769,722	1,048	4,472,671
Mississippi.....	0	0	0	0	6	34,560	6	34,560
Texas.....	22	74,880	21	103,680	204	1,122,992	247	1,301,552
Total.....	569	2,186,609	169	788,129	706	3,612,079	1,444	6,586,817

ONSHORE—WELLS UNDER JURISDICTION OF USGS

ONSHORE FEDERAL

Leases in effect as of September 30, 1974

	Number	Acreage
Nonproducing	102,396	79,574,766
Producing	8,651	4,334,504

Question 1.b. What are the Department's estimates of the oil and gas reserves on these non-producing lands?

Answer. The following are definitions of "Reserves" and "Resources" as used in this reply: Reserves—identified deposits known to be recoverable with current technology under present economic conditions. Resources—materials that have been identified, but cannot now be extracted because of economic or technologic factors, as well as economic or sub-economic materials that are yet to be discovered.

SHUT-IN LEASES—OCS

	Number of leases	Oil	Gas
Estimated recoverable reserves	169	1.3 billion bbls	8.5 trillion cu. ft.
Estimated resources	169	400 to 900 million bbls	3 to 7 trillion cu. ft.

Note: Many of these leases are shut in awaiting completion of drilling on the platforms, awaiting the delivery of ordered platforms, or awaiting pipeline facilities.

	Oil	Gas
Leases not producing and not shut in—OCS: Estimated resources	2 to 5 billion bbls	20 to 35 trillion cu. ft.
All public leases—onshore: ¹ Estimated recoverable reserves	3.3 billion bbls	31.2 trillion cu. ft.
Leases not producing and not shut in—onshore: ² Estimated undiscovered resources for all public lands	15 to 30 billion bbls	15 to 150 trillion cu. ft.

¹ These reserves are for the 8,651 producing leases.

² The estimated resources for the 102,396 nonproducing leases is unknown.

Question 1.c. Has the Department undertaken any studies of the reasons for nonproduction? If so, what are the major findings?

Answer. In January 1974, a study of shut-in leases in the Gulf of Mexico OCS was conducted by personnel from the Federal Power Commission in cooperation with the Geological Survey. This study was made in two phases. The first phase identified and determined the number of producible shut-in leases and the reasons for shut-in. The second phase provided an estimation of the proved and probable reserves attributed to these leases. At that time there were 168 leases in shut-in category. As of September 30, 1974, there were 153 leases so classified in the Gulf of Mexico OCS. The reasons for shut-in are as follows:

Reason	Percent
Awaiting connections to pipelines or negotiations in finalizing contracts	7
Lack of producing facilities or production platform	29
Lack of marketing facilities and pipelines	13
Awaiting completion of further exploration or development	51

As to onshore shut-in wells, a study has been made to determine the reasons therefor. No study has been made to ascertain the reasons for the majority of the onshore leases being nonproductive. However, it is known that 90 to 95 percent of these leases were issued noncompetitively and, as such, their potential for oil and gas production is highly speculative. Only a small number of these leases issued are ever drilled and fewer yet achieved production.

Question 1.d. With respect to existing nonproducing leases, does the Department anticipate taking any action either to encourage production or to cancel the leases?

Answer. On the OCS the Department intends to continue to evaluate shut-in leases in their extended term and issue appropriate requirements to insure that development proceeds in a timely fashion consistent with the OCS Lands Act toward the goal of initiating production from these leases at the earliest practical time.

Onshore the Department cannot administratively cancel a producing or producible lease. This requires a court action. However, where an operator has a shut-in well which is in condition to produce is capable of commercial production, and a marketing outlet exists, the Department can and has demanded that the well be placed on production. As to nonproducing leases, they may be administratively cancelled for failure to comply with the lease terms including the drilling of such wells as the Secretary may reasonably require for the orderly and timely development of the lease.

Question 1.e. If new leasing of the OCS occurs in 1975, what steps can the Department take to avoid a repetition of past patterns of nonproduction?

Answer. In order to minimize the number of shut-in leases, new legislation would need to be enacted and funding granted to permit the Government to subsidize noncommercial operations. For example, a lease with reserves of 12 billion cu. ft. of gas (average reserves of the 64 leases identified with FPC study which were not committed to a gas market) at the present market price of \$.45 per MCF would provide revenues to the lessee (excluding royalties and present worth discount) of 4.5 million. Cost of platform, development costs and equipment to place the wells on production would be \$3.5 million and pipeline (average length of 6.5 mile at \$300,000 per mile) of \$2 million would result in a net loss of \$0.5 million. This would also require devoting resources in short supply (steel) to the development of marginal reserves. Additionally many of the existing shut-in leases do not contain sufficient reserves to warrant FPC certification of a pipeline to connect wells drilled on these leases to a market. Other than this we believe that current procedures for evaluation of the production potential of shut-in leases insures production from these leases in as timely a fashion as practical.

Question 2.a. What are the Department's most recent statistics both for onshore and for the OCS, concerning the numbers of: (1) active oil wells, (2) new well completions, and (3) completed shut-in producible wells? How have these figures changed over the past 3-5 years?

Answer.

OCS

End of year	Wells completed	Active completions ¹		Shut-in completions ¹	
		Oil	Gas	Oil	Gas
1970.....	5,359	5,565	1,574	882	645
1971.....	5,718	5,704	1,872	953	602
1972.....	6,032	3,744	1,803	2,996	872
1973.....	6,421	3,814	2,108	3,054	879
October 1974.....	6,575	3,774	2,155	3,099	946

¹ Sudden change in numbers from 1971 to 1972 due to change in counting procedures.

Over the past 3-5 years the trend in all three categories has been a gradual increase. Certain graphs in Attachment 1 show such a trend for Gulf of Mexico OCS operations.

Onshore—Oil

2(a) (1) Active oil wells as of October 1, 1974.....	20,838
2(a) (2) New oil well completions during September 1974.....	70
2(a) (3) Shut-in oil wells as of October 10, 1974.....	¹ 2,059

¹ A decrease of 43 shut-in oil wells during the past 21 months.

Shut-in oil wells as of January 1, 1974.....	2,119
Shut-in oil wells as of January 1, 1973.....	2,102

Question 2.b. What are the Department's estimates of potential crude production from existing shut-in wells?

Answer. OCS: Enclosure I refers to a study of shut-ins counted during January 1974, in the Gulf OCS. The problem percentages were categorized:

Shut-in percentages

A. Reservoir problems:	
Oil -----	56.4
Gas -----	51.3
B. Mechanical problems:	
Oil -----	42.2
Gas -----	38.6
C. Waiting on facilities:	
Oil -----	1.4
Gas -----	10.1

Applying these percentages to the October 1974, Gulf shut-ins (below), and assuming 50.0% of B. and 100.0% of C. will be activated, an estimated 80,000 bopd and 700 mmcf gpd will result.

Statistics, Gulf of Mexico, October 1974

Wells completed-----	6,385
Active completions:	
Oil -----	3,600
Gas -----	2,155
Shut-in completions:	
Oil -----	3,094
Gas -----	946

Onshore: Estimates of potential production from shut-in oil wells is 12,000 barrels per day.

Question 2.c. Has the Department undertaken any studies of the reasons for an increase, if any, in the number of shut-in wells?

Answer. OCS: Two principle reasons appear to account for the increase in shut-ins. One is that in 1972 we switched to a different classification which increased shut-ins since many were not so previously treated. The other is that production from many gulf wells is maturing, leading both to depletion and reservoir and mechanical problems.

The Gulf of Mexico has over 3,000 producing reservoirs and about 2,000 of these are 1-well reservoirs. This means only 1 completion or 1 zone is being used to deplete the reservoir. Such a situation carries the implication that the reservoirs are small since only 1 completion is needed per reservoir. The fact is that the reservoirs are small, and they deplete rapidly or otherwise develop water or excess-gas problems which frequently mean depletion. These points are reflected in the high percentage (55.1%) of the shut-ins having reservoir problems.

Completions made above 8000' in depth usually require plasticizing or some other sand control measure to prevent sand flow and ultimate sand plugging. Even with control measures the unconsolidated sands break into the well-bore and flow after the plastic or gravel pack is weakened by large fluid withdrawals. The end result is that sand is a chronic problem. Many completions sand up and simply cannot be cleaned and controlled under routine service procedures. Most production wells in Federal OCS waters are drilled from platforms. With the multi-layered sands as found around most salt domes, it is not uncommon to find a platform with 20-25 wells and 40-70 completions. As the completions or zones develop problems and become shut-ins, the operator determines if a workover to the same or another zone is worthwhile. Many zones cannot be reworked because workovers are so expensive; therefore, the dead completions often remain dead for several months or even years awaiting abandonment. The long wait does not end in most cases until the platform is abandoned. As with workovers, well abandonments are expensive; so the choice of performing the abandonment of a platform and the wells simultaneously is the most economical procedure.

Thus, more wells in the Gulf mean more shut-ins if the shut-ins are not cleared from the record. And as more and more completions are being made through the natural development process, then the shut-ins most certainly will continue to increase in number from year-to-year.

Onshore: There has been no increase in the number of shut-in wells on onshore Federal lands; however, the record for each shut-in well has been examined and an analysis of these findings is enclosed.

Question 2.d. What are the corresponding statistics for natural gas wells?

Answer. OCS: The trend of shut-in gas completions has been about the same as that of the shut-in oil completions and the reasons for shut-in are essentially the same, so the future figures on shut-in gas will continue upward the same as the oil. We have included gas shut-ins in the above statistics and explanations.

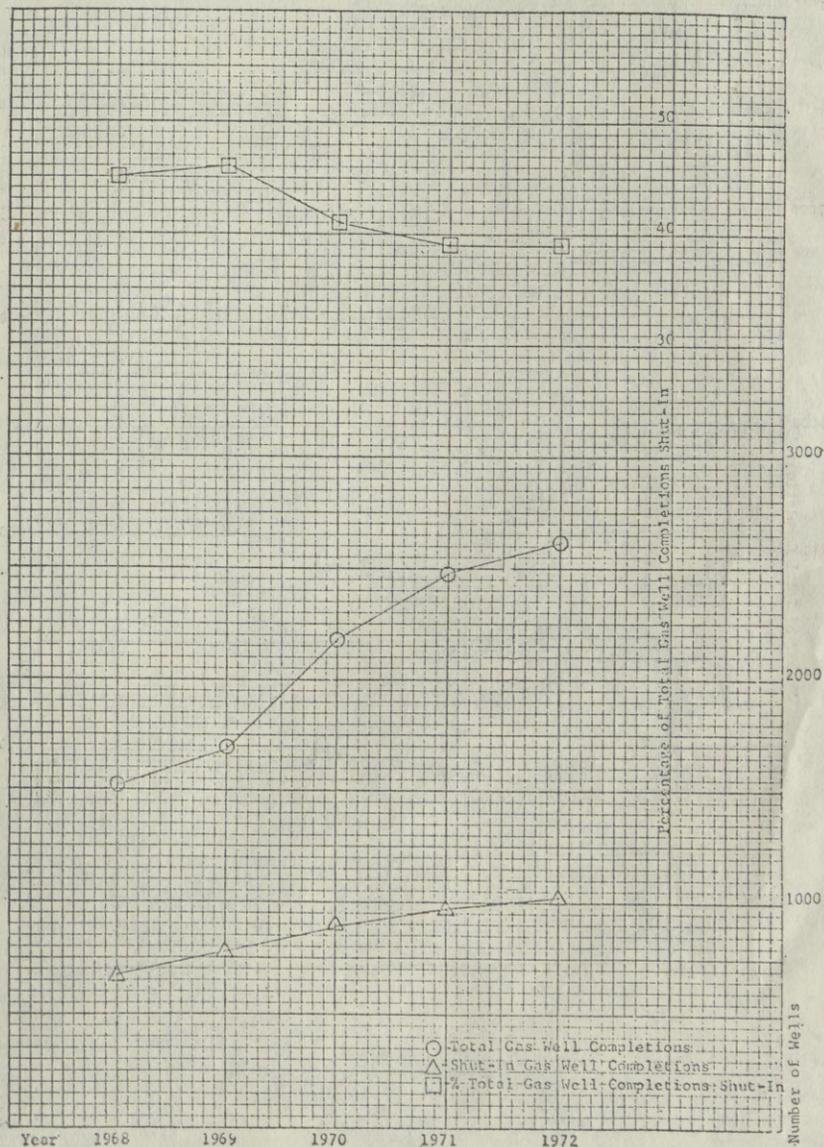
Gas

2(d)(1) Active gas wells as of October 1, 1974.....	10,531
2(d)(2) New gas well completions during September 1974.....	51
Shut-in gas wells as of October 1, 1974.....	¹ 776
Shut-in gas wells as of January 1, 1974.....	872
Shut-in gas wells as of January 1, 1973.....	798

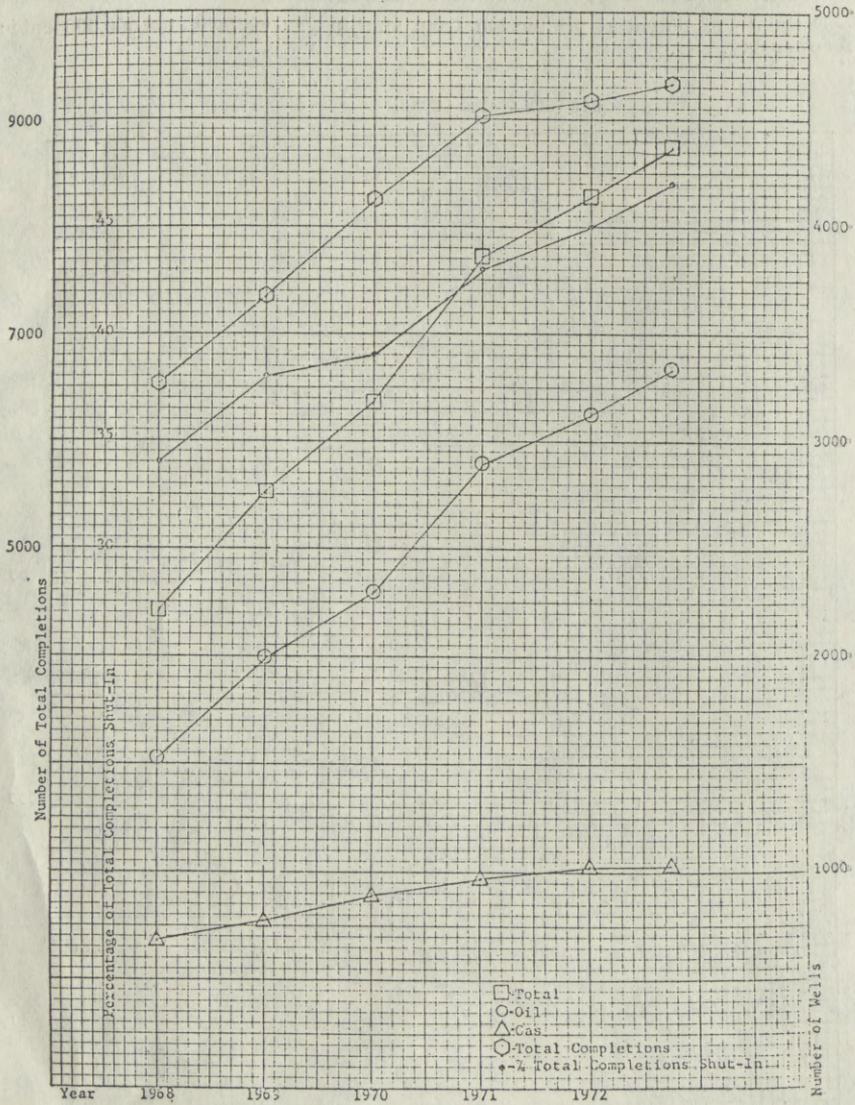
¹ A decrease of 22 shut-in gas wells during the past 21 months.

Estimate of potential production from shut-in gas wells is 160,000,000 cubic feet per day.

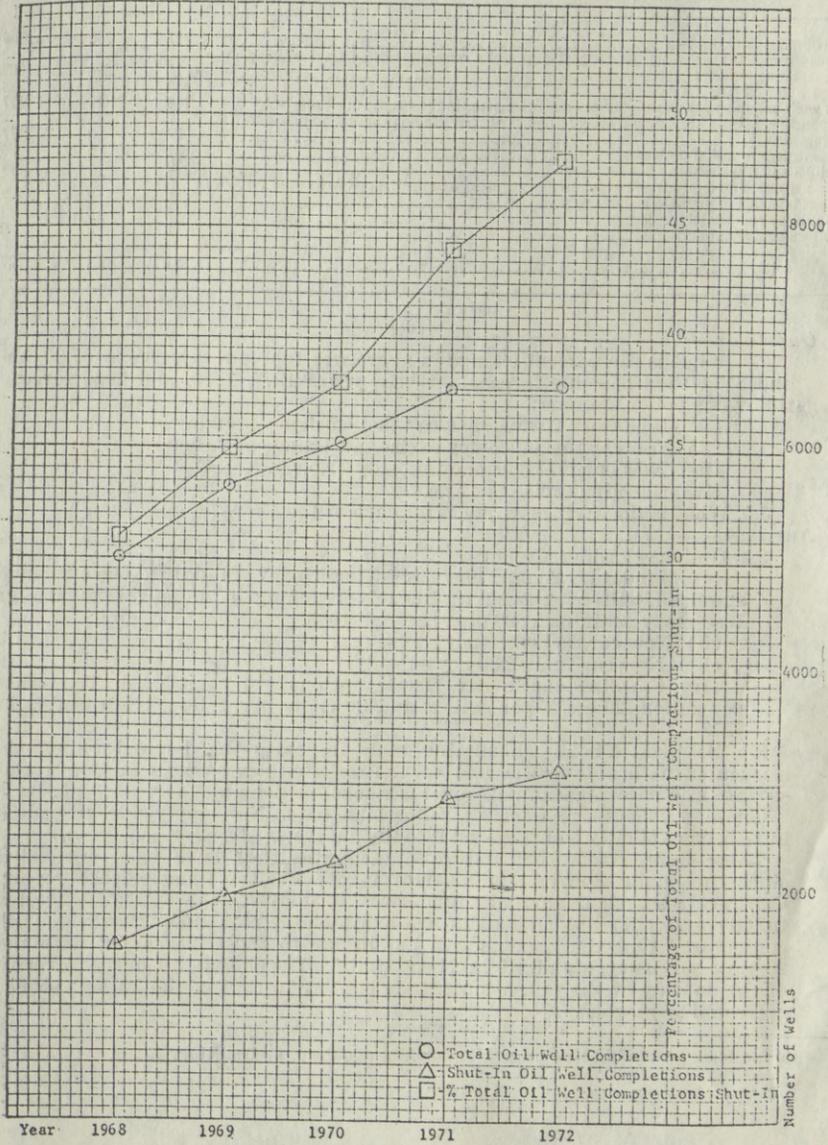
GAS WELL STATUS BY YEAR



SHUT-IN WELL STATUS BY YEAR



OIL WELL STATUS BY YEAR



*Shut-in wells: onshore public leases*¹

The number of producible wells on public onshore leases which were shut-in as of December 31, 1973, was as follows: Oil, 1,874; gas, 653; total, 2,527.

Reason for being shut in	Number of wells		
	Oil	Gas	Total
Low productivity.....	1,237	299	1,536
Newly completed wells not yet connected or wells remotely located from existing marketing facilities.....	11	294	305
High water-oil ratio.....	354	29	383
Oil wells with high gas-oil ratios or gas wells completed in the gas cap of oil reservoirs.....	106	11	117
Producible wells in secondary recovery projects shut in pending conversion to water injection.....	77	0	77
Downhole mechanical problems.....	81	5	86
Helium and CO ₂ wells—no market demand.....	0	5	5
Gas wells used for injection and withdrawal in gas storage projects, or oil wells used for gas injection in pressure maintenance projects.....	5	2	7
Shut in by court order.....	2	0	2
Surface equipment problems.....	1	8	9
Total.....	1,874	653	2,527

Questions—

3.a. What is the percent change in aggregate fuel use, relative to \$7.00/bbl and \$11.00/bbl baseline forecasts, in the years 1977, 1980, and 1985 for the following policy options:

- (i) Mandatory 20 mpg new car fuel efficiency standards.
- (ii) New car fuel efficiency excise tax (range of values).
- (iii) New car fuel efficiency subsidy (r.o.v.).
- (iv) Gasoline excise tax (r.o.v.).

3.b. What is the savings in quads for each of the above?

Answers—

3.a. Options considered:

(i) Mandatory 20 mpg new car fuel efficiency standards. The efficiency standard will be phased in linearly reaching a 20 mpg standard in 1980 and remaining at 20 mpg through 1985.

(ii) New car fuel efficiency excise tax.

(iii) New car fuel efficiency subsidy.

(iv) Gasoline excise tax. Three options are considered. Ten cents per gallon, 20 cents per gallon, and 30 cents per gallon. Each begins in 1975.

3.b. Savings: The accompanying table indicates the demand reductions associated with options (i) and (iv). Presented are savings in Quads and savings as a percentage of passenger car gasoline demand.

These numbers are demand reductions only. No supply-side responses have been explicitly incorporated into the analysis.

These figures represent improved estimates that have been completed since the publication of similar data in the Project Independence report. Contract research is currently underway to quantify the options suggested in (ii) and (iii) but no results are available at this time. However, it is conjectured that the impacts will be similar to those associated with the 20 mpg efficiency standard in their timing. Depending upon the severity of the subsidy or the tax, a magnitude similar to that of the 20 mpg standard could be reached.

¹ Public leases include those on public domain, acquired, and military lands.

PASSENGER CAR GASOLINE SAVINGS IN PERCENTAGES AND IN QUADRILLION BTU'S FOR 20 MPG STANDARD AND FOR GASOLINE TAXES

Policy	\$7 crude price						\$11 crude price					
	77		80		85		77		80		85	
	Per- cent	Quads	Per- cent	Quads	Per- cent	Quads	Per- cent	Quads	Per- cent	Quads	Per- cent	Quads
20 mpg standard.....	4	0.4	12	1.3	21	2.8	2	0.2	8	0.8		
10 gasoline tax.....	5	.5	7	.8	8	1.0	4	.4	6	.6	7	.8
20 gasoline tax.....	8	.8	12	1.4	14	1.9	8	.8	11	1.1	12	1.6
30 gasoline tax.....	12	1.2	17	1.9	20	2.6	11	1.0	15	1.6	17	2.0

Question 3.c. Are there estimates of the macroeconomic impact of each of the above?

Answer. The macroeconomic effects of alternative gasoline conservation measures: Four different proposals are considered:

1. A 20 mpg mandatory efficiency standard.
2. A new car fuel efficiency subsidy.
3. A new car fuel efficiency excise tax.
4. Gasoline excise taxes of 10, 20, or 30¢ per gallon rebated through a tax credit.

The aggregate economic impacts of these measures are smaller than might be expected and the range of the impacts is captured by examining options 1 and 4. Option 1 has the smallest impact and Option 4 the largest.

GNP and inflation impacts were made by adjusting the DRI long-term macro-model to reflect estimated reductions in the sales of new automobiles and to allow for the increased cost of gasoline. Since the tax is rebated, no money is taken out of the economy by the transfer of tax revenues to the government in the forecasts. The following table summarizes the estimated impacts.

Option	1975		1977		1980	
	GNP billion \$58	Inflation (percent)	GNP billion \$58	Inflation (percent)	GNP billion \$58	Inflation (percent)
1. Do nothing.....	853	8.8	932	4.8	1,063	5.1
2. MPG standard.....	853	8.8	932	4.8	1,063	5.1
3. Excise tax:						
10.....	852	8.8	931	4.8	1,063	5.1
30.....	852	8.8	930	.8	1,063	5.1

Note: There are no estimated impacts beyond 1977.

The 20 MPG mandatory standard has no effect since it effectively does not change new car sales (in the forecasts they actually increase but by less than 1%). At the other extreme, a gasoline tax of 30¢ instituted in 1975 would reduce annual GNP by \$1-2 billion dollars through 1977 because of reductions in new car sales through 1977 (12%, 5%, and 1% in 1975, 1976, and 1977 respectively). The 20¢ tax would cause a reduction in GNP of around \$1 billion through 1977. (NOTE: That in 1958 dollars a \$1 billion reduction is equivalent to about a \$1.8 reduction in 1975 dollars.)

It is unlikely that a new car fuel efficiency subsidy would have any effect on the macro-economy, and the size of the effect of a fuel efficiency excise tax would depend upon the size of the tax. If the tax were large enough, it could reduce new car sales. However, it is unlikely that it would have as large an impact as the 20 and 30¢ gasoline taxes. The DRI macro-model estimates were checked by estimating the reduction in auto industry employment associated with the reduction in car sales caused by a 30¢ gas tax. Using 1973 as the base year for the calculations, 13.58 autos were produced per employee and the average salary was \$7,792 in 1958 dollars. The estimated reduction in sales translates into lost income of \$0.6, \$0.3, and \$0.1 billion in 1975, 1976, and 1977 respectively assuming that none of the displaced workers find other jobs. Even if a multiplier of 2.5 is assumed, these reductions are in the \$1 to \$2 billion estimated range of the fall in GNP and this tends to support the figures produced by the macro-model.

Question 3.d. Would the Administration need any new authority in order to implement a gasoline rationing program?

Answer. It may be possible to derive authority for such rationing from the Emergency Allocation Act of 1973. However, there are differing opinions regarding the conditions and extent of the powers inherent in the Act. A clearer statement of the intent of Congress may be necessary.

Question 4. The Project Independence Report concludes that domestic natural gas production could rise to 24.6 TCF in 1985 if the wellhead price for new natural gas is deregulated.

a. What proportion of this production would be new, deregulated gas? What would be the estimated average well-head price for this gas?

Answer. By 1985, nearly all of the 24.6 TCF would be new, deregulated gas. The average wellhead price would be 82¢/MCF in constant 1973 dollars (97¢/MCF in constant 1975 dollars).

Question 4.b. What are the best estimates of our total retail natural gas bill in 1985 if new gas is deregulated? What would the total bill be if current regulation continued, and domestic production declined to 15.2 TCF as the report suggests?

Answer. The average residential consumer would be paying \$222.42 per year in constant 1973 dollars (\$264.23 in constant 1975 dollars) if deregulation occurs. Under continued regulation, the bill would be \$189.38 in constant 1973 dollars (\$224.98 in constant 1975 dollars).

Question 4.c. The report makes no mention of a windfall profits tax to encourage reinvestment in new exploration and development. Was this an oversight, or does this signify a view that deregulation would not need to be accompanied by such a tax?

Answer. Reinvestment in new exploration and development will continue as long as the price received for new supplies of gas justifies the increased costs of this new volume. The need for additional taxes to recoup windfall profits for other uses was not addressed in the Project Independence report because such a tax should not affect the quantity output, the focus of the Project Independence report estimates. However, such a tax will be reviewed in the preparation of Administration legislative proposals.

Question 5. Since the publication of the Project Independence Report, FEA has received many comments, both written and oral, from the public regarding the analysis and options presented in the Report. In addition, we have just completed three days of energy policy seminars which solicited views, evaluations and critiques from a wide range of witnesses on the Report and its implications for national energy policy. A fourth seminar will be held December 19 on the same topic.

QUESTIONS FROM CONGRESSMAN JONATHAN BINGHAM TO SECRETARY ROGERS
MORTON

Question 1. Alternative 4 proposed by the FEA in August would reduce residual fuel oil costs about \$2 a barrel from Florida to New England. Why was Alternative 4 abandoned?

Answer. The imported products eligible for entitlement issuances are residual fuel oil and home heating oil (including No. 2-D diesel fuel). These products account for the major portion of finished product imports into the United States, and the domestic market, particularly the East Coast, is substantially dependent on imports of these products. In addition, these products possess the greatest potential for significant adverse economic impact when import prices rise above prevailing domestic prices in the event of unexpected demand increases or supply shortages. Imports of other finished and unfinished products are not as significant in the overall market for petroleum products, and FEA has determined that inclusion of such products in the program would pose substantial administrative burdens and technical problems, and might operate as a disincentive to utilization and expansion of domestic refining capacity.

Question 2. Is it correct that the newly-proposed regulations would reduce residual oil costs on the East Coast only 30 to 40 cents per barrel?

Answer. No, importers of residual fuel will receive entitlements worth 60 cents per barrel imported. In addition, certain refiners representing the principal supplier of domestically refined residual fuel oil will experience substantial crude cost reductions which could result in price reductions greater than 60 cents per barrel.

Question 3. [If yes] Was this result produced by classifying Amerada Hess as a domestic supplier of residual oil?

Answer. Although Amerada Hess is classified as a domestic refiner, that fact in no way reduces and would tend to increase the fuel savings of East Coast consumers.

Question 4. [If yes] Is it not a fact that Amerada Hess is completely dependent on foreign crude oil and has priced its residual oil, as a result, at about what other importers of residual oil have charged?

Answer. Prior to the implementation of the cost equalization program, the crude costs and consequently the product prices of Amerada Hess were based on an approximate 90 percent dependence upon imports. The new regulations will result in placing all domestic refiners on a roughly equal crude cost structure. Subsequent to the announcement of this program, Amerada Hess in fact announced across the board price reductions.

Question 5. Is it a fact that a supplier with unrecovered costs need not flow through to its customers reductions resulting from the proposed regulations at least to the extent of the unrecovered costs?

Answer. Refiners who were previously unable to pass through all of their increased costs may be able, to some extent, to avoid the immediate flow through of cost reductions by applying "banked" costs against these entitlement revenues. This potential problem is mitigated, however, by several factors, including:

(a) FEA regulations prohibiting the application of more than 10 percent of a refiner's "bank" to a price increase.

(b) Competitive pressures from other marketers who have no "banked" costs or who chose to pass through the cost reductions.

Question 6. Is it also a fact that the FEA, which has the data relating to supplier unrecovered costs, will not permit suppliers' customers access to these data?

Answer. General FEA policy as well as statutes regarding confidentiality of certain corporate data and potential anti-trust violations forbid the release of such items on a specific company by company basis.

Question 7. If a supplier of residual oil also markets gasoline or distillate oil is there any assurance that he will be required to pass through residual oil entitlements to his residual oil customers, or may he pass money back by reducing his price for gasoline, for example?

Answer. Suppliers or marketers may, in some instances, be able to pass through cost reductions to products other than residual fuel. Competitive and economic pressures will, however, tend to direct the application of cost reductions in an equitable fashion.

QUESTIONS FROM CONGRESSMAN ROBERT L. LEGGETT TO SECRETARY
ROGERS MORTON

The following questions concern the proposed decontrol of the price of domestic oil produced by secondary recovery methods:

1. How much of our domestic production will be decontrolled as a result of this proposal?

2. What will be its consumer price impact on such products as gasoline, asphalt, and fertilizer?

3. What will be its profit impact on the oil companies, both per barrel and in the aggregate?

4. The effect of this proposal will be to reverse the normal benefits of mass production: as secondary recovery increases, cost per unit (in this case, barrel) will increase rather than decrease, and the additional supply so contemplated does not appear to be offset by any strong conservation programs. In view of these facts, what, if any, public benefit will accrue to justify government-induced increases of this magnitude?

5. What do you estimate to be the average cost per barrel of the most commonly used secondary recovery methods?

6. By allowing such a large increase in the price of oil so produced, isn't the Administration removing the incentive to develop less expensive secondary recovery techniques?

7. By allowing the price of domestic oil to rise to world, i.e. OPEC—controlled prices, does not Administration policy as currently constituted in fact acknowledge and endorse the propriety of those prices? Do you, Mr. Secretary? If not, what do you propose to bring domestic prices down to realistic levels?

The Federal Energy Administration and other government agencies including the Department of the Interior and the Environmental Protection Agency have been investigating the costs and recovery potential of secondary/tertiary production of crude oil. One of the purposes of these studies is to determine what adjustments could be made to the crude oil pricing regulations in order to stimulate additional recovery through the application of more intensive production techniques. Among the evaluation criteria which are being applied to possible alternatives are:

The economics of the particular recovery technique(s) involved, particularly the price levels necessary to provide a cash flow conducive to the initiation of the project(s).

The extent of the additional oil production realized, both in the short run in terms of increases in the production rate and in the long run in terms of increases in the ultimate recovery from reservoirs.

The impact on the consumer and the economy which would result.

Specific items such as the volumes of production released from controls and the price impact vary dramatically according to the particular fashion in which enhanced recovery is incentivized. For example, whether only new projects were released or all projects; whether the entire production is released or only that portion attributable to the influence of the project. These are critical questions which must be carefully reviewed.

Additionally, the costs and associated additional production are highly dependent upon the unique characteristics of the reservoir and other technical considerations.

STATEMENT OF GEORGE H. LAWRENCE, SENIOR VICE PRESIDENT,
AMERICAN GAS ASSOCIATION

The American Gas Association, representing over 300 natural gas transmission and distribution companies serving over 160 million consumers, welcomes this opportunity to submit a statement for the record with respect to the Project Independence Report. We have very serious concerns as to the possible adverse impact which this report, as drafted, could have on the natural gas industry and its contribution to our nation's energy self-sufficiency, our economy and our environment.

In reference to the Project Independence Report, Mr. Sawhill has stated to you: "This report is the result of a massive interagency effort lead by the Federal Energy Administration and involving over 500 professionals. We believe it is the most comprehensive energy analysis ever performed."

The importance of the report was made quite clear by the Secretary of Interior, Rogers C. B. Morton, in his remarks before this Committee on November 21: "The Project Independence Report will be used to assess energy policy alternatives prior to the President's State of the Union Message in January. Currently, the Energy Resources Council is working with the other Federal agencies to outline and coordinate a series of specific energy policy objectives for the United States and a number of detailed proposals designed to improve our short- and long-term energy situation. The ERC will develop a cohesive energy policy package, using the expertise of these Federal agencies. It will analyze not only the energy implications of various proposals, but their economic, social and environmental impacts as well, determining the feasibility of each prior to the end of this year. The proposals will form the basis for an energy policy statement by the President when the next session of Congress begins."

It is the use of this report as the basis for a National Energy Policy that concerns us, particularly with respect to the Demand Management Concept which is introduced therein. We emphasize this point to explain why we have been protesting the contents of the report so strongly in spite of statements meant to reassure us that the report does not recommend specific policy actions or as Assistant FEA Administrator Duke Ligon told a group of gas men recently: "A number of you here may be members of the American Gas Association, a group which has objected strenuously to some of the suggestions in the Project Independence Report. We would remind the critics, however, that the report represents various alternatives for reducing dependence on oil imports to a manageable level by 1985. The whole purpose of the six-month study was to provide the data base and a list of possibilities from which to develop a comprehensive energy policy."

We feel strongly that the proposed Demand Management must not be a part of our National Energy Policy.

Demand Management emphasizes the substitution of coal and nuclear fuel for oil and gas and thus encourages electrical use rather than direct consumption of oil and gas in the household and commercial sectors.

Such a policy of displacing current and future requirements for oil and natural gas with coal and nuclear generated electricity to solve our import problem, could create serious road blocks in developing sufficient long-term national energy supplies. A national policy of government-directed fuel usage would result in less consumer fuel options at higher costs than other energy alternatives not thoroughly addressed by the Project Independence Report.

We have voiced our concern and reasoned opposition to Demand Management at every possible opportunity:

During the period when the Report was being drafted, we wrote to Mr. Sawhill and tried unsuccessfully to work with the FEA Staff toward at least including an equal analysis of the gas oriented alternatives.

Just before the Report was released but having seen drafts of sections, we expressed our concern in emphatic terms by letter to Secretary Morton and key members of the President's Energy Resources Council. A copy of this letter is appended hereto.

Our President, F. Donald Hart, and Senior Executives of the gas industry testified before the Energy Resources Council hearings held the week of December 9.

The Natural Gas Transmission and Distribution Advisory Committee has voiced its concern to the FEA, and is preparing a WHITE PAPER outlining its position in opposition to Demand Management.

Dr. Henry Linden, President of the Institute of Gas Technology (IGT) and a member of the President's Energy Advisory Council, has actively challenged the accuracy of the assumptions supporting the Demand Management analysis; and finally,

The gas industry representative on the FEA Project Independence Advisory Committee voiced strong reservations with respect to the report as it was evolving, and reemphasized these points in testimony to the ERC.

We hope that our collective voices have been heard by those charged with formulation of our National Energy Policy and that they will correctly assess the part that natural gas can and must play in our nation's economic future.

The remainder of this statement contains a summary of the analysis supporting the gas industry's concern over Demand Management.

ANALYSIS OF PROJECT INDEPENDENCE REPORT

Although the Report contains a massive compilation of statistical data on energy usage and supply in the United States, it fails to address many important ramifications of the policy options it presents. The Demand Management strategy was presented as one of the dominant options, and discussion of this strategy constituted an important part of the Report. In our opinion, the Demand Management strategy represents a misguided and impractical basis upon which to build a national energy policy. We believe it is essential to recognize the very serious problems presented by this strategy.

The Demand Management strategy calls for "disallowing" the installation of natural gas and oil heating systems in new residential and commercial units and a similar prohibition on replacement of such existing systems. The Report concedes that the alternative to such systems, electrical heating, is far more costly to consumers and far less efficient than natural gas and oil heating. The option is put forward, however, on the assumption that most electrical generating plants can be converted to coal or nuclear fuel generation and that the inflationary impact and loss of fuel efficiency inherent in the strategy are offset by a reduction in dependence on fuel that is relatively scarce or that must in large measure be imported. This strategy is founded upon a number of assumptions that are false. Moreover, the policy of displacing current and future requirements for natural gas with coal and nuclear generated electricity in order to solve a short-range import problem could seriously impede the development of sufficient long-term national energy supplies. This national policy of governmentally directed fuel usage could well result in fewer consumer fuel options at higher costs than other energy alternatives which were not thoroughly considered by the Project Independence Report. The following points support the conclusion that the demand management strategy cannot meet our national energy needs.

1. The electricity generated by coal and nuclear fuels could not possibly be sufficient to replace existing or expected usage of natural gas.

The ability of coal and nuclear fueled electrical generation to satisfy the displaced gas demand, even under federally mandated conservation programs, is highly questionable at best.

The Federal Power Commission projects that by 1990 over 20 trillion cubic feet of gas per year must be supplied from potential reserves, synthetic gas and imports, in order to satisfy the demand for natural gas at current level of consumption. If electricity is to replace the development of these new gaseous resources, new generating capacity of 1,200,000 megawatts would be required *in addition* to the AEC's estimated requirement of 508,000 megawatts of new nuclear capacity in 1990. This represents an average requirement of two new 1,000 megawatt nuclear generating plants to be built in every state, every year, for the next 16 years.

