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REAPPRAISAL OF PROJECT INDEPENDENCE BLUEPRINT

HEARING

BEFORE THE

JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES

NINETY-FOURTH CONGRESS

FIRST SESSION

MARCH 18, 1975

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TUESDAY, MARCH 18, 1975

REAPPRAISAL OF PROJECT INDEPENDENCE BLUEPRINT

TUESDAY, MARCH 18, 1975

CONGRESS OF THE UNITED STATES,
JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The committee met, pursuant to notice, at 10:35 a.m., in room 2261, Rayburn House Office Building, Hon. Hubert H. Humphrey (chairman of the committee) presiding.

Present: Senator Humphrey and Representatives Hamilton, Long, and Heckler.

Also present: William A. Cox, professional staff member; Michael J. Runde, administrative assistant; Leslie J. Bander, minority economist; and George D. Krumbhaar, Jr., minority Counsel.

OPENING STATEMENT OF CHAIRMAN HUMPHREY

Chairman HUMPHREY. The committee will come to order. Today's hearing will include testimony by Mr. Eric Zausner, the Acting Deputy Administrator of FEA; and Mr. Samuel Globe of the Battelle Memorial Institute; and Mr. Morris Adelman, accompanied by Mr. Jacoby and Mr. Hausman from the Massachusetts Institute of Technology.

I have a brief opening statement. We have called today's hearing to consider some very fundamental questions now being raised about the accuracy of the Project Independence report.

The report, published last November by the Federal Energy Administration, is a massive compilation of data and projections dealing with energy demand, supply, conservation, environmental effects, and other matters. It was put together in a relatively short time by experts inside and outside of Government and provided badly needed information for energy policy formulation.

Reviews of the report, however, have found a number of apparent flaws and inconsistencies in its projections of the energy demand, supply, and imports for 1980 and 1985. Two reviews have been sponsored, at least in part, by the National Science Foundation, which has done a great public service by helping to provide an independent evaluation of this important Government report.

Today we shall hear from the authors of these two reviews. They go right to the heart of the matter around which energy policy now revolves. The MIT evaluation states, for instance:

> One prediction may safely be made. The report projects 12.4 million barrels of petroleum imports per day in 1985 at $7 per barrel and 3.3 million barrels per day in the $11 case. Both these numbers are biased upward.

Let me point out in connection with these results that the Project Independence report projected zero imports of oil in 1985 at prices of $11 with accelerated development policies, or with some acceleration of supply combined with conservation policies. While one must not make too much of these long-term forecasts, these together with the new MIT results imply that we might reach complete independence at fuel prices lower than $11, or do it alternatively with less sacrifice of environmental quality or consumer welfare.

We also must ask just how "independent" the United States must be to remain secure against supply disruption and political blackmail. Here again, the Project Independence report gives a curious answer. It foresees that with oil at $7, we could obtain over 6 million barrels per day of imports from secure sources in 1985, but at $11 we could obtain only 1 million barrels. I wonder seriously whether this is realistic. I would expect to have more choice of suppliers by 1985 at high prices than at low prices, and there is certainly no reason to expect secure supplies to fall by so much. If this is so, it would imply still more flexibility in choosing among the options before us to achieve an acceptable level of independence.

Yet the administration continues to push for deregulation and extremely high fuel prices, for deferral of higher automobile emission standards, for easier pollution standards for industry, and for all-out development of Western coal and offshore and Alaskan oil. I agree that we must move ahead with an effective energy production and conservation policy. And may I add that last week I introduced a fuel and energy conservation program which is the result of a considerable amount of study on the part of the Joint Economic Committee staff. I hope, however, that we can be judicious in framing this policy to avoid an indiscriminate sacrifice of other goals such as equity and environmental quality.

The kind of challenge to our basic energy forecasts posed by these reviews must be answered. Eric Zausner, acting Deputy Administrator of the Federal Energy Administration and Director of the Project Independence report, is here to comment. We had hoped that Mr. Zausner could stay to respond to the analysis made by the witnesses, but he has a conflicting engagement that he brought to my attention this morning. He has a very important appointment at the White House, and we would like to accommodate him as well as possible.

Now I understand, Mr. Zausner, that you will leave your deputy here, is that correct?

Mr. ZAUSNER. That is correct.

Chairman HUMPHREY. And what is his name?

Mr. ZAUSNER. Mr. Bruce Pasternack, who is deputy manager of the Project Independence report.

Chairman HUMPHREY. And he should be able to respond to some of the analysis or comments made by our other witnesses, is that correct?

Mr. ZAUSNER. Yes, Mr. Chairman.

Chairman HUMPHREY. Would you come up here and proceed then. We do thank you very much for coming. We know the timing is not the most desirable for you, so if you will go ahead now, we know what your schedule is and we will accommodate you.

STATEMENT OF HON. ERIC R. ZAUSNER, ACTING DEPUTY ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATION, ACCOMPANIED BY BRUCE A. PASTERNACK, ACTING DEPUTY ASSISTANT ADMINISTRATOR FOR POLICY

Mr. ZAUSNER. I have just a few opening remarks and then I think it would be most appropriate to hear the other witnesses. I would make just a couple of general comments.

One, as I am sure you know, at the time that the Project Independence Blueprint was started, which was, of course, early last year, right after the Arab embargo ended, there was a wide divergence on what our problems were, and what direction they were going. There had also been massive changes in the price of petroleum. And one thing that we were sure of was that everything that had been done before has likely to be wrong, that the demand would be much too high, and that people's concern for the placing of incentives for oil exploration and exploitation was different. It was likely that we had a completely different world and completely different domestic situation because of the embargo and the quadrupling of prices. What we attempted to set out in the Blueprint was a re-estimate of where we could be, and where we could hope to be given the new world situation and the new domestic situation, and to do it for the first time in a comprehensive manner which had never before been done by the Federal Government.

As you indicated, it was a very large job. It was one with not nearly enough time. I do not even think 2 years would be enough time to do it right. But what we tried to do was put together as best we could an objective assessment of where we are going and what, in fact, various kinds of policy options would do to impact that.

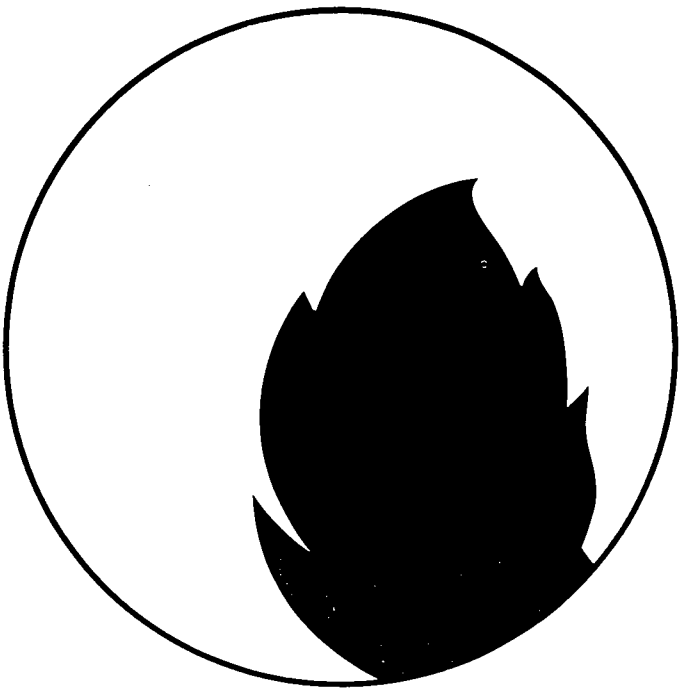
There is no doubt that this study is wrong. Any study which attempts to forecast 10 years in the future must be wrong. As you know, there are tremendous uncertainties in almost every aspect of attempting to forecast into the future. We can say that we might get 2 million barrels a day of oil from the Naval Petroleum Reserves, but we know that until we are there and see what is there, and until actual exploration and development work begins there is no way to ascribe any certainty to the domestic production from the areas we have yet to explore. Similarly there are a wide range of uncertainties with coal, oil, gas, nuclear power, and any of the other fuels.

What we attempted to do was develop, as best we could, an estimate for each of those, and also see how the pieces fit together. I am not concerned about the fact that MIT or Battelle or others differ with our numbers. In fact, as anyone would expect, that is normal and, in fact, that is very healthy to have careful and quantitative analyses and differences of opinion expressed. As you know, we not only used our inhouse expertise and outside contractors in developing the report, but we also held 10 regional hearings on the project during the preparation of the report. We employed outside people to review the study. In fact, we, the Federal Government, in addition to assisting the National Science Foundation in their review also transferred funds to the Commerce Department for their CTAB panel. I would like to make a copy available, for the record, of their very comprehensive and valuable analysis.

[The analysis follows:]

CTAB RECOMMENDATIONS FOR A

NATIONAL ENERGY PROGRAM



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UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

FEB 14 1975

The Honorable Frederick B. Dent
Secretary of Commerce
Washington, D.C.

Dear Mr. Secretary:

On behalf of the Commerce Technical Advisory Board, we are pleased to transmit the final report of our Panel on Project Independence Blueprint.

CTAB established the Panel in July of 1974, to provide an independent source of advice for the interagency effort to develop a Project Independence Blueprint and, if needed, to produce an independent report.

Fortunately, CTAB was able to attract a unique group of people with exceptional records of achievement in the diverse fields pertinent to establishing a national energy program. We believe that the Panel has completed an outstanding effort on the largest single task ever performed under CTAB's auspices. It is estimated that the Panel members contributed over 1600 man days of effort. This effort was matched fourfold by the time contributed by the Panel's more than fifty advisors. The Board strongly endorses the Panel's final report and expresses its deepest gratitude for the effort it represents.

In response to your recent request, CTAB wishes to recommend the use of the SI (International System of Units) metric unit for the measurement of energy, the Joule - the quantity of energy expended when one Watt burns for one second. Effective in January, 1978, the EEC has established a policy of requiring member countries to provide energy data in Joules. CTAB recommends that we begin now to adhere to this international practice. Fortunately, one Exajoule (10^{18} Joules) is virtually identical to one Quad, therefore, the energy quantities given in Quads can be read directly as Exajoules.

Sincerely,

Betsy Ancker-Johnson
Chairman

Richard S. Morse
Vice Chairman

Commerce Technical Advisory Board

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Panel on Project Independence Blueprint

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Vice President and Director—
Research and Development
The Dow Chemical Company
Panel Chairman

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Private Consultant
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Additional information on consultants to the Panel and the Panel Staff may be found in Chapter 7 of this Report

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230
Commerce Technical Advisory Board
Panel on Project Independence Blueprint

Dr. Betsy Ancker-Johnson
Chairman
Commerce Technical Advisory Board
Department of Commerce
Washington, D.C. 20230

DEC 05 1975

Dear Dr. Ancker-Johnson:

We have the honor, on behalf of the CTAB Panel on Project Independence Blueprint, to submit its report.

The Panel was established on July 12, 1974, by the Department of Commerce with funding provided by the Department of the Interior. Its purpose was to make an independent review and assessment of the actions and policies resulting from the Project Independence study which was then under preparation by the Federal Energy Administration (FEA). The Panel, through its members, staff and consultants, interacted closely with FEA and the interagency Task Forces established by FEA.

The Panel presented a verbal report of its findings to Secretary of Commerce, Frederick B. Dent and Secretary of Interior, Rogers C. B. Morton on December 10, 1974. As originally contemplated, the FEA Report was to have contained recommendations on a course of action for the Nation to alleviate or solve the critical energy situation which we face. However, shortly before publication, a decision was made to set forth a number of alternatives rather than make any specific recommendations. The Panel believes that the extreme seriousness of the situation calls for providing direction to the country. The Panel believes that its report includes complete recommendations for an effective and workable National energy program, one that can and should be communicated fully to the public for a better understanding of the energy situation.

All members of the Panel are highly appreciative of the opportunity afforded to work on this most challenging assignment. They wish to express their grateful acknowledgment of the dedicated effort made by Mr. Frank Castellon. They also wish to acknowledge the outstanding contribution to the report made by Messrs. William Dorn, Walter Johnson, and the entire staff.

Sincerely,

Malcolm E. Pruitt
Chairman

W. J. Pietenpol
Vice-Chairman

. . . The economic disruption we and others are experiencing stems in part from the fact that the world price of petroleum has quadrupled in the last year. But we cannot put all of the blame on the oil-exporting nations. We in the United States are not blameless. Our growing dependence upon foreign sources has been adding to our vulnerability for years and we did nothing to prepare ourselves for an event such as the embargo of 1973.

During the 1960s, this country had a surplus capacity of crude oil, which we were able to make available to our trading partners whenever there was a disruption of supply. This surplus capacity enabled us to influence both supplies and prices of crude oil throughout the world. Our excess capacity neutralized any effort at establishing an effective cartel, and thus the rest of the world was assured of adequate supplies of oil at reasonable prices.

In the 1960s, our surplus capacity vanished and, as a consequence, the latent power of the oil cartel could emerge in full force. Europe and Japan, both heavily dependent on imported oil, now struggle to keep their economies in balance. Even the United States, which is far more self-sufficient than most other industrial countries, has been put under serious pressure . . .