Coal-fired generators to serve a 20 TcF displacement in 1990 would require 1700 million tons of additional annual coal production. That is three times current coal production and 60 percent of estimated 1990 coal production as shown in the Report's accelerated development case. This amount would be required not to supply more energy than is currently supplied by natural gas but merely to displace the energy requirements for new natural gas supplies at current consumption levels.

The capital cost on the electric industry to provide this additional generating capacity in addition to its own demands, would be a staggering \$600 billion, a sum equivalent to the total assets of the 1,000 largest industrial firms as listed in *Fortune* magazine. This does not include the cost to present gas customers of converting from gas to electric appliances.

The electrical industry has not demonstrated a capacity to meet this dramatically increased demand. As of December 2, 1974 cancellations and deferrals of planned electric generating capacity in 1974 totalled 163,000 megawatts. This cancelled and deferred capacity is equivalent to approximately 39% of the total electric generating capacity existing in the U.S. at the end of 1973. A Btu output of 163,000 megawatts is equivalent to approximately 13% of the 23 trillion cubic feet of gas delivered by the entire natural gas industry in 1973.

2. The demand management strategy would cost consumers billions of dollars in added fuel costs.

Natural gas is the least inflationary fuel. The higher prices necessary as an incentive for developing new natural gas supplies even if permitted, would have a gradual effect on consumer prices. Essentially all proved natural gas reserves are already under long-term contracts, usually for a term of 20 years, at historically low price levels. The average field price for natural gas is less than 25 cents per Mcf, or per million Btu. This is the energy equivalent price of less than \$1.50 per barrel of crude oil. When the higher prices for new supplies are rolled in with the lower prices of existing supplies under long-term contracts, their impact on the consumer is substantially reduced. Other energy sources are generally not supplied pursuant to such long-term low price contracts. Inflation is a serious national problem; natural gas can not only make a great contribution to domestic energy self-sufficiency, but it can do it with the least inflationary impact.

The impact of replacement of gas systems on American consumers would cause a financial hardship to both industry and consumers. Gas equipment and appliances would be replaced with coal or electrically fueled systems with operating costs significantly higher than any costs now projected for gaseous energy supplies. Even if natural gas wellhead prices were increased to 1.90/Mcf, the Btu equivalent of \$11/bbl oil, the resultant home heating cost to the consumer, adjusted for equipment efficiencies, would be half the cost of operating comparable electric heating systems. Even the higher costs anticipated for coal gasification would cost the consumer only 60 percent of his electric heating "option."

It is estimated that total natural gas shortages made up by electric energy would raise consumer fuel costs by \$7.5 billion in 1974, increasing to \$58 billion in 1985. This burden is larger than the balance of trade deficits that Project Independence would seek to eliminate.

3. Conversion of existing natural gas facilities to electricity would be prohibitively expensive.

A strategy requiring conversion of existing facilities fueled by natural gas to electric generation totally neglects the magnitude of our country's reliance on natural gas. Natural gas is our nation's largest domestically produced energy source and supplies 31% of the nation's total energy demand. Natural gas provides over 50% of the energy used by U.S. industry, more than three times that supplied by any other fuel.

Natural gas has served over 70 percent of the industrial market's energy growth during the last two decades. Sixty-eight percent of our domestic propane supply, vitally needed in agriculture, comes from the stripping of liquids from natural gas production. Tens of millions of residential, commercial and industrial units are fueled by natural gas. Conversion of these units would cost tens of billions of dollars.

4. Adoption of the demand management strategy would severely retard development of natural gas supplies.

There is a huge resource base of potential natural gas supplies in the United States. In addition to the proved reserves of 250 trillion cubic feet at the end of 1973, estimates of potential domestic supplies by the Potential Gas Committee (consisting of the nation's most knowledgeable technical experts) are 1,146 trillion cubic feet. In addition to these potential reserves there are significant potential reserves in tight geologic formations in the Rocky Mountains which will require non-conventional production stimulation techniques. At the 1973 consumption level of 23 trillion cubic feet, this level represents a 50-year supply. Long before these sources are exhausted, supplemental gas supplies will be making a substantial contribution. However, while this is an impressive resource base of natural gas, the proper economic climate must be established to encourage the finding, developing and delivery of these supplies for consumer use. If the market for natural gas were arbitrarily cut off by governmental fiat, these supplies would not be developed. Moreover, as natural gas supplies dwindle as a result of the demand management strategy, the cost of natural gas would rise, since the very substantial fixed costs of existing transmission systems would be spread over a smaller amount of gas.

5. The demand management strategy aggravates environmental problems.

Natural gas is our cleanest fuel. It is virtually free of sulphur and particulates. It does not pollute land or water and offers the best hope for alleviating air pollution, especially in urban areas. Every other fuel, including uranium, requires expensive emission control devices to protect land, water or air environment. In addition the large increase in coal production required by the demand management strategy would involve a dramatic increase in strip mining. As we take the needed steps toward domestic energy self-sufficiency, the contribution which natural gas can make toward our national environmental goals cannot be ignored. Reduction in the use of natural gas would inevitably have a serious adverse effect upon the environment.

6. The demand management strategy replaces the most efficient fuel with less efficient fuels.

Natural gas is our most efficient fuel. Delivered through a \$45 billion, million mile underground pipeline network, 93 percent of the gas produced at the well-head is utilized directly by the consumer. This high efficiency is achieved because there is no need for downstream energy conversion as in the refining of crude oil and in transforming the primary energy of coal or oil into electricity. In addition to the energy losses in these conversion processes, each has its own environmental, capital and time-lag problems.

Adoption of the demand management strategy would entail a substantial loss of fuel efficiency. Even the Project Independence Report, basing its conclusion upon \$11 oil prices, estimates that by 1985 under demand management, household, commercial and industrial use will increase by 12.9 Quads. The energy loss in conversion to electricity would increase by 14.0 Quads, or more than the total energy increase from all sources expected by the markets served by electricity.

The challenge facing energy policy makers is to adopt practices and encourage techniques which result in the least Btu of energy being consumed to accomplish the intended purpose. For example, if the goal is to heat one million homes or buildings, it is necessary to look to the use of Btu's from their starting point—and any waste in that use—rather than limit the efficiency evaluation to just the Btu usage within the building envelope. From this perspective, natural gas heating is by far the most efficient system. It would be most ironic if the government initiated or blessed policies which encouraged additional electric generation or other energy uses—in the name of "energy conservation"—that actually caused the consumption of more energy Btu's to achieve the same economic or social goal.

7. Near total reliance on coal generated electricity would place the health of the entire economy in jeopardy if a coal strike occurred.

The effects of the recent coal strike illustrated the vulnerability of our economy to such disruptions. Even under present patterns of energy usage, a prolonged coal strike would have far reaching effects. Yet coal, including coal-fired electricity, provides only about 22 percent of the energy used by our nation's industry, compared with over 50 percent fueled by natural gas. If a substantial part of that percentage were also made dependent on coal, the effects of a prolonged coal strike on unemployment and productivity could be devastating.

8. The demand management strategy does not promote the most efficient use of our coal resources.

The efficient uses of our wealth of coal supplies must, in the long run, be just as effectively promoted as the use of any other domestically produced natural resources. Gas appliances can be served from coal gasification at an estimated overall efficiency of about 40 percent compared to the 30 percent efficiency of a coal-fired generating system supplying electrical appliances. The Council on Environmental Quality has accurately reported that it takes over twice the primary energy to fuel an electric system supplying an all-electric home as a gas system requires to serve comparable gas appliances.

Coal gasification, as well as the development of natural gas potential reserves, is environmentally more acceptable than coal-fired generation. Polluting properties of coal are most efficiently removed in a gasification process.

Large volume, high efficiency coal gasification technology is now at an early stage of development but the probability of its successful development appears to be significantly greater than that of the perfection of nuclear technology during the next few decades. Operable coal conversion systems have been demonstrated or now exist in Germany, the United Kingdom, Italy and Africa. Reliance on a nuclear fueled electric system in the near-term is a high risk national posture with questions of breeder reactor safety, availability of fissionable fuels, nuclear fuel reprocessing, and nuclear waste disposal and dismantling of old nuclear plants still to be answered.

9. Near total reliance on electrical energy would retard development of efficient nuclear energy systems.

Nuclear systems will eventually be safely developed, but even then, problems of off-peak energy shortage and long distance mass volume energy transmission would remain. The long-sought fusion process, when developed, must also provide for the direct transformation of water into hydrogen. While significant problems remain to be solved, it is clear that we must continue to search for their solution. The combination of fusion-generated hydrogen, a transcontinental pipeline network and tremendous energy underground storage capabilities, make such a combined nuclear-hydrogen system economically and environmentally superior to mass energy supply in only electrical form. Large-scale conversion to nuclear generation at its present rudimentary state of technology could postpone the development of an optimal nuclear technology.

10. The demand management strategy would impede the development of a balanced energy development program.

In order to ensure maximum availability of energy to America on both long and short-term bases, a balanced energy development program must be pursued. We must promote the acceptable development of conventional energy production from out outer continental shelf, surface and deep mining, and deep drilling while encouraging a balanced research and development program for all new or exotic energy possibilities. This will include a strong nuclear development program, with equivalent emphasis on coal conversion and solar conversion including both direct and bio-gasification processes. Advanced recovery techniques of all hydrocarbon resources including secondary and tertiary well stimulation and in-situ methane production from inaccessible coal seams must be supported as well.

Such a balanced national research and development program will result in multiple competing energy systems offering a variety of options to the consumer, while developing an energy insurance system. If the development of any one energy system falters, other systems will be available to replace it.

The concern of the natural gas industry is that the options offered in the Project Independence Report to solve a short range import dependency problem may well lead to counterproductive decisions concerning the direction of research and development programs and funding. The demand management concept, if implemented, will dangerously retard or eclipse alternative energy system development and options. Demand management can eliminate free economic action in the energy marketplace at an enormous additional expense to the consumer. And if unsuccessful, in the long run, demand management may endanger America's industrial leadership and seriously weaken our economic base in a competitive world economy.

Under the policies of Demand Management, young families being formed, city families displaced by urban renewal, and families moving to new homes will be denied the least expensive, cleanest, and most efficient energy our country has to provide. If pipeline and distribution systems load factors decline, the full weight of inflationary costs and lower sales volumes will force accelerated rate increases for the remaining users of natural gas. At the same time consumers would have to pay for additional investment in electric transmission and distribution systems which otherwise would not be required. As industry is forced to turn to coal and electricity with their higher prices and additional environmental costs, the nation's consumers will experience yet another increase reflected in the higher prices of the goods and services they purchase. And those increased costs to consumers, under Demand Management, will not generate one additional Btu of energy for America.

CONCLUSION

It is our view that inclusion of a concept such as Demand Management in a national energy policy would—

render ineffective an efficient energy system that currently supplies $\frac{1}{3}$ of the nation's energy and over half of the energy used by American industry,

seriously affect the new homebuilding industry by mandating substantially higher energy costs for new home owners,

compound the nation's inflationary dilemma by forcing expanded use of higher priced energy,

seriously impair the energy industry's ability to finance new energy projects through sterilization of investor faith,

inhibit, if not eliminate the development of new potential energy sources, such as coal gasification, by disproportionate allocation of R&D funds,

impose a severe technological strain on an already overburdened nuclear power industry,

impose unrealistic demands for maturity of an already overtaxed nuclear power capability.

The irony of the situation is that the result of such a policy would be diametrically opposed to the very objectives of Project Independence by creating serious road blocks in developing long-term national energy supplies. Though the genesis of Demand Management springs from within the framework of a prescribed time frame of 1975-1985 its effectuation would negate the use of more desirable and efficient energy sources for the foreseeable future.

Project Independence purports to offer options but it is not apparent that any real attempt was made to evaluate all available energy systems to provide for the most efficient development and use of each. The preservation of marketplace energy competition is the key to national energy development. We have recommended and continue to recommend that a systems evaluation from source to consumer recognizing the realities and practicalities of our present energy dilemma is the proper basis for consideration of domestic energy options. As we take the needed steps toward achieving domestic energy self-sufficiency, natural gas can make a unique contribution toward achieving an effective national energy policy.

STATEMENT SUBMITTED BY THE AMERICAN PETROLEUM INSTITUTE

ENERGY OPTIONS

The most important feature of the FEA Project Independence Report is that it presents its various scenarios—the business as usual, accelerated supply, mandatory conservation and demand management, and the standby emergency program—as options, not as mutually exclusive alternatives.

This is important, since some other recent reports have claimed that the Nation must choose between specific supply and conservation alternatives. Because major commitments in energy are usually long-term, and involve hundreds of millions of dollars, the Nation's energy policy should be one that enables it to keep as many options open as possible. It would be disastrous to put all effort into only one option, only to find years later it didn't work.

The Nation's energy policy should be *balanced* among the Project Independence Report options, and take full advantage of economies and efficiencies inherent in the private sector.

LEGISLATIVE PROPOSALS

The most important deficiency of the report is that it did not address the adverse effects on domestic supply of some of the more important energy-related tax and regulatory proposals that have been and apparently will be considered by the Congress, including proposals to:

- extend price controls on domestic oil
- extend federal controls on natural gas
- eliminate the percentage depletion provision
- eliminate foreign tax credits.

These proposals if enacted into law would actually work against the aims of Project Independence. They would guarantee higher consumer prices, lower domestic supplies, and an accelerating dependence on OAPEC oil.

The report also takes for granted that the Federal government will deregulate gas and oil prices and maintain present tax policies. When estimating natural gas supplies the report assumes a base case scenario in which the field price of natural gas in interstate commerce is deregulated, or reaches market clearing levels by 1977. This assumption avoided the need to quantify the cost of continued FPC regulation of interstate natural gas prices, both in terms of reduced domestic production and increased dependence on gas substitutes from foreign sources. The minimum, "business as usual" supply estimates rest on the above assumptions, and the report shows relatively high costs of disruption, \$40 billion to \$200 billion annually, even for this case.

For reasons explained in the attached detailed comments on Chapter II, "Domestic Energy Supply", we feel that the report is overly optimistic in terms of its estimates of domestic supply that can be obtained by 1985, and we would hope that the Congress would not be lulled into complacency by the report's projections.

MANDATORY CONSERVATION AND DEMAND MANAGEMENT

The mandatory conservation and demand management strategies, in focusing on ways to reduce oil consumption, neglect to make explicit the increased demand for other resources and the concomitant cost—economic, social and environmental—that these strategies would entail.

In considering mandatory approaches, it is extremely difficult to estimate all the costs associated with the requirements. The suggestion is made that mandatory conservation would achieve a lower rate of demand and this in turn would mitigate inflationary pressures. Unfortunately less demand for energy might reduce prices for energy; but the mandatory steps would very likely increase prices in other sectors of the economy.

The demand management scenario suggests that oil and gas consumption could be reduced by requiring that electricity generated from coal be used to heat all new residential and commercial buildings, and old buildings where possible, even though the amount of fossil fuel consumed would be greater. The Petroleum Industry Research Foundation Inc. estimates the full cost of electric heat to be \$722 annually for a home in the northern part of the country that normally would be oil heated for a full annual cost of \$490; and \$545 annually for a home in a warmer part of the country that normally would be gas heated for a full annual cost of \$245. The report would have done the reader a service by making costs such as these explicit.

FOREIGN OIL AND STANDBY EMERGENCY PROGRAMS

In estimating additional foreign supplies of oil that might come from countries that are not now major oil exporters the report seems unduly pessimistic. For example at \$11/bbl the report estimates that the 1985 maximum potential exports from countries other than the Organization of Arab Petroleum Exporting Countries and Iran would only be 8.4 MMB/D, up from 1973 exports of 8.1 MMB/D (page 29). Considering the potential and incentive for oil and gas discovery on continents and shelves around the world, the report's estimates of world oil production potential appear low. Unfortunately, this is a key parameter of the problem. If potential sources of supply outside of OAPEC do exist, then one way to reduce the insecurity of foreign oil is to develop additional supplies in as many areas as possible, to the point where no one area would have the ability to threaten a meaningful embargo. Such a possibility would speak for retention of foreign tax credits, without which U.S. companies would be placed in a non-competitive position in searching for foreign supplies.

At this time the best short-term answer to the problem of import disruption appears to be a strategic stockpile system. We are pleased to see that the report

addressed this option and feel it should be further developed, and probably implemented.

ACCELERATED DOMESTIC SUPPLY

In the accelerated supply option the report points out ways to increase domestic energy supply through relaxation of many existing governmental constraints on domestic energy production, thereby allowing the private sector to move toward balancing domestic energy supply and demand at least cost to the Nation. We endorse these options.

COST CONSIDERATIONS

If the fundamental problem is how to reduce the Nation's vulnerability to foreign oil disruption at least cost to the Nation, then much of the Project Independence report loses sight of this. The accelerated supply option, i.e., the relaxation of existing governmental constraints, is at least defensible on economic grounds. But the conservation options, and especially those parts requiring government fiat, are probably far more costly than the report would lead one to believe.

The extensive treatment of policies that do not directly address the import disruption problem may be due to concern over quite different issues:

desire to avoid higher consumer energy prices

a desire to reduce imports per se

a desire to reduce or restrict the use of fuels for what some people might view as frivolous purposes (such as automobile transportation) as an end in itself.

Congress can help the Nation by focusing public attention on the problem to be solved—the insecurity of foreign oil—and by making explicit the full cost of the alternatives to accelerating domestic supply.

COMMENTS ON CHAPTER II: "DOMESTIC ENERGY SUPPLY", OF THE FEA PROJECT INDEPENDENCE REPORT, NOVEMBER 1974

The study of potential U.S. energy supplies is misleading because it (1) ignores the substantial impact of inflation in the past year on materials needed to drill wells, open mines, etc.; (2) is totally unrealistic about the cost of capital, particularly risk capital to explore in frontier areas and apply new technology on a commercial scale; (3) is extremely optimistic about results from exploration and untried technology; (4) grossly underestimates the time required to develop energy resources; and (5) overlooks the realities of environmental problems, particularly in developing and transporting resources from Alaska.

Some of FEA's more troublesome assumptions about potential U.S. energy supplies are discussed below.

Oil prices

Projections of future U.S. oil production were based on wellhead prices which would be competitive with imported oil delivered to the U.S. at assumed prices of \$4, \$7, and \$11 per barrel in mid-1973 dollars. It is doubtful that even the highest assumed price would bring forth much new oil for the following reasons:

Using mid-1973 dollars and assuming inflation based on the Consumer Price Index, is completely unrealistic because prices of materials needed to drill for oil have gone up much more than many other prices in the past year; e.g., the September 1974 CPI was 12% above a year ago, whereas prices for casing and tubing have risen about 40% above a year ago.

The study assumes a 10% discounted cash flow on investments in oil. Not only is this inadequate to cover the current costs of capital, but it also fails to recognize the increasing risks of searching for oil in frontier areas and using untried technology to increase recovery. In addition, the study underestimates the time between capital outlays and actual production, which means that the actual DCF returns would be less than 10%.

The report underestimates the high transportation costs from Alaska, which have escalated above initial estimates due to inflation and environmental requirements. Recent estimates indicate that pipeline costs alone to move oil across Alaska will be in the \$2 to \$3 per barrel range, depending upon volumes.

Gas prices

The report assumes that raising wellhead prices for new natural gas from 40¢ to 80¢ per MCF will increase production, but prices above 80¢ per MCF would

add little to future production. Considering that most potential gas supplies lie in expensive areas—deep, offshore and in Alaska—it is doubtful that much new gas could be developed for 80¢ per MCF.

The report further assumes that city gate prices for natural gas will be about \$1 per MCF, implying transportation costs of 20¢ per MCF. This is totally inadequate. Prior to the recent high inflation, it cost about 25¢ per MCF to move gas from the Gulf to the East Coast and estimates of pipelines costs to move Alaskan gas to market are well over \$1 per MCF.

The FEA appears to be misinformed about the relative costs of oil and gas. The report states that "natural gas is generally cheaper to produce and transport than oil". In fact, because of the greater depths at which gas is found, gas wells are much more expensive to drill. In 1972, the average gas well drilled in the U.S. cost \$157,764 compared with \$93,506 for the average oil well. As for transportation costs, gas costs about 2½ times as much to transport as oil. Prior to the recent inflation, oil could be moved from the Gulf to the East Coast for about 9¢ per million BTU's compared with about 24¢ per million BTU's to pipeline gas the same distance.

Oil volumes

FEA's projected oil production appears high, even if realistic prices had been assumed. Their base case, assuming \$11 imports, points to production in 1985 about the same as NPC's high drilling case, Case I. It is unlikely that production of this magnitude could be achieved by 1985 because drilling in the early 1970's was well below Case I, and although drilling has increased in 1974, a recent NPC study indicates that Case I drilling cannot be reached during most of the 1970's due to equipment limitations, mainly drilling rigs.

POTENTIAL U.S. LIQUIDS PRODUCTION

In millions of barrels per day, at \$11 oil

	1985			
	1974 ¹	NPC case I	FEA ¹	
			Base	Accelerate
Lower 48 onshore.....	8.9	9.1	9.1	9.7
Lower 48 NPR.....				.2
Alaska.....	.2	3.5	3.0	3.3
Alaska NPR.....				2.0
Gulf of Mexico.....	1.3	1.8	2.1	2.5
California OCS.....	.1	.9	.5	1.3
Atlantic OCS.....		.2		.5
Other.....			.3	.5
Total.....	10.5	15.5	15.0	20.0

¹ FEA project independence report, table II-9, p. 83.

Gas volumes

FEA's projected natural gas production (Base Case) is a little below NPC's Case I, but it still appears high considering the low prices assumed and the time required to develop new gas supplies and build transportation facilities from remote areas.

POTENTIAL U.S. NATURAL GAS PRODUCTION

[In trillion cubic feet, at 80 cents per thousand cubic feet and \$11 oil]

	1985			
	1974 ¹	NPC case I	FEA	
			Base	Accelerated
Nonassociated.....	16.7	21.2	¹ 18.1	¹ 21.3
Associated, dissolved.....	² 3.7	5.3	² 6.6	² 8.0
Total.....	20.4	26.5	24.7	29.3

¹ FEA project independence report, table II-12, p. 93.

² FEA project independence report, table II-13, p. 94.

Lead times

The study assumes extremely short lead times for developing new oil: New OCS, 2-4 years; New Onshore, 1-3 years.

Even if adequate manpower and equipment were available, much more time will be needed to—

- explore and develop frontier areas
- drill in deep waters offshore, which requires new drilling and production techniques and
- develop tertiary recovery projects which involve technology that has not yet been applied commercially

These time frames also ignore the considerable time needed to build transportation facilities to deliver new oil to markets. For example, FEA's projections of Alaskan oil and gas production would require a second oil pipeline and two gas pipelines, an enormous undertaking considering the environmental safeguards which must be incorporated into such projects, the length and size of the lines and capital required.

Leasing

FEA's treatment of leasing costs is ambivalent. On the one hand, the report stated that leasing costs were excluded in estimating "minimum acceptable price per barrel". It was not clear, however, whether these substantial costs—which the producer must pay—were taken into account in projecting supply, and if they were, at what rates, i.e., high or low, relative to past bonus costs. These assumptions—whatever they are—should be clearly stated.

FEA's proposals to maximize bids are questionable also, i.e., a ban on joint bidding by majors, early disclosure of exploration information and stringent rejection of low bids. Banning joint bids might lower—rather than raise—bids, because companies would be exposed to more risk if they had to bid alone. And rejecting low bids on marginal acreage would be counter-productive because it would reduce the amount of acreage available to explore which would, in turn, reduce potential production.

Coal prices

The Project Independence Report concludes that "the coal industry has the capacity to satisfy almost any foreseeable demand for coal by 1985, at prices near 1972-73 levels and considerably below current spot market levels." It is doubtful that the prices assumed would induce investment in new coal mines because the study does not appear to take adequate account of the impact of inflation.

The time period used for estimating materials equipment costs for new mines is unclear. While one assumption states that costs "are based on 1973 indices at 1974 dollars", another estimates the "delivered cost of coal" as "the minimum acceptable selling price in 1973 dollars." Although it is difficult to pinpoint the time period used, it appears that investment costs are those prevailing at some point in 1973. This is an unrealistic basis for calculating price because mining equipment costs have escalated much more rapidly than the CPI during the past year, and the price levels used in the study already seem overtaken by inflation. The maximum price assumed for coal from new deep mines is \$15 per ton. This is considerably below contracts already negotiated in 1974.

Coal volumes

FEA's projected coal production appears highly optimistic considering the low prices assumed, uncertainties concerning government policies and physical constraints on capacity expansion. Even in the minimum growth cast (the BAU case), coal output is projected to grow at an annual rate of 5.4% between 1972-80.

The study recognizes that government policy uncertainties such as strip mining legislation, pollution control regulations, western coal lands leasing policy, oil import policy, natural gas pricing policy, and nuclear capacity are currently slowing coal development. The study then asserts that "if these uncertainties are eliminated the current coal shortage could be substantially alleviated in three to five years—the time required to open new mines." This is a dubious assertion, for two reasons. First, it is obvious that these uncertainties cannot be resolved overnight. Second, even if many (or all) of the uncertainties over government policy could be alleviated, the FEA has failed to give adequate weight to the following possible constraints on coal production and use:

Productivity. The FEA study assumes that underground productivity has now bottomed out and will begin to rise again. This may happen but it is far from certain. Productivity has fallen consistently since 1969 and the new labor contract is expected to lead to another significant decline.

Water availability. This will be of special importance in mining of western surface reserves and in conversion of western coal to other energy forms. While the total amount of water in the west should be available for coal development, there are significant differences in availability and cost by specific area, and a great deal of detailed hydrological and geochemical planning must be done to prevent water from becoming a limiting factor.

Transportation availability, especially in terms of rail and water transportation.

Rail: The FEA attributes the lack of investment in new rail capacity to past uncertainties about government policy with regard to coal development and the resultant lack of firm requirements for additional rail capacity. They assume that the resolution of these problems will lead to major investments in new rail capacity. This fails to consider two major problems which may limit rail expansion:

Railroads may be unable to finance the growth needed to transport increased coal output. In addition to the funds needed for new capacity, funds must also be raised for maintenance work deferred in prior years.

Sufficient raw materials may not be available to the rail industry. Steel for rails and wheels, and lumber for ties may not be available in sufficient quantities because these capital goods can command a higher price in alternative use areas.

Water: In order to prevent the availability of water transportation facilities from limiting future coal development, a great deal of planning and investment remains to be done. The FEA has probably underestimated the magnitude of this task. Potential bottlenecks include the capacity of river locks on the Mississippi, Ohio, and Illinois Rivers; channel depths in some parts of the inland waterway system; trans-loading facilities on rivers in the Great Lakes; and the capacity of Hampton Roads, Virginia, to accommodate large vessels handling met coal for export.

Nuclear Fuels

While we have no first hand expertise in this area it should be pointed out that considerable uncertainty surrounds the rate at which nuclear power electric generating stations can be brought on line. The accelerated development strategy would call for 93 gigawatt plants in 1980 and 240 such plants in 1985.¹

Electricity

Since the report is based on a linear programming model, and since according to the data given the model nuclear plants generate electricity at less cost than coal fired plants do, the model simply takes as many nuclear plants as the accelerated supply strategy will provide and then "backs-out" an equal amount of coal-fire generated electricity accordingly.

In view of recent increases in the cost of both fuels and plants, and in view of the current financial plight of electric utilities, and in view of the fact that the demand elasticity of electricity appears to be near one, the projected electricity capacity of 922 gigawatts in 1985 vice 424 gigawatts in 1973, in the "business-as-usual" scenario appears high.

Other energy sources

The chapter goes on to review shale oil, solar energy and geothermal energy. In no case does the report credit these sources with a major role in providing energy prior to 1985; the highest estimate being 1.5 MMB/D in the accelerated supply case, coming principally from oil shale (1.0 MMB/D). These projections do not appear unreasonable.

¹ A gigawatt is a million kilowatts.

STATEMENT SUBMITTED BY AMERICAN PUBLIC POWER ASSOCIATION

FUEL PRICING

"Project Independence" suggests solving our energy self-sufficiency problem by raising the consumer cost of domestic fuels to the level of world oil prices set by the OPEC cartel. It thus relies largely on the price mechanism to achieve energy self-sufficiency. This approach ignores the fact that (a) piggy-back pricing policies bear no relationship to production expenses; (b) taxpayers own the majority of U.S. fuel resources; and (c) there is relatively little competition in the fuels industry.

Over the last year, we have witnessed a rapid rise in windfall profits by fossil fuels producers. Prices charged by oil, coal, and gas companies—a number of firms hold positions in all three fuels—have soared to record heights based on the market theory of "whatever the traffic will bear." Ability to obtain these prices has been aided by gratuitous Federal policy decisions and inept enforcement of minimum Federal regulation.

It is ironic that American citizens own major fuel resources but must pay excessive prices for their development. Over half of our nation's remaining oil and gas resources, about 40% of our coal and uranium, 80% of our oil shale and some 60% of our geothermal energy sources are located on Federal lands. "Project Independence" proposes that we continue present policy in transferring these resources to private parties with power to control both the pace of development and the level of prices. Yet Congress has before it legislation to create Federal corporations to help bring these resources to the market. Such an approach would supplement existing private development, stimulate competition, encourage price reductions, and provide a yardstick by which we could judge the performance of non-governmental producers. At a time when countries throughout the world are giving increased recognition to the direct role which government may play in protecting the energy interests of their citizens. "Project Independence" studiously avoids discussion of this possibility.

Fuels companies stand to make a lot of money out of the "energy crisis."

Analysis by the Tennessee Valley Authority—the nation's leading purchaser of coal—indicates that recent prices for coal are out of all proportion to any increase in mining costs, even after allowing for a 20% return on investment.

Net profits of a number of the nation's major oil companies rose in excess of 100% over the last year.

Gas producers are pushing for deregulation—a possibility incorporated in "Project Independence"—which could cost consumers as much as \$11 billion a year and boost company rate of return to in excess of 150%.

Fuels firms appear to be controlling production to push prices higher.

A 1974 study of Federal coal leasing showed that of 474 leases outstanding in seven Western states, only 52 or about 11% were under active production and 321 leases had never produced a single ton of coal. In other words, the public transferred these assets—for miniscule fees—to firms who have been sitting on the resource waiting for prices to rise.

The U.S. Geological Survey has reported to Congress that shut-in oil producible zones off-shore jumped from 953 in 1971 to 2,966 in 1972 and to 3,054 in 1973, while active oil wells fell from 5,704 in 1971 to 4,744 in 1972 and 3,814 in 1973. The survey noted that this decline in active wells had taken place even though new well completions continued over this three-year period at the rate of 300 to 400 a year.

The Federal Power Commission has found in a review of 168 offshore shut-in producible gas leases that these areas contained proved reserves of 4.7 trillion cubic feet and an additional 3.3 trillion cubic feet in probable reserves of gas. The total amounts to 2½ times the gas produced in 1973 from offshore wells.

The aim of fuels producers appears to be to use the political decision of Middle East countries to dramatically raise world oil prices to justify higher prices at home for *all* fuels—regardless of the actual costs of production. The objective of fuels producers appears to be to set the price of all fuels at an equivalent price, per Btu, of oil—irrespective of the cost of production of each fuel. "Project Inde-

pendence" analysis accepts this self-serving marketing decision as a basic assumption for formulation of national energy policy.

"Project Independence" does not contemplate an attack on what probably constitutes one of the country's most significant energy problems—the growing concentration of private control over fuels and energy.

Available evidence suggests that what is needed is a few less grand designs and a few more grand juries to determine whether or not antitrust laws are being violated.

It may be true that the era of "cheap energy" is over. But that is no reason to open a new age of consumer exploitation. Fuels and energy policy is too important to be left to producers or set on the basis of the shifting sands of Arab politics.

The following steps are needed:

1. Examination of possible price fixing or other anti-competitive activities by American fuels companies.
2. Rollback of fuels prices to a level where they can be justified by costs and reasonable profits.
3. Use of public corporations to aid in developing needed public resources.
4. Application of cost-of-service and equitable rate of return principles to regulated energy industries.
5. Avoidance of subsidies which enhance company earnings without increasing production or aiding consumers.
6. Improvement in Federal mineral leasing policies to insure competition and production.
7. Enforcement of conflict-of-interest statutes to prevent unwarranted influence over Federal energy policies.
8. Increased freedom of information about the operations of energy companies.

COAL LEASING

APPA believes that Federal coal leasing laws must be changed to facilitate the reduction of the increasingly large concentration of Federally-owned coal reserves held by major energy companies. Unless steps are taken to increase competition in obtaining these reserves, future price competition in the coal industry may be endangered and supply diminished. Measures must be adopted in new coal leasing legislation which will provide effective opportunity for smaller companies, cooperatives, and state and local public agencies to secure fuels on Federal lands in order to protect the public against anti-competitive activities of large companies.

One step to be taken is the elimination of the present bonus bidding system. Smaller entities could participate if bidding for coal resources becomes based on royalties or deferred bonuses rather than on the amount of capital that can be mustered at the time of the bidding.

As an alternative to these kinds of bidding, consideration should be given to the granting of preference rights to non-integrated fuel corporations. Another possibility for granting of a leasing preference right would be to allow small corporations which have not engaged in much development to have an opportunity to obtain leases before other bidding begins.

Finally, consideration should be given to the kind of preference rights which have been used to stimulate competition in the electric utility industry. Under such a plan, state and local public agencies which might be interested in developing coal leases would be given first opportunity to obtain such leases (as state and local agencies are given first opportunity to obtain electricity from Federal hydroelectric projects). If no public agencies wanted such leases, the area would be included in those lands open for competitive leasing.

It should be noted that the purpose of these preference rights is only to stimulate competition by encouraging additional agencies and corporations to obtain and develop coal leases.

Changes in the coal leasing program should also provide for an antitrust review similar to that contained in section 105(c) of the Atomic Energy Act. Such a review of leasing applicants should result in the denial of a lease to any applicant whose activities under the lease "would create or maintain a situation inconsistent with the antitrust laws". APPA suggests that such a review is needed before granting new coal leases to energy companies, in order to insure that competition will be maintained and anticompetitive practices will not be continued if they are found to exist.

APPA also suggests that the term "diligent development and continuous production" be precisely defined in changing coal leasing laws. A specific definition of

this term will prevent companies from continuing the present practice of obtaining leases and then not developing the coal resources. If a company does not meet the standards of diligent development and continued production, its lease should be revoked.

While the United States has great resources of coal, development of which could aid in achieving greater fuels self-sufficiency, monopolistic control and pricing could retard this opportunity or exact an unfair price from consumers.

RENEWABLE RESOURCES

National energy policy should give heavy emphasis to renewable resources. One of these resources is hydroelectric power.

Thus far, we have developed only about one-third of the available hydroelectric power capacity. According to the Federal Power Commission, the average annual generation that could be obtained from undeveloped hydroelectric resources would be more than 477 billion kilowatt-hours—almost one-fourth of the Nation's total generation at the present time.

The Federal Energy Administration, in a recent report, identified a large number of possibilities for increasing capacity of existing hydro facilities. These possible additions would add about 13,000 megawatts to peak power capacity.

Expedited construction of these hydro projects, FEA said, would "reduce the probability of power curtailments in the areas served." The Congress and the Administration should get on with this job as quickly as possible.

The annual figure for residual oil equivalent to potential hydroelectric development is 734,186,330 barrels. These are annual figures, but average lives of hydroelectric sites are well in excess of fifty years. Thus, the gross savings of residual oil (if oil is used as an alternate fuel) would be at least 21,200,000,000 barrels for existing hydro and 36,700,000,000 barrels for undeveloped hydro, assuming a 50-year life for these plants.

Many existing hydroelectric plants are in full production after many more than fifty years. It is really very difficult to find any absolute limit of time after which such projects would be unavailable for the production of kilowatt hours. Theoretically, with a full modernization and maintenance program, these projects have an indefinitely long life and the annual savings in alternate fuels would continue.

These figures indicate the value of a complete study of the potential of undeveloped hydroelectric sites in the United States to determine the technical and economic feasibility of further development in light of current fuels problems.

We should also advance with all practical speed the development and demonstration of solar energy. The sun provides an opportunity to supply energy in a form and manner which avoids many of the economic and environmental problems involved with fossil and nuclear fuels. Congress this year recognized the merit of accelerating advancement of solar energy by passage of the Solar Heating and Cooling Act and the Solar Energy Research, Development, and Demonstration Act.

Our remaining fossil fuels are a valuable resource for purposes other than burning. It took centuries to produce them. With present patterns of use, they may be gone in a relatively short period of time. Solar energy can stretch these fossil fuels and preserve them for objectives which cannot be served by other substances.

PLANNING

It is becoming apparent that a more rational means of planning the use and development of energy resources is needed on the national level. Considering the demands being made upon our energy resources, we cannot much longer tolerate conditions where both the supply and demand of energy resources are not subject to more comprehensive planning.

No enterprise relishes the prospect of additional governmental controls, but the complexity of our society and the demands being made upon limited natural resources by a growing population will inevitably, I believe, lead to further planning on a regional and national basis. Such planning—and the tough decisions it implies—is at the heart of the development of a national energy policy. We should be devoting some of our best thinking to devising ways by which such planning can be carried out, while at the same time allowing for maximum input and flexibility at the local level.

For instance, we should be planning means of blunting the impact of a disruption in foreign oil shipments. Considering the problems that we experienced last winter during the oil embargo, it is astounding that no positive action has been taken to establish a national petroleum reserve which could be drawn upon during periods of shortage. Existence in the United States of a significant petroleum stockpile also would allow us to cushion the cost of shortages and to bargain better with oil producing nations. Our present reserves can be measured in a few days, whereas many European nations maintain stored resources sufficient to handle their requirements for several months. A similar volume of storage should be developed here.

We should also be planning better electrical interconnections within regions and between regions. Linking of power plants by a nationwide extra-high voltage grid would allow the movement of large blocks of power from region to region to take better advantage of economic dispatch, daily and seasonal diversity, and fuel conservation.

Two recent reports support the need for accelerating the building of transmission lines. A report published in October, 1974, by the Interregional Review Subcommittee of the Technical Advisory Committee of the National Electric Reliability Council stated: "In view of the many uncertainties confronting the utility industry, efforts should be made to strengthen—rather than delay—transmission facilities to provide flexibility for the transfer of power."