GERALD R. FORD
STATE OF THE UNION MESSAGE
JANUARY 15, 1975

CTAB RECOMMENDATIONS FOR A

NATIONAL ENERGY PROGRAM

March 1975

U. S. DEPARTMENT OF COMMERCE,
Frederick B. Dent, Secretary

Dr. Betsy Ancker-Johnson,
Assistant Secretary for
Science and Technology

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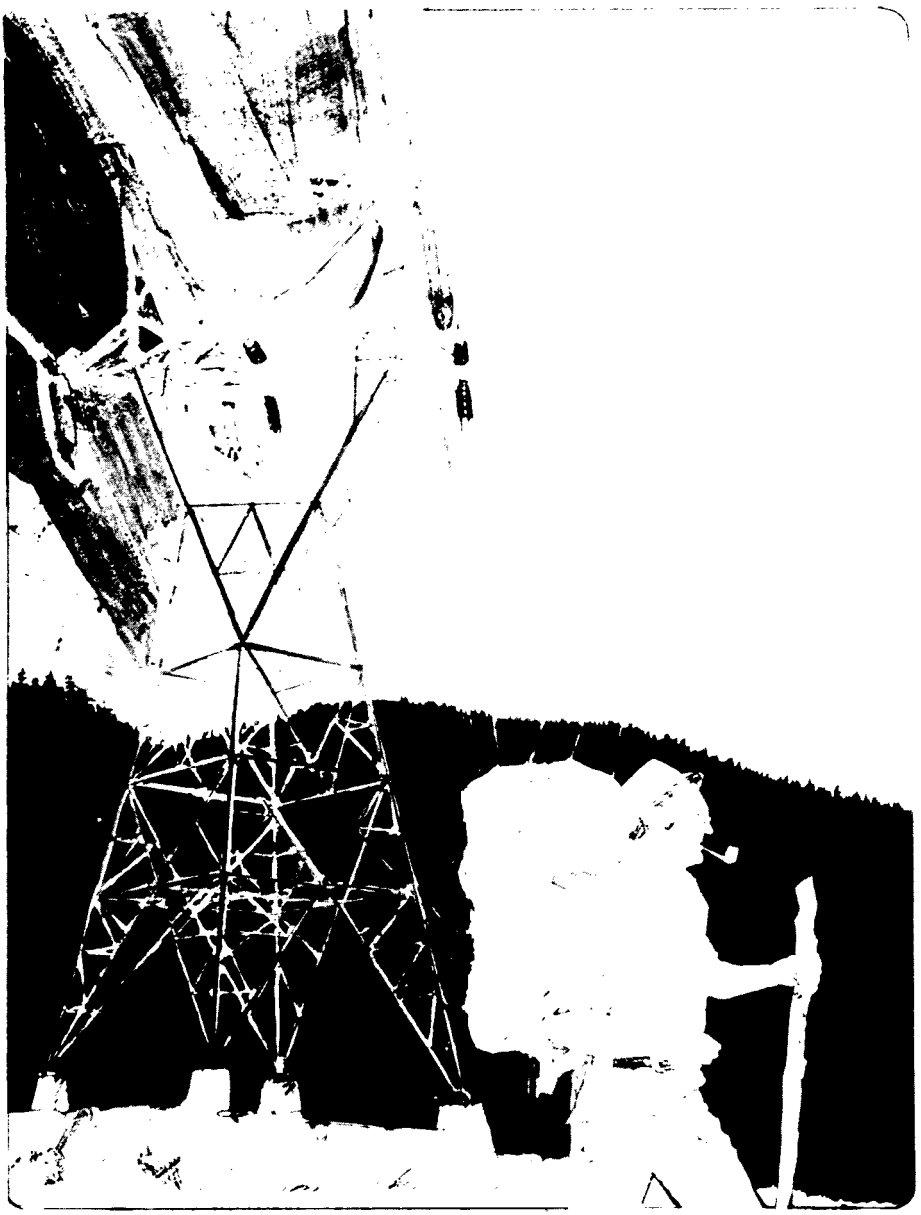

Executive Summary

A Call to Action

In the Fall of 1973, petroleum liquids were being produced in the U.S. at the rate of 10.8 million barrels per day—in the Fall of 1974, the rate of production had declined to 10.3 million barrels per day—*down 5 percent.*

In the Summer of 1973, U.S. miners were producing coal at a rate of about 580 million tons annually—in the Summer of 1974, the rate of coal production in this Country was still about 580 million tons—*no change.*

In the Fall of 1973, natural gas was being produced domestically at a rate of 22 trillion cubic feet per year—a year later, the production rate was about one trillion cubic feet per year less—*down 5 percent.*

In 1973, nuclear power generated over 1 percent of the Nation's energy—in 1974, about 1-1/4 percent—*up 20 percent.* But during 1974 more than half of the planned nuclear generating capacity addition was deferred and some canceled.

Excluding the period of the embargo, 1973 U.S. imports of crude oil and oil products averaged 5.8 million barrels per day—again excluding the embargo period, the 1974 imports averaged 6.6 million barrels daily, increasing U.S. dependence on foreign energy—*up 14 percent.*

The U.S. today is paying about $25 billion annually for foreign energy; without prompt action the cost of imports, assuming today's world oil prices in 1985, could rise as high as $52 billion per year.

The statistics tell the story. During the first year following the sudden cutoff of oil from the Middle East, little, if any, tangible progress was evident toward a lessening of our dependence on foreign energy. The optimistic prediction of former President Nixon of independence from foreign sources of petroleum by 1980 now has been abandoned. *The U.S. is more vulnerable to an embargo today than it was in the Fall of 1973.*

Although Federal and State Governments, industry and the American people have undertaken

some actions designed to conserve and to increase energy supplies, the sense of urgency aroused throughout the Nation by the oil embargo has diminished with the lifting of the ban and a seemingly ample supply of gasoline.

There is a danger of being lulled into a sense of complacency because the current economic recession has reduced energy demand. Such a reduction in energy demand is to be expected to accompany a slowdown in the economy. Decisions must be made today and actions taken now, to ensure the Nation's future economic growth with adequate supplies of domestic energy. *To do otherwise invites disaster.*

Demand and Supply

The Panel has developed an estimate of supply and demand for 1985, as shown in the table on p. 3. A review of the data in this table shows that complete independence from imports by 1985 is unlikely. However, the relative dependence on foreign sources of energy will be declining by that time, if appropriate measures are undertaken immediately. The table also shows domestic oil and natural gas production increasing slowly, returning to 1972 levels. It shows coal production and nuclear energy both increasing rapidly. Demand is shown as restrained by price effects and by conservation.

Long lead times are required to increase supplies of energy, to develop new energy sources, to implement fuel substitutions, and to change patterns of demand growth. This means that the Nation's percentage of dependence on imports will continue to rise for the remainder of this decade. Therein lies the danger of delaying action.

Caution must be taken in effecting reductions in energy demand. Historically, downturns in economic activity have been accompanied by downturns in energy consumption. The reduction in energy consumption caused by the supply curtailment during the recent embargo resulted in a significant downturn in GNP.[1]

This apparent link between primary energy consumption and real GNP will be difficult to break in the short run, and demand reduction actions should be undertaken which cause the least disruption to the economy. Over the long run, however, increases in energy prices, substantial applications of technology and capital investment, and changes in energy use practices may result in a reduction in energy consumption relative to real GNP.

The Panel emphasizes that the status of declining dependence on foreign energy sources will exist by 1985 only if a strong, coordinated, all-encompassing national energy supply and conservation program is *implemented immediately.* Such a program is outlined in the Panel's recommendations.

Panel Recommendations

To achieve the supply and demand balance that the Panel believes prudent and attainable, immediate positive steps must be taken. Not only must the Nation increase the domestic supply of and reduce the demand for energy; but also, it must transfer much of its future energy growth requirements from petroleum and natural gas to coal (through direct burning, gasification and liquefaction) and to nuclear energy. To these ends, the Panel believes that:

- The main underlying principle is the maintenance of a strong, competitive market. The competitive market needs time to absorb and adjust to the significantly higher cost of energy. Due to the urgency of the situation, certain actions may be required, in the short term, to accelerate the supply and demand responses. Mandatory actions, however, must be carefully screened for their effect on the economy.
- The role of the Government is to act as a catalyst and provide a climate for the private sector to achieve the required goals. Elements of this climate include a well-informed public, a clear definition of national energy policies, a commitment to those policies, a stable domestic economy, and the promotion of the ready flow of energy at stable prices in international commerce.

[1] Project Independence Report, Appendix AV, Economic Impact of the Oil Embargo.