The "Project Independence" report also pointed to the advantages of better interconnections.

"Transmission interconnections between systems with complementary peaking characteristics hold significant promise of leveling load peaks," the report declared. The report estimated that better interconnection could flatten load peaks by 3% by 1985.

Although there have been many industry studies of the need for stronger regional and inter-regional interconnections, I strongly suspect that biases are inevitably contained in each of these studies. It would therefore seem desirable for an appropriate Government agency to make a comprehensive study of the advantages that could be obtained by better interconnections, putting aside questions of ownership of individual generating systems or transmission lines.

There are many imponderables facing us today, particularly with respect to the rate of future growth in demand for electricity, but I do not believe that these uncertainties should paralyze us into a state of inaction.

Virtually every study that I have seen, including that of the Ford Foundation and Project Independence, project a continued growth in demand for electricity. Some studies predict an even faster growth in the future, because of the substitution of electricity, in some areas, for other forms of energy now used for residential and industrial purposes.

Because of the long lead time required in building new facilities, there is more peril to our nation in underestimating rather than overestimating requirements. Furthermore, underestimating growth in demand could result in shortages that would make it necessary for us to turn to expedients that would be less efficient, use up more scarce resources, and increase levels of pollution.

Although Project Independence should focus on ways by which the nation can utilize energy more efficiently, we must give equal attention to the ways by which energy supplies can be increased in an environmentally acceptable manner, to provide for the future needs of our citizens.

STATEMENT OF KEN BOSSONG, FOR CENTER FOR SCIENCE IN THE PUBLIC INTEREST

The Center for Science in the Public Interest (CSPI) is a non-profit, tax-exempt research organization that collects and disseminates information on a wide range of issues including energy, environmental protection, consumer and worker safety, and health and nutrition. Since February 1974, CSPI has been closely following the development and preparation of the Project Independence report by the Federal Energy Administration.

While recognizing the need for and strongly supporting the development of a national energy policy, CSPI sees many serious shortcomings in the FEA's Project Independence study. CSPI is particularly concerned by the study's treatment of consumer and social impacts issues as well as the issues of environmental protection and energy conservation. CSPI has also been concerned by the pro-

cedures currently available to the public to participate in national energy policy-making. This statement will discuss the above-mentioned areas and offer some recommendations to alleviate the problems cited.

The Economic & Social Impacts Chapter of the Project Independence study repeatedly acknowledges that almost any energy strategy adopted will have regressive and adverse impacts upon low and middle-income consumers. The chapter concludes that we can expect a program to achieve energy "independence" by 1985 will enable the rich to get richer while the poor become poorer. It states that "the combination of general price inflation and energy-related price increases is already causing hardship to those with low incomes. If the Project Independence options, when translated into predicted consumer prices, lead to considerably higher energy prices, then additional and separate policies must be considered to alleviate the problems of those of low income." Yet, in spite of this conclusion, the study fails to outline program options to alleviate these problems. Only vague references are made to the possibility of income transfer programs. There is no mention of other prominent options such as a fuel stamp system or a negative income tax.

Another major shortcoming of the Economic & Social Impacts Chapter of the study is the omission of analysis and data for the proposed energy conservation option for a national energy policy. The study was intended to present detailed analyses of four distinct options for energy planning; yet, data is provided for only the accelerated fuel development option. Even for the accelerated development option, the data is incomplete. Without complete analytical materials, it seems virtually impossible to develop rational and informed energy programs.

Moreover, the report contains many fundamental assumptions that are not accompanied by any data, analysis, or even verbal explanation to justify them. A glaring example is found in the Economic & Social Impacts Chapter which includes the assumption that "overall growth of the economy is one of the chief means of improvement in the material well-being of the American consumer and has also proved to be important in alleviating poverty over the last two decades." Insofar as a number of noted economists and sociologists have contested this view in recent years, it is puzzling, at the very least, that the report makes such an unsupported statement.

The severe health and safety problems that may accompany accelerated domestic fuel production are not discussed nor analyzed by the Project Independence study. CSPI wonders what became of the study of this issue prepared by the Resources, Inc. consulting firm for the FEA in late summer 1974. That study was highly critical of the Project Independence program on the grounds that it posed potentially dangerous risks to workers and consumers alike.

The Environmental Assessment Chapter of the report frequently refers to the "secondary impacts" that will be experienced by coastal communities due to offshore drilling, superports, oil refineries, etc. However, the reader is left to guess what these "secondary impacts" might be. More importantly, no program options are suggested to minimize these impacts.

The Environmental Assessment Chapter of the study makes the assumption that air and water pollution problems by 1985 will be less than those currently existing; this conclusion is reached by assuming that the present provisions of the Clean Air Act and the Water Pollution Control Act will be strictly enforced. However, this assumption is inconsistent with the facts that (a) to date, there has not been anything near full compliance with either statute and (b) the remainder of the Project Independence report argues strongly for easing the requirements of the Clean Air Act and implicitly urges easing up on other environmental legislation. Consequently, the Environmental Assessment Chapter's conclusions about future pollution problems is based on conflicting, misleading, and incorrect assumptions.

Key environmental pollution issues are totally ignored. For example, there is no analysis of the impacts of certain water pollutants such as dissolved gases and liquids that are discharged into the nation's waterways. Secondary air pollutants such as PAN are also by-passed.

Even though the Project Independence report recognizes the industrial sector to be the largest user of energy, it nonetheless seems to place the burden for energy conservation programs upon the low and middle-income consumers. The report devotes almost three times as much space to consumer conservation programs as it does to industrial conservation programs. The Administration has apparently failed to recognize the fundamental principle that its voluntary and mandatory energy conservation programs are doomed to failure if the consumer perceives that the conservation burden is not being equitably distributed.

The Conservation Analysis Chapter of the Project Independence report has totally omitted consideration of some of the most promising and obvious energy conservation program possibilities. For example, there is no mention of resource reduction programs or the need for major industries to recycle energy-intensive materials such as aluminum. Transportation conservation measures are virtually limited to discussion of truck and automobile transport; there is no mention of energy waste in air travel or proposals to reduce that waste.

Although electric utilities have long been a target of both energy conservationists and poverty organizations, key utility energy-saving ideas have been omitted. There is no mention of the utilities' undesirable practice of promoting increased rather than decreased electricity use. There is virtually no discussion of ways to flatten utility rate structures and eliminate the progressive structures that encourage wasteful energy consumption by large users. The Lifeline Rate Design concept, which is currently getting highly-publicized hearings before many state public service commissions, was not even considered.

Throughout the entire Project Independence study is the implicit assumption that continued growth in energy usage by the nation is both desirable and inevitable. The study fails to consider the "Zero Energy Growth" option outlined by the Ford Energy Policy Project report that concludes that achieving a zero energy growth rate by 1985 is both doable and desirable.

The Project Independence study has also by-passed the very fundamental issue of the market structure of the energy industry. The study does not provide any analysis of the effects of monopolistic practices, interlocking directorates, etc. upon the availability of fuel or the prices consumers must pay. FEA has stated that its study is based upon the assumption that the energy industry operates in full accordance with the principles of free-market capitalism and that there is no serious anti-competitive behavior within the industry. It is not necessary to discuss that patent absurdity of such an assumption. It is however, important to realize that FEA has stated that the conclusions drawn by its report will not be valid if the "free-market" assumption is incorrect.

The Project Independence report has also overlooked telling its readers how much of a financial burden achieving energy "independence" will place upon low and middle-income consumers. Clearly, the price to be paid will be high. Recent estimates by the New York Stock Exchange have put the price for Project Independence at over \$820 billion by 1985—this occurring at a time when the U.S. is also projected to experience a capital shortfall approaching \$650 billion (at current import levels). Where will the necessary capital come from and out of whose pockets?

In spite of these and other serious shortcomings in the Project Independence report, opportunities for consumers to voice their concerns have been and continue to be limited. Consumers have been frustrated in their attempts to work with federal agencies that are developing and implementing the nation's energy policies.

The Project Independence report itself was prepared with little real citizen input. During the months the report was being written, FEA suspended its Consumer and Environmental Advisory Committees and sought to cut the staffing of its Consumer Affairs Office by more than half. Although FEA sponsored ten regional public hearings this summer on the Project Independence effort, the agency provided too little information for the public to make effective comments. Moreover, FEA repeatedly violated the provisions of the Freedom of Information Act by refusing to provide consumer groups and individuals copies of Project Independence documents legitimately requested under the provisions of the statute. Further, the transcripts from FEA's ten regional hearings, in almost all instances, did not arrive back in Washington, D.C. in time for the report's authors to include the views expressed by the public.

Following the issuance of the Project Independence report, the Energy Resources Council sponsored six "Energy Policy Seminars" to discuss the provisions of the report before going to Camp David to finalize the Administration's energy platform. Though billed as "open to the public", those seminars were kept a virtual secret from the public. (There was no publicity other than a notice in the Federal Register two working days before the seminars began; even FEA's Office of Consumer Affairs/Special Impacts was not told about the seminars in advance.) Most of the Washington, D.C. consumer, poverty, and environmental organizations learned of the seminars either through leaks in FEA or from one another.

Presently, Mrs. Virginia Knauer is the only communications link between consumers and the Energy Resources Council, which has been charged with con-

tinuing the work on Project Independence. There is no direct public input into the Council even though it is responsible for developing a national energy policy that will have far-reaching effects on all segments of American society.

Furthermore, in the Federal Energy Administration, we have witnessed the dissolution of the FEA Project Independence Advisory Committee—the only real public access to national energy policy-making. The situation on other federal departments responsible for energy matters is even worse; most do not have consumer offices, offices of public counsel, or consumer advisory groups.

To correct some of the problems with the Project Independence report and its accompanying implementation procedures, CSPI would like to present the following series of recommendations:

(1) To minimize the regressive and unfair impacts new energy policies will likely have on low and middle-income consumers, the Administration and the Congress should develop a fuel stamps program or negative income tax system or other similar measures to accompany the package of energy legislation.

(2) The Energy Resources Council should create a Citizens Advisory Panel with representatives of low and middle-income consumers, industry, labor, and state & local governments to work with it. To date, numerous public interest and governmental organizations have requested the Council to create such a Panel but their requests have gone unanswered. One possibility would be for the Council to resurrect FEA's Project Independence Advisory Committee and transfer it to the Energy Resources Council.

(3) Either the Federal Trade Commission or the Justice Department should immediately undertake a study, to be later released to the public, of the implications of current energy industry market structure upon consumer prices and the availability of fuel supplies.

(4) Industry must bear a larger responsibility for energy conservation. Conservation efforts should include flattening utility rate structures, recycling energy-intensive materials, and reducing industrial space heating.

(5) The President should broaden the "inflation impact statements" that are now accompanying legislative proposals and agency regulations into "consumer impact statements." The latter would consider by economic and geographic sector the effects of proposed energy policy-making upon unemployment, buying power, prices and supplies of essential goods, and physical disruptions of communities.

(6) All major federal energy agencies should establish consumer advisory committees to work with them on the national level as well as similar groups to work with their regional offices. Likewise, the major federal energy agencies should create consumer offices within their departments.

(7) All future major energy policy decisions that will impact upon consumer prices, fuel supplies, environmental quality, etc. should be preceded by public hearings.

In addition to the above more-general energy policy guidelines, CSPI would like to present a number of specific recommendations. The following are based upon proposals developed by Dr. Albert Fritsch, Co-Director of CSPI, and discussed further, in part, in his book "The Contrasumers":

(a) Require all fuel producers who have previously advertised increased energy consumption (within the last decade) to spend equal time and money on corrective advertising. Oil companies should spend half their advertising budgets on energy conservation announcements.

(b) Require conservation of all vented methane in coal mines, and use within the national natural gas system. Industrial natural gas use should be restricted to industries that cannot use alternative fuels (e.g. glass blowing).

(c) Have a graduated tax on gas-guzzling automobiles and legislate that all cars made after 1977 obtain 20 miles/gallon or better.

(d) Give preferable loan treatment to multiple unit home dwellings and provide incentives to home owners to retrofit their homes and reduce energy waste.

(e) Advocate a national energy policy of zero growth rate for fossil fuels by 1985. First step would be to freeze petroleum imports to no more than current levels.

(f) Adopt a national moratorium on further nuclear powerplant construction and phase out existing nuclear plants by 1990.

(g) Bust the Highway Trust Fund and use the monies for mass transportation systems. The Gateways Policy for inter-state trucking must likewise be revised.

STATEMENT OF DR. PETER E. GLASER, VICE PRESIDENT, ARTHUR D. LITTLE,
INC., CAMBRIDGE, MASS.

INTRODUCTION

We have become aware of the disruptions that can occur when energy supplies are insufficient to meet energy demands. The dramatic events set in motion by the oil embargo, and the subsequent rise in fuel costs, have led to new initiatives, as exemplified by Project Independence, to forestall the recurrence of a politically imposed imbalance between energy supply and energy demand. These initiatives are leading us to take steps to reduce energy consumption. They are requiring us to seek new approaches to self-sufficiency in energy so that we can remain in charge of our economic destiny and serve the interests of other nations in the process.

Whatever the political motivations for self-sufficiency in energy, few people now believe that energy shortages and fuel price escalation are short-term or one-time phenomena. Demand for energy will continue to rise, while the Earth's finite resources of fossil fuel become exhausted—oil and gas in a matter of decades, coal in a matter of a few hundred years. Furthermore, the use of fossil fuels, presents us with a number of undesirable environmental consequences. Thus, the overwhelming consensus today is that alternative sources of renewable non-polluting energy must be developed—first as a supplement to our present non-renewable energy resources, and eventually as a replacement for them.

One of the few such alternatives available to us is the sun.

Today, the application of solar energy is perceived as one means of meeting future energy demands. In many countries, government and industry groups are investigating different concepts for harnessing solar energy. Government funds for solar energy have increased dramatically over the last three years, reaching about \$50 million in fiscal 1975. Congress is expected to pass several bills designed to support solar energy. These bills range from \$50 million for demonstration projects for solar-heated and -cooled buildings to a \$600 million across-the-board effort over five years which would be guided by an Office of Solar Energy Research.

This nation is not alone in recognizing the potential of solar energy. Japan has announced its "Sunshine Project," for which multibillion dollar expenditures are being planned over the next 25 years. Australia is planning an expanded solar energy program, and similar efforts are underway in Europe. The Soviet Union has had and is continuing to pursue a significant solar energy development program.

The degree to which solar energy applications can be successfully moved beyond the research and development phase will depend upon many factors. All of these, however, relate to the competing alternative energy sources available at the various stages of development and to the cost/benefit trade-offs which will have to be made in arriving at a coherent energy policy. Any energy policy must endeavor to satisfy a multitude of conflicting national objectives, for example, the need for energy self-sufficiency versus the need for a clean environment, or the need to tap new resources to meet a burgeoning demand for energy versus reducing this demand and constraining the forces of inflation. Solar energy certainly is abundant enough to provide self-sufficiency and clean enough to satisfy the most ardent environmentalists. The challenge lies in finding methods for converting this energy efficiently and economically into useful forms.

The amount of energy the United States land area receives from the sun is enormous—some 500 times more energy than the energy consumption projected for the year 2000. Even though sunlight is filtered by the atmosphere, one square yard of land exposed to direct sunlight receives the energy equivalent of about 1 horsepower, or about 1 kilowatt. However, this vast amount of solar energy is not easily convertible and certainly is not "free." It can be considered a widely distributed resource somewhat akin to low-grade mineral resources. Sophistication is required to "mine" solar energy effectively.

There are two obvious obstacles to harnessing solar energy. First, it is not constantly available on Earth. Thus, some form of storage is needed to sustain a solar-powered system through the night and during periods when local weather conditions obscure the sun. Second, solar energy is diffuse. Although the total amount of energy available is enormous, the collection and conversion of solar energy into useful forms must be carried out over a large area, which entails a large capital investment for the conversion apparatus.

Solar energy, therefore, most likely will be developed not because it is cheaper than alternative energy sources, but because these alternative sources sooner or later will be exhausted, will become increasingly more expensive, will continue to be subject to political and economic control by the nations possessing them, and will produce undesirable, and as yet incompletely understood, environmental consequences, especially on the huge scale that will be required to meet projected demands even with controlled growth.

Obviously, the harnessing of solar energy is a goal worth pursuing, but a goal difficult to achieve. The successful and widespread introduction of devices that utilize solar energy will require considerable development to strike the appropriate balance between technology, the environment, and society's needs. Results are unlikely to come about quickly. It is not because of the lack of advanced technology, but rather because of too little industrial experience with such technology. As yet, there is no capacity to mass produce systems at a cost low enough to create a large market or the institutional arrangements needed to ease the introduction of solar-powered systems.

Nevertheless, the potential payoff of research and development in solar energy applications has been recognized and is being supported on a significant scale for the first time. Thus, the stage is set to establish and examine the following options available for solar energy conversion and assess their technological, economic, and social attractiveness within the context of a coherent national energy policy.

SOLAR HEATING AND COOLING

The most promising near-term application for solar energy is in the heating and cooling of buildings. A number of houses in the United States, Japan, and Australia already include solar heating systems. Moreover, solar hot water heaters are in wide use in many countries. Furthermore, several demonstration projects are in various stages of completion. For example, several schools, have been equipped to use the sun's energy for a portion of their hot water, heating and cooling needs. Public buildings, office buildings, and residences in many locations will shortly provide information on the degree of success achieved in solar-heated and -cooled buildings.

A substantial fuel saving is possible if an increasing percentage of new and existing buildings are heated and cooled with solar energy. By 1985, the energy consumed for household and commercial purposes will amount to 21% of our total energy use. If solar energy were used for many of these applications, more than one-half of the total energy used in the year 2000 to heat and cool buildings could be saved. These savings could exceed the yearly amount of oil to be delivered to the United States through the Alaskan Pipeline.

A typical solar heating and cooling system includes the following:

Solar collector.—a means for capturing solar thermal radiation in an enclosure with a glass or plastic cover. Since the cover is transparent to the incident solar radiation but opaque to the re-radiated energy, the solar collector, like a greenhouse, serves to trap solar energy and turn it into heat.

Heat storage system.—material which has a high specific heat or experiences a change of phase accepts collected solar heat as available and allows it to be withdrawn as needed.

Source of auxiliary energy.—fuel or electricity to provide heat during extended cloudy periods and to avoid the need for uneconomically large collection and storage facilities.

Heat-actuated air conditioner.—a unit that can be driven by the collected solar heat.

Auxiliary equipment.—the necessary piping, controls, heat exchangers, heat transfer fluid, valves, pumps, motors, etc., to couple the essential elements into an operating system.

These systems could be integrated into buildings designed for efficient thermal control through the choice of appropriate insulating materials for windows, roofs, and floors while maintaining aesthetic architectural design.

Major innovations take time to be introduced into the housing industry and to be accepted by the builder and buyer. However, the stage already has been set to develop the application of solar energy to provide hot water, heating, and cooling in buildings. At least five factors favor such applications:

Rapidly rising fuel costs, widespread demand for air conditioning, industrialization and increased sophistication of the construction industry, public pressure for environmental quality, and, government actions supporting development of solar-energy applications.

The annual capital charges for the solar equipment (e.g., the additional mortgage interest payments attributable to the incremental cost of the solar equipment) indicate that solar heating and cooling could be competitive with conventional systems, particularly with electric heating. Heating and cooling costs can be minimized when solar energy accounts for approximately one-half the total heating or cooling load.

The installation of the equipment for heating and cooling buildings and providing hot water presents the consumer with the need to raise a substantial capital sum for the equipment and its installation at a time when interest rates are rising and mortgage funds are becoming increasingly scarce. Economic conditions today conspire to prevent the consumer from appreciating the full benefit of this solar energy application, which will depend upon the increasing life cycle benefits of saving fuels which most likely will continue to further escalate in price. It is apparent that a comparison of costs of solar equipment with conventional fuels may not adequately reflect the hidden costs, whether they be environmental, social or political, which now are not charged against the conventional fuels. As a more representative cost accounting is developed, these hidden costs will be exposed. Thus, the cost benefits of solar heating and cooling of buildings can be expected to become increasingly favorable as compared with competing fuels.

The basic economic case for substituting solar energy for competing fuels is the desirability of substituting capital for these non-renewable fuels. The capital costs of the installed solar equipment are largely made up of labor at the various stages of production of the equipment and components and the installation of the equipment. Therefore, the application of solar energy embodies human labor together with a certain amount of materials and requires an investment in the equipment as opposed to adopting the easier, short-term option of continuing to use increasingly scarce fuels. The financial burden and the materials and energy used in building the solar equipment present themselves clearly at the time of the initial installation. But once installed, the advantages of solar equipment continue to be experienced over the many years of its operation.

The potential market for solar heating, cooling and hot water will depend on competitive fuel prices and availability, government policies, and the effectiveness of manufacturing and marketing strategies. The total energy requirement for these purposes in new buildings will reach about 14 quadrillion Btu by the year 2000. By comparison the projected U.S. energy demand will be about 160 quadrillion Btu. Supplying solar-heated water to existing buildings could lead to substantial savings, as about 4 quadrillion Btu are being consumed annually for this purpose alone in existing buildings. Theoretically, up to 75% of the energy for these purposes could be substituted for by solar energy, resulting in a maximum potential savings of about 13 quadrillion Btu, which corresponds to about 8% of the projected U.S. energy consumption in the year 2000. Should this theoretical savings be approached, it would equal the likely volume of fossil fuel imports at that time.

Whether the theoretical savings could be approached will depend upon the speed of market penetration and the effective use of materials and energy required to produce the solar equipment. The solar equipment will be a significant user of material. The energy saving will be small during the introductory period. In a typical installation, it will take about one year for the equipment to save the energy required to produce it. Over the life of the equipment, about 20 times the energy required to produce it will be saved. Once solar equipment has been installed on a large scale, the energy required for production will be small compared to the direct savings from the operation of the equipment. The sustained use of solar equipment will have beneficial effects on the trade balance by helping to reduce—and eventually eliminate completely—the projected need for heavy fuel imports. Should this be achieved, the gain to the balance of payments from the operation of solar equipment for heating and cooling of buildings could theoretically be \$20 billion per year.

The environmental benefits of this use of solar energy will be directly related to the environmental damages caused by the fuel which will be replaced. Damage to the environment by solar equipment operation is virtually inconsequential compared to any of the conventional fuels: such use of solar energy does not cause air, water, or thermal pollution; it does not require solid waste disposal, fuel storage, or pipelines, transmission lines or other forms of fuel transportation; it does not create potential hazards. Furthermore, solar equipment sharply reduces land use.

Industry is confident that it can meet the challenges of this emerging market, that it can develop products based on present technology, and that it has the capacity to supply the required resources and equipment. For example, Arthur D. Little, Inc., has brought together in one project 85 industrial organizations that could make a solar heating and cooling industry a reality. The objectives of this project are to define the technology base, establish market prospects and economic projections, and provide the data on which product development and business decisions can be based. An industry based on this near-term solar application not only could be profitable to those contributing to it, but would provide an important alternative to reduce energy consumption.

RENEWABLE FUELS

The fossil fuels burned today were deposited millions of years ago as the result of solar energy-induced photosynthesis. To supplement these fossil fuel deposits, solar energy also could be used to produce organic materials that could then be sources of clean gaseous, liquid, and solid fuels.

For example, gaseous fuels could be obtained from organic materials produced as part of agricultural activities. One ton of dry organic material could produce about 10,000 cubic feet of methane gas. Assuming a 2% conversion efficiency and good growing conditions, one acre could produce 20 tons of organic materials per year. Thus, by adding less than one-third the acreage now used for farming and devoting it exclusively to growing organic material for fuels, current requirements for natural gas could be met by raising crops on 5% of the land area of the continental United States.

In addition to producing methane from organic materials, organic materials could be pyrolyzed to produce combustible gases and oil suitable for use in power plants. One ton of dry organic material would produce about two barrels of oil. Thus, two-thirds of the present U.S. petroleum requirements could be met by utilizing the same 5% land area to raise organic materials. Using the maximum recoverable organic urban solid wastes and agricultural wastes, a useful energy input of 15 quadrillion Btu per year could be obtained. But oil produced from dry organic materials could not compete with natural crude oil unless there were land that could be devoted to this purpose and major developments in farming and harvesting of crops at low cost. For example, the energy required to produce fertilizer would have to be accounted for to establish the net energy produced as well as the energy to provide irrigation water. If all of the urban waste produced in the United States were pyrolyzed, the liquid fuel produced—in addition to disposing of the waste—would satisfy about 1½% of the annual petroleum requirements of the United States. The credit received from the waste disposal would help make liquid fuels produced by modern plants competitive with natural fuel resources.

The alternative of tree farming on a large scale has also been explored. Using modern growing, harvesting, chipping, and drying processes, one could power a 1,000-megawatt steam electric power plant with the wood grown on about 400 square miles of land. Recently, Green Mountain Power, Vermont, was reported to be seriously considering the burning of wood to supply its power plant.

There are no significant environmental impacts associated with the production of renewable fuels. On the contrary, utilization of organic wastes would solve an ever-growing disposal problem.

SOLAR HEAT ENGINE POWERPLANTS

The prospects of focusing the sun's energy to generate steam for a power plant has always been intriguing. A solar-powered steam engine, using a large mirror to focus solar radiation on a boiler, was the central attraction of the 1878 Paris World Exposition. Similar plants were built in California in 1901 and in Egypt in 1913.

Large-scale terrestrial solar power plants have been proposed to work in conjunction with conventional power plants. Several design approaches for solar-energy-concentrating mirrors and thermal storage devices are being investigated. In one approach, arrays of linear parabolic sun tracking mirrors would focus solar radiation onto heat-absorbing tubes. These tubes, coated with effective solar radiation-absorbing coatings, would heat a circulating fluid. This fluid would transfer the heat to thermal storage. Alternatively, heat pipes could be used to transfer the heat from the tubes to the thermal storage. The heat would be withdrawn from storage during cloudy days and at night and transferred to a working fluid, which would then drive turbine generators to produce electricity.

To overcome the heat losses associated with collecting the heat from a large number of parabolic mirrors, an alternative approach that is being investigated is one in which mirrors focus sunlight onto a central boiler placed on top of a tall tower to produce temperatures of up to 1000° C. The design for such a power plant was investigated in Russia several years ago. There, the mirrors were designed to be mounted on supports which could be moved on a circular track surrounding the boiler located on top of the tower. To be effective, the mirrors (heliostats) must track the sun in two dimensions. Computer-controlled tracking could be used to focus individual mirrors onto the central boiler. The tower for a one-square-mile mirror field with a useful power content of 100 megawatts would be about 1500 feet high. With only six hours of energy storage, such plants are projected to have a capital cost of \$800 per kilowatt. Much engineering remains to be done to identify optimum system parameters, evaluate specific component designs and energy storage approaches, and establish the economics of various systems to decide on the specifics of a pilot plant.

Both of these approaches work at their design efficiency only on clear sunny days, indicating that the choice of suitable locations will favor the desert area of the Southwest.

Investigations of the various aspects of such solar heat engine power plants are under way, funded by the National Science Foundation. If these investigations are successful, 10-megawatt demonstration plants are expected to be built during the next five years, and large-scale power plants shortly thereafter. These plants could also be part of total energy systems delivering both heat and electricity.

The environmental impacts of solar heat engine power plants are primarily due to land use, effects of shading of predominantly desert areas, and induced demographic pattern changes.

WIND ENERGY

Solar energy also is available indirectly through the winds, since solar energy sustains the winds. Of the 1 kilowatt per square meter of surface area—the average solar energy reaching the Earth—2 to 20 watts per square meter are converted into kinetic energy. The theoretical power potential in the winds over the continental United States and its seashore exceeds—by at least a factor of 10—the projected needs of the United States for electricity in the year 2000. A practical goal would be to supply 5% of the electrical energy demand exceeding the contribution of hydro-electric plants. Winds are remarkably repeatable and predictable, and the moving air can be extracted by wind generators installed in suitable locations. A wind power system could incorporate an energy storage system; for example, the electricity produced and not directly used could be used for the electrolysis of water to produce hydrogen for transmission through pipelines as an alternative fuel.

In 1915, wind power was generating 100 megawatts of electricity in Denmark. In the 1940's, an 1100-kilowatt machine was experimentally operated in Vermont. Substantial advances in the design of very lightweight airfoils indicate that small-scale wind power generation also may be feasible.

There is a certain minimal wind speed below which a wind generator will not produce power. This "cut in speed" is usually about 15 miles per hour, so to be certain of obtaining adequate wind velocity the generator has to be mounted above the ground level. Although the velocity of the wind increases logarithmically with height above ground, the structures to support efficient wind generators would have to be more than 100 feet high. The practical problem is that the taller the support structure, the greater its cost. In addition, there are aesthetic considerations. Since practical wind power systems cannot be constructed to blend easily with the surrounding landscape, they would either have to be constructed in less-populated regions or in offshore locations.

Where the winds are moderate to strong, large machines are more economic. The typical sizes for a wind generator can range from 20 kilowatts to about 2 megawatts. Preliminary estimates for wind power systems located in the prairie states, in the Lake Ontario region, and in upper Michigan indicate that they could compete in cost with other power-generation methods. There are no critical technical feasibility problems in the design of wind generators. The major unknowns are associated with the degree to which cost reductions and cost uncertainties can be eliminated. Present estimates indicate that the costs of wind generators, without energy storage, will range between \$500 and \$700 per kilowatt.

The land use for wind generators is comparable to that of fossil fuel plants. No significant adverse environmental impacts are expected. Appropriate energy storage methods, such as pumped water, compressed air, or electrolysis of water to produce hydrogen, would have to be developed.

The wind generators could be located off the Atlantic coast, where wind conditions are excellent and there is a huge continental shelf to which floating wind generators could be anchored. The power could be delivered to shore by cable, or the sea water could be used to produce hydrogen (by electrolysis) for pipeline delivery, assuming that this would not result in undesirable environmental effects. The National Science Foundation is sponsoring studies and experiments are in progress to reduce the uncertainties in the application of wind generators.

OCEAN THERMAL GRADIENTS

The temperature difference between the sun-heated upper layer and the deeper cold water of oceans offers another indirect use of solar energy to provide energy for use on land. This temperature difference can be used to power very large heat engines. The concept of using the sun-heated ocean was first put forth in the early 1900's. Experimental power plants were built in 1929 off the coast of Cuba and in 1956 off the coast of Africa. These plants failed because of design limitations and damage by a hurricane. If successfully developed, this approach would make it possible to tap the tremendous heat energy stored, for example, in the Gulf Stream.

Hundreds of specially designed platforms (with a generating capacity of 500 megawatts each) could be anchored in the Gulf Stream to extract this energy. The warm surface waters would be passed through heat exchangers which boil a fluid such as propane or ammonia to drive huge turbines coupled to generators. The cold water pumped from the ocean depth (about 3000 feet) would be circulated through heat exchangers to condense the working fluid. The process would require heat engines that would operate over a temperature difference of about 40°F, for which a practical system efficiency would be about 2 percent. The major challenge would be to develop very effective heat exchangers and to design the large turbines to extract energy from the working fluid. In addition, the materials would have to be able to withstand the effects of seawater for prolonged periods and be kept free of marine growths. The National Science Foundation is sponsoring research programs to explore several design concepts and cost parameters for plants of 100 megawatts or larger. No significant environmental effects of this energy generation method have yet been identified.

DIRECT SOLAR ENERGY CONVERSION

Solar energy can be converted directly to electricity by means of solar cells utilizing photovoltaic conversion. In contrast to thermodynamic conversion, photovoltaic conversion involves no moving parts, no circulating fluid, and no consumption of material. Furthermore, a solar cell can operate for long periods without maintenance.

The first successful silicon solar cell was demonstrated in 1953. Today, silicon solar cells are a necessary part of the power supply system of most spacecraft. As a result of space programs, there is now a substantial technological base for further developments. The two primary research goals are increased efficiency and lower costs. Efficiency of 16% have been obtained. The theoretical maximum for silicon solar cells is 23%.

Silicon solar cells can be purchased today for about \$20,000 per kilowatt. With further expansion of the markets for unattended packaged power supplies—e.g., communication equipment, navigational aids and signaling devices—costs are projected to drop to about \$5,000 per kilowatt over the next several years. New techniques for the production of single-crystal silicon and automated assembly of solar cells could reduce prices to less than \$1,000 per kilowatt over the next 10 years. Once a major market has opened up to justify major investments in the production machinery, the cost of silicon solar cells could decline to as little as five times the cost of plate glass.

The basic raw material for silicon solar cells is beach sand. But several other solar cell materials are under development. A modified gallium arsenide solar cell has resulted in an efficiency of 18%. Today gallium is expensive, but it is as abundant as lead and there is promise that it can be developed as an alternative solar cell material, particularly for use in spacecraft. Another possibility is

copper oxide-cadmium sulfide thin-film cells. These cells, which can be produced by vacuum deposition, are cheaper to make than silicon crystal cells but their efficiency is less than 7%.

Other solar cell material combinations are likely to be developed to meet expanding market needs. For example, the Russians have developed a modified silicon solar cell which can be subjected to a large concentration of sunlight without substantially decreasing their efficiency.

Solar cells in combination with a solar collector could also supplement electricity requirements of a building. Large installations of concentrating mirrors combined with solar cells could lead to low-cost direct solar-energy conversion systems. For example, one square mile of land (e.g., desert area) covered with such devices that have an efficiency of just 10% could generate 180,000 kilowatts when the sun shines. Such large installations could have significant impacts on land-use patterns and future demography. Shadings of areas by solar energy collecting surfaces could unfavorably affect the ecology, particularly in desert areas.

SOLAR ENERGY CONVERSION IN SPACE FOR USE ON EARTH

Terrestrial conversion systems suffer from the fact that sunlight is not constantly available and is diffuse. Thus terrestrial systems will need large solar energy collecting areas and some form of energy storage (e.g., water, pumped to a reservoir, compressed air, electrical storage batteries, or production of hydrogen by electrolysis of water). Consequently, solar energy conversion systems to generate power on a substantial scale will be economical in only those few favorable geographical locations where the capital-intensive conversion systems can be used to best advantage.

These are Earth-bound obstacles, and the way to overcome them is to move the conversion systems to outer space where solar energy is constant 24 hours a day. One approach for the continuous conversion of solar energy is to place a satellite solar power station in synchronous orbit 22,300 miles from the Earth's equator. Two symmetrically arranged solar collectors would convert solar energy directly to electricity by the photovoltaic process. The electricity would then be fed to microwave generators incorporated in a transmitting antenna located between the two solar collectors. The antenna, in turn, would direct a microwave beam to a receiving antenna on Earth where the microwave energy would be converted back to electricity.

Today, microwaves can be converted directly to electricity with an efficiency of 85%. This very high conversion efficiency greatly reduces the undesirable effects of thermal pollution associated with all known thermodynamic processes for power production. The low microwave power density within the beam results in microwave levels beyond the receiving antenna which can meet the severest international standards for exposure to continuous microwave radiation.

Such a satellite can be designed to generate 3,000 to 20,000 megawatts of electrical power on Earth. A system of satellites maintained stationary at a desired orbital location could deliver power to most desired geographic locations with the receiving antenna placed either on land or on platforms over water near major load centers. The absence of gravitational forces and the active environmental influences present on Earth permit the deployment in space of very large areas of lightweight solar collector structures which could not be installed on Earth. Because of the continuous availability of solar energy in synchronous orbit, about one-tenth the area of solar cells necessary to achieve the equivalent power output on Earth would be required. Furthermore, there would be no requirement for energy storage.

A space transportation system based on a modified space shuttle-space tug combination would be used to orbit the satellite. The capital cost of a 750-megawatt prototype satellite, including the orbital and ground-based systems, space transportation and assembly, is projected to be \$1500 per kilowatt. Further cost reductions for larger-output satellites could be achieved by advanced space transportation systems.

The feasibility of such a satellite solar power station was assessed by a group of companies (Arthur D. Little, Inc., Grumman Aerospace Corporation, Raytheon Company, and Textron, Inc.) with partial support from NASA. The results of this feasibility assessment have shown that this concept is worthy of consideration as an alternative energy production method, and that it could be cost competitive with other advanced energy production systems. Furthermore, a pilot experiment could be performed in orbit in less than 10 years. Using state-of-the

art technology, a prototype satellite could be demonstrated in the early 1990's and a commercial system could come on-line before the year 2000. This significant application of space technology could benefit not only the United States but many nations which do not have large sunlit areas within their boundaries.

The satellite solar power station environmental impacts are expected to be less than those of other energy generation methods of comparable output. The features which will lessen environmental effects are: the high energy conversion efficiency at the receiving antenna (85% microwave-to-DC already demonstrated); the reduced land area for energy conversion (one-tenth of the area of terrestrial solar energy conversion); reduced shadowing effects at receiving site (receiving antenna is 80% open mesh structure); a one-year energy payback period for system components and space transportation propellants; control of receiving antenna albedo so that desired energy balance can be approached (average microwave energy density is about one-fourth of solar radiation received by antenna;) choice in receiving antenna sites to reduce transmission line requirements. A preliminary assessment of environmental impacts—such as, troposphere and stratosphere pollution from space transportation system exhaust products, microwave effects on plants, birds and aircraft, and radio frequency interference—indicates that these could be controlled and reduced to acceptable levels.

THE FEDERAL ROLE

There are several steps the Federal Government can take to hasten the introduction of solar technology. Once technological and economic feasibility and potential market acceptance for specific applications are demonstrated, industry should be able to build up the capability to mass-produce the systems and components required. To achieve this, the Federal Government should support such industrial development as the R&D and demonstration programs. The Federal Government should explicitly prepare and reveal a consistent and coherent National energy policy. The importance of the Government's energy role in today's world is obvious. Yet, this role is in flux. Industry does not know whether National policy will result in an energy price structure which is high or low or which directs efforts on developing alternative energy sources toward meeting short- or long-term goals. Hence, industry decision-makers are still in the dark concerning future investment strategies.

In addition, the Government has an important role to play: i.e., the development and demonstration of solar energy on a commercial scale, the establishment of a central source of standards and research literature, the aggregation of the market among Federal agencies, the identification of and reduction of institutional barriers, and the development of legal concepts to define and protect "sun rights."

Because of the potential harvest of new ideas and developments of solar-powered systems, special attention should be given to solar energy applications within the bureaucratic framework of a government agency to ensure the richness and diversity of development. Hence, solar energy should be supported by a distinct, viable office within the Federal bureaucracy which has public visibility.