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CTAB Panel
Domestic Demand—Supply Estimates for 1985

DEMAND	Range Quads	Panel's Planning Base Quads
If Historical Trends Continue	125	125
Reduction Due to Price Effects	10—15	13
Reduction Due to Additional Conservation	2— 5	4
Projected Demand	105—113	108

SUPPLY

	Range of Panel Estimates (in conventional units)			Conventional Units	Panel's Planning Base (in conventional units)	Panel's Planning Base (in equivalent Quads/yr.)
Coal	1.0	—	1.4	Billion Tons/Yr.	1.2	26
Oil	11	—	13.5	Million Bbl./Day	12	25
Natural Gas	21	—	24	Trillion Cu. Ft./Yr.	22	22
Nuclear	250	—	300	Gigawatts	275	16.5
Shale Oil	0.25	—	0.5	Million Bbl./Day	0.25	0.5
Hydroelectric	58	—	65	Gigawatts	58	3.5
Geothermal	3	—	8	Gigawatts	3	0.2
Solar	0.1	—	0.2	Quads/Yr.	0.1	0.1
Solid Waste	0.1	—	0.5	Quads/Yr.	0.2	0.2
Synthetic Oil	0.1	—	0.2	Million Bbl./Yr.	0.1	*
Synthetic Gas	1.0	—	2.0	Trillion Cu. Ft./Yr.	2.0	*
Total Available Supply	85	—	107	Quads/Yr.		94

BALANCE

	Demand	Supply	Imports Required	Cost of Imports at $11 per Barrel
Imports Using Panel's Planning Base	108	94	14 Quads/Yr. (7 MMBPD)	$28 Billion/Yr.
Imports Using Panel's Maximum Expected Demand and Minimum Expected Supply	113	85	28 Quads/Yr. (13 MMBPD)	$52 Billion/Yr.
Imports Using Panel's Minimum Expected Demand and Maximum Expected Supply	105	107	Balanced	—

Notes:

In addition, these demand-supply estimates have been converted in Appendix 6 to equivalent values utilizing other energy measurement units. Conversion factors are given in Appendix 4.

* Included with Coal

The planning base demand and supply levels of the panel are premised upon the immediate implementation of the recommendations contained in this report. It would be imprudent to expect to attain the planning supply levels if programs are not in place during 1975 and any delay will reduce the attainable levels.

- Laws and regulations should reflect the need for efficient extraction, transportation, and utilization of energy. Increasing the supply of and decreasing the demand for energy is deterred by many existing laws and regulations enacted during a period of time when supplies of energy were readily available and inexpensive.

- The solutions to the long-term energy supply and demand problem must come from technological developments. Research and development must also play a significant role in the nearer-term, providing new techniques for more efficient extraction, transportation, and utilization of energy, and for alleviating impacts on the environment and public health.

- A system to identify supply and demand trends in their early stages is fundamentally necessary to provide a basis for prompt and sound actions. Such a system would monitor the results of higher energy prices, conservation, and measures designed to stimulate domestic energy production; and would provide cost/benefit studies of the economic and social effects of various alternative actions.

With these underlying principles in mind, the Panel has put together a comprehensive and integrated set of recommendations for a National Energy Program. The recommendations constitute a minimum program to reduce energy demand without serious effects on the rest of the economy, to increase domestic supply with due regard to health, safety, and environmental needs, and to monitor the process to assure prompt implementation of other emergency actions if they become necessary.

The Panel makes the following recommendations:

Have the Energy Resources Council coordinate governmental review of this report to obtain immediate action in appropriate areas.

Develop a Public Information Program:

- In order to elicit the full support of the Nation a comprehensive public information program should be initiated immediately. The program should provide a full appreciation and understanding of the energy problems facing the Country and their possible sollutions.

Take Appropriate Energy Conservation Measures:

- Stimulate voluntary conservation by all segments of the Nation.

- Revise transportation regulations to promote the efficient use of energy.

- Develop vehicles with improved fuel economy.

- Promote energy efficiency in residential and commercial buildings, via appropriate standards and incentives.

- Encourage and support industry to generate electric power while producing process steam; and encourage utilities to provide steam to industry from central power stations.

- Encourage all industries to participate in energy conservation programs.

- Stimulate substitution of coal and nuclear energy in the production of electricity and steam. This is necessary to make oil and natural gas available for higher priority uses.

- Study socio-economic effects of possible implementation of accelerated mandatory conservation actions as emergency alternatives.

Increase Domestic Energy Supply:

- Promote increased coal production and utilization.

  —Provide an economic, regulatory and environmental climate conducive to the rapid development of coal supply and coal utilization.

  —Provide Federal funds to mitigate social and environmental problems of regions impacted by coal production and conversion.

- Initiate measures for increasing oil and natural gas supplies.

  —Remove price controls on petroleum and petroleum products and deregulate the price of new natural gas production.

  —Pool talent and technology to maximize secondary and tertiary recovery of petroleum.

  —Open Naval Petroleum Reserve No. 4 to exploration and development on the same basis as any other Federal lands.

—Expedite approvals for transportation systems from areas of new oil and gas discovery, particularly for Alaskan natural gas.

- Stimulate nuclear development.

—Address the public concern regarding nuclear plant safety and environmental compatibility.

—Improve the licensing process for nuclear power by simplifying, and shortening, and by eliminating duplication in Federal and State procedures.

—Delineate and evaluate uranium resources and increase enrichment capability.

- Promote synthetic fuels from coal.

—Develop an integrated comprehensive program for a viable synthetics industry.

—Streamline regulatory procedures.

- Expand leasing of Government lands.

—Conduct lease acreage sales in each of the prospective frontier Outer Continental Shelf areas and in the Gulf of Mexico at the maximum rate that can be efficiently assimilated by the industry for exploration and development.

—Modify the Federal Mineral Leasing Act (1920) so that lessees can acquire sufficient resources for large-scale coal development.

—Promote adequate shale leasing acreages.

- Ensure the availability of skilled human resources.

—Expand the support by Federal and State Governments for new technical and degree-level education programs.

—Establish a program of Federal loans and grants to generate employment in labor-intensive energy enterprises.

- Study socio-economic effects of possible implementation of wartime supply provisions as emergency alternatives.

Provide a Balanced Environmental Climate:

- Modify existing Federal air quality regulations to permit the maximum use of fossil fuels within the limits of health standards.
- Review and modify legislation controlling air and water pollution, where this legislation restricts energy supply growth.
- Streamline site certification procedures for all energy facilities.
- Establish realistic Federal environmental regulations for strip mining.
- Consider cost/benefit trade-offs for all environmental regulations.

Improve the Economic Climate for Energy Production:

- Revise tax laws pertaining to dividends, capital gains, and capital losses to attract additional capital.
- Revise tax laws to increase investment tax credit and increase allowed tax depreciation to improve corporate cash flows.
- Review and modify Federal and State rules and regulations for rate proceedings to reduce delays and increase return on equity.
- Strengthen the mechanisms by which bond and equity securities are marketed.

Strengthen and Expand Research and Development Programs:

- Have Government assume primary responsibility for funding long-term programs with high risk but potentially high payout including breeder reactors, solar energy, and fusion.
- Increase Federal funding for research and development programs related to improved coal mining, coal conversion and utilization, advanced power generation methods, radioactive waste disposal, and energy related public health effects.
- Provide Government assistance for construction and operation of at least the following advanced commercial-scale demonstration plants: coal gasification (2 plants), coal liquefaction (2 plants), and oil shale (1 plant).
- Support further development of computerized energy information systems to assist in the evaluation of future energy policy issues.