The early introduction of solar energy appears to rest in large part on effective encouragement by the Federal Government. Thus, concurrent with successful demonstrations, both producers and consumers must be encouraged to take the next logical steps toward developing a mass market through selected and effective subsidy programs. Therefore, legislation dealing with government incentives as well as government support of solar energy-related research and development will be required.

Although research and development are necessary, the market and product development needs must also be addressed. For example, the technology base for heating and cooling of buildings is adequate to meet demonstration program needs. However, other solar technologies need further development, particularly to achieve cost reductions so they could be competitive. Industry is looking for potential markets to initiate significant development activities.

Industry should be encouraged to invest in new product development and be given the opportunity to retain commercial proprietary rights. An enlightened Government policy on proprietary rights will greatly increase industrial participation.

Before making major investments, industry needs to be assured that, as the market for solar technology develops, there will be a continuity of Government policy.

CONCLUSIONS

The evolving energy situation has led to a re-examination of the various solar energy options to meet projected energy demands. The importance of the contribution of these options will increase as the required developments proceed and as other alternatives are found to have potential conflicts with resource conservation, public health, international trade and politics, environmental protection, and social equity. A consensus is emerging that solar energy has a significant place as new research initiatives, institutional mechanisms and policies are being developed, combined, and coordinated to evolve a rationale for National energy policies to benefit society.

Industry is recognizing the potential of the solar energy options and is taking initiatives to develop products and provide services in several important solar energy application areas. These activities can be reinforced by Government funds directed to support research and development in the most promising solar energy application areas and to undertake demonstration projects. At present the funds allocated to these activities by the Government are still only a small percentage of the total United States energy R&D budget, but successful demonstration of solar energy application should lead to significant increases in the funding levels.

Congress senses that the public wants to benefit from expanded solar energy applications and is passing effective legislation to support development and demonstration projects. It is obvious that there are many devices and processes which remain to be invented and developed and to which this Nation should devote an appropriate measure of attention.

There is every reason to think that the increased activities in solar energy applications will be of worldwide benefit—for solar energy is the only energy source available to all nations. Its effective utilization by all will not diminish the source of supply and could result in society achieving the balance with nature which will be necessary to attain the full potential of human civilization. The steps we take now to develop solar energy will contribute not only to the goals of Project Independence but also will be vital to future world economic development to assure a planned transition from limited non-renewable energy sources to alternative energy sources.

STATEMENT OF GULF OIL Co.

In recent months a considerable amount of attention has been focused on the need to establish a broad-ranging and achievable national energy policy. The efforts reported in the Project Independence Blueprint were a major step in the formation of such a policy. Gulf, with other interested citizens, contributed our thoughts on the policies necessary to achieve energy independence. We appreciate this opportunity to again highlight those points.

The establishment of a viable national energy policy is a necessary and desirable step if we are to meet our country's long-term energy needs. The U.S. should strive to produce ninety percent of its total energy needs from domestic sources within the decade. This goal can be achieved if industry and government work together to establish a consistent energy policy that is designed to best meet the long-term needs of the nation. This goal can be achieved if industry and government work together to establish a reasonably permanent, consistent, long-range energy policy that is designed to utilize the proven effectiveness of the profit incentives inherent to a free market economy. Encouraging conservation of energy by industry, government and the public is also an important step. Private enterprise can effectively increase America's energy production only within a framework of favorable public policies. Gulf proposes immediate attention by the government to the following issues:

Elimination of price controls.—To stimulate rapid development of all energy sources, a return to free-market conditions is absolutely essential. Controls on the price of petroleum and natural gas must be eliminated. Decontrol of prices will encourage maximum supply in the shortest time and in optimum forms to balance and further discourage wasteful use of existing energy supplies. Resulting acceleration in domestic drilling would also cause increased domestic production of petroleum and natural gas, as well as encourage the development of alternate energy sources.

Gulf has proposed that a "profits plowback" law be enacted for a period of three years which would permit a credit for investments in new energy develop-

ment, research, and environmental protection. The public would thus be assured that increased industry profits would be used in efforts to accelerate the search for new energy.

The Federal Energy Administration Task Force in drafting "Project Independent Blueprint" recognized the importance of prices; the Blueprint contrasted development of domestic supplies and conservation, given either \$7 or \$11 per barrel crude oil prices. Enhanced recovery methods spotlight the need for free-market prices; secondary and tertiary recovery methods are also increasingly expensive. Two-thirds of secondary recovery oil is still price controlled. Such methods are economically unattractive without incentives, and less effort is made to recover supplies under present controls. For these reasons all domestic crude prices should be decontrolled and two-tiered price system completely eliminated.

Deregulation of natural gas.—Decontrol of natural gas prices will encourage more efficiency use of energy. On a BTU equivalent basis, electric utilities were buying natural gas for 44¢ per million BTU in April of 1974 as compared to 64¢ for coal and \$1.89 for oil. The average price of intrastate natural gas sold in Texas on a free-market basis has been about \$1.30 per thousand cubic feet. Under a new ceiling approved by the FPC for interstate new natural gas, the price is 51¢. Obviously, this will encourage excessive use of natural gas in applications where other more plentiful fuels should be used. Gulf has stated consistently that natural gas prices must be decontrolled. Action necessary to correct this problem should include the following points:

1. "New" gas should be free from price regulation to find its true market value.
2. "Old" gas which becomes available as a result of expiring contracts should also be freed from controls and FPC regulations. This also includes "old" gas which is newly entering the area of interstate commerce.
3. The government should increase the size and frequency of leases of federal lands for development of oil and gas.
4. The use of natural gas in undesirable areas such as for boiler fuel, etc., should be discouraged.

Mandatory allocations.—A most negative impact on energy supplies was caused by the mandatory crude petroleum and product allocation program, which merely redistributed present supplies. By penalizing those who invested millions of dollars to develop new resources, these mandatory rules have only discouraged any further risk of capital toward development of domestic crude resources. Minimizing energy supplies in the future is the first priority to serve the public interest, not the redistribution of our present supplies.

Conservation.—Gulf fully supports a national commitment to the conservation ethic. A return to the free market prices for all fuels will generate conservation on a voluntary basis as consumers act to minimize their energy costs. The American people must also continue the admirable conservation practices which they have begun. Mass transit systems must receive an increased commitment. Detroit should be encouraged to produce smaller, more fuel-efficient automobiles, and serious consideration should be given to the prospect of a horsepower or weight tax on automobiles.

Outer Continental Shelf.—In a maximum effort to develop available energy sources, development of the Outer Continental Shelf is a high-priority item. The OCS has the greatest potential for undiscovered reserves of oil and gas. Accordingly, the Department of Interior must accelerate its OCS leasing program. The Atlantic Coast should be opened for exploration and drilling, and leasing must be resumed in the Santa Barbara Channel. These sections of the country should contribute their fair share to the nation's energy needs by encouraging rather than attempting to delay development of resources in these offshore areas.

To achieve swift development of the OCS, the delay factor in the leasing procedures must be overcome. Presently, each OCS lease sale is preceded by environmental hearings which are extremely time-consuming when conducted on the present sale-by-sale basis. It is necessary to evaluate possible environmental problems, but this could be done more efficiently if data for entire OCS areas were developed prior to the decision to initiate sales in those areas. Lease sales covering specific tracts could then proceed over an extended period of time as they do now.

That the OCS can be developed with little effect to the environment is proved by past experience. Since federal leasing began, more than 18,000 wells have been drilled. Only four major spills have occurred, and none of these caused any lasting environmental damage.

To provide necessary capital requirements for development of offshore tracts, Gulf suggests modifications in the present bidding system. A major portion of capital requirements now goes toward lease bonuses, rather than development of new reserves. A system to channel this bonus money into drilling and evaluation of OCS leases is needed. The Halbouty proposal (calling for cash bonus biddings to continue with sealed bids submitted, and the lease awarded to the highest bidder) is the best one at present. Rather than paying an actual sum to the government, cash bonuses would obligate the successful bidder to spend an amount equal to the cash bid for exploration and development of the tract. Only those sums not so used would flow into the treasury. Security for commitment of funds could be in the form of a bond or bank letter of credit. Gulf proposes using the money in a basic order of priority.

1. Development of OCS tract acquired.
2. Development of other OCS tracts acquired in current or previous sales.
3. Development of other sources of energy.
4. Research and development of petroleum and other sources of energy.

Deepwater Ports.—Since some importation of foreign crude is inevitable, it is in the national interest to improve receipt of oil from supertankers. The U.S. now has no offshore oil ports to accommodate these efficient tankers. Costs of transporting a barrel of crude oil from the Persian Gulf to the Gulf of Mexico can be reduced by as much as thirty-eight percent using a 500,000 ton ship. The Nathan Report (prepared for the Corps of Engineers) estimates savings of \$600 million for the U.S. in 1980—a definite advantage to the consumer. Use of supertankers also provides an environmental advantage, as reduction in ship traffic would decrease accident potential.

Urgent need is one powerful reason why superports should be built by oil companies. Two years have already been spent planning two offshore ports on the Gulf Coast; these ports can be put into operation faster and more efficiently by the profit motive oriented oil companies. If it were even possible in these economically-complex times to use taxpayers' money to build such ports, practical considerations indicate oil companies' far greater preparedness to provide necessary capital. Financial risks involved in offshore port construction indicate that private ownership is essential. SEADOCK alone is estimated to require \$700 million; and additional \$125 million is necessary for pipelines. No corporation would risk such an enormous investment without the hoped-for benefits of ownership.

Refinery Siting.—In the matter of refinery siting the cooperation of industry and government is necessary if we are to meet the energy needs of the nation. Since a larger portion of the crude oil we will be importing will be of high sulfur content there will be a great need in the future for domestic refineries that have the capability for charging sour crude. The government must establish a consistent and reasonable regulatory process for approving refinery sites. All areas of the nation must accept the fact that refineries must be built somewhere if we are to attain a significant degree of energy self-sufficiency. It is particularly along the East Coast that refining capacity is needed since this area has forty percent of the daily domestic demand for petroleum products but only about twelve percent of the refining capacity.

Coal.—Coal can again play a vital role in meeting U.S. energy needs during the 1980's. America has an abundant supply of coal (as much as 300 or more years, according to some estimates). A workable environmental trade-off must be made to utilize this valuable resource. New technological processes to extract oil and gas from coal should be encouraged. Coal liquefaction is especially needed for future demand. Cooperation between industry and government will cause a liquid fuel from coal project to be brought on-stream fairly soon.

Nuclear Power.—Construction of 275-300 domestic nuclear power plants should begin immediately. The arguments put forth by the environmental lobby against the construction of these plants are based on grounds seeking perfection to minimize remote risks and ignoring the outstanding safety record of the nuclear power industry to date. A massive nuclear fusion research program should be developed over the next thirty years, along with an accelerated program for development of breeder reactors.

Energy Research Programs.—Government should fund and encourage industry participation of long-range research projects in coal liquefaction and gasification. The role geothermal power and solar energy can play in meeting U.S. energy needs should be studied and outlined.

Crude Oil Storage.—In order to prevent a situation with which we were faced last winter, Gulf feels Congress should approve the creation of 500 million barrels of crude oil storage as recommended by the National Petroleum Council. This could be located in one or more of the Gulf Coast salt dome projects.

Ecology.—Development of new and alternative energy sources must begin *now*. Protection of America's environment and increased energy supplies can be balanced. A common ground, wherein environment survives or improves and maximum energy is produced and used, must be found.

In conclusion, there is one important factor which pervades all of the issues previously discussed. That factor is the uncertainty of government action.

It is difficult for any business to operate in a climate where the ground rules are constantly changed. The oil and gas industry is a high-risk business with unusual economic and planning conditions. An atmosphere of political uncertainty greatly compounds the problems of evaluating risks of future operating conditions. Provided with a stable and reasonably assured long-term national energy policy within which to work, private enterprise can make the investments necessary to obtain energy self-sufficiency as rapidly as possible. This can, however, only be done in a climate in which industry and government work together to achieve America's energy goals.

STATEMENT OF THE NATIONAL ASSOCIATION OF MANUFACTURERS

I. INTRODUCTION

The NAM believes the *Project Independence Report* represents a highly worthwhile undertaking in that it brings together analyses which can serve as a springboard for public debate. As the Report states "The embargo made obvious the need to reevaluate our domestic and international energy policies and to fashion a new energy program." Unemployment caused by this embargo struck 500,000 workers, while Gross National Product dropped 10 to 20 billion dollars.

Although we have not yet fully analyzed the *Project Independence Report*, we can make some general comments which convey our views on what a National Energy Policy should be, as well as some of our reservations in regard to the Report. Some of these reservations relate to the serious problems of capital formation in this country, of materials and equipment shortages, and of the balance of payments deficit resulting from excessive reliance on overseas sources of petroleum. We believe a number of the alternative assumptions and conclusions contained in the Report are overly optimistic in view of the continuing efforts to restrict development.

II. HIGHLIGHTS OF NAM VIEWS ON NATIONAL ENERGY POLICY

The basic issue underlying the development of a National Energy Policy is "quality growth" versus "no growth." This country has historically pursued a "growth" policy and it has served us well. In recent years, we have followed a "quality growth" policy, and we should continue to do so. Within the context of a growing economy, we have accomplished many socially desirable objectives.

The close correlation between GNP per capita and energy use can be shown. While such a correlation does not necessarily mean that energy consumption is the sole cause of increased Gross National Product, this relationship has been apparent through time in the United States and across countries. The relationship between energy and GNP, employment, standard of living, etc., must be seriously considered, and we must question what the consequences might be to the United States if the relationships are valid and we fall short of the needed energy resources.

We believe that the adoption of a "no growth" policy would be highly dangerous. Our nation must either grow or die. Failure to grow would inevitably mean:

- Weakening of our national defense.
- Limited job opportunities.
- Curtailed of trade opportunities abroad.
- Drain upon our resources and our ability to expand in other areas of the economy.
- Reduced ability to protect our environment.
- Reduced ability to protect our health and safety.
- A decline in our standard of living.

Abundant energy supplies at reasonable prices are indispensable to growth, and a unified national energy policy should be designed to assure this goal for the United States. The National Association of Manufacturers supports the development of a National Energy Policy which would facilitate the production and distribution of all forms of domestic energy resources with appropriate environmental safeguards. This National Energy Policy should embrace:

- Long range planning and accelerated research by both government and the private sectors.

- Removal of regulatory impediments to production and distribution of abundant energy supplies.

- Decontrol of oil and gas prices.

- Opening of public lands, including the Outer Continental Shelf, to development.

- Accelerated development of nuclear power generating capacity.

- Establishment of a new federal department incorporating agencies presently dealing with all aspects of pollution control, water and land use planning, and natural resources planning and development.

- Reasonable and practicable air and water quality standards.

- Taxation policies which would attract capital and manpower into enterprises producing and distributing energy supplies.

- Encouragement of an aggressive voluntary program of energy conservation.

In the July 1973 "Report on Emergency Preparedness for Interruption of Petroleum Imports into the U.S.," the National Petroleum Council concluded that in 1974 the U.S. would be importing 42 percent of its oil requirements and by 1978, 59 percent of its requirements. Most of these additional imports were to have come from the Middle East.

The October 1973 cut-off of petroleum by several Middle Eastern countries is a clear warning that the U.S. must not rely on uncertain sources for so important a commodity. Today, these sources are again available. If we elect to buy oil over a long period of time at the new, dramatically higher prices, the Balance of Trade deficit will become an intolerable burden and significantly reduce the resources available for domestic development.

Clearly the option of "Business as Usual" is not an acceptable alternative because of the size, cost, and uncertainty of future oil imports. The situation on the contrary indicates that a vigorous program to increase domestic energy supplies is essential. At the same time a complementary program of energy conservation is also needed.

We generally support the policies to accelerate domestic supply outlined in the Report. However, we are concerned that, to achieve the projected supply increases, will require actions several years in advance. While a number of potential constraints on increasing supply have been acknowledged, it is not clear that capital, equipment, and manpower will be available early enough in the 1974-1985 time frame. Capital funds have recently been in very short supply and it does not appear that GNP growth in the very near future will offer any large increases in capital funds.

In addition to economic constraints, we are concerned that other constraints will be significant problems. We believe that OCS leasing should be undertaken aggressively, consistent with proper environmental safeguards. Because of political problems it appears less and less likely that this will occur on a scale necessary to reach the FEA projections.

OCS areas appear to be our most promising potential and possibly least environmentally objectionable source of supply. With this in mind, an aggressive OCS leasing program must be pursued.

To meet air and water quality standards, more funds, not less will be required by industry and the public sector. These standards and the redirection of funds to achieve them will present barriers to achievement of the FEA supply projections. Government policy however could achieve two beneficial results by allowing intermittent control systems to achieve standards for ground level concentrations of sulfur dioxide. Use of tall stacks and intermittent control systems could reduce consumption of scarce low sulfur fuels by 90 percent, and avoid substantial capital costs for installation and operation of so-called scrubber technology. The health related standard would still be met.

We endorse the proposals of the FEA to amend the Clean Air Act to provide that tall stacks and intermittent control systems are allowable as permanent

control strategies, and to require the EPA Administrator to review all sulfur emission limitations under State air implementation plans and to extend compliance deadlines in areas where the limitations are more stringent than required to attain ambient air standards, if a clean fuels deficit exists.

NAM has supported reasonable surface mining legislation which would encourage restoration of mined lands. However, it appears that the bill recently passed by the Congress could significantly inhibit the coal industry's production at a time when coal is an important part of a domestic supply strategy.

The target for accelerating supply should be set higher. The Report is based on the assumption that products and services can be produced in the future with considerably fewer units of energy than is currently the case. *Project Independence* assumes energy use per unit of GNP below even the 1964 rate, the lowest in the period since World War II. A survey of the historic trends in the relationship between energy consumption and Gross National Product shows that this is unlikely to be the case. Consequently, we believe the target for accelerating supply should be set higher.

On the subject of energy conservation, we support an aggressive voluntary program. There are many problems of equity, administration and effectiveness which we believe make a mandatory program undesirable. Further, progress has been made through a voluntary program, and such a program could be improved to make it more effective.

Earlier this year, the NAM and the U.S. Chamber of Commerce published the results of a survey of industrial energy consumers. This showed that 95% of the companies responding (612) had undertaken an assessment of energy usage and about 80% had adopted a plan to conserve energy, 95% had undertaken specific measures to reduce energy consumption, 28% indicated that they were investing capital to achieve this objective. At the time of the survey, many firms had already achieved 5% reductions in energy consumption and some even more. In addition, many individual manufacturing companies have participated in the FEA/Commerce voluntary conservation program the past few months. This program has future potential. Adjustments are thus being made within the present voluntary system. For several reasons we believe that moving over to a mandatory system would not be as helpful as might at first seem apparent. The following comments relate to problems within industry, but many similar problems would also apply to individuals.

First, it would be unwise for instance to establish as a matter of law, a set percentage reduction for all industry, or any component. Each industry and process often starts from a different basis and has different economies and energy conservation potential. For some industries and processes significant conservation may be possible. For other industries and processes, however, significant conservation probably is not possible without a technological breakthrough. Some companies and industries have already done much to conserve energy and unless this is taken into account, they could be penalized unfairly under a mandatory program.

A mandatory energy conservation program neglects the impacts on the wider economy. Energy is only one of many inputs into the manufacturing process. Selection of a system which minimizes energy consumption may well result in a waste of capital, manpower or of other materials. A balance will have to be struck and this balance will be best achieved through a voluntary system relying on market forces.

We think it would be unwise to alter the present system. However, we feel that it should be considerably strengthened in order to attain our national conservation goals.

Serious attempts at energy conservation will not be made unless a serious problem is perceived. Once the embargo was lifted a certain complacency about energy supplies set in both among the general public and among individual firms. The comments of public officials have contributed to this situation. Some of these comments have induced the public to believe that energy supplies are adequate for this winter when, for certain fuels such as natural gas, they are plainly inadequate. A voluntary program will become more effective when a more accurate picture is presented to the public. Accordingly, we recommend an aggressive program of public information.

Second, information on conservation techniques must be more widely and effectively disseminated, and NAM is committed to cooperative efforts in this regard.

Thirdly, we believe that existing barriers and disincentives to conservation should be removed. The basic rationale behind conservation efforts is to reduce the dependency of the U.S. on energy imports; industrial conversion to alternative energy sources such as coal and wood residues would contribute toward the objective. Environmental constraints coupled with technological and economic constraints significantly inhibit our ability to make use of our domestic energy resources in the near and middle term.

Industry and the federal government must jointly identify constraints on energy conservation, particularly those government-imposed, and should develop recommendations for legislative or administrative action to remove these constraints.

III. NAM STUDIES IN THE ENERGY FIELD

We would like to submit for the record of the hearings several NAM documents which are relevant to the matters being considered by the Committee.

The first of these is entitled "A National Energy Policy to Improve Our Quality of Life and Insure National Security." This was the product of six months of intensive work by NAM Committees, and was adopted by the NAM Board of Directors in December, 1972, well before the oil embargo. Perhaps its most significant statement is that "The ad hoc diffuse, and often conflicting approaches to individual energy issues that have marked the past can no longer be tolerated. There needs to be full recognition that all energy-related matters must be analyzed as parts of a total and unified subject which has as its foundation well defined energy policy direction, and which recognizes the interplay of economic, reliability, and environmental concerns."

Another submission is the NAM Action Program for Energy Use and Conservation. The Action Program, while used to encourage member companies to conserve energy in their operations and produce energy-efficient products, is primarily a program of activities to assist companies achieve energy conservation within their operations. Mr. Chairman, we pledge to continue our cooperation with the government in the cause of energy conservation and in the dissemination of information to the general public.

We are also submitting a copy of our testimony on energy conservation legislation which we presented to the Senate Commerce Committee on November 26, 1974, and a copy of our statement on implementation of the Clean Air Act which we submitted to the Senate Public Works Committee on May 31, 1974, and which indicates that EPA may be insisting on control technology involving excessive energy demands. This also underlines the point that abundant energy supplies are essential to effective pollution control programs.

IV. CONCLUSION

Government studies indicate that we should create 40 million jobs by the end of the century. Each year of delay could increase the unemployment rolls by two million people. American industry would like to create those 40 million jobs. But we won't be able to if there is inadequate energy to power our plants.

STATEMENT OF CARL E. BAGGE, PRESIDENT, NATIONAL COAL ASSOCIATION

My name is Carl E. Bagge. I am president of the National Coal Association, which represents most of the nation's commercial coal producers and selling companies. NCA appreciates the opportunity to present testimony on the Project Independence Report prepared by the Federal Energy Administration.

I. INTRODUCTION

During the nationwide hearings on Project Independence six witnesses representing the National Coal Association presented testimony on the role of coal in an energy independent America. From these presentations came a clear call for positive government action to enable the coal industry to maximize the huge potential wealth inherent in America's vast coal resources.

It is evident that there must be a national commitment to coal development. Absent that commitment there can never be real energy independence for the U.S. or even a sufficiently viable domestic option for energy supply to permit us to maintain a semblance of bargaining parity with the oil producing nations of the world.

We have received the final version of the report on Project Independence prepared by the Federal Energy Administration and are disturbed by its seeming lack of concern for coal, America's number one energy resource. In addition we decry the cavalier way in which it treats those things necessary to permit the coal industry to reach its full potential.

In the following we have attempted to touch upon those parts of the report which we find most objectionable and which would, if uncorrected, most hinder the growth of the coal industry.

II. CRITIQUE OF THE PROJECT INDEPENDENCE BLUEPRINT

From the beginning, the coal industry has pointed to the central role of coal in any national strategy to achieve even the option of Project Independence. Our position was shared by many if not all knowledgeable observers who accept the basic premise that America simply cannot continue to depend upon foreign energy resources for a growing percentage of its energy needs.

Unfortunately, the report by the Federal Energy Administration does not come to the same conclusion. From reading the Project Independence blueprint the coal industry can only conclude that its future contribution to the energy needs of the nation will be minimal, that the industry could well slip back into the chaotic competitive situation of the 1950's and 1960's, and that the nation's energy future belongs to the oil and gas industry, imported fuels and nuclear power.

We find it difficult to accept such a conclusion in view of the huge reserves of coal available to the U.S. and the real opportunities to reduce our dependence upon foreign sources by rational conversions to coal. Moreover, the tremendous potential for both economic growth and national security inherent in the development of the coal resource argue persuasively against such a conclusion.

Perhaps the greatest short-coming of the report is the cavalier way in which coal expansion is treated. The blueprint suggests that coal production levels of one to two billion tons by 1985 are possible, the only constraint being demand. It therefore assumes a large and untapped coal capacity in being, or one which could be brought onto line with a minimum of effort.

The National Coal Association believes that the coal industry is capable of almost any level of expansion, provided that the external climate is conducive, and provided that the signals for such expansion are given in a timely manner. But, given existing conditions, there cannot be and will not be the type of expansion which this nation needs, except during periods of emergency such as we are now experiencing. The report supports the continuation of coal as an energy ambulance, and eschews the needs for a comprehensive national policy looking to coal expansion on a rational and systematic basis.

The thrust of the report suggests a significant decline in the price of imported oil. Such an assumption is open to serious question given the current solidarity of the producing nations. It also dooms the development of a domestic synthetic fuels industry based either on coal or oil shale. For absent a proper response from government the current level of entrepreneurial risk is intolerable.

Finally, the treatment of coal vis-a-vis both oil and nuclear power is not in keeping with the facts, for at least three reasons.

First, to seriously suggest the continued or even increased reliance upon oil for power generation, as the report does, is indefensible. Regardless of short term price fluctuations in the price of foreign oil, we cannot believe that a rational energy policy would permit the growth of already scarce oil for boiler use when abundant coal resources can adequately meet this need.

Second, while we recognize the value of nuclear power and the role it must play in our energy mix, and while we are prepared to compete with it for the utility market, the report's assumption that nuclear power is cheaper than coal is certainly questionable. There are too many intangibles involved in power plant economics to support such a conclusion as recent experience has demonstrated. In addition, the economics of nuclear power is tied to the solution of pressing problems such as enrichment capacity which should eventually be turned over to private industry if the nuclear and coal industries are to compete on an equitable and truly competitive basis.

Third, the report tends to minimize the impact upon coal if oil and nuclear development fall short of the optimistic projections contained in the report. Thus, coal can well find itself, in a decade, in a position of critical importance without being able to meet that responsibility because of still another decade of neglect by the nation's energy policy makers.

Finally, we must question the conservation section of the report. We believe in energy conservation and have and will continue to support measures to achieve substantial measures of energy saving. But, as we read this report, and others of a similar nature, we question whether Americans will be willing to accept a lowering of lifestyle called for by such conservation measures. For, in a sense, our energy shortages stem from the way in which we use energy, not from a shortage of energy resources. Given this, we must look to energy development with at least the same degree of urgency, as we look to energy conservation. The report does not do this.

Perhaps we should define the term "energy conservation" as we use it. Surely the term has been widely used, often to suggest a curtailment of our national living standard in order to achieve other supposedly desirable goals, such as environmental quality, freedom from reliance on foreign fuels, etc. To us, true "energy conservation" is a concept with far broader implications which could include the following:

Using abundant resources where possible, while saving scarce resources for those uses where they have unique advantage.

Developing more efficient methods of fuel production, distribution and utilization. (For instance, increasing the thermal efficiency of a generating station from 40% to 50% would make possible major fuel savings and thus stretch the life of our fuel reserves.)

Encouraging more careful use of energy by the public within present lifestyles. For example, properly insulated homes not only conserve fuel; they are more comfortable.

Finally, actual curtailment of energy use if no other course remains open, and when continued rates of consumption would obviously damage the national welfare.

The treatment of coal development in the report underscores the secondary position to which the authors have consigned the coal industry.

For example, on page 20, coal is not even mentioned as one way to increase the domestic supply of energy. Rather, the strategies involved call for accelerating federal leasing on the Outer Continental Shelf, opening the naval reserves to commercial exploration and removing regulatory delays to nuclear power. It is inconceivable that coal would not be considered as a viable option.

On page 28 the report states, "Domestic coal supply is not expected to be a constraint." Historically, coal capacity has greatly exceeded coal demand. That circumstance, however, is no longer valid in light of current supply/demand relationships. We can mine as much coal as America needs. But in order to do so the coal industry needs a positive climate for growth and a national commitment which will permit orderly coal expansion, tied to recognized demand, at profit levels sufficient to attract capital. Equally important, this commitment must be undertaken in time to bring capacity on line. If such a commitment does not take place, the ability of the coal industry to respond to future demand will be greatly minimized.

On page 48 the report states that the accelerated supply case results in a decline in coal production. The logic upon which the authors could base the conclusion that a more rapid than normal growth in demand would result in a decline in the production of coal seems to us to be convoluted at best.

On page 67 the report states, "The potential for coal development is virtually unlimited under accelerated conditions if no equipment, manpower or demand constraints are assumed." Such assumptions simply do not square with existing realities. To assume that such constraints exist—indeed to assume that they are the only constraints—demonstrates that we are still laboring over the delusion that coal, in fact, can remain as the principal emergency fuel without close attention being paid to its long-term development.

On page 106 the report comes to a conclusion which is inconceivable to us. It says "The coal industry has the capacity to satisfy almost any foreseeable demand for coal by 1985, at prices near 1972-1973 levels and considerably below current spot market levels."

Coal mining is a highly complex industrial undertaking. For significant expansion to occur there must be favorable climate for such expansion. To assume that the coal industry can grow by a factor of two or three simply by an extension of past trends without a conscious national decision to encourage such growth, ignores the realities of normal industrial life. A new coal mine requires heavy front-end capital investment. The labor force has to be recruited and

trained to deal with complex machinery in a hostile environment. Technical skills must be developed over time as must the managerial ability to insure the smooth, safe and economic operation of the mining facility. This, under modern conditions, is no easy task, especially since the task involved exceeds that of any other point in history for the coal mining industry. Therefore, to assume infinite capacity is simply at variance with both fact and logic.

Finally, we believe that the demand structure of future energy needs unfairly excludes coal. We do not, for example, agree that nuclear energy is the cheapest source for base-load energy. We do not think that lumping nuclear and coal capital costs together as is done on page 122, accurately portrays the true parameters of nuclear-coal competition. Nor do we believe that the 30 percent nuclear capacity suggested by the report is feasible in the timeframe involved. At the same time we do not believe that the nation's electric utilities should ever again be permitted to expand their use of oil, especially since oil must increasingly come from foreign sources. Instead, we believe that for many reasons the utilities will turn increasingly to coal if in fact they are permitted to do so.

There is one final point which should be considered. A part of achieving Project Independence involves an examination of end-use patterns for fuel. This must be done within the parameters of the free market system. But true energy independence and true conservation involves singling out those fuels which we have in abundance and "conserving" those energy resources which are in short supply for unique application. Therefore, to the extent that the report on Project Independence ignored this aspect the report does not truly address the full requirements of an energy independent America.

The inter-agency coal task force on Project Independent Blueprint made a series of recommendations which we believe forms the basis for a coal industry responsive to America's future energy needs. These recommendations are set forth below because in our opinion they address the key ingredients of coal growth.

"1. The coal task force's first concern is the resolution of policy issues pertaining to the following, which now or in the future will affect increased coal production: (1) air pollution regulations, (2) oil imports and prices, (3) natural gas pricing and policy, (4) western land leasing, and (5) surface mining legislation. Such resolutions would reduce the uncertainties affecting the coal industry and thereby stimulate the investment required (a) to satisfy the demand determined to a large extent by the first three policies and (b) to develop the reserves of a type and in the areas determined to a large extent by the latter two policies.

"2. The coal task force's second concern is that these five key policy issues be resolved in favor of coal. This means:

"a. Implementing the Clean Air Act such that health-related air quality standards are attained and new source performance standards are met by new sources, but such that (i) these standards are met in the least costly way consistent with the Clean Air Act, (ii) state implementation plans which are more stringent than required by these standards are amended, and that (iii) coal users are to implement appropriate control strategies such that secondary standards will be attained within a reasonable time.

"b. Implementing an oil import program (and/or related policies) that would stimulate the use of coal rather than oil in large boilers (e.g., electric utilities) and also the production of synthetic fuels from coal.

"c. Implementing a natural gas policy that through price or allocation would discourage the use of natural gas in large boilers.

"d. Implementing a strip mining policy that insures that land is adequately reclaimed but that does not unnecessarily restrict the availability, nor drastically increase the costs of, strip mining.

"e. Implementing a new western leasing policy that enables leaseholders with noncontiguous parcels to accumulate large enough blocks for more economical mining; that results in enough leaseholders such that those who show a bona fide interest in early, active development of minable reserves are not precluded by conditions where present leaseholders of underdeveloped reserves in effect control reserve availabilities; that uses information currently being developed in the Northern Great Plains Resources Program study and other studies as a guide to an optimum balance between coal production and utilization, and that is contingent upon adequate planning for the development and protection of all resource values affected, and upon maximum control over stimulating production, where desirable, while at the same time protecting social and environmental values from unnecessary or irreversible damage."

We believe that the energy independence of the United States is a vital national objective. To us there is no conceivable way to achieve energy independence without heavy reliance upon coal. Such reliance presupposes the movement of coal from a secondary position to one of primacy. Such a movement can take place within reasonable economical, environmental and socio-political parameters. But it will not, and it cannot, take place unless the nation is prepared to do what is necessary to assist the coal industry to meet this new challenge. If it does, we can, in fact, be independent or even self-sufficient.

During the hearings on Project Independence held across the country, six coal industry witnesses representing the National Coal Association testified on the potential and the problems surrounding coal growth. Since much of this material was not reflected in the report on Project Independence, we wish to summarize it for your consideration, in the hope that it will help you and others charged with the development of a truly responsive national energy policy. We also are enclosing copies of the coal industry witnesses' statements for inclusion in the record.

From the coal witness presentations, several major facts emerged about the coal industry and its role in the future of this nation. We believe strongly that the consensus reached by the coal witnesses and the implications for national policy which flowed natural from such consensus deserves careful attention by the framers of Project Independence.

It is quite clear that the United States is entering upon a new era insofar as energy is concerned. It is also evident that a proper response to the new energy environment must, first of all, involve a national commitment to indigenous energy resource development. That commitment, made within the framework for free market economy, will permit us the option for domestic energy adequacy and allow our nation to participate in world affairs on a constructive basis free of the threat of international blackmail or the need to engage in an unstabilizing competition for available oil supplies.

All in all, coal's role has shifted dramatically because of the contingency of the new era. The challenge to coal, to those who now or will depend upon the development of the coal resource and, indeed, to the nation, is to structure a response in keeping with the magnitude of the challenge.

III. THE PARAMETERS OF COAL IN PROJECT INDEPENDENCE

Among coal experts, there is an emerging consensus that coal production by 1985 will be in the range of 1.2 to 1.5 billion tons annually. Given an all-out effort to increase production with the necessary incentives to do so, the production level by 1985 could be significantly higher—approaching 2.0 billion tons per year. On the other hand, unless some of the currently pressing disincentives to coal production are removed, the total, by 1985, could be substantially lower and conceivably might even approach present production levels.

If that unfortunate scenario unfolds, there will assuredly be an energy crisis of major proportions because we cannot see any alternative indigenous energy resource capable of meeting even a reduced energy demand level consistent with acceptable lifestyles. Nor, do we believe that any supply/demand disequilibrium could be balanced with imported energy sources without a disastrous impact upon our economy as well as upon the stability of the international community.

Therefore, we believe that a coal consumption target for 1985 in the 1.2 to 1.5 billion ton range is certainly reasonable. This level of production has been accepted as possible by coal spokesmen at the various hearings, if positive incentives for expansion are given and, conversely, if the negative disincentives retarding development are expeditiously removed.

Even though there is a consensus on the achievability of a 1.2 billion ton annual production, its attainment should be put into historical perspective.

Coal production has never exceeded 630 million tons in any one year. This year, barring a work stoppage in November, we will approach or exceed the record obtained 27 years ago. Moreover, a chart displaying the historical behavior of coal production at least for the period since 1920, resembles a roller coaster. This historic behavior cannot be viewed by responsible business or governmental leaders as anything more than a quaint anachronism which is now dangerously outmoded as a guide for future plans.

In a sense, we in coal have come to a moment of discrete change in our historical development. The combination of energy demand, available resources, and the geopolitical circumstances surrounding resource development and its use

have highlighted the potential of U.S. coal reserves. Such reserves, estimated to be 390 billion tons which are recoverable with present technology and within present cost parameters, represent the largest available reserve of energy in the free world.

Our task is to maximize that potential.

Doing that should involve, at the very least, a doubling of our coal production. Doubling coal production, as we have pointed out, is possible given clear signals to industry that stable long-term demand is present. But the magnitude of the task indicates the needed intensity of the signals to industry if, in fact, coal development is to move forward on an expedited basis.

We have many studies which outline the task involved in doubling coal production. One done by the National Academy of Engineering was referred to extensively by coal witnesses during these hearings. There is little need to repeat the bald numbers cited by NAE except to reiterate the point that the sheer size of the needed expansion underscores the need for a climate conducive to sustained growth, not only in coal mining, but throughout the entire coal delivery system.

What is involved, is a complex industrial structure stretching from the design and manufacture of machines through the coal production process to the distribution system and ending only with the successful disposal of the unwanted by-products of consumption. At every point in the system, forces are at work which can either cause the entire system to expand or, conversely, to stagnate with the resultant ability or inability of the entire system taken as a totality to meet newly emerging demand.

Another assessment of the parameters of a coal industry producing in the 1.1 to 1.3 billion ton annual range was made by an Inter-agency Coal Task Force assigned to work on Project Independence. While some of the statistics indicate a somewhat more limited challenge, the report is nonetheless instructive in outlining the scope of coal structure by 1990. We use this latter year in this instance because it represents the most advanced date for projection made by the study committee.

To produce 1.3 billion annual tons in 1990, the report suggests the need for: 460 new coal mines of which 227 will be underground and 233 will be surface. All of these mines will be over 1 million tons of annual capacity and all will require heavy front-end capital investment.

An increase in the number of men working in the industry from the 157,000 employed in 1973 to 211,000 employed in 1990. (It must be remembered, however, that the total number of men who will come into the industry during this period will be larger than the above total because of a fairly heavy retirement rate in the near-term future. It must also be remembered that the task of recruiting, training and motivating the coal workers of the future is a truly major one which will require the close attention of industry, labor and government.)

An increase of 125,000 hopper cars and 6,000 locomotives with an estimated cost of 5.1 billion dollars.

A minimum 15 per cent return, discounted after tax, over the 20-year life of a new mine.

Accumulative capital investment in the coal industry of 13.8 billion dollars in 1985 and 21.8 billion dollars in 1990.

In addition, a major new effort to recruit and train the engineering and supervisory personnel in the coal industry must be made to overcome a decade or more of neglect of this important sector of the coal work force.

It is important to note that all of the above projections are for a "business as usual" scenario. Some indication of the escalation potential if we go beyond "business as usual" may be gained by looking at the cumulative investment required by 1990. Under "business as usual" the capital requirement as projected above is 21.8 billion dollars. Under accelerated development, which projects a coal production of approximately 2.0 billion tons, the capital requirement by 1990 is 52.4 billion dollars.

Omitted in this discussion is any treatment of the requirements of the consumption portion of the coal system. Clearly, any rational analysis must deal with consumption and with the forces which impact on investment and operating decisions made by present or potential coal consumers.

In the period between now and 1985 it appears that the bulk of coal will continue to be consumed along current lines. The electric utility industry will remain our largest and fastest growing customer, although we look forward to the coming of the age of a coal-based synthetic fuels industry some time at the beginning of the next decade. However, whether the ultimate consumer is the

utility, the synthetic fuel producer, a steel company or an industrial consumer, there still must be assurances of both supply and predictable cost and viable operation before any consumer can commit the huge resources necessary for the construction of a coal-based industrial or utility facility. Assurance, therefore, which is vital in the production section of the coal system is equally so in the area of consumption. Indeed, certainty and attractiveness are the key words for coal's future response to our national energy dilemma.

Before concluding this area of discussion, there are two points which have troubled the coal industry recently. Latent, but never totally hidden, is a feeling on the part of many political leaders that there is a built-in conflict between the future of eastern coal and the rapidly developing coal areas in the West. Logic demonstrates that this is not the case. In fact, the coal witness in Denver highlighted what to us is the way western coal development must be viewed. He suggested, and we completely agree, that the demands that will be placed upon coal in the next decade will require the fullest development of all available American coal resources. This will mean a balanced development with eastern coal growing rapidly and with western coal, although increasing much more rapidly in terms of percentage, still being developed largely along regional lines with changes from such regional development being caused more by environmental concerns than by economic pressures.

It is also quite clear that absent western development, there will be a serious shortfall in the availability of total coal production to meet anticipated demand. We simply cannot exclude the vast reserves of the West any more than we can stop eastern development and still expect to have a viable coal production base in the timeframe indicated. We must have both and any effort to create an unnecessary sense of rivalry between sections of the country is, in our opinion, extremely detrimental to the future ability of the United States to be independent in terms of energy.

Second, many of the proponents of overly restrictive federal surface mining legislation have attempted to create the impression that the continuation of widespread surface mining of coal will irreparably damage the deep mining segment of the coal industry. This simply is not true.

Surface mining, which today accounts for approximately 50 per cent of the U.S. production, is a large and important segment of our coal production capability. But it is not, nor can it be, a substitute for deep mining production to any significant degree. In fact, the method of mining used will vary according to the geology, economics and resource availability as well as particular demands of a particular consumer at a given site.

In addition, when careful attention is given to the problems and potential of doubling our coal production by the year 1985, it is quite clear that in that year all parts of the coal industry will be taxed to their limit. To the degree that either surface mining or deep mining is circumscribed, there will be shortfall rather than opportunity for one or the other segments.

Therefore, we suggest that the problem of coal over the next decade is a problem of how to increase supply from all sectors, not whether one sector will expand or contract at the expense of another.

IV. INGREDIENTS OF GROWTH

It is therefore important to consider those things which are necessary for the coal industry to grow in order to meet its potential and to contribute significantly to energy independence for the United States.

There are several major positive ingredients to such growth which include the following.

A. A National Commitment to Coal

From all of the hearings, and from all of the testimony of the coal witnesses, there is one point upon which there is unanimous consensus. In order for the coal industry to meet a production target of double today's output, there must be a national commitment to coal. The nation's political leaders, as well as its citizens, must come to recognize the value of the coal resource, and work to create a climate within which that resource can be most expeditiously developed.

All too often in the past, coal has been the neglected stepchild of the American energy industry. In times of crisis, it was called upon for superhuman efforts. When the crisis had passed, the industry was permitted to languish in the obscurity of neglect and its problems were ignored by those charged with policy-making in the energy field.

This attitude is no longer tolerable in our changing energy economy. Rather, there must be a recognition on the part of the American public that if we are to achieve energy independence and if we are to maintain viability of our energy production and consumption, we are going to have to develop the American coal resource. And, to do so, we as a nation must of necessity commit the resources and create the climate which will make such development possible.

This fact is now recognized by many in both the political and industrial sectors of our society. Leaders in both the executive branch of government and in the Congress have called for production levels at or exceeding the 1.2 billion tons per year which we have stressed throughout this paper. Leaders in industry have also come to recognize the value of coal, and there is today clear evidence that both major energy consuming industries, as well as those which depend upon coal, have arrived at a single and inescapable conclusion—the need to commit ourselves to the task of building upon the coal resource base.

B. Clean Air Restrictions

Perhaps no single problem threatens the effective development of the coal resource more than clean air restrictions. Witnesses by coal industry executives before the FEA hearings pointed again and again to the debilitating effect of pollution abatement programs upon the development of America's coal resources. It is not our intention to repeat that testimony. Rather, we only suggest that as now constituted, more than 50 per cent of the coal presently burned by utilities will by 1975 be precluded from the utility sector.

There are, however, certain legislative and regulatory revisions in current clean air programs which we believe will assist the coal industry to plan for orderly growth and at the same time provide the necessary protection of the environment. These are as follows:

First, there should be an extension of the deadline permitted for achieving air quality goals set by the states in their implementation plans. Currently, such extensions are limited to 1977 and such a timeframe is obviously inadequate in the face of today's energy challenge.

Second, we urge that the use of intermittent control systems be approved by the Environmental Protection Agency when such use will permit the consumption of relatively high sulfur fuels without impacting upon human health.

Third, we strongly recommend that the entire question of "significant deterioration" be resolved so that the coal industry and those industries which consume coal can plan, build and operate major coal-burning facilities. It is our view that congressional action is the only solution to this problem and until definitive legislation is enacted, the future of American energy resource development is severely clouded.

The doctrine of a "significant deterioration" involves national land use decisions. Congress, this year, has overwhelmingly rejected consideration of land use legislation. We believe that the Congress had no intention of instituting national zoning through the subterfuge of the Clean Air Act of 1970. We, therefore, believe that there is a need for a review of the "no significant deterioration" concept and its application to the American society with full recognition of the cost involved in the widespread use of this doctrine.

Fourth, we strongly urge that the Environmental Protection Agency, as well as the full weight of the Federal government, be applied to secure necessary revisions in state implementation plans. No single subject is of such high priority, especially in view of the early over-zealous action on the part of many states to enact clean air restrictions which are clearly beyond the bounds of both economic and technological feasibility.

Fifth, we strongly support EPA recommendations which would permit the pass-through of sulfur dioxide removal costs by means similar to the fuel adjustment clause. In our opinion, such a pass-through will encourage the installation and use of such systems which will enable the utilities involved to burn large quantities of high-sulfur coal.

Sixth, we urge that EPA use authority granted to it in Section 4 of the recently-enacted "Energy Supply and Environmental Coordination Act" to bring to the attention of state regulatory agencies the questions of air quality and energy supply. This should include a plant-by-plant review of the effects of regulation on our energy and environmental objectives. EPA's prompt utilization of this authority would result, in our opinion, in a reduction of the current regulatory overkill often contained in state air implementation plans.

Finally, we strongly urge that the Environmental Protection Agency and other government agencies now charged with environmental protection, begin to bring to the conscience of the American public the need for a reconciliation of the current dichotomy between clean air and energy abundance. This is of crucial concern because until there is public awareness of the current energy/environmental impasse, there can be no effective action taken to resolve it.

C. Federal Leasing

Currently, the federal government is a resource monopolist insofar as western coal is concerned. The degree to which the federal government acts in the manner of a true monopolist will profoundly affect the public welfare in the area of energy self-sufficiency. Currently, there is a moratorium on the leasing of coal on federal lands. This moratorium has had a most serious impact on proper development of the western coal resource, and has hindered producers, transporters, and consumers of coal in the rational development of this vast coal resource.

We recognize that this question is one with grave implications for the national well-being. But, we also recognize that unless there is a prompt initiation of coal lands leasing and unless future leasing is done in such a way as to permit the expeditious, economic, and environmentally proper development of the West, there will be a grave crisis in the not-too-distant future.

We, therefore, urge that the current moratorium on leasing be immediately rescinded. At the same time, the issuance of prospecting permits, which are so vital to the rational development of the coal resource, should be continued. Likewise, the awarding of leases should provide for preferential rights to those operators who are operating on leased land which abuts additional federal lands suitable for the continuation of the mining operation. Finally, the question of bidding should be carefully reviewed so that entry into western coal development will not be limited to only a very few companies with the ability to fund large front-end bonus payments.

D. Manpower Developments

We have touched upon manpower development in this paper and in a previous hearing before the FEA Project Independence panels. The question is one that currently is extremely delicate. However, we of the American coal industry look upon manpower as the key resource for our future development. We believe that unless careful attention is given to the future enhancement of the human resource in coal, that coal can never achieve the objectives which are now set forth for it.

The question extends beyond the rank and file coal miner and touches every facet of the manpower dilemma up through the executives of coal corporations. We need men who are well trained and equipped to operate the complicated machinery in both underground and surface mines efficiently and safely. We need technicians who can maintain such machinery in proper running order. We need engineers and scientists who can cope with the increasing complexities of extraction and preparation in the coal industry of the future. And, finally, we must tie the human resources with the capital and machinery together into a viable overall coal industry.

Involved is not only training but also public recognition of the work of the manpower resource in coal and a public willingness to enhance the image of employees of the coal industry in line with the contribution they make to society.

E. Surface Mining

There simply cannot be the attainment of the goals of Project Independence without a large and viable surface mining sector of the coal industry. Legislation which would hamper surface mining unduly by imposing upon the industry unrealistic reclamation requirements, or by prohibiting vast sections of the surface mining industry altogether, simply is not defensible in light of our current needs. Nor is it appropriate for an industry geared to growth, an industry which is not affected by the severe economic constraints of the past when coal struggled for survival and when all too often the cost of production did not or could not include the total social costs of mining the product.

F. Research and Development

Much attention was given by coal witnesses to the question of research and development. It is quite apparent that an expanded research and development program is essential to the future well-being of the coal industry. There are

technological gaps at every part of the coal delivery system including the mining cycle, distribution and consumption. We are hopeful that the current accelerated federal research effort on coal will continue.

However, we must point out that to be successful, there must be the full cooperation of the private sector in research efforts. This will not only insure that the R&D being done is that which directs itself at the major unsolved technological problems, but it will also insure an orderly and rapid technology transfer from the research program to commercial application.

We also strongly support the centralization of total energy research and development programs. Such centralization must include the institutionalization of an expanded coal research and development effort, and the carrying out of that effort by people dedicated to the enhancement of the technology of coal production, distribution and use.

All too often, this was not the case in the past when research and development tended to be centered on nuclear power. But, it is clear that the contingencies of the present and the future require a new emphasis on fossil fuel research and a growing cadre of scientists dedicated to that end.

G. Transportation

Currently, one of the major constraints to an expanded coal industry is the transportation bottleneck. We support programs to aid the railroads to expand their capability, especially those in the Northeast. We also support and urge early enactment of federal eminent domain for coal slurry pipelines. Finally, we suggest activity which will rationalize the regulations surrounding transportation so that the transportation industry can expand to the degree necessary to permit the orderly and rapid movement of large quantities of coal.

H. Financial Requirements

It is clear that large additional sums will be required by the coal industry if it to expand to the degree that has been suggested in this paper. Attracting this money, especially since much of it will be front-ended with the payout period well into the future, will require a rate of return comparable to the risk involved. Coal must now compete for capital and its success in such competition is largely a matter of insuring a reasonable chance for the planned operation of the mine and a rate of return adequate to attract capital from other potential sources.

For the coal industry, the present and coming era of capital requirements poses a great new challenge. Hopefully, there will be a proper environment which will permit the coal industry to meet that challenge. Involved, also, is the need for a tax climate conducive to expansion. The National Coal Association has several proposals for such tax incentives currently pending before Congress. It is our hope that these proposals will be enacted as soon as possible.

V. CONCLUSION

It is clear that the U.S. coal industry has a growth potential which was not possible during any part of the Twentieth Century. It is also clear that the interests of the coal industry and those of the nation are closely intertwined, perhaps to a degree never before possible. We recognize the inherent challenge of this potential. But we also recognize that as we grow, we, as an industry, can add to the well-being of the people of the United States. This is our challenge, a challenge which we willingly accept. All that we ask is that there be created a legal, political and economic environment conducive to growth. If that climate is, in fact, created, we can grow. To the extent that it is not, coal can never fulfill its inherent promise for the American public.

I sincerely hope that this expression of concern of the American coal industry regarding the Project Independence Blueprint is helpful to this Committee in its review of the report.

RESOLUTIONS OF THE NATIONAL LEAGUE OF CITIES

RESOLUTION ON PROJECT INDEPENDENCE

Substitute resolution to replace Resolution on Project Independence submitted by the Environmental Quality Steering Committee.

Whereas, in recent months, the Administration has proposed, and in some cases, implemented with minimal public debate, a series of measures aimed at developing energy self-sufficiency in the United States by the end of the current decade;

Whereas, these measures which are in the main intended to increase energy production, place heavy emphasis on developing fuels which at this time are either environmentally unacceptable themselves (such as high sulfur coal when used in areas having unacceptable levels of air pollution or in areas without implementation of adequate control technology) which cause the environment to be degraded during their production, and which will increase the cost of energy and other scarce resources;

Whereas, the nation's cities are concerned about the lack of analysis: of the potential effects of the development of western coal and oil shale in that such policies may cause the abandonment of investment in existing energy production elsewhere in the United States; of the effects of coastal oil development; of the high capital cost and inflationary effects of funding a massive resource development program in an era of limited capital availability; of the potential contamination and depletion of water resources from some forms of energy production; of the creation of "new towns" in environmentally fragile areas;

Whereas, many of the policy decisions now being made in the name of energy self-sufficiency will preclude the exercise of other policy options in the future and will chart an irreversible energy policy which will affect the country for many years;

Whereas, the Administration's proposals place much greater emphasis on developing additional energy supplies rather than on decreasing or stabilizing energy consumption through more judicious use of our natural resources;

Whereas, the recently completed Project Independence Report developed by the Federal Energy Administration sets forth a preliminary basis upon which to base a national energy policy;

Therefore, be it resolved that the Administration sponsor a rigorous and wide-ranging public discussion to bring into full view the relative merits of energy self-sufficiency and the concomitant economic, social and environmental trade-offs required to achieve that end and specifically that a representative of Citizens Advisory Council which would include representatives of consumer groups and local government to the newly formed Energy Resources Council be appointed by the Administration;

Be it further resolved that because the nation's cities are directly affected by Federal actions of the type and magnitude presently being contemplated, the Federal government—including the Federal Energy Administration and the Congress—should assure representatives of general purpose local government an active role not only in these discussions, but also in subsequent national energy policy development processes;

Be it further resolved that the National League of Cities believes that in spite of some shortcomings, in particular a less than complete analysis of conservation alternatives and a superficial analysis of environmental and social impacts, that the Administration should not attempt to scuttle the constructive accomplishments of the Report and the concept of national energy planning embodied in Project Independence;

Be it further resolved that the United States should embark upon a massive program of energy conservation which will ensure that the needs of all sections of the country will be met without significant disruption and which will provide much needed additional time to develop adequate control technologies for alternative fuel resources prior to their utilization as major fuel sources. The Federal Government should emphasize the implementation of mandatory, as well as voluntary, energy conservation goals. However, where possible conservation programs should be implemented by states and local governments with adequate flexibility to take into account the environmental and resource conditions in each region.

8.700 ENERGY POLICY GOALS

Steps must be taken to develop a National Energy Policy that will guarantee reliable and adequate supplies of energy, minimize environmental degradation, and balance energy supply and demand. The Congress of the U.S. should develop guidelines and policies which will regulate the administration of a national energy policy, the cornerstone of which should be the goal of significantly reducing overall per capita energy consumption.

Cities require an adequate and reliable supply of energy. Energy shortages and interruptions negatively affect industrial production, the local economy, employment opportunities and essential public services. Energy shortages and higher energy prices require a national energy policy which encourages the reduction of non-productive and non-essential energy uses and the development of appropriate new energy sources.

8.701 A NATIONAL ENERGY STRATEGY

Congress and the federal government must take a more active role in responding to the energy crisis by :

A. Maintaining a mandatory allocation system which assures local governments of adequate fuel stocks at reasonable prices to provide essential services.

B. Adopting a major program of energy conservation with the overall objectives of significantly reducing energy demand without excessive disruptions in current life styles.

C. Establishing a comprehensive energy information system with adequate authority to obtain information from public and private energy entities which will facilitate immediate and continuing objective assessments of domestic fuel reserves and projected demands.

D. Eliminating pricing policies and tax subsidies to energy production which artificially lower the cost of energy rather than making the market cost of energy reflect its full cost.

E. Implementing appropriate safeguards to those portions of the population which, without assistance, cannot purchase basic and necessary amounts of energy.

F. Developing and enforcing environmental safeguards in the energy field through laws, regulations, and procedures which are uniform, coordinated, realistic, and expeditious so that the public obtains the protection it is paying for at reasonable cost. Government decisions should be based on a careful balance of economic and environmental factors.

G. Adopting a major Federal program to fund greatly expanded research, development and demonstration of energy resources and energy conservation techniques to insure consideration of the National interest, representation of the interests of consumers, conservation of natural resources and provision of an equitable and adequate method of raising the large sums needed. All research and development efforts should be initiated with projected environmental ramifications as a preliminary consideration.

H. Officials of local government should be consulted by utilities and regulatory agencies considering any plan for curtailment or load shedding designed to deal with the inability of energy suppliers to meet demand. Priorities must take into account the impact on the community in terms of public services, employment, productivity and individual citizens.

The program should :

1. Emphasize the exploration of unconventional means of producing energy as well as deal with problems of producing energy from conventional fuels, such as control of liquid and gaseous effluents and radioactive by-products and wastes from power plants, underground transmission and transportation of oil. Private industry should be encouraged to undertake similar research.

2. Consider new methods of supplying energy with greater efficiency, less adverse environmental impact, and greater economy.

3. Provide local government with usable information and research in support of local energy planning and functional programs and involve local governments in the development of those programs.

8.702 REDUCING ENERGY CONSUMPTION

The United States has been endowed with very extensive energy resources. As a consequence, we have become somewhat profligate in their use. Because of these excessive consumption patterns we now find ourselves in a situation whereby the only way we can increase our available energy supplies in an amount necessary to sustain the historic rate of increase is to undertake a resource development program which has negative impacts.

Fuels which either are environmentally unacceptable themselves or which cause the environment to be degraded during their production would be developed. Fuels for which adequate human and environmental safeguards have yet to be perfected would be developed, or our reliance on fuel products imported from foreign countries would be increased.

As part of any energy conservation program, the Federal government should :

- A. Revise transportation freight rates to encourage greater utilization of recyclable products and reclaimed materials and to save energy.

- B. Revise tax laws to discourage energy inefficient urban sprawl.

- C. In cooperation with local governments, provide incentives for the development of energy efficient modes of transportation such as mass transit, bicycles, walking and car pools.

D. Require mandatory "energy efficiency" labeling of all energy consuming products and increase public knowledge of the costs of using energy.

E. Revise government procurement policies to take into account not only initial cost, but also potential for energy savings so as to encourage manufacturers to develop more efficient equipment.

F. Expand support for energy recovery programs under the Solid Waste and Resource Recovery Act of 1970, with particular emphasis on recovering and using heat from power plants and incinerators, and burning solid waste to produce energy.

G. Provide federal assistance to cities to:

1. Review and revise building codes to maximize energy saving techniques; and

2. Apply potential new approaches to energy conversion and supply, such as the fuel cell.

8.703 PROVIDING AN ENERGY SUPPLY

The growing shortage of energy supplies and high prices for energy may be due partly to regional disparities in energy supplies and artificial, monopolistic restrictions on the supply of energy.

A. A federal-state-local procedure should be established to review the siting of energy producing and generating facilities, including electric generating stations and routing of associated transmission lines with the aim of creating economically and environmentally effective sources of power supply in an orderly and timely fashion.

B. Congress and the federal government should:

1. Remove obstacles to the development of a national power grid which would permit power exchanges that increase electric reliability, cut costs and decrease land devoted to rights-of-way.

2. Consider the formation of regional generation and transmission entities to supply bulk power to distribution utilities at the lowest cost consistent with environmental safeguards.

3. Provide for a continuing public forum including review by appropriate state, regional and local agencies prior to implementation of major energy supply projects, such as gasification and liquification of high sulfur coal, use of oil shale reserves, use of nuclear plants and off-shore oil drilling. Such projects should be undertaken only if it can be shown that development of these resources will be done in an environmentally-safe and cost-effective manner and are consistent with a National Energy Strategy.

4. Establish a quasigovernmental corporation to expedite the exploration, production and distribution of fuels as a means of supplementing existing supplies and providing an economic and environmental yardstick for measuring the performance of private firms in the field if and when industry fails to provide adequate energy supplies.

C. Regulation of the rates charged for energy should be improved to insure that users pay fair prices. This requires more rigorous activity by regulatory agencies, increasing information available to consumers and establishing utility consumers counsels to help guarantee that the public interest is fully represented. Utility rates should not allow one group of users to pay less than the actual cost, including a fair allocation of capital and servicing costs, of providing energy.

D. Vigorous competition between fuels and within fuel industries should be guaranteed by the federal government to assure economic efficiency in production and consumption and to avoid the misallocation of scarce productive resources.

The creation of such competition will require at least the following action:

1. Antitrust policies should be vigorously enforced to protect the consuming public against anti-competitive activities and prevent monopolistic control of fuels and energy through "energy companies" which acquire holdings in competing fuels or processes. No fuel producer should own or control production or reserves in any other fuel, except in the case of oil and gas, which often occur together in nature.

2. Procedures utilized in the leasing of government-owned land should be revised so that small producers are guaranteed an equal chance of bidding successfully for such land. Also, the government should place a limit on the amount of time that firms which lease government-owned mineral intensive land may withhold such land from production.

RESOLUTIONS OF THE U.S. CONFERENCE OF MAYORS

ENERGY CRISIS

Whereas, a shortage of petroleum and other energy products brought about by a combination of factors including—construction of the Federal-Aid Highway system, regressive utility rates, tax laws, tariff and import regulations which encouraged foreign investment at the expense of developing domestic resources, environmental restrictions, and a general lack of competition within the petroleum industry—continues to adversely affect large numbers of cities throughout the country; and

Whereas, spiraling fuel prices have forced many localities to amend previously adopted budgets, respond to the social demands created by an increase in urban unemployment, suffer a decrease in state shared motor vehicle revenues due to a lower volume of gasoline sales, and absorb the increased demands for "human services" by the urban poor, who watched the rapidly rising price of fuel further deplete their inflation-ridden budgets; and

Whereas, the Administration has proposed measures which would delay the achievement of environmental goals, failed to effectively hold down the price of fuel in spite of existing legislative authority, and failed to take effective actions to increase competition within the petroleum and natural gas industry,

Now, therefore, be it resolved that Congress and the Administration should take actions to insure that the prices of fuel and profits earned through their manufacture and sale are strictly controlled. Such actions should include the establishment of a rollback on current and a ceiling on future fuel prices; and

Be it further resolved that Congress and the Administration should develop, fully fund, and implement a coordinated policy which will meet the problems of urban unemployment before it reaches crisis proportions; and

Be it further resolved that funds generated by an energy consumption, Federal income, or other tax should be provided to cities to subsidize mass transit operations; and

Be it further resolved that the Federal government must develop the capability to undertake immediate and continuing assessment of the quality, quantity, and costs associated with the energy crisis and should provide such information to city officials so that they may effectively deal with local fuel problems; and

Be it further resolved that measures which would limit the horizontal diversification of petroleum companies and restore competition within the industry should be enacted and implemented at the earliest possible date. At a minimum such actions should include:

Prohibiting oil and gas producers from owning or controlling production or reserves in any other fuels,

Removing wellhead price regulations for small producers of natural gas,

Revising leasing procedures for government-owned land so that small producers are guaranteed an equal chance of bidding successfully for such land, and

Establishing an independent government corporation to explore, develop and refine petroleum products as a means of supplementing existing supplies, and providing an economic and environmental yardstick for measuring the performance of private firms in the field.

Be it further resolved that the goal of energy self-sufficiency by the end of this decade should be reconsidered and fully debated in the appropriate public forums in view of many social, economic and environmental considerations involved.

Note: Proposed Resolution No. 5 (Oil Companies) and No. 6 (Tax-Exempt Financing OMB Circular A-70) were tabled by the San Diego Resolutions Committee.

SOLID WASTE AND ENERGY RECOVERY

Whereas, last year Congress delayed consideration of substantive changes in the Solid Waste Disposal Act for a period of one year; and

Whereas, solid waste disposal remains a critical problem at the local level as exemplified by the fact that one-half of the nation's cities will run out of landfill sites within the next five years; and

Whereas, air and water quality legislation in the United States has increased and compounded disposal problems on the land; and

Whereas, solid waste collection and disposal represents the third largest expenditure item in local governmental budgets, amounting to some \$6.4 billion nationally in 1973; and

Whereas, solid waste is a non-polluting source of fuel which, if current technology is implemented, could amount to 86% of the energy supply gap, 12% of current utility coal use, or 2% of the national overall energy demand; and

Whereas, various Federal policies discourage the use of reclaimed materials in spite of the fact that recycling of municipal waste offers significant energy savings in addition to preserving scarce natural resources; and

Whereas, a coordinated national program of resource recovery and energy recovery from solid waste would reduce the land space required for disposal by 85%.

Now, therefore, be it resolved, that the U.S. Conference of Mayors urges Congress to take immediate action on legislation which would provide for a comprehensive system of waste management and resource recovery at the state and local levels. Legislation should provide for effective consultation between Federal, state and local governments and should focus on:

energy recovery from solid waste,

Federal financial assistance for construction of solid waste management and resource conservation facilities,

expanded Federal programs of planning, technical, and other assistance to local government,

reduction of the overall volume of solid waste through source reduction;

Be it further resolved that the Federal Solid Waste and Land Protection program should have recognition comparable to air and water protection with the Environmental Protection Agency and in Congress; and

Be it further resolved that Federal policies including transportation freight rates, procurement practices, and packaging and container design standards should be revised and established to encourage the utilization of recycled and reclaimed materials.

ENERGY AND THE ENVIRONMENT

Whereas, the Administration has recently proposed and in many cases implemented without adequate public debate a series of measures aimed at developing energy self-sufficiency in the United States by the end of this decade; and

Whereas, these measures are primarily intended to increase energy production and place heavy emphasis on developing fuels which at this time are environmentally unacceptable themselves, which cause the environment to be degraded during their production, and which will increase the cost of energy and other scarce resources; and

Whereas, many of these policy decisions now being made will preclude the exercise of other policy options in the future and will chart an energy policy affecting the country for many years; and

Whereas, the Administration's program could commit United States energy policy to the department of certain fuels to the virtual exclusion of other equally promising resources, such as energy generated from solid waste; and

Whereas, the Administration places heavy reliance on states in determining the location of energy facility sites and has repeatedly proposed excluding local governments from the siting and review process,

Now, therefore, be it resolved that the United States should, locally and nationally, embark upon a massive program of energy conservation which will insure that the needs of all sections of the country will be met without significant disruption and which will provide much needed additional time to develop adequate control technologies for various fuel resources prior to their utilization as major fuel sources.

Be it further resolved that a rigorous and wide ranging discussion be initiated at the Federal and local levels, through the United States Conference of Mayors and the National League of Cities, to bring into full view the relative merits of energy self-sufficiency and the concomitant economic, social and environmental conditions involved before committing the country to such an end; and

Be it further resolved that, because the nation's cities are directly affected by Federal actions of the type and magnitude presently being contemplated, the Federal government—including the Federal Energy Administration and the Congress—should assure representatives of general purpose local government an active role not only in these discussions, but also in subsequent national energy policy development and implementation processes.

STATEMENT SUBMITTED BY MR. LOUIS S. CLAPPER ON BEHALF OF THE
NATIONAL WILDLIFE FEDERATION

Mr. Chairman, The National Wildlife Federation appreciates the invitation and opportunity to comment on the Project Independence Report recently released by the Federal Energy Administration as outlined in your letter of December 11, 1974.

We believe that an honest attempt to collect data on energy sources and options and make projections on supply and demand under various conditions is one of the primary requirements for policy makers to determine which way of meeting this nation's energy needs is truly in the public interest. The effort of the F.E.A., we felt, clearly makes an important contribution to providing such data base. We have for some time been urging that a rational and comprehensive national energy policy be adopted and the kind of data developed in the report must be the foundation of such a policy.

This report can only be considered a first step in the formulation of a national energy policy, however, and in many ways, the easiest step. It should be obvious to all that, in the final analysis, the crucial decisions in the adoption of such a policy will be based at least as much on political as empirical considerations. Given the immense economic advantages or disadvantages which will accrue to special interests like the energy companies and utilities depending on how a national energy policy is finally worked out, there seems to be only one way to insure that, above all, the public rather than private or special interests are served. That way is if there is a full and informed national dialogue on the issues and trade-offs which will be part of any national energy policy. The Federation is especially interested in aiding such a national debate because we know that in such an atmosphere environmental questions will get the kind of consideration which their extreme importance requires if the public interest is, in fact, a prime concern.

We believe there are several specific concerns which must be included in a national energy policy if it is going to be in the public interest. These were presented in some detail in testimony presented by Mr. Thomas L. Kimball, Executive Vice President of the National Wildlife Federation, at Project Independence hearings last fall. A copy of his statement is attached for the record.

We do not mean to imply from our references so far to the Blueprint Report that we believe it provides sufficient, or even valid, data in all areas. It has, we feel, a number of deficiencies which should be recognized as limiting its usefulness to a policy maker who is trying to formulate a responsible energy policy. A few examples will illustrate the kinds of concerns we have about the report.

Perhaps our strongest concern is that the Environmental Assessment Chapter of the report is incomplete and far too general. Environmental considerations for some supply areas lack specific rate estimates which would allow a reader to determine adverse impacts. In some cases major environmental concerns lose significance when placed side by side with those of minor importance if they are not ignored entirely. For example, the problems of revegetation are not mentioned in the oil shale discussion. This raises doubts in our minds whether the environmental costs of any national energy policy could be judged using the report.

Another of our concerns in energy policy development is that proper emphasis be placed on the development of environmentally safe and economically sound alternate energy sources such as solar, geothermal, tidal, and wind. The report tends to down play the potential of these by giving production estimates which are far more conservative than those of other studies, including, in some cases, those done for F.E.A. For instance, the Blueprint's production potential estimates for geothermal energy are substantially less than even those given in the F.E.A.'s task force report. The following table details a comparison between the various predictions.

ELECTRICAL PRODUCTION POTENTIAL FOR GEOTHERMAL ENERGY IN MEGAWATTS

	Blueprint	Task force	Hickel	Futures group
Business as usual:				
1985 -----	4- 6, 000	30, 000	-----	9- 11, 000
1990 -----	10-15, 000	100, 000	-----	1 55-200, 000
Accelerated:				
1985 -----	7-15, 000	33, 000	132, 000	27- 40, 000
1990 -----	60-85, 000	113, 000	395, 000	1 270-800, 000

¹ By year 2000.

It goes without saying that to rationally formulate a national energy plan and insure the most effective research and development efforts, realistic predictions are necessary. In at least some cases they apparently are not found in the Blueprint.

One of the most significant findings outlined in the Blueprint Report is the tremendous potential of energy conservation in meeting our energy needs. The findings provide important substantiation for what conservation organizations like the Federation have been saying for some time and what independent studies like that of the Ford Foundation have illustrated. That is, of course, that we can, through energy conservation, be better off economically, environmentally and socially than we are today and at very little cost or sacrifice.

It is fortunate that another comprehensive energy analysis was completed and released at approximately the same time as Project Independence. The Ford Foundation's Energy Policy Project report, "A time to Choose: America's Energy Future", both analyzes the energy situation and makes recommendations on where this nation should go from here in planning to meet energy needs. The emphases on energy conservation and research and development of alternative sources, combined with findings that economic growth is not closely tied with increased energy consumption and that such large energy savings are possible through relatively painless means are, we feel, highly significant. They offer the best hope that we can meet our energy problems in a rational way, especially with respect to preserving environmental quality. We do not need a crash energy development program.

In conclusion, the Federation agrees with Secretary Morton, who, during these hearings before the Subcommittee, emphasized that the Project Independence Report is merely a "building block" and that "with additional economic, social, and environmental analysis we can move with far greater confidence in formulating our energy future."

The Report is a step in the right direction, but, as the Secretary points out, much more work and analysis needs to be done. We urge that it be done as quickly and responsibly as possible and that Congress and the Executive cooperate fully to keep the public fully informed and involved throughout the process of formulating a national energy policy.

STATEMENT OF THOMAS L. KIMBALL PRESENTED ON BEHALF OF THE NATIONAL WILDLIFE FEDERATION TO THE FEDERAL ENERGY ADMINISTRATION HEARING ON THE ENVIRONMENT AND PROJECT INDEPENDENCE, IN PHILADELPHIA

Mr. Chairman, I am Thomas L. Kimball, Executive Vice President of the National Wildlife Federation which has its national headquarters at 1412 Sixteenth Street, NW., Washington, D.C.

Ours is a private organization which seeks to attain conservation goals through educational means. Affiliates of the National Wildlife Federation are located in all 50 states, Puerto Rico, Guam and the Virgin Islands. These affiliates, in turn, are made up of local groups and individuals who, when combined with associate members and other supporters of the National Wildlife Federation, number an estimated 3½ million persons.

We regard the formulation of a national energy policy as an issue of the highest importance. We are therefore pleased to have the opportunity to express our views on some of the environmental implications of such a national energy policy.

It is almost too obvious to need mentioning that Project Independence, which is, after all, a blue-print for a national energy policy with the precondition that this country be as independent as possible of foreign sources of energy, will have a profound effect on the environment to be enjoyed or endured by Americans now and in the future. There are a number of ways in which such a national energy policy could be implemented which would have more or less environmental as well as social and economic impact.

We could, I suppose, make simply getting enough energy the most important thing in this nation, selling our souls if necessary to get it and damn any consequences. At the other extreme, we could say "all right—the 75 quadrillion Btu's of energy we consumed last year is the absolute ceiling. We must learn to make do with no more than that forever and even extracting that amount depends on meeting any environmental, social, economic or aesthetic concern first." Obviously the choice of either of these extreme national energy policies would have different social, economic and environmental consequences. Certainly there are those in this country who advocate one view or the other. There are, however, a number of other scenarios between two extremes and it will be the job of responsible policy makers to choose one of them.

This task is, I submit, not quite as formidable as at first it may appear. There is a question which, when answered, can immediately eliminate some of these options. It is, simply, what is the public interest? What is it that the majority of citizens will support? Applying this simple test we can quite clearly eliminate the extreme options. No responsible member of the conservation community advocates a "zero growth" policy or placing environmental or aesthetic concerns above any other social and economic consideration—the self serving charges of some in business and government to the contrary notwithstanding. Similarly, I know that responsible businessmen are not advocating the extraction and production of energy to the exclusion of all other considerations. The answer to what option is in the public interest must be then, is, as is often the case, somewhere in the grey area between black and white.

There will be, of course, many facets to the national energy policy which would most nearly meet the public interest. I want to touch on several which the National Wildlife Federation believes must be included in such a plan.

The first consideration is that the cost of the various types of energy available must reflect the environmental costs of its extraction and processing. In other words, the environmental costs associated with utilizing a form of energy must be internalized.

Let me give a brief example. Strip mining in recent years has accounted for an increasing share of U.S. coal production. About a decade ago, $\frac{1}{3}$ of our coal production was stripped. Last year, that proportion was slightly over $\frac{1}{2}$. In ten years, it has been estimated, this portion might climb to 60%-70%. Why is this the case? There are a number of reasons, but one of the most important is that it is generally cheaper to strip coal than to deep mine it.

A major reason it has been cheaper is that the operator does not pay the full price of the extraction of the mineral. Because of lax and/or corrupt state regulatory efforts, even the very minimum reclamation standards of many states are not enforced. The result is only too apparent to anyone who has traveled through Appalachia. It is estimated that over 20,000 miles of exposed high-wall remain in this area, presenting not only a physical danger but also isolating other resources such as timber and wildlife habitat.

In addition, some 13,000 miles of streams and rivers have been affected to a significant degree by acid mine drainage and siltation as a result of coal operations. Not only does this reduce or eliminate the recreational and food producing potential of these streams by adversely affecting the aquatic ecosystems, but the increased siltation has other effects more easily measured in economic terms. For example, the accumulation of sediment in stream channels can increase flooding and can reduce the useful life of reservoirs. Last year, for instance, the General Accounting Office conducted a survey of damage from coal mining on eight Corps of Engineers projects in Appalachia. At one project, Fishtrap Lake in Kentucky, the G.A.O. found that the Corps will have to spend more than \$1.2 million 1973 dollars to reclaim project lands damaged by mining and to construct additional dams to control sediment from mining. Over a million dollars at just one project!

If building this project was in the public interest in the first place—and with many of these projects we feel that that is a big "if"—then is it in the public interest to allow this much damage to be done in a relatively short time? Pos-

sibly, if the savings to the public outweighed all the costs. In this particular case it appears that they don't. The Congressional Research Service of the Library of Congress estimated last fall that the extra cost of electricity for the average family which would result in using entirely the more expensive deep mined coal would be about \$15 per year. Think how many taxpayers would have to contribute \$15 per year to pay for the more than \$1 million needed for repairing damage.

Another aspect of strip mining which is environmental in the broad sense is the removing of land from production. There are an estimated 500,000 acres of land in this country which have been stripped and left abandoned and unreclaimed. One result of this has been to force people to leave the area and move to overcrowded cities or to become welfare recipients. The attendant human suffering and misery are more difficult to quantify but no less real, and must be counted part of the cost.