Critique of Project Independence Report Summary

General

The Panel has several concerns about the Project Independence Report Summary, including:

- The Summary gives the impression that it will be easy to achieve energy independence, and that a choice of routes exists.
- The Summary does not indicate the urgency of the situation nor how any of the goals may be achieved.
- The Summary places inadequate emphasis on coal development.
- The Summary underestimates the impact of Federal, State and local political constraints and environmental restrictions.

Finance

- The Panel believes that the Project Independence estimate of capital requirements for the period 1975-1985 of $454 billion (1973 dollars) is too low by more than $100 billion because these figures do not include replacement capital costs, investment for tanker fleets, lease bonus payments, etc.
- The Panel does not agree with the FEA statement that the economy can generate the required capital through conventional means.
- The Panel regards as questionable several basic assumptions concerning the Federal Government's attainment of a balanced budget, and a favorable trade balance; and of the magnitude of OPEC investment in the U.S.

Energy Supply and Demand

- The estimates factored into FEA planning have resulted in the statement, "The implementation of a limited number of major supply or demand actions could make us self sufficient." This statement is questionable in the judgment of the Panel.
- To reach 1985 oil and gas supply levels predicted in the Summary will take unprecedented discovery and production rates.
- The Panel believes that if more realistic estimates had been used for oil and gas supply projections in the Summary, the role of coal in meeting future demand would be shown to be much greater. Maximum development of coal for all energy end uses, including synthetic fuels, will be essential to meet demand.
- The Panel disagrees with FEA's policy option to meet any new residential and commercial energy requirements with electricity to the exclusion of oil and gas, and the corresponding de-emphasis of the need for synthetic fuels from coal and oil shale. The Panel believes that maximum development of coal supply for all end uses is essential, and that the distribution of these end uses should be left to the marketplace in lieu of Government mandated control.

General Introduction

In July 1974, the Commerce Technical Advisory Board (CTAB) organized the Panel on Project Independence Blueprint. The duties of the Panel, its membership and organization are given in Chapter 7 of this report.

The Panel, through its members, staff, and consultants, interacted closely with the Federal Energy Administration (FEA) and the interagency task forces established by FEA. Due consideration was given to other studies dealing with the Nation's energy future. A wide cross-section of experts was consulted to assure a comprehensive view of the many intangibles and uncertainties inherent in approaching the difficult and complex problem of energy self-sufficiency.

The Panel used this extensive background as a framework for formulating its recommendations for an effective national energy program. The coordinated and interdependent set of recommendations is presented in this report, which has been reviewed and approved by CTAB.

The Panel believes that acceptance of its recommendations would have a significant impact upon domestic energy availability, and it recognizes that the cost will be substantial. However, the cost of *not* embarking on a coordinated national energy program could be prohibitive. As follows from the table (p. 3), the cost of oil imports in 1985, at no change in present world oil prices, may vary from zero to close to $52 billion per year, depending on how successful the U.S. is in increasing its domestic energy supplies and reducing its demand. Due to time constraints, the Panel did not cost each of its specific recommendations. Instead, it arrived at its estimates of aggregated cost based on historical data and analysis of FEA data. It is clear that sound energy policy depends on responses to the energy crisis, and on judgments concerning allocations of money. High priority must, therefore, be given to determining and publicly disseminating the full costs of the Panel's recommendations for Federal financial incentives.

The Panel operated largely through Subpanels, with necessarily some overlap of interests and expertise. Accordingly, there is some redundancy in the recommendations throughout this report—this has been done purposefully in the interests of completeness, since a single recommendation may affect a number of areas.

There is no doubt that the energy picture is extremely difficult to discern. The outlook has been clouded with many uncertainties which have made precise forecasting and planning a very complex challenge. These uncertainties include:

- the future price and availability of imported oil,
- the potential of offshore domestic oil and natural gas reserves,
- the economics of alternate sources of energy, such as liquefaction or gasification of coal and the extraction of oil from shale and tar sands,
- the environmental and financial restraints on coal and nuclear energy utilization,
- the real effects of conservation as a result of higher prices, public response or governmental mandates,
- the future demand for energy.

The FEA, in preparing the Project Independence Report, amassed and analyzed a comprehensive volume of energy information, providing a data base and methodology essential to the formulation of energy policy. However, the FEA report sets forth a number of alternatives rather than making any specific recommendations. The Panel, in this report, presents its recommendations, designed to provide for the energy needs of the Nation for this and succeeding generations.

Underlying the recommendations given in this report are the Panel's beliefs that:

The competitive market needs time to absorb and adjust to the significantly higher cost of energy.

Little is yet understood about the price-demand and price-supply elasticities of energy. As the cost of energy (and therefore, all other products) increases, the public will determine how much it wants at such higher prices, industry will conserve energy in its own financial interests, and the resulting lower demand will provide a completely new base permitting more precise future planning. Concurrently, the energy-supplying industries will have the opportunity to accelerate their efforts and install the new facilities justifiable in a climate of increased price expectations.

The Panel recognizes that by advocating the use of the marketplace to achieve the allocation and conservation of energy resources, differing impacts on various sectors of the economy will result. For example, more energy-intensive industries will feel a greater impact than less energy-intensive businesses.

Persons in lower income brackets will be affected more significantly by higher energy prices than others, since a higher proportion of their income now is devoted to energy expenditures. The more rapid the change toward full pricing the more acute the problem, since the lower income persons are less able to switch from old, less efficient energy utilization devices. The Panel fully recognizes the impact of this form of redistribution of real purchasing power and recommends that it be addressed by the appropriate Government agencies. The Panel was unable to do so, because it was not constituted with the expertise to properly handle this issue.

The recommendations of this Panel on tax changes are consistent with the idea of a competitive market. Most such recommendations are an attempt to decrease the present disincentives to investment. Others address development of energy sources and acceleration of the conservation response because of their unique value to the Nation. Without this assist, the competitive market would effect such changes, but not until a much later time.

Laws and regulations should reflect the need for efficient extraction, transportation, and utilization of energy.

Most Government laws and regulations were adopted when energy was readily available and inexpensive; therefore, they did not reflect a primary concern for efficient extraction, transportation, and utilization of energy. For example, some transportation regulations are designed to assure the economic protection of various transport modes, even at the expense of increased fuel utilization.

These laws and regulations are one of the most basic deterrents to the early solution of the energy problem before the Nation.

Existing laws and regulations should now be reviewed, taking into consideration the present shortages and the higher cost of energy. Decisions can then be made, on the basis of economics, energy conservation, and other considerations, as to whether the laws and regulations should be modified, and the enabling legislation or rule-making prepared and adopted.

The solutions to the long-term energy supply and demand problem must come from technological developments. Research and development must also play a significant role in the nearer term, providing new techniques for more efficient extraction, transportation, and utilization of energy, and for alleviating impacts on the environment and public health.

Solutions to the post-1985 energy supply and demand problems place a high priority on today's research and development efforts, because of the long lead-times required to develop alternative sources of energy.

High priority must also be placed on research and development aimed at nearer-term problems. More energy needs to be produced from existing sources (e.g., secondary and tertiary oil recovery). Fuels can and should be used more efficiently (e.g., in transportation, and power generation). Impacts on the environment and public health can be alleviated through technological improvements in the extraction, transportation, and utilization of energy.