What has been the cost to the public expressed solely in economic terms of not internalizing the costs of stripping coal? It has been estimated that to reclaim the existing abandoned stripped lands will cost at least \$10 billion and this figure does not include the price which silt and acid drainage and other problems resulting from the devastated condition of these mined areas exact every year and will continue to exact until the \$10 billion is spent to remove the source of the problem. Who will pay for the continuing damage and the cost of reclaiming this area? The coal companies? Of course not. It will be the people who, as usual, pay. Who benefited most? The coal company operators and stockholders at the expense of other public values. The people also will pay for the unemployment and welfare payments to the people in Appalachia who have been displaced as a result of irresponsible stripping.

All of us, I believe, share some part of the human costs which cannot be easily translated into dollars and cents. The saving of about \$15 per year on their electric bill by the average family being serviced by a utility using irresponsibly stripped coal has not been worth the tremendous costs. This seems especially true when a number of studies have shown that the extra costs of stripping and adequately reclaiming would be quite small—perhaps 40 to 50 cents a ton more—adding only a few cents per month to the family bill to prevent the billions of dollars worth of damage.

If these environmental costs of stripping had been internalized, not only would the public have had an accurate idea of the true cost of stripped coal, but market forces also would have determined how much would be used. The price would unquestionably have been somewhat higher, but, as I pointed out, it still would be less than the public will have to pay for the continuing damages caused by irresponsible stripping, let alone for eliminating the cause itself. In a vicious cycle, the artificially low price of coal encouraged more stripping, which caused more damage, which is costing the public more money. Requiring that these social and environmental costs be avoided or internalized would have prevented this situation.

I comment on coal stripping for purpose of illustration only. All energy used in this country does not reflect the true environmental costs of extraction and processing. This can be the result of factors such as government subsidies and other interference with market forces as well as not internalizing the environmental costs, but it is the latter with which our organization is most concerned. If these hidden costs were reflected as part of the actual costs, not only would we have a cleaner environment, but we also would be better able to decide how much energy use and growth we can really afford.

One aspect, then, of any national energy policy if it is in the public interest, must be that it reflects the full environmental costs of energy extraction and production. Only the most naive believe that you get something for nothing; yet a distressing number of policy makers in government appear to be naive in this respect. Man cannot insult the environment in any of his activities with impunity. Every insult exacts a price—in economic or human terms. This is a fact as immutable as the laws of nature on which it is based. Ignoring it or wishing it were not so will not alter it, no matter how much easier it might make things for policy makers. The question, then, for any policy maker concerned with the public interest must be "what are the trade-offs? Do the benefits of this course of action outweigh the costs?"

Unfortunately, during the past year it has become apparent that some individuals in government and many in industry are reacting to the energy and economic crises by ignoring the benefits and looking only at the costs of environ-

mental trade-offs. The public is blitzed by slick ad campaigns suggesting that federally required pollution controls are "arbitrary" and largely responsible for the energy predicament we face. Some in government claim that investment in such controls is a "luxury" which the nation cannot afford, because they are "nonproductive" and stimulate inflation.

The implication of such criticism is that environmental protection is fine, but with a grave economic crisis on our hands, we have to deal with our more important problems first. For the polluter that usually means weakening environmental standards, pushing back deadlines, removing "bothersome" environmental restrictions, supposedly in the interest of the public. But no mention is made of the economic and aesthetic benefits that result from achieving the environmental standards we've already set for ourselves.

In our judgment, this kind of misleading criticism can only serve to abet continuing energy and economic crises, not to mention crises of public health and the aesthetic values that make life worth living. If our comments on strip mining indicated the major economic losses resulting in areas where environmental controls are still needed to internalize costs, then some comments on the benefits of air pollution control will evidence the serious losses that will result if existing standards are arbitrarily relaxed.

But before getting into specifics on this, I think it is worthwhile to call attention to a fundamental conceptual distinction recognized last month by CEQ Chairman Russell Peterson on the question of the "non-productivity" of environmental controls. According to Mr. Peterson, "Statements which refer to expenditures for environmental purposes as 'non-productive' demonstrate a basic confusion between accounting terminology and reality. Improved environmental quality is of fundamental importance to the improved quality of our life and in some instances to life itself." In other words, talking about the "non-productivity" of pollution controls can only mislead the public as it attempts to understand the real costs and benefits involved.

The better approach is to consider such investments—of dollars, labor, time, energy, and materials—in terms of conservation and construction versus loss and destruction. For if the control of pollution does not spew forth an endless stream of marketable products that are easily tabulated into the annual GNP, it very definitely reduces serious damages to health, property, vegetation, and aesthetics. In doing so, it cuts down on the need to expend precious resources to take care of environmental damages and losses. Certainly the costs of cleaning up after unregulated strip mined land are proof of that.

Without pollution controls, we would be forced into the world of Alice in Wonderland in which increasing amounts of resources have to be expended just to keep up with environmental damages rather than to move forward with new constructive developments which improve the quality of life.

In talking about the costs and benefits of existing pollution controls in context of a discussion of Project Independence, air pollution is perhaps the most appropriate, both because the energy crisis has focused particularly critical attention on the requirements of the Clean Air Act and because more extensive data have been developed on the monetary costs of air pollution than for other sources of pollution.

For several years, public and private efforts have been put into developing comprehensive economic evaluations of both the damages caused by pollution when it is unchecked and the costs of environmental controls to reduce those damages. The students of environmental cost-benefit analysis warn us that it is still a crude science involving large margins of error. Keeping that in mind, I'd like to refer to the conclusions of a number of reports which have come out in recent months on this subject. This spring and summer, EPA published its 1974 report to Congress on "The Cost of Clean Air" as well as its most recent report on "The Economic Damages of Air Pollution." In addition, the National Academy of Sciences in September reported to the Senate Public Works Committee on the results of a year long investigation into national air quality and pollution controls. And the Technical Advisory Committee on Conservation of Energy to the Federal Power Commission's Task Force on Conservation and Fuel Supply has released a draft report on the health effects of not enforcing national standards for limiting sulfur oxide emissions.

If the findings of these reports cannot be regarded as 100 percent accurate, they nevertheless substantiate the fact that the monetary costs of controlling air pollution are just as great, if not greater than, the costs of implementing those controls. According to EPA, for fiscal years 1971 through 1979 combined the total

investment costs for implementing air pollution abatement will run between \$42 billion and \$52 billion—\$47 billion is considered the best estimate. Annualized costs by 1979 for maintenance and operation of controls are estimated to run from \$14.5 billion to \$18.9 billion, with \$16.9 billion the best estimate.

In contrast, EPA's Washington Environmental Research Center reports that for 1970, the cost of air pollution damage in the United States is estimated at \$12.9 billion, but it could run as low as \$6.1 billion or as high as \$18.9 billion. In considering these damage figures, we think it's important to keep in mind several points which suggest that they are conservative. They do not cover the damage caused by all pollution but only the damage caused by pollution exceeding our national standards. Nor do they cover damages caused by all pollutants—the damages for sulfur oxides, particulates and oxidants are dealt with but not for carbon monoxide. Nor do they cover all the damages caused by even these particular pollutants. Monetary assessments of pollution's effects are made for health, employment, aesthetic properties, man-made materials, and vegetation, but they are not developed for the effects on either wildlife and domestic animals or the natural environment.

It's also important to remember that monetary assessments do not truly represent the full extent of damages caused by pollution. EPA points this out in its "Economic Damages" report when it states, "it is common of see references that cite health effects separate from the economic effects." The inference is: "the effects of air pollution on health transcend economic values." In other words, there are so-called "non-dollar" as well as dollar costs and benefits involved in pollution control. In the view of EPA, "non-dollar benefits—such as psychic benefits—do exist and they are likely to be quite large. Even if such controls are substantially greater than dollar benefits, non-dollar benefits could be sufficiently large at the margin to justify quite stringent policies."

For example, the Federal Power Commission's advisory committee estimates that between 1970 and 1980 uncontrolled sulfur emissions could result in approximately 25,000 excess or premature deaths plus millions of days of excess illness. A monetary evaluation of this damage in terms of work hours lost and health care cannot begin to measure the full loss to the individuals themselves, let alone to their families and society.

In view of all this, we are of the opinion that current monetary evaluations of air pollution-induced damages should be regarded as conservative at best when comparing them with the costs. EPA itself has been reluctant to draw direct cost-benefit comparisons, because of the potential for error. But the National Academy of Sciences did analyze the costs and benefits of controlling just auto emissions, and it found that the monetary benefits from checking these emissions—the nation's biggest source of air pollution—are at least commensurate with the costs of implementing the controls. Whereas the annual benefits are estimated between \$2.5 billion and \$10 billion, the annual costs are estimated between \$5 billion and \$8 billion. NAS emphasizes that if national control strategies in some areas are adjusted, the annual costs could be brought down to as low as \$1.5 billion or \$2 billion.

What does all this information suggest to us? Two things: First, that there clearly are very substantial benefits as well as costs involved in implementing existing pollution standards and both must be considered fully. Second, the state of the art of environmental cost-benefit analysis is admittedly unrefined, but it is absolutely crucial to the development of any realistic policy choices about energy development and the economy. Instead of pouring millions of dollars into superficial advertisements and making misleading statements about the "non-productivity" of pollution controls, industry and government spokesmen should channel their resources into improving cost-benefit analyses if they are truly concerned about effecting what is in the public's best interest.

With these comments on the costs and benefits of environmental controls—both existing and needed—it should be clear that the public interest is directly affected by how we obtain energy and how well policy makers understand the natural laws under which they determine the costs and benefits of environmental trade-offs. In trying to understand fully the environmental facets of a national energy policy, it also is helpful to take a larger view of the role of energy in our society.

As I have already mentioned, responsible conservationists accept as a given fact that energy is the life blood of our society and that the public interest requires that any national energy policy supply energy? How much is specified by the public or national interest? The answer, of course, is "enough." Enough

energy for industry, for hospitals, schools, churches and houses and, if at all possible, enough to provide us with the luxuries and conveniences we all enjoy. As far as the narrow public interest is concerned, it is only necessary that we have enough energy. Yet, there are several ways to supply enough and how we meet this facet of the public interest may have important implications for other facets.

Let us consider an example. If we assume that it is in the public interest to supply energy for air conditioning a home, then that factor will have to be taken into consideration when weighing the cost/benefit of environmental trade-offs in the production of that energy. Let us suppose that while there is some environmental deterioration associated with extracting the coal required to operate that air conditioner, the benefits are determined to outweigh that environmental cost. We may even imagine that we could determine that one ton of coal used results in 10 units of deterioration. Now, we know that different kinds of air conditioners are more or less efficient in converting the energy of the coal into cooling the home. If we look only at the narrow facet of the public interest which requires that the home be cooled, then it makes little difference how efficient the air conditioner is, just so it does the job. But if the public interest also requires—as we believe it does—that the energy our society needs should be extracted with the least amount of environmental damage, then it quickly becomes obvious that the public interest is directly affected by the efficiency of energy use. An air conditioner which is twice as efficient as another will not change the ratio of ten units of environmental damage for each ton of coal used. But if we can get twice as much value out of that coal, we will cut in half the amount of environmental damage which must be accepted to meet a valid societal goal.

The use of energy by our society is analogous to the example of the air conditioner. There have been a number of studies by groups such as the Office of Emergency Preparedness and the Energy Policy Project of the Ford Foundation which show that we waste about one-third of the total energy we use in this country. These studies, especially the EPP study, show that we could enjoy basically the same standard of living we now have and are projecting out into the future and still reduce environmental impact without major social dislocation if we just practice energy conservation and use energy more efficiently. The narrow range of the public interest would be served either way—through continuing the wasteful practices of today, which EPP calls its "Historical Growth Scenario," or through what it labels the "Technical Fix Scenario" in which conservation practices are implemented. In both cases "enough" energy is produced. However, when the broader public interest is considered it is clear that only the energy conservation scenario is truly in the public interest.

Every Btu of energy saved through conservation or more efficient use is a Btu for which environmental trade-offs will not be required. In addition to this immediate advantage of reducing the amount of environmental impact of producing enough energy for the needs of our nation, an energy conservation policy also would have the important long range advantage of extending the time we can depend on domestic fossil fuel reserves which are, by definition, finite.

We have heard distressingly little from policy makers about the importance of long term energy conservation and increased energy efficiency programs. There have been some undeniable bright spots, such as reduction in use by the Federal government, some industries, and much of the general public. But the apparent stress of Project Independence to date has been to find new domestic fossil fuel sources to meet a growing energy demand which is at least $\frac{1}{3}$ wasted.

What talk there has been of energy conservation usually has been in the vein of "we need to conserve until we are over the hump and domestic production can catch up." We hear of plans to open the Northern Great Plains to massive coal stripping, to develop on a large scale the oil shale reserves of the West, to drill on the Outer Continental Shelf oil fields, and to expand greatly the number of nuclear power plants with their attendant environmental problems and safety uncertainties.

Virtually everyone involved concedes there will be some environmental damage, but most seem to think this is acceptable and required by the public interest. I submit that this is not the case. Development should proceed only at a pace that considers a maximum conservation effort, after all environmental costs are internalized. It can only be considered absolutely necessary to develop these sources when it has been proven that energy conservation and increased efficiency along with current sources of production are not able to meet the demand.

There can be no valid reason for not stressing energy conservation as the

most important part of a national energy policy if it is truly to serve the public interest. There is little or no technology to be developed. We can save a tremendous amount of energy with the knowledge and techniques we already possess. I have not used many examples of specific amounts of energy which could be saved because by now they should be familiar to most. I know of no data which would refute the estimates of the energy savings we could realize, and any energy policy which does not recognize and incorporate these findings cannot be, we believe, in the public interest. Lest there be any misunderstanding before I leave this topic, let me be blunt. Any national energy policy which does not emphasize energy conservation and increased efficiency of energy use to at least the same degree as increasing production is absolutely unacceptable to the National Wildlife Federation, and we will oppose it any way we are able.

There is one other aspect of what we believe any good national energy policy must contain which I want to mention briefly. This is the area of energy research and development. We are making a good start this fiscal year on developing a concentrated program to explore all our energy alternatives. Once we are aware of the true potentials as well as the problems of such alternative sources as solar and wind power, geothermal energy, energy recovery from wastes, nuclear fusion, and in situ coal gasification we can judge rationally which sources to emphasize in the future. Obviously it does not matter in the narrow sense I've outlined whether needed energy comes from coal or the sun, yet in the broad view which we must take it is clearly important.

If the environmental impact of producing the energy needed to cool that house can be effectively reduced by energy conservation techniques, then it can be reduced to almost nothing by using the free and limitless power of the sun to supply at least the major part of the energy required for that home's cooling needs. Engineers tell us this kind of technology using the sun's heat to cool buildings is only a few years away from common availability with a sustained research effort. Using the sun to heat water and for supplemental space heating is available now. In fact, the National Wildlife Federation currently is conducting a feasibility study of retrofitting our Virginia office building with solar collectors to provide supplemental heating.

Conservation of energy takes on greatly added importance when the time required to determine the true potential of various alternative energy sources is considered. By reducing demand through conservation techniques we can buy the time we need to determine which of all our energy sources, both conventional and alternative, we should depend on in the future. Without conservation, we have no choice but to greatly increase our reliance on conventional sources, even though some alternative source may be more in the public interest.

As I mentioned before, any national energy policy which is in the public interest must require that adverse environmental impacts associated with energy production be kept to the minimum possible. In order to do that the development of more environmentally sound energy sources like solar and fusion must receive the highest priority.

The National Wildlife Federation has long been interested in the impact of energy production on the natural environment. We believe that consideration of the four areas of concern I've outlined today—cost internalization, environmental costs and benefits, energy conservation, and exploitation of untapped clean energy sources—must be reflected in any national energy policy if it truly is to serve the public and national interest. We offer to any governmental organization involved with Project Independence our full assistance in the effort to draft such a national energy policy. Thank you.

STATEMENT OF PACIFIC GAS AND ELECTRIC COMPANY

GEOHERMAL DEVELOPMENT

I. Introduction

Interest in geothermal energy in recent years has spiraled, figuratively, from the quiet status of a lazy fumarole to that of a giant, noisy geyser. The possibility of harnessing massive quantities of energy from the bowels of the earth has captured the collective imaginations of layman, scientist, geologist, engineer, politician and opportunist.

It is not the purpose of this discussion to provide a review of the technological information available on geothermal energy. The purpose is, first, to attempt to place the subject in reasonable context by reviewing what might be practicable for geothermal electric generation, and, second, to estimate how that might impact upon the total demand for electricity.

The initial spur for advocating more development in the United States probably came in 1960 following the successful commercial operation of Pacific Gas and Electric Company's first geothermal electric unit at The Geysers in Northern California. This first unit was cautiously sized at 11 megawatts. There followed a careful probing of the resource, so that by the end of 1968 the total development had reached only 78 megawatts in four small units.

But, the knowledge obtained by the drillers and resource developers, coupled with the operating experience of Pacific Gas and Electric Company which purchased the steam, instilled increasing confidence in all concerned. This confidence resulted in adoption of an orderly developmental program. The result is that by the end of 1974, 502 megawatts will be in operation, and the schedule calls for more than 900 megawatts by the end of 1977.

Geothermal energy has been widely described as environmentally pure. This reputation makes it especially appealing in light of the ongoing nationwide concern for the environment. Certain forces opposed to fossil-fueled, hydroelectric and nuclear power plants believed that large amounts of geothermal resources were ready for immediate, easy exploitation. These individuals and groups therefore began to champion geothermal power, along with solar power, as wise and viable alternatives.

On the heels of the environmental thrust came a recognition by a growing number of people that the United States' production of petroleum was waning and that the nation would become increasingly dependent upon foreign sources of petroleum products. This was brought dramatically into focus after the Middle East oil embargo of 1973 had kicked this nation into collective shock. Analysts of the fuel supply problem had warned for years of an impending national energy shortage. But, it was those long waits at the gasoline station, an unprecedented increase in the price of fuel of all kinds, and some unpleasant deprivation that grabbed the undivided attention of the American Public, and shook its political representatives. In response to immediate needs and to an awareness that the United States should not allow itself to become strongly dependent on foreign energy sources for reasons of national security and economic well-being, a number of new, untried energy sources began receiving serious attention from government and the energy industries. Not surprisingly, geothermal energy was found high on the priority list for accelerated investigation of its technologic and economic feasibility. Obviously, extraction of the natural internal heat of the earth would result in conservation of valuable fossil fuel resources. The conservation aspect alone evoked additional enthusiasm. With the support of some congressional representatives, governmental agencies, and foundations, substantial funds for investigation and experimentation are beginning to emerge. Across the nation, research organizations are clamoring to become involved.

II. Present Geothermal Resource Utilization

It is interesting to look at the relatively small base of geothermal usage in the world today and to note the contrastingly great mass of material written on the subject, mostly in recent years.

For centuries, man has used natural hot waters and steam for heating, bathing and therapeutic purposes. In a few areas, wells have been drilled to produce steam or hot water for space and process heating and electric power production. In Reykyvaik, Ireland, geothermal energy is used by about 100,000 people for residential heating. In New Zealand, a pulp and lumber facility uses it for process heating. In a number of places in Europe and Asia, geothermal energy is used to heat greenhouses for year-round crop production. In Klamath Falls, Oregon, and in Boise, Idaho, it has long been used for space heating in several hundred buildings.

The most dynamic use, however, is conversion of geothermal energy into electrical form. In that form, it can be moved great distances and put to innumerable uses. Table A, following, summarizes the world development of geothermal electric generation. The summary shows that geothermal power, however important it may be locally, still represents only a very small percentage of the total electric power generation of any nation.

TABLE A.—WORLDWIDE STATUS OF GEOTHERMAL POWER DEVELOPMENT

Country	Approximate 1973 geothermal electric capacity (megawatts) ¹	Reservoir fluid ¹	Power cycle (F, flashed steam; D, dry steam; B, binary)	1972 total electric installation megawatts ²	Geothermal as a percent of total electric installation
Iceland: Namafjall	3	Hot water	F	400	0.76
Italy:					
Lardarello	365	Steam	D		
Monte Amiata	25	do	D		
Total	390			36,000	1.1
Japan:					
Matsukawa	20	do	D		
Otake	13	Hot water	F		
Total	33			76,000	.043
Mexico: Cerro Prieto	75	do	F	8,000	.95
New Zealand:					
Wairakei	192	do	F		
Kawerau	10	do	F		
Total	202			4,000	4.15
United States: Geysers	396	Dry steam	D	419,000	.095
U.S.S.R.:					
Pauzhetsk	5	Hot water	F		
Paratunka	1		B		
Total	6			175,000	.003
Total World development	1,105				

¹ Geothermal energy by P. Kruger and C. Otte 1973.

² U.N. Statistical Yearbook 1973.

³ Wairakei geothermal project; New Zealand Ministry of Works March 1972.

⁴ 1973 figures.

The first production of electric power from natural steam occurred at Lardarello, Italy in 1904. This area now produces 365 megawatts from a dry-steam or vapor-dominated geothermal reservoir. The Wairakei fields of New Zealand are liquid-dominated resources from which 202 megawatts have been developed using steam flashed from hot water wells. In Northern Mexico, the 75-megawatts Cerro Prieto plant was recently commissioned for use of steam flashed from hot brine having about the same salinity as seawater. Geothermal power installations in Russia, Japan and Iceland are relatively small.

The most rapidly expanding development is at The Geysers field in California. (This is not truly a geysers, but rather a fumarole area.) Technology for utilization of dry steam at this location has been reported upon in considerable detail.

Those who have worked with geothermal resources recognize fully that geothermal steam, hot waters and brines represent valuable and important resources for the future development of electrical power, as well as other potential uses. However, these resources must be developed in a rational and practical manner. Pacific Gas and Electric Company has been deeply involved and is enthusiastically pursuing the development of geothermal energy for production of electricity. At the same time, it rejects the fallacy that geothermal energy is the panacea for all of the world's energy problems, its pollution problems, and, above all, that it is available today simply for the taking.

No one can hope to be completely objective in areas where he is individually involved. Nevertheless, the following comments on geothermal electric generation review the case in a fair manner from the utility perspective. It is hoped that these comments will contribute constructively to a timely and economic development of the resource.

III. The Source of Geothermal Heat

A widespread view on the source of geothermal heat is that it arises largely from the decay of radioactive material. In addition, exothermic chemical reactions and frictional sources within the earth undoubtedly contribute some of the heat. This heat is transmitted to the earth's surface everywhere. In most regions, however, it is too diffuse to be noticed. In other regions, it is found in dramatic volcanic lava flows and in geyser displays such as Old Faithful in Yellowstone Park.

In some regions of recent volcanism, generally associated with tectonic plate boundaries, large amounts of heat are contained in solidified magma at relatively shallow depths. In some of these areas, surface water percolates into the formations. When the water comes into contact with the hot rock, convective cells are formed causing hot water or steam to rise toward the surface. If this water penetrates the surface, geysers, hot springs or fumaroles appear. In the United States, such areas are found predominantly in the West.

IV. History of the Geothermal Electric Development at The Geysers in California

In the 1920's, a number of test steam wells were drilled in the Imperial Valley and at The Geysers in California. However, relatively inexpensive hydroelectric power was then abundant, and the potential for generating power from geothermal sources was not economically attractive. Furthermore, there also were some unknown, untested problems associated with the use of geothermal steam. The resource was in a remote area which would not justify expensive transmission installations for the relatively small size of units that would have been practical in that era. Nevertheless, developers continued to pursue its possibilities.

In the late 1950's, following the commendable drilling and developmental effort at The Geysers by the pioneering Magma and Thermal Power companies, Pacific Gas and Electric Company became interested in testing the feasibility of geothermal electric generation. The resource appeared promising, and contracts between the utility and the steam developers were signed to cover a program of continuing installation of geothermal electric generation. Expansion was geared to further exploration and successful production of additional steam. These contracts led to the first commercial production of electricity from geothermal energy in the Western hemisphere. This 1960 event initiated an ever-increasing interest in the future potential of geothermal resources.

The first small unit (11 megawatts) provided the basic economic and technological data for using this local dry steam resource. As confidence grew, the size of the units also grew. The largest now in operation is 53 megawatts, the largest under construction is 106 megawatts, and the largest planned is 135 megawatts. With the installation of the ninth and tenth units in 1973, The Geysers project became the largest geothermal power installation in the world with an output of 396 megawatts. Thus, in less than 15 years, the use of geothermal energy for electric power production in Northern California has progressed from the status of a R&D project to that of an important supplemental power source.

Five additional power units are scheduled to become operational in the years 1974 through 1977. This will raise the output of The Geysers project—still the only commercial geothermal-electric development in the United States—to more than 900 megawatts. Beyond that, about 110 megawatts of additional capacity are planned for installation each year through 1983. Annual reappraisals of the potential of the steam field probably will justify continuing the development many years beyond 1983. Addition of new generation at a rate greater than 110 megawatts a year is possible if the steam suppliers accelerate their resource development program.

The combined investment of the steam developers and Pacific Gas and Electric Company in this project is now about \$100 million.

Because of the relatively low pressure and temperature of the natural steam, the physical size of equipment per kilowatt of generation is relatively large. The secondary-class access roads into the mountainous area impose limits on the weight and dimension of equipment which can be transported to the steam field. Fortunately, the economic unit size and road limitations are closely compatible. Relatively small units provide a reasonable economic balance between the cost of delivering steam from distant wells and the lower cost per megawatt of installing larger generating units.

V. The Types of Geothermal Resources

It is convenient to separate geothermal resources into major types and subtypes:

1. Hydro-thermal systems :
 - (a) Dry steam (vapor-dominated) systems.
 - (b) Hot water (liquid-dominated) systems, mildly mineralized.
 - (c) Hot water (liquid-dominated) systems, highly mineralized.
2. Geopressure systems.
3. Hot, dry rock systems :
 - (a) Hot, dry rock without added heat.
 - (b) Hot, dry rock with nuclear heat added.

4. Magma.

Following is a brief discussion of each of the types:

1. *Hydro-thermal systems.* The systems which produce steam, either directly from vapor-dominated fields or flashed from liquid-dominated fields, provide all the geothermal resources used for electric power generation today. Proven technology now exists for these systems and they are, therefore, the easiest to develop.

(a) *Dry steam (vapor-dominated) systems.* The Geysers steam field in the United States and the Lardarello development in Italy are the major fields which produce dry steam for electric generation. Power installations using dry steam at Monte Amiata, Italy and Matsukawa, Japan are small. The potential for added development at these locations is not known. D. E. White¹ suggests that the higher-temperature vapor-dominated sub-types such as Lardarello and The Geysers probably require a discharge area with recognizable surface manifestations and, therefore, we probably are already aware of all such systems. Other vapor-dominated systems at relatively low temperatures such as that at Monte Amiata will be harder to find because surface manifestations will not be readily observed. Fields like Lardarello and The Geysers are commercially attractive, but it must be always kept in mind that the economics and technology for their utilization cannot be transferred directly to the liquid-dominated or other types of geothermal resources.

(b) *Hot water (liquid-dominated) systems, mildly mineralized.* Because liquid-dominated systems are much more abundant, techniques for utilizing this source of heat are currently receiving increasing attention. Much of the exploration throughout the Western United States in recent years has located hot water sources. The Wairakei and Kawerau installations in New Zealand, the Cerro Prieto plant just south of the United States border in Mexico, and an installation in Japan all utilize heat from hot water systems by allowing the superheated water to flash to steam. While this process of obtaining steam for power production is simple, it does leave large quantities of residual water, sometimes of high mineral content, that must be disposed of.

An alternative method for extracting heat from hot water or brines is through the use of heat exchangers. The Magma Power Company has been particularly active in developing and promoting its Magmamax binary system, in which even fairly low-temperature hot water or hot brine from liquid-dominated systems can be circulated through a heat exchanger and transferred to an organic liquid such as isobutane or freon. Such liquids have low boiling points (14° F at one atmosphere for isobutane) and can be converted into gaseous form, just as we convert water to steam.

The expanding gas then acts as the driving medium to turn the turbine. Such a system will be important if we are to extract much electrical energy from the more abundant but relatively low-grade geothermal heat sources. The very small binary system installed on the Kamchatka peninsula of Russia, with freon acting as the working fluid, seems too small for commercial extrapolation. Commercial development of the more abundant, low-grade, liquid-dominated heat sources, therefore, awaits demonstrated heat exchange technology and demonstrated economic feasibility.

In most cases, it is contemplated that the "spent" hot water from binary systems would be reinjected into wells to avoid environmental problems stemming from surface disposal.

(c) *Hot water (liquid-dominated) systems, highly mineralized.* A notable example of a highly mineralized water system is that in the Imperial Valley of California near the Mexican border. Tremendous quantities of heat are found in the hot water underlying large areas of the Valley. Numerous wells have been drilled and the potential of the area has been under study for many years by the University of California at Riverside, by steam developers which include some of the oil companies, and by Southern California utilities.

A major effort is under way to use the heat for electrical generation and for extracting potable water. Most of the problems in extracting the heat relate to the very high mineral content of the hot water, as much as 10 times the mineral content of seawater in some areas. Special technology will have to be applied to overcome problems of corrosion and scaling in plant equipment, particularly heat transfer equipment. The best prospect for using this heat to generate electricity is thought to be through the use of a binary system similar to that de-

¹ *Geothermal Energy*; edited by Kruger and Otte.

scribed under 1(b) above. An experimental module of such a system has been installed through the joint efforts of the Magma Power Company and San Diego Gas & Electric Company. Some interest has been exhibited in obtaining valuable chemicals from the brines, but it is clear that all of the chemicals could not be removed economically. Reinjection of "spent" brines into wells appears to be the only environmentally acceptable method of disposal for this area.

2. *Geopressure systems.* A rather fascinating potential resource exists along the Gulf Coast in geopressure systems. While exploring for oil, drillers have encountered "geopressure" areas between the Continental Shelf and about 100 miles inland in an area extending from Texas to Florida. These zones are believed to result from the entrapment of water along geologic faults. Subsequent subsidence and compaction of material above the faults has occurred until the entrapped water itself has become the load-bearing substance creating a "geopressure" reservoir. In some of these reservoirs the water is quite hot, it has an extremely high-flowing wellhead pressure, and contains up to 30 cubic feet of dissolved methane gas per barrel of water.

These systems have potentially great energy capability because of three physical characteristics: (i) the water is at such pressure that it could be run through hydraulic turbines to extract energy; (ii) there is enough heat in the water that energy could be extracted through a binary-cycle system; and (iii), very importantly, the methane gas could be extracted from the fluid and its energy utilized.

C. S. Matthews² of Shell Oil Company has stated: "The problem of locating large, hot, highly productive geopressured reservoirs will be a very difficult exploration problem. Its solution will require both skill and luck." A. T. Maasberg and O. Osborn² of the Dow chemical Company have made this succinct assessment: "The economics of power production from Gulf Coast geopressured waters appear very attractive, and the potential returns are high. However, the risk is also high, and the development costs will be large."

3. *Hot, dry rock systems.* The hot, dry rock systems offer theoretically the greatest amount of potential energy; but to date they have not been exploited beyond preliminary research. Hot rock underlies all the earth's surface. However, due to economic and physical limits for deep drilling, it is only where the higher temperatures are relatively close to the surface that we might expect to extract their energy.

Currently, the Subterrene draws considerable interest because it offers the possibility of overcoming some of the depth limitations. The Subterrene is a system invented and patented by the scientists at the Los Alamos Scientific Laboratory for making vertical or horizontal holes in the earth by melting rock and soils. The penetrator which acts as the drill bit would be heated either electrically or with a specially-designed nuclear fission reactor. Practical development of the Subterrene would provide substantial advantages over conventional methods of deep drilling, not only for geothermal energy exploitation but for other purposes as well.

(a) *Hot, dry rock without added heat.* An over-simplification of the concept for extracting heat from hot, dry rock requires two or more holes to be drilled into a high-temperature rock system. In the absence of natural permeability, hydro-fracturing processes would be used to open the formations between holes. Water, or perhaps another fluid, would then be injected from the surface into one or more of the holes. The fluid would circulate through the reservoir and return to the surface through the other holes at an elevated temperature, either as a liquid or as steam. The fluid in this manner would "mine" the heat of the dry rock system. Drilling and experiments for utilizing this resource are under way in Montana and New Mexico.

(b) *Hot, dry rock with nuclear heat added.* Battelle-Northwest Laboratory, working with the American oil Shale Company and others, in 1971 prepared a comprehensive study of a potential utilization of hot, dry rock. It was proposed to drill into hot, dry rock and create a permeable pocket at depth through an atomic detonation. The atomic detonation would add heat to that naturally present. A water injection hole and a separate heat extraction hole would then be drilled into the permeable pocket. The combination of both heat sources was indicated as necessary to achieving overall economic feasibility.

² Hearing before Committee of Science and Astronautics, Subcommittee on Energy, H.R. 11212, The Geothermal Energy Research, Development and Commercial Demonstration Act of 1973.

There are two readily-apparent problems associated with this type of geothermal development: (i) The detonations would be required at fairly frequent intervals in order to maintain enough energy for continued operation of a power plant. Detonations would require hardening the plant against shocks or designing the plant so that it could be moved temporarily away from the area of detonation in a canal or on rails. While technologically possible, the complications of dealing with the explosive shocks seriously erode the economics. (ii) Although the proposed procedure responsibly considered all the features required to make it radio-logically safe, the concept is still hampered by the public's reluctance to accept atomic detonations in any form.

While this plow-share type project has not been abandoned, it is definitely on the back burner.

4. *Magma*. Solidified magma might be tapped as an energy source through the hot, dry rock concepts described under 3 above. Tapping the energy of molten magma or lava systems would require totally different technology. Such molten systems do contain immense amounts of energy in spectacularly evident form, but these are found only in a few places in the world and on a somewhat unreliable, intermittent basis. In any event, such systems may defy practicable technology to harness the energy.

VI. Calculated Geothermal Resources

The heat content of the earth is immense. How much, no one knows for sure, but it is not conceivable that man could ever exhaust it, assuming he could find a way to make it all available. Much effort has been expended in estimating and guessing at the size of the geothermal resource. Many assumptions have to be made and one is never quite sure what mix of theoretical, practical and promotional elements may be contained in the estimates.

Some of the calculations of geothermal potential are reminiscent of an old high school chemistry exercise which calculated the weight of the gold in the sea. The calculation shows 56 pounds of gold per cubic mile of seawater which would be worth about \$130,000 at today's prices. With the sea containing over 320,000,000 cubic miles, its gold content is worth over \$41 trillion.

The real question, of course, is what can be extracted in a practical and economic manner. While there is probably little gold likely to be extracted from seawater, we do know that of the vast geothermal resource, the small part that can practically be used will be important. Calculations of the total resource within defined parameters do serve a useful purpose in furthering our understanding of the enormous base of energy with which we are dealing. But, these estimates should never be confused with what may be realistically obtainable. White¹ estimates the resources in the top ten kilometers of the earth at 3×10^{20} calories. Under the United States alone, his estimate indicates 6×10^{24} calories. This is many orders of magnitude above what can be considered as a recoverable resource base.

Our real challenge, then, is to learn more about the nature of geothermal energy, to find where it is accessible, and then to learn how to develop and use it at reasonable cost. Only then can this resource be mined in a competitive, commercial manner.

¹ Ibid.

TABLE B.—PARTIAL TABULATION OF ESTIMATES OF GEOTHERMAL POTENTIAL AT THE CALIFORNIA GEYSERS AND IN THE UNITED STATES

	Megawatts of electrical generation	Year corresponding to the level of generation	Attributed to—	Publication	Date of publication	Comment
California geysers—known geothermal resources area:						
(1).....	2,000	Ultimate	J. P. Finney ³	Public Utilities Fortnightly	Jan. 31, 1974	Project engineer for Pacific Gas & Electric Co., geysers development. Estimated based primarily upon the size of resource exposed by completed drilling, with little extrapolation for unproven areas.
(2).....	4,800	do	Geothermal Resources Board of California.	Economic Potential of Geothermal Resources in California.	January 1971	
(3).....	25,000	do	Dr. R. W. Rex	USAEC Hearing, Diablo Canyon Indirect Units, docket Nos. 50-275, 323.	May 19, 1972	Corresponds to the production of the entire geothermal area at same rate per acre as the presently developed area.
United States:						
(4).....	3,000-19,000	1985	National Petroleum Council.	U.S. Energy Outlook	December 1972	Range depends on price, technological development, and the degree of institutional and ecological impediment.
(5).....	20,000 to 30,000	1985	Interagency Panel for Geothermal Energy Research.	Report to Office of Management and Budget.	June 10, 1974	
(6).....	132,000	1985	Walter J. Rickel	Geothermal Energy, from estimates reported at the 1972 Geothermal Resources Conference.	1972	Assumes development of hydrothermal, geopressed, hot rock, and magma systems.
(7).....	6,000	2000	Dr. Chauncey Starr ²	Report to Office Management and Budget.	September 1971	President of the Electric Power Research Institute.
(8).....	200,000	2000	Interagency Panel for Geothermal Energy Research.	Geothermal Energy from estimates reported at the 1972 Geothermal Resources Conference.	June 10, 1974	
(9).....	395,000	2000	Walter J. Rickel	Geothermal Energy, edited by Kruger and Otte.	1973	Assumes development of hydrothermal, geopressed, hot rock, and magma systems. Includes proved, probable, and possible reserves at 1972 prices and technology.
(10).....	12,350	Ultimate	D. E. White	do	1973	Hydrothermal systems only. Assumes 50 percent increase in price.
(11).....	19,500-19,000	do	do	do	1973	High figure based on undiscovered hot rock systems at much higher prices than present.
(12).....	14,750-150,000,000	do	R. W. Rex and D. J. Howell	do	1973	

¹ Original estimates were given in the form of megawatt-centuries. For comparison purposes, they have been converted to megawatts of installation based upon a 30-yr. life of plant operating at 70 percent capacity factor.

VII. Practical Resources and the Economics of Geothermal Generation

Making estimates of the practical or economically recoverable geothermal resources is a relatively easy task. Supporting those estimates with solid data and proven technology is not only infinitely more difficult but actually impossible because supporting data and technology are non-existent. Consequently, we find estimates all too often severely shaded by the analyst's individual optimism or pessimism. Table B, following, shows a few of the many estimates that have been made. The table has been included here not to define the size of the recoverable resource, but rather to illustrate the very broad range of thinking which reflects the uncertainty attached to this fledgling industry. Most estimates have some rational basis, and it is generally unfair to criticize them out of hand. Others, unfortunately, have been designed to promote geothermal energy as a kind of exotic and glamorous source, and to thrust aside the need for continuing development of fossil-fueled and nuclear energy production.

Those engaged in drilling and utilization tend to arrive at conservative estimates based more on what is proven than what might be projected. The California Geysers development is the most explored and developed geothermal area in the world. Information on the field has been accumulating since the early 1920's and especially since significant utilization began in 1960. Periodic reassessments of the resource have increased confidence and commitment so that over 900 megawatts are scheduled to be in operation by 1977. But, even in this well-studied area, the size of the resource is uncertain. Some wells drilled in the Known Geothermal Resource Area (KGRA) have failed to produce steam while other wells to be drilled outside the defined KGRA are almost sure to produce steam. It is clear that there is more energy than can be developed but that the ultimate size of the resource is not known. It can best be defined through a careful, evolutionary-type drilling program.

From the information now available, it appears highly unlikely that the amount of geothermal energy will ever supply more than 10 percent of the nation's needs. Indeed, it is doubtful that, even with the several attractive geothermal developmental areas in California, geothermally-produced electricity will ever exceed 10 percent of the State's requirements. This does not indicate, by any means, that geothermal energy is an unimportant source. The future electrical energy growth rate in California alone is very large and a 10 percent share is likewise substantial.

There is little information upon which to base a price-availability relationship for geothermal energy except from The Geysers development. The price paid for steam at The Geysers is adjusted in relation to the cost of alternative sources of thermal power. These price adjustments apply to all the steam whether delivered to old or new generating units. Precipitous increases in steam prices, therefore, follow the dramatic increases in cost of fuel oils which soon will become the primary alternative heat sources for electrical generation in this area. The price paid for steam initially was 2 mills for each kilowatt-hour of electricity generated. Under the contract price formula, it is estimated that in 1977 when Unit No. 15 goes into service, steam will cost over 7 mills per kilowatt-hour (\$8.00/barrel for fuel oil).

Obviously, the cost of geothermal power will depend to a considerable degree upon the quality of the energy. Ideally, it would be in the form of dry steam under very high temperature and very high pressure, but nature has not offered it in this form. Developers willing to accept what nature does offer see no insurmountable technological problems with using superheated waters or low-quality steam. It must be recognized, however, that The Geysers area is unique. Development of the field has been singularly successful because the steam was dry and the technology for utilization was available at the time the development began. The first unit installed at The Geysers applied the turbine and generator technology of the early 1920's through the installation of used equipment of 1923 vintage which was moved from a retired, inoperative plant. Furthermore, much of the early steam was found relatively near the surface and was developed at relatively low cost. The technology and economics of The Geysers development must never be used as a measure for evaluating other locations having even modestly different characteristics.

Table C, following, summarizes data on The Geysers development including the utility capital investment.

Table D details the estimated capital investment for Unit No. 15, and Table E details the estimated power costs for that unit.

In appraising the economics of geothermal electric generation, one must distinguish between cost and price. The steam developers seldom expose their costs, but utilities, through state regulatory control, are normally required to show theirs. Consequently, the mix between the price paid for the steam and the cost to the utility does not really tell the actual overall cost. It merely shows the cost of power to the utility.

TABLE C.—GEYSERS DEVELOPMENT

Unit	Year	Mega-watts	Cumulative mega-watts	Steam producer	Date certified for construction by California Public Utilities Commission	Date of commercial operation	Electric utility capital investment	Cumulative Electric utility capital investment
1	1960	11	11	U-M-T ¹	Apr. 7, 1959	Sept. 25, 1960	\$4,010,000	\$4,010,000
2	1963	13	24	do	July 11, 1961	Mar. 19, 1963		
3	1967	27	51	do	Sept. 22, 1964	April 28, 1967	7,610,000	11,620,000
4	1968	27	78	do	July 12, 1966	Mar. 2, 1968		
5	1971	53	131	do	Jan. 23, 1968	Dec. 15, 1971	12,756,000	24,376,000
6	1971	53	184	do	Nov. 12, 1968	do		
7	1972	53	237	do	Nov. 23, 1971	Aug. 18, 1972	10,982,000	35,358,000
8	1972	53	290	do	do	Nov. 23, 1972		
9	1973	53	343	do	do	Oct. 25, 1973	2 13,520,000	2 48,878,000
10	1973	53	396	do	do	Nov. 30, 1973		
11 ³	1974	106	502	do	Sept. 12, 1972	Jah. 1, 1975	2 14,404,000	2 63,282,000
12 ⁴	1976	106	608	do	Sept. 1, 1974 ²	Sept. 1, 1976	2 14,727,000	2 78,009,000
14 ⁴	1976	110	718	do	Nov. 1, 1974 ²	Nov. 1, 1976	2 16,350,000	2 94,359,000
15 ⁴	1977	55	773	PEC ⁵	Mar. 1, 1975 ²	Jan. 1, 1977	2 11,303,000	2 105,662,000
13 ^{4,6}	1977	135	908	Burmah	do	Mar. 1, 1977	2 20,217,000	2 125,879,000

¹ Union Oil, Magma Power, and Thermal Power.

² Estimated.

³ Under construction.

⁴ Proposed unit.

⁵ Pacific Energy Corp.

⁶ Lake County.

TABLE D.—Estimated capital cost of the Geysers powerplant unit 15 (55 MW) and necessary step-up substation and transmission facilities

Item	Estimated cost (1973 price level)
Production:	
Land and land rights	
Structures and improvements	\$1,569,000
Structures and improvements (equipment)	115,000
Boiler plant equipment	1,005,000
Turbine-generator equipment	3,999,000
Accessory electric equipment	582,000
Miscellaneous powerplant equipment	85,000
Communications equipment	36,000
Engineering and other allocable costs	734,000
Overhead construction costs	1,462,000
Total production	9,587,000
Step-Up substation:	
Station equipment and transformers	463,000
Engineering and other allocable costs	46,000
Overhead construction costs	92,000
Total substation at plant	601,000
Transmission:	
Towers and fixtures	2,000
Overhead conductors and devices	2,000
Engineering and other allocable costs	1,000
Overhead construction costs	2,000
Total transmission	7,000
Total project	10,195,000
Estimated additional cost for escalation to date of completion	1,109,000

TABLE E.—ESTIMATED COST (ESCALATED TO DATE OF COMMERCIAL OPERATION; 1977) OF POWER FROM THE GEYSERS POWER PLANT UNIT 15 (55 MEGAWATTS)

	Steam production	Step-up sub.	Transmission
Estimated construction cost (thousands)	\$10,590	\$705	\$8
Total project (thousands)		11,303	
Estimated annual cost (excluding fuel), fixed charges, percent of capital:			
Return and depreciation	10.23	9.96	9.93
Taxes on income	2.43	2.19	1.83
Property taxes	1.69	1.69	1.69
Insurance09	.09	.09
Total	14.44	13.93	13.54
Annual cost (thousands):			
Fixed charges	1,529	98	1
Operation	66	3	0
Maintenance	47	3	1
General expense	34	2	0
Total excluding fuel	1,676	106	2
Total project		1,784	
Fuel requirements and power costs:			
Basic data:			
Net capacity, megawatts		55	
Unit steam cost, mills/kWh (includes 0.5 mill for effluent disposal)		7.40	
Transmission losses on energy, percent		6.00	
Capacity factor operation, percent		70	80-90
Net annual energy production, million kWh		337	385-434
Net energy at end of lines, million kWh		317	362-408
Annual (steam and effluent disposal) cost (thousands)		\$2,494	\$2,849-\$3,212
Other annual costs (thousands)		1,784	1,784-1,784
Total annual costs (thousands)		4,278	4,633-4,996
Average delivered cost, mills/kWh		13.50	12.79-12.26

VIII. Environmental Considerations

Geothermal energy, as mentioned earlier, generally enjoys the reputation of being environmentally pure. Many people who oppose construction of fossil or nuclear generating projects therefore urge geothermal generation as the ideal environmental alternative.

Unfortunately, geothermal power is not without environmental problems. On the positive side, we can note that these problems seem manageable, even though costly. So long as environmental constraints are imposed within reasonable and responsible bounds, development can proceed.

Most natural hydro-thermal systems contain noncondensable gases in varying amounts. Hydrogen sulfide is only a small portion of such gases but is readily detected through its characteristic rotten-egg odor. If the geothermal steam development is located in a relatively unpopulated area, the presence of hydrogen sulfide may, in terms of environmental effect, be quite unimportant. However, regulatory limits seldom recognize the location or unique circumstances and can be unrealistically restrictive. In addition to natural release of hydrogen sulfide through fumaroles at The Geysers project, some hydrogen sulfide is released to the atmosphere from the plant condenser vents and cooling towers. To comply with the applicable air quality standards, a major research effort has brought to pilot plant stage a process for abating the release of hydrogen sulfide gas from the power units. The process results in the production of elemental sulfur in the form of a wet sludge having no commercial value. It is planned to dispose of this in a controlled land fill.

Initially, at The Geysers, the unevaporated condensate from the power cycle was released to the natural drainage channels, and no problems were detected. However, as development grew, the ammonia content and the quantity of effluent increased to the point where there was potential for an adverse effect upon the local fish life. Further, small concentrations of boron in the condensate created concern because it was known that boron in small quantities could be harmful to certain types of vegetation. Both the ammonia and boron questions were

resolved by reinjecting the unevaporated condensate into the underlying steam-producing formations, where it is believed to be reheated by the hot rock and flashed to steam, thereby extending the productivity of the reservoir. For development in other areas where brines or even relatively pure waters are to be released in drainage channels or into bays or the ocean, the impact of those liquids upon the aquatic environment must be considered carefully.

Characteristically, geothermal resources are found in areas of seismic activity. One of the techniques for locating potential geothermal resources is through measurement of micro-earthquakes. Although there have been some questions raised about the possibility of wells being offset in a seismic break, the probability is so remote as to be ignored, and structural designs of surface facilities to resist earthquakes are quite manageable.

Land subsidence has been reported at the Wairakei project in New Zealand and the Cerro Prieto project in Northern Mexico. It is believed that this problem will generally be associated with withdrawal of hot water from geothermal reservoirs, particularly in sedimentary formations. In rock formations such as those at The Geysers, subsidence is not expected.

Geothermal projects have been affected by increasing concern over possible effects on the environment. Regulatory agencies now require submittal of extensive environmental data statements, which are both time-consuming and expensive. Unfortunately, the burden continues to be imposed upon each new increment to the development. Because the geothermal generating units have relatively small capacity, new units must be added at fairly frequent intervals. In California, it is presently necessary to prepare detailed environmental data statements for each addition, even though the individual geothermal area may have been discussed in detail in several earlier data statements. The burden and cost to the utility of preparing statements may be manageable, but the cost and delay are compounded immensely because regulatory bodies must prepare their own environmental statements after reviewing those of the steam developer and the utility. Unfortunately, the detail required for these reports and statements is excessive and the regulators are not geared to processing the applications expeditiously. Acceptance of a single environmental report for each specific geothermal resource area would be helpful. The value of such a concept has been recognized at the state level in California and currently there are legislative efforts to streamline the regulatory review, reduce costs, and advance the rate of geothermal development.

In some areas, land use compatibility of geothermal development could be a problem. Construction and operation of geothermal plants are basically industrial activities. Roads must be constructed to individual well sites, wells must be drilled, and piping systems must be installed to carry the steam or hot water to the generating or process plants. The plants themselves and associated electric transmission lines must be constructed. Even at The Geysers, located in an area having relatively few other uses, matters of land use compatibility must be addressed and resolved.

Aside from the possibility of suffocating institutional restraints, it is believed that the environmental problems of geothermal development in most places can be solved through applied technology. There is no reason to believe geothermal energy will be attended by any more serious problems than energy from fossil-fuel sources. With a growing realization of the importance of conservation and early development of domestic energy resources, there is every reason to develop and impose environmental constraints in a reasonable manner. If, however, additional layers of unnecessary environmental requirements are imposed, costs will get out of hand and projects will be stopped by the sheer impossibility of meeting such requirements. It would be a national tragedy, indeed, if this valuable natural resource were stultified by unnecessary or punitive environmental requirements.

IX. Major Problems and Their Solutions

Once a geothermal resource is brought to the earth's surface, most of the technology already developed for the utilization of other kinds of heat sources will be applicable to the conversion of geothermal energy for man's use. The technology for the use of dry steam such as that found at The Geysers is basically the same technology that has been used for decades in electrical generation. Nature has merely provided the boiler and the steam is run through low-pressure low-temperature turbines of a design not too different from that of 50 or more years ago. Because of the chemical content of the steam at The Geysers project, there

are turbine blade deposits which require additional maintenance. Surfaces in contact with the steam or condensate require special treatment and certain sensitive electrical gear is confined to special rooms away from the corrosive effects of hydrogen sulfide. Rock and dust that get past the centrifugal separators and screens can create serious turbine blade problems. However, when one considers that the steam used in fossil or nuclear units is extremely pure, it is remarkable that these geothermal units operate at and above a 70% capacity factor. Most of the design and operational problems are now well understood and efforts are being made to push output of the project substantially above 70% capacity factor.

The more hostile forms of geothermal resources such as heavy brines will require use of special materials. Scaling of conduits and heat exchangers through which the brines will move may be a serious problem.

Certainly, there needs to be a demonstration of the workability and reliability of heat exchangers and of energy conversion machinery to be used with working fluids such as isobutane and freon.

The only long-term experience with reinjection of geothermal effluents is at The Geysers. Similar experience will be needed in other areas.

Probably the most pressing technical problems associated with accelerating expansion of geothermal energy use lie in the areas of resource exploration, assessment and development. Too little is presently known about the location and potential of this resource, assessment techniques are limited, and less expensive ways of drilling for and producing the resource are needed. We must learn much more about all these subjects.

Also, we must clear away certain non-technical problems which tend to inhibit geothermal development:

1. *Institutional Problems.* Sixty percent of the identified potential geothermal property is on federal land. Bids totaling about \$6.8 million were opened in January 1974 for geothermal leases on 53,000 acres of federal land in California. This implementation of the Geothermal Leasing Act of 1970 was long overdue, and further leasing should be expedited to stimulate development of this nation's geothermal reserves. The ownership of steam on large acreages in the West where mineral rights are reserved to the federal government is still being argued in the federal courts. Adjudication of these questions should be accelerated.

2. *Scarcity of Tubular Goods.* Limited supply of tubular goods such as well casings has been reported recently as a limiting factor in the development of oil and gas resources. Competition for supplies of this kind poses a serious problem for a large-scale geothermal development program. Expansion of mill capacity for producing these goods should be encouraged.

3. *Availability of Drilling Rigs.* Drilling rigs are specialized, expensive, large pieces of equipment which take a long time to manufacture and put into operation. It would take about half of all the rotary drill rigs in the United States today working until the end of this century to develop the resources suggested in the Hickel report. And this assumes that every well would be successful and that the wells would produce for nearly a century without the necessity for redrilling or developing fill-in wells. Advancing the rate of development of geothermal resources, therefore, will have to be accompanied by a significant increase in availability of drill rigs.

4. *Availability of Electrical Generating Equipment.* There is no question of the manufacturers' ability to produce equipment for the utilization of geothermal steam for generation of electricity. There is doubt, however, how far the geothermal electric industry must be developed before manufacturers will see sufficient potential profit to commit the necessary plant for manufacture of the specialized equipment at other than custom-made prices. Manufacturers need a large enough assured base to justify entering the market competitively and economically. Since The Geysers-type equipment will not be usable at most other areas which call for different technology, convincing suppliers to dedicate their resources to making standardized equipment for other types of geothermal energy may be slow process.

5. *Availability of Capital.* The average steam well at The Geysers project currently costs somewhere between one-quarter and one-half million dollars to complete. The cost of the electric generation and associated facilities is estimated to be about three times the cost of wells and other production facilities. If resources of the expansive magnitude suggested by some should be developed, we would be looking for about \$4 billion per year. It can only be with *proven* economics and an *assured* supply of heat that industry would ever make such an enormous financial commitment.

X. Necessary R&D Programs Relating to Electrical Generation

The following are major technological areas where R&D seems to require concerted effort. Some were mentioned earlier.

1. Exploration technology.
2. Deep, hot drilling technology.
3. Geothermal reservoir engineering.
4. Material corrosion and heat transfer scaling investigations.
5. Organic fluid power machinery.

Locating oil reserves is a reasonably advanced technology, developed over many years through identification of specific types of geological structures. This is not true with geothermal resources. Generally, we start from surface indications such as hot springs or fumaroles. Heat-flow studies from relatively shallow holes can provide some information. The final test, of course, is in drilling. New and more efficient exploration technology should be a high priority R&D goal.

Present techniques for deep drilling in geothermal areas are those developed in the gas and oil industry. If some of the deep hot rock formations are to be reached and utilized, new methods will be needed. The Subterrene, described earlier, offers one possibility.

After a geothermal resource is located, drilled and tested, it needs careful assessment. In the case of vapor-dominated systems, techniques similar to those used for assessing natural gas reservoirs can be utilized. If, as some believe to be the case, vapor-dominated systems are recharged from liquid reservoirs at great depth, the resource is much greater than would exist with a vapor reservoir alone. Wells about 9,000 feet deep at the California Geysers have not reached an interface. More would be known about the nature of the reservoir if such an interface could be found, and suggestions have been made for drilling holes on the order of 20,000 feet deep to answer this question. Such a hole would be very expensive and evaluation of what benefits might be obtained from such an effort is still under study.

To the extent that utilization technology still has gaps, research effort should be made on the problems of material corrosion and heat-transfer surface scaling. These gaps are fairly well closed in utilization of the dry steam at The Geysers where research has been completed or is under way, but the gaps are wider for utilization of heat from liquid-dominated systems, especially those having high mineral content. Current research programs to investigate the binary cycle using organic fluid power machinery should be accelerated.

The fact that some research has been undertaken does not mean that parallel research efforts using different techniques should not be started. Both new and backup research programs leading to development of new economic techniques are needed.

XI. Who Should Conduct R&D

There is a great body of technology for utilizing geothermal energy that has already been developed by the nation's resource companies, equipment manufacturers and the electric utility industry. Historical precedent gives assurance that these industries can provide the goods and services to develop the resource once it has been found, assuming reasonable economic incentive. Government's historic relationship with the mining and oil and gas industries has generally provided incentive that permitted resources to be developed to the benefit of the country.

A similar relationship should be extended to the geothermal industry in most aspects of resource exploration, evaluation and development. The government should continue to examine prospective areas using existing agencies such as the U.S. Geological Survey. A federally sponsored national or at least a Western geothermal heat-flow study—consisting of study wells on a regular grid pattern—would undoubtedly locate additional resources, and would provide a less speculative appraisal of the nation's geothermal resource. Information of this kind should then be disseminated widely. Industry should be allowed to evaluate the information, determine the location of the most promising geothermal resources, and then be allowed to carry out their development, production and utilization in a competitive manner.

Some research programs such as those relating to the use of dry, hot rock, development of the Subterrene, and potable water production are presently under federal sponsorship and undoubtedly will require substantially more government funding.

XII. How Fast Should Geothermal Development Proceed

The rate at which geothermal development occurs will not be controlled by a predetermination of how fast it *should* proceed, but rather by constraints which now exist and which may build up around it. Such constraints will be both technological and institutional, but, basically, the rate of development will be controlled by the confidence that grows with success in various aspects of research and discovery, and then, finally, through the test of cold economic realities of investment and operation. Electric utilities, which are prospectively the major users of geothermal resources, have been notably cautious in shouldering large, speculative investments because of the regulated nature of their business. The rate of development of such an infant industry as geothermal should, in utility view, be continued on an evolutionary basis to match the proven resources, rather than presuming that the resource is available and attempting to match the presumption. The rate of development certainly can be accelerated, but the whole concept would be seriously harmed if the rate of commitment to development should overrun the availability of the resource and usable technology.

Even though geothermal energy might develop more slowly utilizing the free marketplace philosophy, it should do better and be stronger if it develops under the test of economic viability. It can then assume an increasing role in the energy mix as a competitive form with other energy sources, as it presently does in Northern California. Large geothermal leasehold positions are being taken in the Western United States by many of the nation's energy companies. These include not only the small venture-capital firms which pioneered the exploration of this resource, but also some of the nation's major oil companies. These firms are necessarily profit oriented and are motivated to accelerate geothermal energy development. Working in concert with the nation's utilities, a balanced development program will evolve. With the proper economic incentives and regulatory climate, these industries will combine their diverse talents to bring this resource to its timely and full economic potential.

XIII. Summary and Conclusions

Many factions want to increase the production of geothermal energy—including environmentalists, drillers and producers of steam, electric utilities, research organizations, geophysicists, geologists, and some politicians who properly understand that the energy crisis is real and long-term. With this support, geothermal energy is likely to be developed to its maximum economic capability. Geothermal energy needs enthusiastic voices to keep its development moving, but that enthusiasm should never lead to irresponsible suggestions, as have been made in the past, that everything should stop while we wait for a full geothermal economy to arrive. The nation should not overreact to geothermal energy's appeal and follow a course of wasting another important resource—our nation's dollars.

While the potential for using geothermal heat in electric generation is quite important, extrapolations of the present, meager information on this resource should not overshadow the need for continuing development of other sources of electrical generation. While pressing very hard for development of geothermal energy as a proper part of the mix of world energy resources, we must continue to use the full range of energy sources available now.

Two centuries ago, the industrial revolution began with the extensive use of fossil fuels. First coal, and then oil and gas served man's ever-increasing need for energy. In the period to the end of this century, nuclear energy holds promise of becoming a dominant energy source. In fact, it will be essential if we are to meet the nation's need for electric power. Coal will also be an important heat source. In this period, geothermal energy can be expected to become an increasingly important supplemental energy source in a number of regions in the West; but it is now difficult to conceive of geothermal power providing 10 percent of the electric energy needs of the nation or even of one of the more active geothermal areas, California. In some areas, production of potable water is possible through the use of geothermal energy, and in those areas where highly-saline geothermal waters are available, raw materials for the chemical industry could be important.

One utility, Pacific Gas and Electric Company, appreciates fully the great benefit geothermal power bestows in saving valuable fossil-fuel resources. It maintains an aggressive, optimistic view with respect to The Geysers development.

Encouragement is needed for advancement of the technology necessary to assess and develop this resource, wherever it can be found, so that the economic sources will be utilized as rapidly as possible.

STATEMENT OF GARRY DELOSS, STAFF ATTORNEY, PUBLIC INTEREST RESEARCH
GROUP AND CORPORATE ACCOUNTABILITY RESEARCH GROUP

My name is Garry DeLoss. I have been monitoring the activities and policies of the Federal Energy Administration for Ralph Nader since last winter.

I am submitting the following discussion of energy pricing policy and its relevance to Project Independence for your consideration and as background information in support of my oral remarks.

We all recognize that a major ingredient in the expanded rate of inflation over the past year, perhaps even the greatest single inflationary factor in our economy today, is the increased cost of energy. Project Independence is in part an effort to protect our economy from the inflationary effect of dependence on monopoly priced foreign oil by substituting energy conservation measures and domestic energy supplies for the OPEC priced foreign oil. OPEC's ability to set a monopoly price for the oil which we import, however, is not the only reason our energy costs have increased. We import only 16 percent of the energy which we consume. If Project Independence means increased independence from OPEC-induced increases in our energy costs, we must also guard against indirect OPEC control of the prices of our domestic oil, natural gas, and coal through the upward influence of the OPEC oil price.

Unfortunately for the quality of public debate on the causes and cures of inflation, Administration spokesmen and commentators have focused on the cost of our imported oil and concluded that since we cannot force or cajole OPEC into reducing its price, we cannot do much about our increased energy costs. FEA Administrator John Sawhill often refers to our entry into a "new era of high energy costs." He may be correct if he means that energy costs will never subside to the level of the 1960s. But he is wrong if he means that we must accept as inevitable the increased cost of energy which we have incurred in 1974.¹

The truth is that a major factor in our increased energy costs this year has been the failure of the federal government to intervene and prevent the OPEC oil price from leading the prices of our domestically produced oil, natural gas, and coal upward. While the increased cost of imported oil will add \$17.9 billion to our energy costs in 1974 over 1973, prudent government control of the prices of our domestic oil, gas, and coal could have reduced our energy costs by at least \$18.4 billion (see text infra).

The increase in our energy costs in 1974 and its inflationary effect, then, is at least double what it should be because we have permitted OPEC to effectively set the prices for much of our domestic oil, gas, and coal, as well as the oil which we import. To paraphrase Mr. Sawhill, we have entered the era of *avoidable* high energy costs.

OIL PRICES

The OPEC prices which we are paying for uncontrolled domestic oil and other unnecessarily high oil prices are adding \$10.4 billion annually to our energy costs.

In August, 1973, all domestic crude oil was controlled by a price ceiling of \$3.90 per barrel. As part of Phase IV, the Cost of Living Council (CLC) created in August a two tier price system that continued control of the price of "old" oil (1972 production levels), while decontrolling the price of "new" oil (production in excess of 1972 levels from old oil properties and production from newly developed properties) as an incentive for increased production. CLC strengthened the incentive to produce new oil from old oil properties by releasing a matching barrel of old oil from price controls for every barrel of new oil produced on an old oil property. The decontrolled matching barrels of old oil were termed "released oil." Finally, CLC raised the price of old oil from \$3.90 to \$4.25 per barrel, a rise of 9 percent. During September and October the price of uncontrolled oil rose rapidly, but even that rate of increase was accelerated when OPEC began its embargo and price increases and the price of uncontrolled domestic oil kept pace. In addition, in November Congress freed more domestic oil from controls and permitted it to rise to the OPEC price when it exempted "stripper" oil (oil from wells producing 10 barrels or less per day) from price controls.

¹The Department of Commerce reports that the cost of oil imports for the first eight months of 1974 has been \$15.8 billion. Since the recent monthly average cost has been \$2.4 billion, the cost of oil imports over the remaining four months of 1974 will probably be an additional \$9.6 billion, for a 1974 total of \$25.4 billion. Minus the \$7.5 billion cost of imported oil in 1973, the added cost of imported oil in 1974 will be \$17.9 billion.

Thus by the time the Federal Energy Office was created in December, the uncontrolled price of new, released, and stripper oil had more than doubled since the previous summer as it rose with the OPEC price, and the controlled price of old oil had been increased 9 percent. Domestic oil producers were taking in more money than they could reinvest in new production because expansion of production was severely constrained by shortages of drilling rigs, tubular steel goods, rig crews, and professional manpower. Despite the unforeseen magnitude of the price rise for domestic oil and the knowledge that the real constraint on increased production was equipment and manpower shortages rather than price, FEO Administrator William Simon did not ask CLC to reimpose price controls on new and released oil. Instead, he participated in the decision by CLC to raise the price of old oil from \$4.25 to \$5.25 per barrel, an increase of 23.5 percent on top of the 9 percent August increase. Indeed, at a December 18 meeting with CLC officials, Simon's aide, William Johnson, argued for raising the price even higher.

A week after the old oil price increase the authority to regulate oil prices was officially transferred from CLC to Simon's control at FEO. In subsequent months he refused to recontrol the price of new and released oil and vigorously defended the old oil price increase as an incentive to increase production and necessary to cover increased production costs, though he refused to provide any economic analysis to support the price rise. When I secured the relevant "Supporting Memoranda" relied upon by CLC in deciding to raise the price of old oil, my suspicions about Simon's inability to provide supporting analysis were confirmed. No such analysis existed. The Supporting Memoranda concluded that the price rise was not justified by an increase in production costs, would not stimulate production of old oil because the real incentive for increased production was the higher, uncontrolled price of new and released oil, and would not reduce demand. A recent GAO report concluded that the old oil price increase was unjustified. Rolling back this unjustified and unnecessary \$1 per barrel increase in the price of old oil would reduce the inflationary pressure of energy costs by \$2 billion per year.²

The inflationary effect of the \$1 increase in the price of old oil is bad enough, but an even greater inflationary increase in energy costs is traceable to failure to control the price of new, released, and stripper oil, which collectively account for 40 percent of domestic production. Because the price of this oil has risen to the OPEC price level, OPEC is, in effect, controlling the price of 40 percent of our domestic oil, as well as the price of our imported oil. Hence proponents of the uncontrolled price of new, released, and stripper oil are really arguing that we should pay the OPEC price for such oil because that price is needed as an incentive for increased exploration and production of domestic oil. They point to the 25 percent increase in drilling in 1974 as evidence that the incentive is working. The truth is, of course, that our historically declining drilling activity would have increased by several hundred percent in response to the new oil price of about \$10.25 but for the constraint of equipment and manpower shortages. Conversely, the current shortage-constrained increase in drilling activity could have been stimulated by a price much lower than the OPEC monopoly price.

Indeed, an internal FEA document notes that "while the oil producers may object publically [sic] to any price reduction, privately many have admitted that a \$7 to \$8 price is adequate." The same document observes that paying the uncontrolled OPEC price for our new oil "appears to have overstimulated development, causing an acute shortage in equipment and personnel, and spiraling equipment costs." Thus a recent survey discloses that by June, 1974 oil production equipment costs had risen 59 percent in one year, and are still rising. Hence the uncontrolled price of new oil has caused severe inflation within the oil production industry, as well as in the economy as a whole. Rolling back the price

²The calculations in this and subsequent footnotes assume an average 1974 new oil price of \$10.25/barrel and an average daily domestic production of crude oil of 9,000,000 barrels/day (MBD), divided among old oil (60%), new oil (16%), released oil (11%), and stripper oil (13%). The author has previously provided similar computations in testimony before the Legal and Monetary Affairs Subcommittee of the House Committee on Government Operations on August 20, 1974. Since then, the Economics Division of the Library of Congress has verified my methodology and arrived at similar dollar figures in a study prepared for Congressman John Moss (D-Calif.) and dated October 3, 1974.

The \$2 billion annual cost of the \$1.00/barrel increase in the price of old oil is derived as follows:
 $(\$5.25 - \$4.25) \times .6 \text{ (9MBD)} \times 365 \text{ days/year} =$
 $\$1.00 \times 5.4 \text{ MBD} \times 365 \text{ days/year} = \$1.971 \text{ billion/year.}$

of our new oil from the OPEC price to a reasonable incentive price of \$7 per barrel would reduce our energy costs by \$1.7 billion annually.³

If the OPEC price for our domestically produced new oil is already excessive, there is no justification for continuing the bonus which released oil provides for each barrel of new oil produced from an old oil property. The extra money gained by producers from selling released oil at the OPEC price rather than the old price means that we are paying about \$15.25 per barrel of new oil produced from old oil property. Rolling back the price of released oil so the proper old oil price of \$4.25 would reduce our energy costs by \$2.2 billion annually.⁴

Paying the OPEC price for stripper oil is unjustified also. While Congress created the stripper exemption Simon and Sawhill have supported its continuation, though with the customary lack of supporting economic analysis. Of course, the supporting analysis doesn't exist. An internal FEA document recently conceded that it would take FEA a year to collect the data needed to judge how much oil is really being kept in production by the stripper oil exemption. Presently unverified estimates of the oil kept in production by the stripper oil exemption lead to calculations of the incremental cost per barrel of stripper oil as anywhere from \$28 to \$280 per barrel.⁵ Any such cost is unacceptably inflationary. Rolling back the present OPEC price for stripper oil to the proper old oil price of \$4.25 would reduce our energy costs by \$2.6 billion annually.⁶

As for the need to provide an adequate incentive price for increased secondary and tertiary recovery of oil, this goal could be accomplished by a price policy which directly rewards production of high recovery cost oil at a cost of a few hundred million dollars annually rather than the \$6.8 billion per year inherent in the \$5.25 price for old oil and the uncontrolled OPEC price we are paying for released oil and stripper oil. The difference between a rifle shot and a shotgun approach in this case is several billion dollars per year in added energy costs and inflationary pressure.

Another Simon and Sawhill pricing policy is the 3 cents per gallon increase in the profit margin of gasoline marketers permitted in January and March. This 37 percent increase in the profit margin on gasoline was intended to offset the loss of sales volume due to the gasoline shortage last winter and hence permit dealers to cover their fixed costs. Today, however, gasoline sales have increased to near their 1973 level while the number of service stations has dropped by 10 percent in the past year. Therefore the sales volume per station is greater than during the pre-embargo period. Nonetheless, FEA has maintained the 3 cents per gallon increased profit margin, ostensibly on the ground that increased operating costs justify it. Assuming for the sake of argument that a 1 cent per gallon, or

³ $(\$10.25 - \$7.00) \times .16$ (9MBD) $\times 365$ days/year =

$\$3.25 \times 1.44$ MBD $\times 365$ days/year = \$1.708 billion/year.

⁴ $(\$10.25 - \$4.25) \times .11$ (9MBD) $\times 365$ days/year =

$\$6.00 \times .99$ MBD $\times 365$ days/year = \$2.168 billion/year.

⁵ The aggregate cost of the stripper well exemption is \$2.562 billion/year (see footnote 6, infra). If the amount of crude oil kept in production by the stripper oil exemption is 25,000 to 50,000 barrels/day, as stated by FEA during a Congressional hearing, then the incremental cost per barrel is from \$280/barrel [$\2.562 billion/year \div 25,000 barrels/day $\times 365$ days/year] to \$140/barrel [$\2.562 billion/year \div (50,000 barrels/day $\times 365$ days/year)]. If the amount of crude oil kept in production by the stripper oil exemption is the unrealistic 250,000 barrels/day claimed at one time by a stripper oil trade association, the incremental cost per barrel is \$28/barrel [$\2.562 billion/year \div (250,000 barrels/day $\times 365$ days/year)].

Another method for computing the incremental cost per barrel of stripperoil was by a "veteran petroleum engineer" at FEA who found an incremental cost per barrel of \$29 based on the assumption that a \$10/barrel uncontrolled price for stripper oil "might add a billion barrels additional stripper oil production to the approximately 4 billion barrels stripper oil reserves available at \$5.25 per barrel. Five billion barrels at \$10/bbl is equivalent to 4 billion barrels at \$5.25 plus 1 billion barrels at \$29 per barrel." Remarks by Philip L. Essley, Jr., Deputy Assistant Administrator for Policy Analysis and Evaluation, Federal Energy Office, before the Society of Petroleum Engineers Symposium on Improved Oil Recovery, Tulsa, Oklahoma, April 22, 1974.

Mr. Essley goes on to point out that even the \$29/barrel cost may be misleading because "in a stripper waterflood, the energy input to inject the water and lift the combined water and oil production is quite high. The net energy output from some stripper wells is thus quite low, in some cases approaching zero percent. If we assume that the cost of the gross incremental stripper well production is \$30/barrel, and that the average net output of such incremental production is only 50 percent then, the incremental cost to society of each *net* additional barrel of stripper well oil added to our energy supply is about \$60 per barrel."

⁶ $(\$10.25 - \$4.25) \times 365$ days/year =

$\$6.00 \times 1.17$ MBD $\times 365$ days/year = \$2.562 billion/year.

14 percent increase, is justified by increased operating costs, the remaining 2 cents per gallon is adding an unnecessary \$1.9 billion per year to our energy costs and should be rolled back.⁷

The total reduction in energy costs available if the above corrections in our oil pricing policies are made is \$10.4 billion annually.

As if the multi-billion dollar handout to Big Oil provided by the decontrol of new, released, and stripper oil were inadequate, Secretary of Treasury Simon went before the National Petroleum Council on September 10 and advocated decontrol of the price of old oil, which comprises 60 percent of domestic oil production. Of course, he offered no evidence to support his proposal, since even the present \$5.25 price for old oil cannot be justified, much less a price of \$10.25. Instead, he spoke of a return to free market pricing of oil, although he knows that there is no free market price for oil in the world today. The so-called world market price is an OPEC monopoly price unrelated to the incentive price which the law of supply and demand would create in a truly free market. Thus Simon is actually advocating that we pay the OPEC price for our old oil. Then OPEC would be setting the price for all of our domestic oil, as well as our imported oil. If Simon's proposed decontrol of old oil is accomplished, it will add another \$10 billion per year to our already inflationary energy costs.⁸ FEA Administrator John Sawhill must be credited with publicly opposing the Simon proposal to decontrol old oil in an interview on September 10, though I'm not sure that he will be permitted to continue his opposition to decontrol now that the White House is advocating the decontrol policy.

NATURAL GAS PRICES

In addition to proposing that we permit OPEC to set the price of our domestic oil, which supplies 33 percent of our energy, the Ford Administration is advocating deregulation of the price of natural gas, which supplies another 30 percent of our energy. A favorite argument of the proponents of deregulation of natural gas is that in a "free market" the price of natural gas would rise to an energy commodity price near the price of an equivalent amount of oil. Since the so-called free market price of oil is really the OPEC monopoly price, they are really arguing that we should permit OPEC to control the price of our natural gas through its ability to influence the price of our oil. Even the partial decontrol of natural gas proposed by Senator Buckley would add over \$10 billion annually to our energy costs due to OPEC pricing.⁹

In fact, OPEC is already influencing our natural gas prices upward in the unregulated intrastate sales of natural gas where the commodity pricing phenomenon is taking effect. Hence the argument that the recently increased prices for intrastate sales of natural gas are evidence of the need to permit the interstate price of natural gas to rise to an equivalent level is an argument in favor of OPEC pricing of another 30 percent of our energy supply. The correct anti-inflationary argument is that we should extend price regulation to intrastate sales of natural gas to end the OPEC influence on the price of our natural gas. Federal regulation of intrastate sales of natural gas at a reasonable incentive price rather than OPEC pricing of that gas would reduce our energy costs by billions of dollars annually. An exact calculation of the average price for intrastate sales of natural gas is not available. Estimates range from \$1.00/Mcf to \$1.50/Mcf. Given a \$1.00/Mcf average price for intrastate natural gas, a reduction to 50 cents/Mcf, which is the highest current price permitted by the FPC in interstate sales of natural gas (Southern Louisiana), would reduce our energy costs by \$5.5 billion per year.¹⁰

⁷ Gasoline sales are averaging about 6.4 MBD, which equals 98.1 billion gallons/year. In May, 1973 CLC froze gasoline dealers' profit margins at 7.25 cents/gallon. For a while after the January and March, 1974 increases totalling 3 cents/gallon, dealers' margins averaged around 11 cents/gallon. Competition has since eroded the average margin to 10.2 cents/gallon. At that rate the extra margin allowed dealers in January and March would give them an additional \$2.89 billion/year from consumers. Permitting dealers to retain a 1 cent/gallon increase over the May, 1973 margin instead of the close to 3 cents/gallon increase they have been given would save consumers \$1.91 billion/year [$\$2.89 \text{ billion/year} (\$0.01 \times 98.1 \text{ billion gallons/year})$]

⁸ $(\$10.25 - \$5.25) \times .6 (9\text{MBD}) \times 365 \text{ days/year} = \$5.00 \times 5.4 \text{ MBD} \times 365 \text{ days/year} = \$9.855 \text{ billion/year}$.