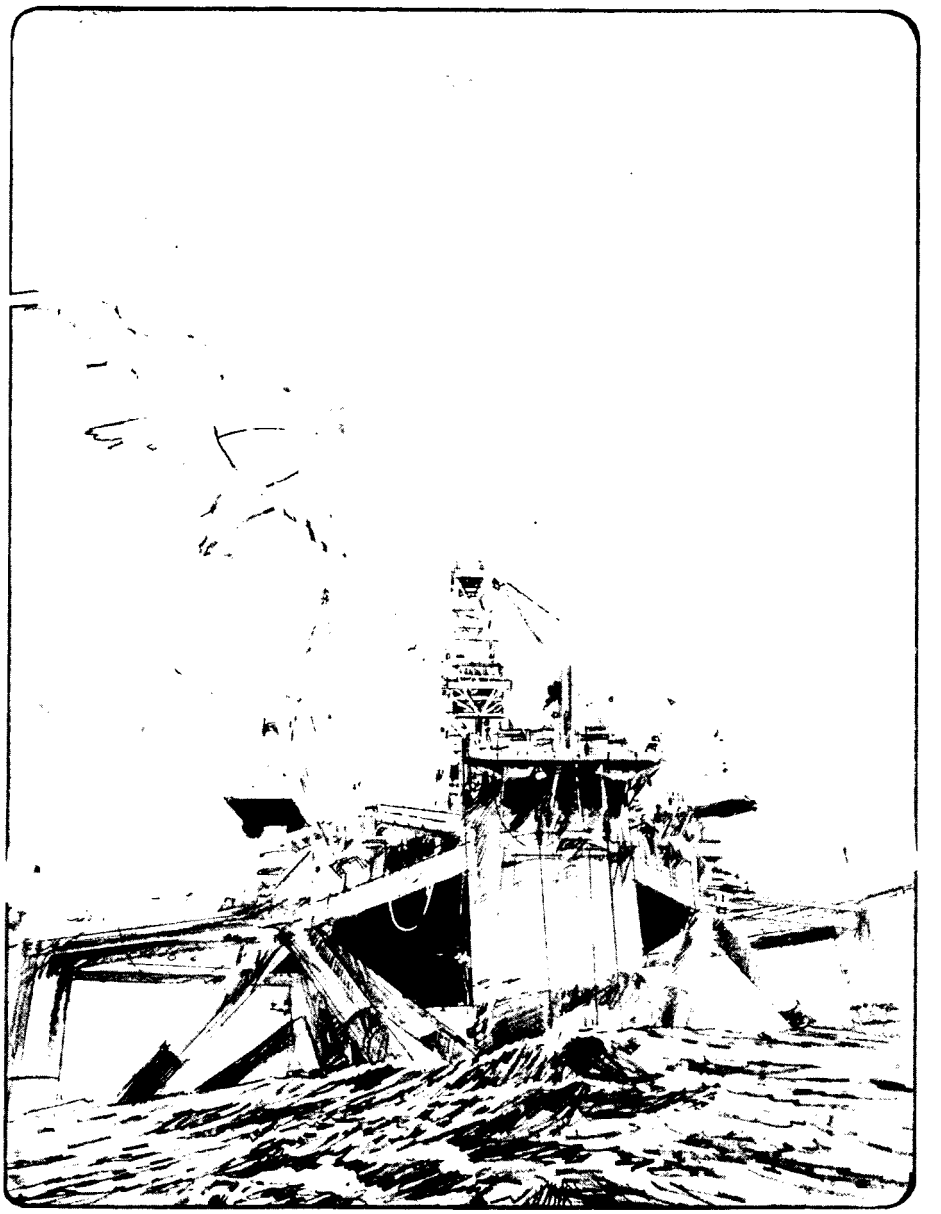
A monitoring system to identify supply and demand trends in their early stages is fundamentally necessary to provide a basis for prompt and sound actions.

Both near-term and long-term considerations point toward the desirability of fully developing and implementing a system for continuously monitoring energy supplies and demands in meaningful detail. At the present time, adequate data are available and reported regularly to the Government to define the current demand and supply, both domestic and imported. There is a need to relate this information to a projection of trends of demand and of domestic supply development far enough into the future to allow judgments on performance trends. Also, the degree of risk and potential harm to national security and to the economy needs to be determined.

Such monitoring should not interfere with market forces unless a clearly evident need to implement emergency plans is detected. Rather, it would be expected to provide information needed for sound decisions about elimination of constraints impeding supply development. It also should provide additional incentives for voluntary restraint of demand to enable the market mechanism to keep on the course toward less dependence without sacrificing the future of the economy, the environment, or any segment of the population.

The assignment of activities (collection of data, projections, and comparisons with expected progress) should be done through the Energy Resources Council, which would also determine the adequacy of emergency plans and be responsible for initating them.

Certain elements of the monitoring systems are addressed by the Panel in Chapter 3, Transportation Section, Recommendation II, and Human Resources Section, Recommendation 1, and in the Research and Development Chapter 4, Recommendation IX.



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Energy Demand and Supply

Introduction

This chapter of the report sets forth the Panel's consensus of findings and recommendations pertaining to attainment of satisfactory relationship between the Nation's energy demands and its domestic supplies. In formulating its recommendations the Panel recognized that during the past year very dramatic changes have taken place in the total energy picture, particularly with respect to prices and sources of supply. Patterns of consumption and levels of demand for specific energy sources are both undergoing significant changes.

However, not enough time has elapsed since the embargo to establish the relative extent to which an apparent slowing in energy demand growth is due to the state of the economy, to higher prices, or to the price control/regulatory impacts.

The Panel believes that a much greater public awareness of the extent and implications of the energy problem must be a first step in alleviating the problem. Conservation can provide immediate benefits; however, a program of fuel substitution, as presented in the Panel's recommendations, should be instituted as soon as possible to improve the longer term situation. It also is important that emergency plans should be prepared and ready for implementation if other measures are not effective.

The panel recognizes that in the case of a serious and sudden disruption of imports, severe curtailment of consumption is the only solution and the resulting economic penalties incurred must be accepted.[1] However, it does not appear appropriate to initiate a program of mandatory conservation actions without first studying carefully the social and economic effects of each action and determining which are least detrimental and most effective.

[1] Letter, G.L. Decker to Dr. S. William Gouse, Jr., See Appendix 1.

As an initial step in studying demand and supply interactions, the demand and conservation Subpanel used "Reference Energy Systems." The specific "Reference Energy Systems" used by them were developed by the Brookhaven National Laboratories and are described in Appendix 2.

Demand and Supply Balance

1985 Outlook

The table, "Domestic Demand-Supply Estimates for 1985," given on p. 13, sets forth the demand and supply balances for 1985. After studied consideration of each consuming sector and each energy resource the Panel derived these values by consensus. As reflected in the table, the many uncertainties involved have led the Panel to view both supply and demand in terms of a range of values rather than as specific forecasts.

The upper section of the table deals with demand, using as a starting point 1972 energy consumption. Applying the historic growth rate of 4.3 percent/year, 1985 energy consumption would be 125 quads.[1] With an oil price of $10-12 per barrel (1973) dollars), as opposed to the much lower prices prevailing previously, a demand reduction in the 10-15 Quads range is estimated as a price elasticity effect. Additional conservation measures (55 mph speed limit, for example) would have a relatively small but important incremental effect in the 2-5 Quads range. All of this results in a 1985 projected demand in the 105-113 Quads range.

The Panel realizes that such projections are uncertain and subject to error, particularly since little is known concerning the likely effect of the large price changes that are now taking place. The Panel has attempted to forecast prudently and consistently, avoiding projections that might tend to overestimate supply and/or underestimate demand. Thus, the Panel, on a consensus judgment basis, agreed on 108 Quads as a prudent planning base for 1985 demand, a reduction of 17 Quads from demand based on historic growth rates. This estimate is based on full economic recovery within one year from now.

The middle section of the table presents the ranges of supplies for each energy source. These estimates are dependent upon the rapid implementation of the recommendations presented in subsequent sections of this Report. Following the procedure used in the demand section, the total 1985 domestic supply estimates fall in the 85-107 Quads range from which a supply planning base of 94 Quads has been derived. Individually and collectively the supply estimates fit between those projected in other major energy studies, as shown in Appendix 5. The upper limit of the supply estimate, 107 Quads, is a summation of the maximum production of all fuel sources; thus, reaching that level of supply is considered highly improbable since all supply resources would have to reach maximum development simultaneously.

The table further shows that the Panel views imports equivalent to 7 million barrels per day in 1985 to be a base for planning.

Near Term Outlook—Present to 1985

In the view of the Panel, the following conditions will exist in the immediate future:

- The demand for energy will continue to grow, although higher prices and conservation effects will slow the rate
- Domestic supply will not be able to stay abreast of the demand until new sources of oil and gas are found, additional uses for coal are instituted, and more nuclear plants are built at a higher rate than presently exists.
- Coal and nuclear energy cannot be substituted for oil and natural gas immediately. Time is necessary to evaluate the feasibility and to implement conversion in each case.

Thus, domestic energy supplies will not be able to keep up with potential demand throughout the rest of the 1970's. During this decade the slow development of energy supplies (due to long lead times), slow demand reduction and slow progress toward fuel substitution will prevent early achievement of an acceptably low level of import requirements. This will call for more risk than is desired.

The Panel believes that full economic recovery, combined with still declining domestic oil and gas production (during the next few years) will result in

[1] See Appendix 3 and Appendix 4, for symbols and abbreviations, and for conversion factors.

CTAB Panel
Domestic Demand—Supply Estimates for 1985

DEMAND	Range Quads	Panel's Planning Base Quads
If Historical Trends Continue	125	125
Reduction Due to Price Effects	10—15	13
Reduction Due to Additional Conservation	2— 5	4
Projected Demand	105—113	108

SUPPLY

	Range of Panel Estimates (in conventional units)			Conventional Units	Panel's Planning Base (in conventional units)	Panel's Planning Base (in equivalent Quads/yr.)
Coal	1.0	—	1.4	Billion Tons/Yr.	1.2	26
Oil	11	—	13.5	Million Bbl./Day	12	25
Natural Gas	21	—	24	Trillion Cu. Ft./Yr.	22	22
Nuclear	250	—	300	Gigawatts	275	16.5
Shale Oil	0.25	—	0.5	Million Bbl./Day	0.25	0.5
Hydroelectric	58	—	65	Gigawatts	58	3.5
Geothermal	3	—	8	Gigawatts	3	0.2
Solar	0.1	—	0.2	Quads/Yr.	0.1	0.1
Solid Waste	0.1	—	0.5	Quads/Yr.	0.2	0.2
Synthetic Oil	0.1	—	0.2	Million Bbl./Yr.	0.1	*
Synthetic Gas	1.0	—	2.0	Trillion Cu. Ft./Yr.	2.0	*
Total Available Supply	85	—	107	Quads/Yr.		94

BALANCE

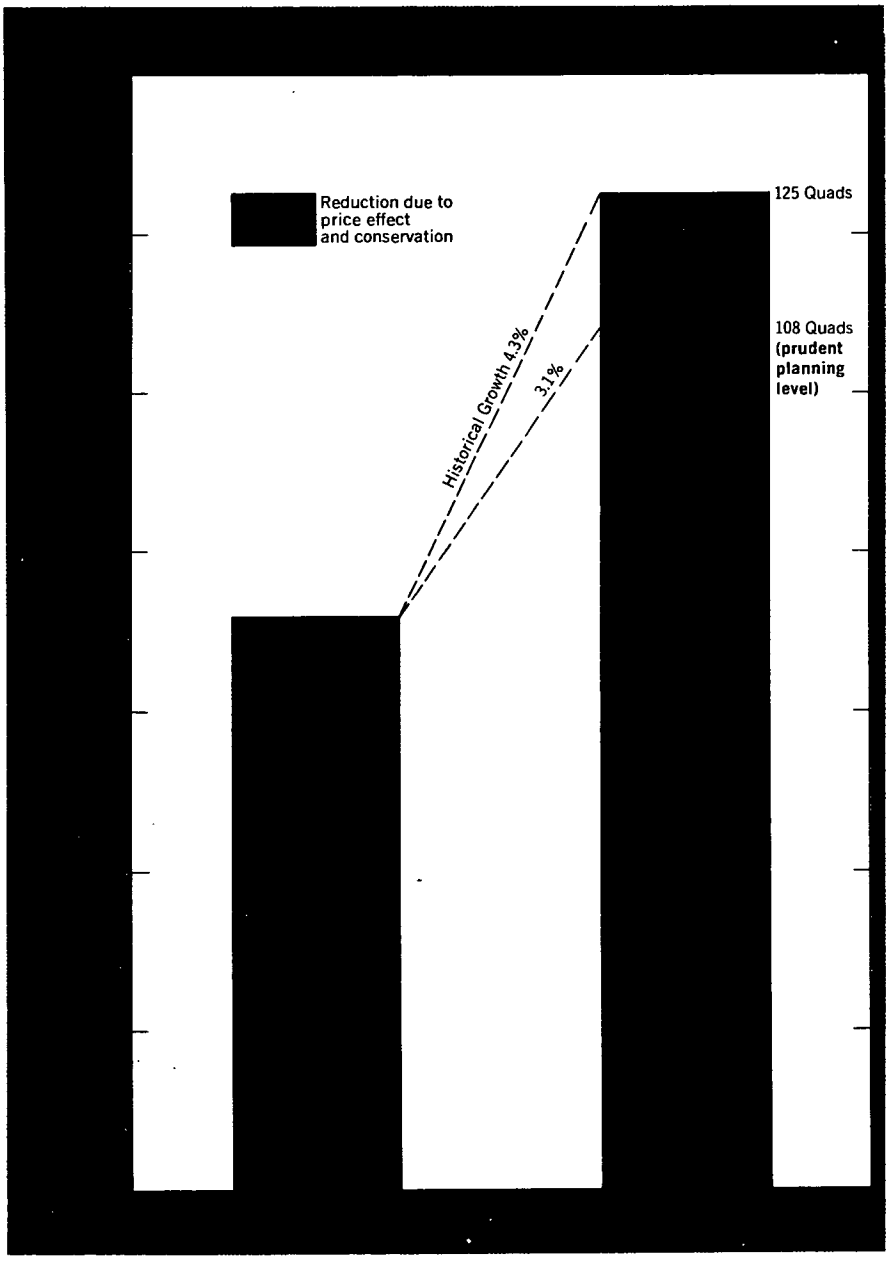
	Demand	Supply	Imports Required	Cost of Imports at $11 per Barrel
Imports Using Panel's Planning Base	108	94	14 Quads/Yr. (7 MMBPD)	$28 Billion/Yr.
Imports Using Panel's Maximum Expected Demand and Minimum Expected Supply	113	85	28 Quads/Yr. (13 MMBPD)	$52 Billion/Yr.
Imports Using Panel's Minimum Expected Demand and Maximum Expected Supply	105	107	Balanced	—