⁹ See attached Public Citizen fact sheet on natural gas.

¹⁰ In 1973 intrastate sales of natural gas totaled 11 trillion cubic feet (TCF), or 11 billion Mcf. A 50 cents/Mcf reduction in the average price of such sales would reduce energy costs by $\$0.50/\text{Mcf} \times 11 \text{ billion Mcf} = \5.5 billion/year .

COAL PRICES

The OPEC monopoly pricing of oil on the world market and the energy commodity pricing phenomenon have also combined to push upward the price of our coal, which supplies 18 percent of our energy. The spot-market price of coal has risen 400 percent for some utilities in the past year. This price rise is affecting the price of contract coal. TVA reports that the price of coal on one contract has been renegotiated upward by 250 percent. FPC statistics through June 1974 disclose that the national average price of coal bought by electric utilities increased by 67 percent since September, 1973. Due to the OPEC pricing of our coal beyond any relevance to cost of production plus a reasonable profit, coal companies are reporting record profits. As in the case of oil, however, even the record profits cannot create a dramatic short term increase in production due to a shortage of strip mining equipment and the long leadtime needed to open a deep mine. If the OPEC induced 67 percent average increase in the price of coal were cut back by government controls to a more reasonable 20 percent increase, our energy costs would be reduced by \$2.5 billion annually.¹¹

SUMMARY

As I noted earlier, the rise in the price of our imported oil will add \$17.9 billion to our energy costs in 1974. The avoidable OPEC-induced increases in the cost of domestic energy supplies discussed herein add up to \$18.4 billion/year (\$10.4 billion for oil, \$5.5 billion for natural gas, and \$2.5 billion for coal). Thus the avoidable increase in the cost of domestic energy is equal to the increased cost of the energy which we will import in 1974. We have learned that we cannot do much about the latter cost. Therefore we must take action to reduce our energy costs where we do have the power to effect events, at home.

The dirty little secret of energy costs which this Administration's energy policy makers and the energy industry prefer to ignore is that we can reduce our energy costs, and their inflationary effect, drastically if we will only act on the knowledge that there is no longer a "free market" for energy. When the Administration and oil industry spokesmen claim that energy costs would be governed by a free market if we decontrolled old oil and new natural gas, they are actually advocating that we should permit OPEC pricing to add *another \$20 billion in avoidable energy costs* to the inflation which already burdens us. Indeed, when they defend existing pricing policies, which are currently imposing billions of dollars of avoidable energy costs on our economy, they are in effect arguing that the OPEC monopoly price for oil is an appropriate incentive price for 40 percent of our oil, half of our natural gas, and all of our coal.

I doubt that OPEC has by chance chosen an oil price which is the correct incentive price for increased production of energy in this country. Even if long term incentive prices for oil, natural gas, and coal are higher than the liberal incentive prices which I have suggested are appropriate in the short term (\$7/barrel for oil, 50 cents/Mcf for natural gas, and \$10.92/ton for coal), we cannot afford to pay the higher long term prices today. We must start at a more reasonable short term incentive price and work our way up as warranted by demonstrable increases in costs of production.

We need today a comprehensive system of cost-based price controls for all domestic energy supplies. Such a program is an essential part of Project Independence because it will protect us from OPEC control of the price of our domestic energy supplies. In order to provide suitable supplies of oil, natural gas, and coal we must build on our experience with multiple tier pricing of oil and natural gas. Oil prices, for example, should be arranged in three tiers, \$4.25/barrel of old oil, \$7.00/barrel of new oil, and the OPEC price for imported oil. Perhaps we can even control the third tier price for imported oil if the proposals of some experts on ways to control the price of imported oil prove to be feasible. If not, the least we can do is to control the price of our domestically produced oil at an anti-inflationary level rather than allow it to rise to a monopoly price level set by a foreign cartel.

¹¹ We consume 600 million tons/year of coal. The 67 percent increase in the average price from \$9.10/ton in September, 1973 to \$15.17/ton in June, 1974, meant an increased annual cost of $(\$15.17 - \$9.10) \times 600 \text{ million tons/year} = \$3.642 \text{ billion/year}$. If the price increase had been held to 20 percent, or \$1.82/ton, the increased annual cost would have been $\$1.82 \times 600 \text{ million tons/year} = \$1.092 \text{ billion/year}$. The avoided energy cost would have been $\$3.642 \text{ billion/year} - \$1.092 \text{ billion/year} = \$2.55 \text{ billion/year}$.

In sum, in a world where the so-called free market price of oil is an artificially high OPEC monopoly price, we cannot afford to allow the OPEC monopoly price to establish a commodity value for our domestic oil, gas, and coal. If we don't act to prevent the price of our domestic energy supplies from being influenced by the OPEC price for oil, OPEC will control the price of our domestic oil, gas, and coal as well as the price of the oil which we must import.

President Ford recently acted to prevent a similar inflationary intervention in our economy by a foreign power when he prevented the Soviet Union from completing a grain purchase which would have further inflated our food prices. The Ford Administration must now seek and exercise authority to insulate the prices of our domestic energy supplies, which supply over 80 percent of our energy, from the inflationary effect of the OPEC dictated oil price on the world market.

STATEMENT OF GARRY DeLOSS, STAFF ATTORNEY, PUBLIC INTEREST RESEARCH GROUP AND CORPORATE ACCOUNTABILITY RESEARCH GROUP

My name is Garry DeLoss, I have been monitoring the activities and policies of the Federal Energy Administration for Ralph Nadar since last winter.

In my statement today I will comment on the need for a program of mandatory energy conservation, the weaknesses of the Project Independence Report's premise of reducing oil and gas consumption by substituting increased generation of electricity from coal and nuclear power, the necessary targets of mandatory controls on energy consumption, and the possible means for administering a program of mandatory energy conservation.

THE NEED FOR MANDATORY ENERGY CONSERVATION

1. A program of mandatory limits on energy consumption will permit price rollbacks on domestic oil, gas, and coal without stimulating an undesirable increase in energy consumption.

The strongest single inflationary pressure in our economy over the past year has been the rising cost of energy. The \$18 billion increase in the cost of imported oil due to the OPEC cartel's monopoly pricing has been beyond our control. As I testified on Monday, however, we have incurred another \$18 billion of energy costs and inflationary pressure during 1974 which we could and should have avoided. We are paying this \$18 billion of avoidable energy costs because our government has pretended that a free market for energy still exists and, accordingly, has permitted domestic energy producers to price 40 percent of our oil, half of our natural gas (intrastate sales), and a significant fraction of our coal at or near the Btu equivalent price of OPEC oil. Thus we have incurred the burden of direct OPEC pricing of the 16 percent of our energy needs which we import and indirect OPEC pricing of much of our domestic energy supply.

It's time to quit allowing our domestic energy producers to charge us the OPEC monopoly price for our oil, gas, and coal. One argument against rollbacks of oil, gas, and coal prices to reasonable incentive levels has been that the high prices help discourage consumption. The truth is that our economy cannot afford price rationing in the form of \$18 billion of excess profits for the energy industry. Hence this Administration's ideological rigidity must give way to concerns over the health of our economy. The pretense of a free market in energy must be dropped.

Rumors that the Administration will soon propose mandatory limits on energy consumption are a welcome, though belated sign of recognition of the need for government intervention. But let's not stop short. The intervention should be extended to price rollbacks. One of the best reasons for invoking the contemplated program of mandatory energy savings is that it will make possible a rollback of domestic energy prices from their present monopoly levels without a consequent increase in consumption in response to the reduced cost of energy.

Conversely, the price rollbacks would help make the mandatory reduction in energy consumption palatable to the public. The tradeoff is giving up some energy consumption and getting lower cost energy in return.

2. Mandatory energy conservation is anti-inflationary.

Mandatory reductions in energy consumption would be a strong weapon against inflation because squeezing energy waste out of our economy would improve efficiency in the production of goods and delivery of services.

3. Mandatory energy conservation can eliminate our trade deficit.

Our trade deficit this year is expected to be about \$5 billion. Since the cost of our oil imports will be \$18 billion higher than in 1973, the \$5 billion trade deficit is entirely due to the increased cost of oil imports, which will total over \$25 billion in 1974. If we could reduce our consumption of imported oil by about 1.14 million barrels per day, or 7.1 percent of our total oil consumption, we could eliminate our trade deficit.

4. Mandatory energy conservation can enhance national security by reducing our dependence on imported energy.

5. Mandatory energy conservation can reduce natural gas curtailments.

Mandatory allocation of natural gas is feasible and could prevent the closing of factories, schools, and other interruptible users of natural gas unable to find substitute energy supplies during the projected shortage of 10 percent or more this winter. Allocation is the only way to provide to low priority users during the next few winters, since substantial new supplies cannot be developed during the next 2-3 years at any price.

6. Mandatory energy conservation would reduce energy-related demands on our capital markets.

Electric utilities could postpone raising some of the hundreds of millions of dollars for expansion which they continue to seek today on the assumption that electricity demand will continue to increase at a rapid rate. Also, the projected investment of hundreds of billions of dollars in sharply expanded production of domestic oil, gas, and coal could be stretched out over a longer time period. Reducing energy-related demands on the capital markets would lower the upward pressure on interest rates and free the unneeded capital for use in housing and other sectors of the economy.

Of course, measures undertaken to reduce energy consumption would create their own demand on the capital market since they represent in many cases a substitution of capital for energy. We need more information on the relative merits of investments in energy production versus investments in efficiency of energy consumption, and policies based on that information.

7. Mandatory energy conservation would reduce environmental disruptions inherent in the exploration, development, processing, transportation, and consumption of energy.

PROBLEMS WITH CONSERVING OIL AND GAS BY SUBSTITUTING ELECTRICITY

Questions of efficiency and practicality are raised by the Report's premise that end use of oil and gas can be reduced by substituting the use of electricity generated from coal and uranium. It seems wasteful to substitute the inefficiencies involved in the generation, transmission, and consumption of electricity for resistance heating for the relatively efficient heating by burning oil and gas. Moreover, at an Energy Resources Council Seminar on December 10 by FPC Chairman John Nassikas, the natural gas industry has a \$40-50 billion capital investment which cannot be wastefully cast aside.

As for practicality, knowledge gained at a conference of utility company executives and other experts last month is causing a drastic downward revision in FPC's estimate of the number of oil-fired power plants (existing and planned for construction through 1980) which can be converted from oil to coal. Revisions in the predicted availability of nuclear power would be appropriate as well. The practicality of greatly accelerating our reliance on nuclear power is denied by recurrent problems with the cost, reliability and safety of nuclear power plants.

In regard to the cost and reliability of nuclear power plants, I have submitted for the record a recent study on nuclear power plant reliability conducted by David Comey of Business and Professional People for the Public Interest titled "Will Idle Capacity Kill Nuclear Power?" and published in the November, 1974, issue of the *Bulletin of Atomic Scientists*. Contrary to the remarks made at the Energy Resources Council Seminar by John W. Simpson of Westinghouse, and Chairman of the Atomic Industrial Forum, Mr. Comey's calculations of the capacity factors for nuclear power plants are not distorted by the inclusion of old, obsolete plants and the inclusion of plants which have just begun operation. Comey found that the average capacity factor for all operating nuclear power plants larger than 100 megawatts during 1973 and the first six months of 1974 was only 54 percent, although nuclear power plant vendors sell their light water reactors with the claim that they will have an average capacity factor of 80 percent.

One explanation offered by the AEC to excuse this poor record is that large light water reactors require a "break-in period" of about three to four years. When Comey tested this hypothesis, he found that the capacity factors of the light water reactors do reach a peak after three to four years of operation, but rather than leveling off the capacity factor then begins to decline. Hence this problem of idle capacity will not disappear. As Comey puts it, "[t]he conclusion to be drawn from all this is that light water fission reactors cannot be expected to provide a reliable source of electricity during the period of interest to Project Independence. Reliance on them would only exacerbate the energy problem, not solve it."

Concern about the safety of nuclear power plants was reinforced at the Energy Resources Council Seminar where panelist Alvin Weinberg couldn't find any utility company witnesses willing to forego the protection from liability for nuclear power plant accidents provided by the Price-Anderson Act in spite of the Rasmussen Study's assurances of the improbability of an accident. If these hard-headed businessmen are unwilling to gamble their corporate assets on the safety of nuclear power, why should we and our posterity be forced to take that gamble? Nuclear power proponents characterize their critics as idealists and utopians, but they are the greatest utopians of all time. The safety of the nuclear fuel cycle and nuclear power plants depends upon the existence of a technological and social perfection which mankind has never enjoyed. Obviously the businessmen who seek the shelter of the Price-Anderson Act know that this paradise has not arrived.

TARGETS OF MANDATORY CONTROLS ON ENERGY CONSUMPTION

In designing a program of mandatory limits on energy consumption, the paramount goal must be to acquire and maintain public support. At a meeting with FEA officials last summer, Margaret Mead warned that her experience during World War II in mobilizing citizen support for rationing and other aspects of the war effort indicated that people won't support a burdensome program such as rationing unless they feel that they are being treated fairly.

With fairness as a guide, it's clear that last winter's energy saving program should not be repeated. It singled out home heating oil users and their suppliers, motorists, and the tourism industry to bear the energy saving burden. Since tourism is the primary industry in some states, there was a regional discrimination as well. This time the burden must be spread around. All energy users must be asked to bite the bullet.

Thus all residential, commercial, and industrial users of energy must share the burden of reducing energy consumption. This will require that all energy forms be subject to controls—natural gas, electricity, coal, and oil. As noted earlier, the restriction of natural gas consumption by high priority users will have the desirable side effect of permitting diversion of limited supplies to interruptible users. Also, restriction of electricity consumption may free enough coal and nuclear power plant capacity to substitute some electricity for oil and gas consumption after all.

MEANS FOR LIMITING ENERGY CONSUMPTION

Last winter's experience was helpful in one regard. We now have experience with the allocation fraction system for limiting consumption of gasoline and home heating oil, and the administrative machinery for nationwide allocation of those fuels is in place. We also know from an experience in Los Angeles that allocation of electricity is feasible. Los Angeles Water and Power limited its electricity customers to a fraction of their base period consumption and added a stiff surcharge for excessive use, with the threat of cutting off service to flagrant violators. It was a very successful program and could be replicated by other electric utilities around the country. And if it works for limiting consumption of electricity, it will work for limiting consumption of natural gas, since gas is delivered and metered in a similar fashion.

Although the allocation fraction system is not without its problems, it is preferable to further price rationing. We have already incurred an OPEC "surtax." Moreover, as I argued in my opening remarks, we should be fighting inflation by reducing the cost of energy, at least in the short run.

BREAKING THE ENERGY POLICY STALEMATE

(By S. David Freeman)

Our high energy civilization seems on the verge of falling apart. The money managers tell us the world-wide petrodollar drain is like a time-bomb, set to go off by next summer and wreck the world's monetary system, unless defused. United States dependence on Arab oil is a cloud casting a shadow of war that limits our role as a peacemaker in the Middle East. Poor Americans can't afford to buy enough heating oil to keep warm this winter. Air pollution from burning huge quantities of gasoline and boiler fuel continues to endanger the public's health. Even dirty energy is apt to be in short supply this winter due to the coal strike, natural gas shortages and the possibility of cutbacks in oil imports. And if we continue business-as-usual, shortages of clean energy threaten to be a key bottleneck in overcoming the recession that now grips the country.

This parade of horrors—which we call the energy crisis—is no secret. The Administration, the Congress, the press and the public are painfully aware of its existence. In fact President Ford and his top aides have been leaders in escalating the rhetoric to a crisis level. But when it comes to the actions necessary to overcome the crisis, the Ford Administration has thus far put on a pitiful display of inaction and ineptitude while following the wait-and-see attitude of its predecessor.

The basic course of action that is required to overcome the crisis is also no mystery. The Energy Policy Project of the Ford Foundation is not alone in recommending energy conservation as the key ingredient. And we are also not alone in believing that mandatory actions by government are needed to make it happen. The FEA's Project Independence blueprint in general confirms our estimates of the potential savings and the need for mandatory actions. Secretary Kissinger has made drastic conservation measures the keystone of his plan for resolving the foreign policy and monetary aspects of the crisis. And all the others in the administration concerned with energy—Messrs. Simon, Sawhill, Train, Peterson, and even Morton—now seem to agree that tough conservation measures are a must. The only vote that's missing is the one that counts.

Let me pause for a second here and state that my views today are purely personal. I do not speak for the Ford Foundation or anybody in the Congress. If you want to blame anyone else for my remarks perhaps it should be the President of the Mobil Oil Company who played such a key role in making this talk possible.

The energy crisis we face is not caused by lack of material resources or technology. It is a political crisis. And since the crisis is political, only the political process can solve it.

If there is a rationale for the Administration's current energy policy, it is that somehow a "free market" will match supply and demand better than any actions by government. The problem with that theory is there is no free market in energy. Everyone knows the price of petroleum is fixed by the OPEC cartel, and unless restrained by controls the price of every form of energy would rise to that level. Everyone also knows that in a truly free market there would be very little development of additional oil in this country. Middle East oil production actually costs less than 50 cents a barrel compared to upwards of \$10 a barrel for shale and synthetics in the United States. The vague possibility that the OPEC nations may someday cut prices is already inhibiting domestic projects with large capital investments. A truly free market would bring screams of anguish from domestic producers and officials concerned with foreign policy.

In truth a free market in petroleum is a myth. It didn't exist during the 1960's when quotas and prorationing put a floor under domestic prices and it doesn't exist today when the so-called market price is being fixed by OPEC.

Natural gas regulation is a good example of how blind adherence to a free market that doesn't exist dominates Administration thinking. The highest priority legislative item in the President's energy program is, to quote the President, "the long-sought deregulation of natural gas supplies." The words "long-sought" are quite well chosen. The oil industry has been trying to abolish the consumer's protection on natural gas prices for over 25 years. It has taken vetoes by President Truman and Eisenhower (because of a bribe attempt of a Senator by an oil lobbyist) and constant vigilance by consumer state congressmen to hold the line.

The argument in favor of decontrol is that price controls have caused the natural gas shortage. But price controls are really not the prime cause. In fact natural gas production increased spectacularly for over two decades under FPC price controls. It's worth noting that the natural gas shortage parallels the oil shortages, and this is no accident because most gas is found as part of the search for oil. Oil shortages have cropped up despite large increases in the price. Actually the price of new natural gas has doubled in recent years under the FPC. Genuine environmental concerns, and not price controls, are the primary constraint on offshore drilling; and lax administration of the outstanding leases by the Secretary of Interior is depriving consumers of gas that has been discovered in the Federal domain but is not being sold.

FPC price controls are far from perfect and there is a real need for legislation to remove the uncertainty over natural gas prices and provide prices that reflect inflation, so that incentives are sufficient and stay sufficient. But decontrol would in reality substitute the cartel of OPEC nations for the FPC as the price fixer.

Actually, the prospect of decontrol which the President dangles before the producers could be a major cause of our shortage as supplies are being held back for that glorious day when the price would jump from 43 cents per Mcf to some \$2.00 per Mcf, the OPEC fixed price for oil. Yes, the President's gas deregulation legislation has the consumer trapped in a Catch-22 sort of situation. It probably makes today's shortages worse and if passed will make tomorrow's natural gas much more expensive.

Blind faith in the "free market" has also led to callous disregard of the impact of runaway energy prices upon the poor. Low income Americans spend 15 per cent of the family budget on energy, compared with 4 per cent for the well-to-do. If these low income families are to continue to heat and light their homes and get to work, they will need government help.

The first principle of this Administration's energy policy is to leave it to the market; and the second is to concentrate on supply, with nothing but lip service for a genuine conservation program. But in an effort to develop every conceivable source of energy supply, regardless of environmental consequences, it is failing to concentrate on the domestic sources that offer the most promise.

The cornerstone of the Administration's supply-oriented policy is to push hard for rapid development of oil and gas in the previously-undeveloped areas off the Atlantic and Pacific Coasts and in the Gulf of Alaska. Never mind that millions of acres of leases in the Gulf of Mexico, where environmental problems are under control, have not yet been developed. The Administration is in effect saying drill now in these new areas and worry about the beaches and wetlands later. It calls for leasing 10,000,000 acres next year, an area far beyond the industry's ability to explore. This rapid leasing of offshore lands to oil companies could turn out to be the biggest "white sale" in our nation's history. The government cannot prevent a giveaway of the federal domain until it has some idea of how much oil and natural gas is out there. Today it does not. The government cannot minimize the recreational and environmental problems inherent in that development until it has detailed knowledge of its impact. Today it does not.

In the recent election, voters in several key states sent Washington a message about their concern for exploiting energy resources in their area without due consideration of the environmental costs. In California the voters elected a new governor who is publicly committed to a ge-very-slow approach on offshore oil and gas. In Colorado they elected a new governor who is an outspoken environmentalist and who is opposed to any coal strip mining or oil shale development where the land cannot be reclaimed. In Wyoming they elected a new governor who opposed an elaborate scheme for moving coal slurry out of the state because of the strain it would put on that state's limited water resources. And on the East coast, voters in several states elected new public officials or returned old ones to office who are on record as demanding assurance of environmental protection before development goes ahead. They want to know that the recreation potential and the ecology of the coastal zone will in fact be protected before they will permit development of offshore oil and gas and the accompanying onshore activities—refineries, terminals and so on.

In my view this slow growth trend is the fastest growing movement in America. If we as a nation are to break the energy stalemate, it would be wise for those in Washington who are working on national energy policy to listen to what the voters from California and Colorado to Connecticut are saying.

Perhaps the most baffling failure of current energy supply policy is the lack of a well-planned program to switch away from scarce oil and gas to abundant domestic coal for boiler fuel. Our Project's calculations reveal that as starters we could replace 600,000 barrels/day of imported fuel oil with 60 million tons per year of coal. But unless present air quality laws are enforced such a switch could add thousands of cases of lung disease and death to susceptible children and adults. As long as the President continues to waffle on the timetable for enforcement, company executives are encouraged to delay the purchase and installation of scrubbers and other technology to burn coal cleanly. Perhaps some subsidies and allocation of scarce materials are required to make the switch to coal a reality and to protect lives and lungs. All that can be said at the moment is that here again the marketplace is not functioning to serve the public interest and a federal program to make it happen is sadly missing.

It is on the international front, however, that the President's failure to take decisive action is hardest to explain. The well-orchestrated speeches by the President and Secretary of State Kissinger about the continuing economic perils of \$11 a barrel oil have not been backed up by concrete actions to ease our demand for that oil. Vigorous energy conservation in the United States would encourage other oil-importing nations to follow suit. As the Secretary of State's latest proposal makes clear, such action would come closer to reducing prices than all the huffing and puffing that has been going on.

The President is of course not the only actor on the energy scene. State government has a key role. And at the federal level the Congress in the final analysis makes domestic policy. The Congress, which traditionally waits for the President, has been slow to take initiatives. But the energy stalemate is no longer tolerable. We have run out of time. If the Administration persists in its present course, the new Congress will in my opinion have no choice but to move swiftly to break this nation's energy policy stalemate. In the end of course, Congress and the President will have to work together, to make energy policy work.

The first step in getting off dead center is for the Congress to enact an effective energy conservation program and for the President to sign and implement it. By this I mean enacting concrete measures which will supplement market forces by encouraging and, where necessary, requiring more efficient consumption of energy in the United States.

The final report of the Ford Foundation's Energy Policy Project lays out a program for achieving a cut in the nation's energy growth from the 4.5 per cent of the last eight years to about 2 per cent a year. Congress, and where appropriate state government, should:

Adopt minimum fuel economy performance standards for new cars, so as to achieve an average fuel economy of at least 20 miles per gallon by 1985.

Enlarge the funding for public transportation, especially buses which can be built quickly.

Encourage more efficient space heating and cooling by making credit easily available for energy-saving investments in existing buildings, by setting higher standards for insulation and heating and cooling systems, by helping to upgrade building codes and providing technical assistance to builders.

Shift federal research and development money toward energy conservation technology, and stress government purchases of energy conserving equipment—thriftier cars, tighter buildings, recycled materials and the like.

Encourage industry to conserve energy through prices that reflect the full costs of producing energy and other appropriate measures. This means Congress should eliminate the special tax privileges of the energy industry—oil depletion allowance, expensing of intangibles and special foreign tax credits—all of which constitute subsidies to an already rich industry. It also means abolishing promotional discounts for big electricity users and facilitating on-site generation of power to make beneficial use of waste heat.

Through these and other measures, the nation could bring its energy growth rate down to a more manageable 2 per cent without in any way limiting economic growth, employment or household comforts. This kind of energy conservation program would pay some very handsome dividends for the nation. There would be less investment in new coal mines and oil refineries and drilling rigs and power plants and more investment in energy-saving technologies. The result would be less inflation since investments to save energy are cheaper than investments in getting more. Slower energy growth means that net savings in capital investments over the next 25 years would amount to some \$300 billion.

It would also mean that from the present to 1985 the nation could meet energy demand without resorting to developments that threaten grave environmental damage and that threaten the independence of our foreign policy. It would be possible to keep oil imports below today's level and still stop strip mining for coal in the arid West or on steep slopes in Appalachia. Alternatively, the nation could halt new construction of nuclear plants and also preserve the Atlantic and Pacific Coasts from offshore development. In any event we would buy the time to permit all of these energy sources to be developed at a more cautious rate.

On the supply side, Congress and the Executive can take a number of sensible actions which will also help bring our energy budget into balance. Most urgent is the program to enlarge the market for coal, with due care for the land, miners' lives, and everyone's lungs. There are billions of tons of coal to mine in the Midwest where reclamation is feasible, or in deep mines, with rigid enforcement of safety laws.

Congress and the Executive can encourage more recovery of oil from existing wells through a tax or price incentives. They can require public investments in the strategic oil reserves the government owns in California and Alaska, so as to have a ready stock of oil on hand for emergencies. It is hard to believe that a year has gone by since the embargo and we have yet to build up oil stockpiles. The government reserve in Alaska may well contain more oil than has been discovered in the North Slope. But it's of no use in an emergency unless it's discovered, and the investments are made to deliver it to market. Despite all the talk, we are just one year older and deeper in debt.

Even with the annual growth rate in energy held to 2 per cent, the nation's energy supply will need to be 28 per cent larger in 1985, than in 1975. And if that growth rate continues past 1985 then development of some of the more troublesome domestic energy sources will be necessary. For this reason, the Congress should take action now to study the desirability of moving to zero energy growth after 1985. This would require giant strides toward increased efficiency; but it could be achieved with no loss in jobs or economic output. In addition Congress should provide today adequate funds for research and development of cleaner, renewable energy sources for the future. With a good R&D effort, solar and geothermal energy, solid and organic wastes, and maybe, in time, nuclear fusion can supplement the conventional energy fuels in the period after 1985.

In my view Americans are eager for leadership, real leadership that spells out the bad news that the joyride is over, and sets forth a program of energy thrift to assure that sacrifices will be shared equally by all of us.

Political leaders are underrating the American people when they fail to offer them straight talk and tough action to conserve energy. Blind faith in corporate decisions that favor waste and pollution must give way to bold measures to protect the vital interests all citizens have in equitable prices, independent foreign policy and a healthy environment.

SUMMARY OF THE ENERGY CONSERVATION AND DEMAND MANAGEMENT OPTIONS
PRESENTED IN THE PROJECT INDEPENDENT REPORT (BLUEPRINT) BY ROBERT W.
ANDERSON, ANALYST IN ENVIRONMENTAL POLICY, ENVIRONMENTAL POLICY DIVI-
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The Project Independent Report presents two sets of options for reducing our dependency on insecure foreign sources of energy:

energy conservation—the reduction of demand for all energy sources through more efficient energy utilization, and

demand management—the reduction in consumption of oil and gas through the use of alternative energy sources.

Summaries of the options are given in Tables I and II.

Potential energy savings listed in the tables are given in "quads"; a quad consists of 10^{15} BTU's (a million billion) and is equivalent to 170 million barrels of oil. For points of reference, current end use energy consumption figures for 1972 were:

	Quads
Household/Commercial sector-----	18.1
Industrial sector-----	23.1
Transportation sector-----	18.1
Total -----	59.3

FEA divided the energy conservation options (as listed in Table I) into several categories in accordance with the anticipated method of implementation and their potential savings. The respective option categories are identified as given below and are as listed in the first column of Table I.

V—voluntary conservation—those requiring no government intervention.

A—accelerated conservation options—those mandated by government action to force conservation.

C—conventional conservation options.

O—other conservation options—those requiring additional analyses to quantify the potential savings.

OND—others not discussed—options considered but having marginal potential for savings.

The energy savings listed in Table I are those developed assuming oil prices at \$11 per barrel.

TABLE I.—SUMMARY OF ENERGY CONSERVATION OPTIONS AS GIVEN IN APP. A.III, CONSERVATION SECTORAL ANALYSES

Type of options	Energy conservation options	Estimated savings, quads		Requires new legislation	Requires additional Federal appropriations
		1980	1985		
A. TRANSPORTATION SECTOR					
A	Mandatory 20 miles per gallon auto efficiency standard.	1.13	2.20	Yes	No.
A	Increase use of public transit and discourage inefficient use of automobiles.	1.75	1.90	Yes	Yes.
	Upgrade mass transit systems				
	Restrict auto travel in urban areas				
	Increase costs of tolls and parking in urban areas.				
	Impose tax on gasoline				
C	Conduct public education and voluntary new car fuel economy programs.	.41	1.00	No	Yes.
C	Enforce 55 mph speed limit	.18	.35	No	No.
C	Promote use of carpools			No	No.
C	Maintain current urban public transit policies	.18	.14	No	No.
C	Modify intercity freight transportation and regulatory policies.			Yes	No.
O	Amend the Clean Air Act to permit relaxation of emission standards.			Yes	No.
O	Impose excise tax on new cars in relation to fuel economy.	1.18	2.31	Yes	No.
O	Implement R. & D. directed toward improving automobile efficiency.			Yes	Yes.
OND	Improve traffic flow management			No	Possibly.
OND	Encourage better driving habits			No	No.
OND	Increase frequency of automobile tuneups			Possibly	No.
OND	Install fuel-saving devices on existing automobiles.			do	Possibly.
OND	Enactment of the Transportation Improvement Act (H.R. 12891).			Yes	Yes.
OND	Federal subsidization of energy-efficient transportation modes.			Yes	Yes.
B. RESIDENTIAL AND COMMERCIAL SECTOR					
V	Set down space heating thermostat (68° F. day/60° night).	1.41	1.35	No	No.
V	Set up space cooling thermostat (78°)	.13	.13	No	No.
V	Set down domestic hot water temperature	.50	.46	No	No.
V	Reduce usage of domestic hot water by 1/3	.44	.41	No	No.
V	Tune-up space heating furnace	.51	.41	No	No.
V	Tune-up space air-conditioner	.07	.06	No	No.
V	Insulate ceiling of existing buildings	.71	.67	No	No.
V	Weatherstrip and caulk existing homes	.31	.30	No	No.
V	Install storm windows and doors on existing homes.	.12	.12	No	No.
A	Institute a 25-percent Federal tax credit for improving thermal efficiencies of existing residences (to expire in 1980).	.45	.76	Yes	No.
A	Minimum property standards for Government insured mortgages on existing residences.	.287	.40	Yes	No.
A	Mandatory Federal minimum efficiency standards for new residences.	.435	.785	Yes	No.
A	Institute a 15-percent Federal tax credit for improving thermal efficiencies of existing buildings (to expire in 1980).	.174	.204	Yes	No.

TABLE I.—SUMMARY OF ENERGY CONSERVATION OPTIONS AS GIVEN IN APP. AIII, CONSERVATION
SECTORAL ANALYSES—Continued

Type of options	Energy conservation options	Estimated savings, quads		Requires new legislation	Requires additional Federal appropriations
		1980	1985		
B. RESIDENTIAL AND COMMERCIAL SECTOR—Continued					
A	Mandatory Federal minimum efficiency standards for new commercial buildings.	.107	.251	Yes.....	No.
A	Establish minimum performance standards for appliances.	.250	.624	Yes.....	No.
A	Mandatory lighting standards.....	.241	.328	Yes.....	No.
A	Institute 50-percent tax credit for incorporating sales appliances.	0	.550	Yes.....	No.
C	Education and public information to reduce heating and cooling requirements in existing residence.	.28	0.39	No.....	Yes.
C	Education and public information to reduce heating and cooling requirements in new residence.	.24	.42	No.....	Yes.
C	Establish improved minimum property standards for Government insured new residences.	-----	-----	No.....	No.
C	Education and public information to reduce energy consumption in existing commercial buildings.	.12	.14	No.....	Yes.
C	Education and public information to reduce energy consumption in new commercial buildings.	.06	.15	No.....	Yes.
C	Education and public information concerning energy efficient appliances (with mandatory labeling).	.61	.10	No.....	Yes.
C	Education and public information concerning FEA voluntary lighting guidelines.	-----	-----	No.....	Yes.
C	Issue an Executive order requiring all Federal contractors to comply to FEA lighting guidelines.	.26	.32	No.....	No.
C	Support application of solar appliances through R. & D.	0	.28	No.....	Yes.
OND	Exemption of energy conserving innovation from State and local taxes.	-----	-----	-----	-----
OND	Deduction from gross taxable income for homeowners retrofitting energy conservation items.	-----	-----	No.....	No.
OND	Direct partial reimbursement of retrofit cost of energy saving measures by the Federal Government.	-----	-----	Yes.....	No.
OND	Use the HUD title I loan insurance to a vehicle for financing retrofit.	-----	-----	Yes.....	Yes.
OND	R. & D. for technical and implementation improvements.	-----	-----	No.....	Yes.
OND	Mandatory labeling of energy efficiency of new residences.	-----	-----	Yes.....	Yes.
OND	Restriction of certain fuels for new construction.	-----	-----	Yes.....	No.
OND	Retrofit Government buildings for more efficient energy utilization.	-----	-----	Possibly.....	Yes.
OND	Voluntary labeling program of appliances for energy efficiency.	-----	-----	No.....	No.
OND	Adoption of minimum energy efficiency standards for all appliances procured by the Federal Government.	-----	-----	No.....	No.
OND	Install solar systems on Federal buildings.	-----	-----	Possibly.....	Yes.
OND	Provide Government-backed warranty insurance for solar appliances.	-----	-----	Yes.....	Yes.
OND	Modify local property taxes to give preferential treatment to buildings using solar appliances.	-----	-----	No.....	No.
C. INDUSTRIAL SECTOR					
A	Mandatory industrial energy conservation programs, including federally supported R. & D.	.90	1.50	Yes.....	Yes.
C	Federal investment in energy conserving technology including marketing research and technology transfer.	.75	1.50	No.....	Yes.
C	Support solid waste recovery and utilization through technical assistance, R. & D. and technical and economic feasibility studies.	.31	.64	No.....	Yes.
C	Support use of reusable containers and packages through public information and support of states programs.	.02	.04	No.....	Yes.
O	Regulate the amounts of energy sources used by industry; energy budgeting.	3.00	7.3	Possibly.....	Yes.

TABLE I.—SUMMARY OF ENERGY CONSERVATION OPTIONS AS GIVEN IN APP. AIII, CONSERVATION
SECTORAL ANALYSES—Continued

Type of options	Energy conservation options	Estimated savings, quads		Requires new legislation	Requires additional Federal appropriations
		1980	1985		
C. INDUSTRIAL SECTOR—Continued					
O	Provide for accelerated depreciation of energy conserving investments and provide for R. & D. in industrial processing.	1.0	1.9	Yes.....	Yes.
O	Provide a 12-percent investment tax credit for energy conserving investments plus support of R. & D.	1.0	1.9	Yes.....	Yes.
O	Provide for guarantees for energy conserving investments.	1.0	1.9	Possibly.....	Yes.
O	Provide investment tax credits for solid waste recovery systems.	.28	.57	Yes.....	Yes.
O	Provide 30-percent operating subsidy for solid waste recovery systems.	.34	.68	Yes.....	Yes.
O	Provide 75-percent construction grants for new solid waste recovery systems.	.50	.85	Possibly.....	Yes.
O	Provide 75-percent interest subsidy for investments in new solid waste recovery systems.	.40	.85	Yes.....	No.
O	Mandatory deposits for beverage containers.	.32	.36	Yes.....	Yes.
O	Prohibition of nonreturnable containers.	.28	.31	Yes.....	No.
D. ELECTRICAL GENERATING SECTOR					
A	Demonstration in support of energy conservation standards for State public water commissions.	.468	.911	Possibly.....	Yes.
C	Support demonstration projects on alternative rate structures and metering devices.	.094	.094	No.....	Yes.
C	Encourage State regulatory offices to allow prompt pass-throughs of generation costs.	1.531	1.579	No.....	No.
C	Advocate state of the art conservation actions by both utilities and consumers.	.07	.07	No.....	Yes.
C	Perform studies on electric demand behavior and build knowledge base of state of the art techniques.	0	0	No.....	Yes.
O	Enactment of Federal tax credits for the more efficient types of generators and apply consume tax surcharges for consumption above specified levels.	0	0	Yes.....	No.

TABLE II.—SUMMARY OF DEMAND MANAGEMENT OPTIONS AS GIVEN IN CH. III, ENERGY CONSERVATION AND
DEMAND MANAGEMENT: OPTIONS TO REDUCE OIL AND GAS CONSUMPTION

Demand management option	Reduction in oil and gas requirements in 1985, quads				Requires new legislation
	Without conservation		With conservation		
	\$7 oil	\$11 oil	\$7 oil	\$11 oil	
A. Utilities:					
Prohibit use of oil and gas for utility base-loads (use coal); oil and gas to be used only to meet peak loads.....	2.7	1.45	2.85	1.43	Yes.
Prohibit use of oil and gas in new generating plants.....	1.82	0	.02	0	Yes.
Convert oil and gas generating plants to coal (plants used at intermediate load).....	.60	.60	.60	.60	Possibly.
B. Residential and commercial: Prohibit installation of oil and gas space-heating systems in new building—coal used to generate electricity to meet additional base load demand.....					
	1.3	1.3			Yes.
C. Industrial: Prohibit use of oil and gas in industrial processes, where applicable.....					
	1.56	.21	1.13	0	Yes.

ANALYSIS OF ENERGY CONSERVATION OPTIONS IN THE AIR CONDITIONING SYSTEMS OF THE UNIVERSITY OF CALIFORNIA, BERKELEY

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