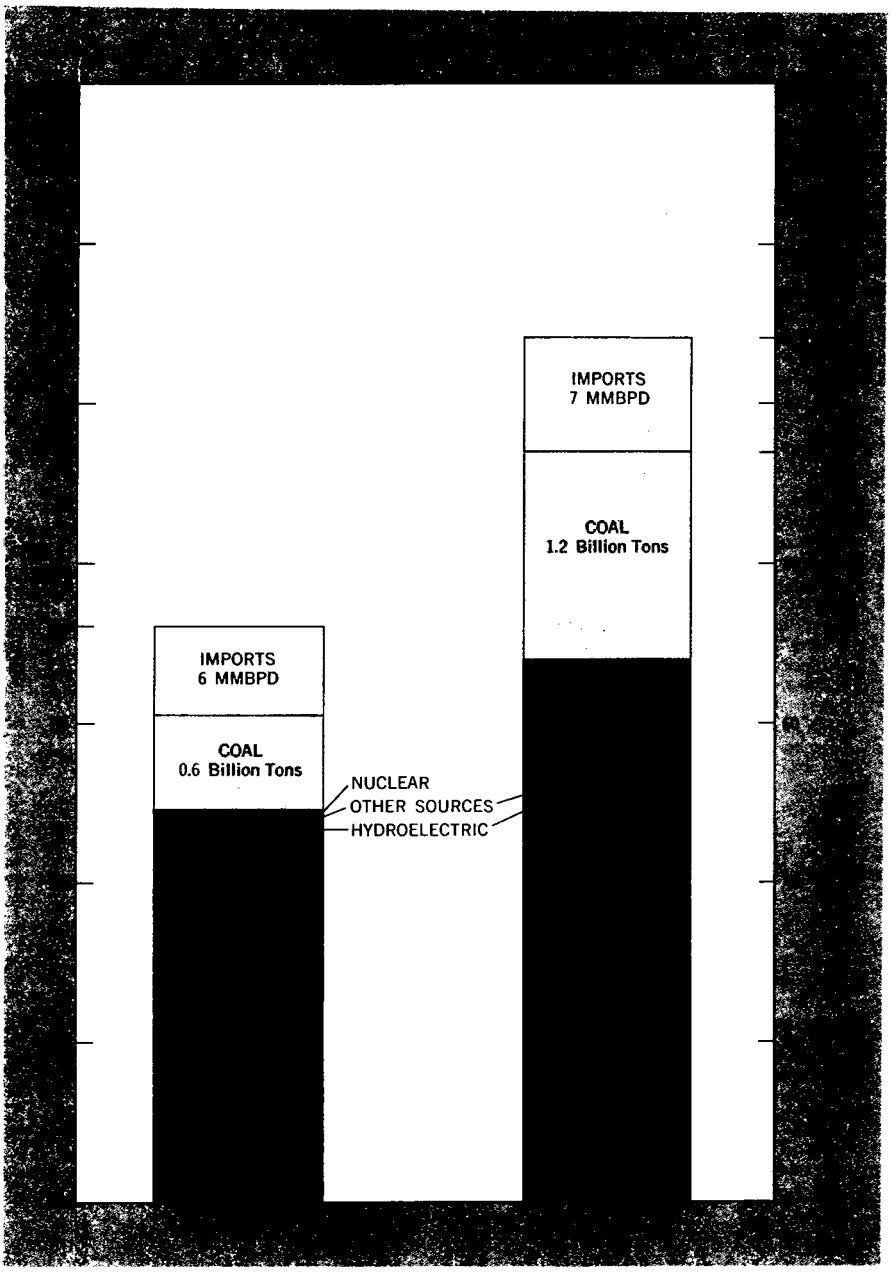
Notes:

In addition, these demand-supply estimates have been converted in Appendix 6 to equivalent values utilizing other energy measurement units. Conversion factors are given in Appendix 4.

* Included with Coal

The planning base demand and supply levels of the panel are premised upon the immediate implementation of the recommendations contained in this report. It would be imprudent to expect to attain the planning supply levels if programs are not in place during 1975 and any delay will reduce the attainable levels.


Reduction due to price effect and conservation
125 Quads
108 Quads (prudent planning level)
Historical Growth 4.3%
3.1%


IMPORTS
7 MMBPD
COAL
1.2 Billion Tons
IMPORTS
6 MMBPD
COAL
0.6 Billion Tons
NUCLEAR
OTHER SOURCES
HYDROELECTRIC

an increasing level of imports of oil over the next five years. Prompt initiation of the program to decrease demand and increase supply, if carried through successfully, should limit the import peak and initiate a downward trend by about 1980. This will lead to the level of imports predicted in the forecast for 1985. Failure to initiate such action immediately or to carry the program through successfully will result in oil imports continuing to increase, assuming that a healthy economy is maintained.

Long Term Outlook—Beyond 1985

In spite of the fact that the Panel's planning base does not provide for independence by 1985, the percent of dependence will be on a declining track by that time.

Declines in imports will continue beyond 1985 only if the Panel's recommendations are followed and new energy sources make increasing contributions to total supply. Domestic oil and natural gas production will decrease sharply unless a vigorous program of secondary and tertiary recovery and production from the various offshore and other frontier areas are realized. Even though the contributions of nuclear energy and coal will continue to increase, we will be able to meet both growth in demand and reductions in imports of oil only if recommendations in the areas of coal liquefaction and gasification, breeder reactors, oil shale, solar, geothermal and other research and development programs are implemented as soon as possible. *Urgency in accelerating these programs is vital* in order that these other energy sources will start to make significant contributions to the supply as soon as possible after 1985.

Delays in implementing the program will result in moving further into the future the time at which imports, and dependence on those imports, will be reduced to a level at which the risks will be acceptable. The task will not be easy.

Energy Consumption and Relation to the Economy

One of the most critical problems in assessing future energy requirements is the relationship of primary energy consumption to real GNP.

In the short run, the link between primary energy consumption and real GNP is probably very close. However, there exists some energy consumption which can be reduced with minimal effects on GNP, but the amount of such energy consumption is small.

In the long run (the next decade and more) there is an opportunity for changes in the way energy is utilized by development of technology and investment in projects to conserve energy. Such changes and investments may enable a greater reduction in energy consumption with only a small effect in GNP. However, history does not provide experience to make reliable estimates on the extent of such potential changes.

Emergency Preparedness Plans

The Nation must be prepared at any time for emergencies, such as a renewed embargo, which would necessitate a crash program to accelerate supplies or reduce consumption rapidly. A monitoring system to detect both the need for and best manner of imposing such a crash program is an essential element in the Panel's plans. The requirements for such emergency programs and the likely results of them should be understood as much as possible.

The Panel's recommendations are:

I. Provide appropriate risk coverage for supply emergencies.

The Panel supports the International Energy Program (IEP). It makes no specific recommendations regarding this program inasmuch as the IEP is working to establish an action program to restrain consumption and share shortfalls, and is well along in development. Even though some storage may occur under IEP, the Panel believes that it should also make the specific recommendation that a domestic crude oil storage program be undertaken immediately. The NPC and FEA have determined that the lowest-cost storage would be in the salt domes on the Gulf Coast.

II. Fund a study of the social/economic/political effects of a wartime provision supply case and an accelerated conservation case (mandatory measures)[1].

[1] Reference "Plausibility of a Restricted Energy Use Scenario", Stanford Research Institute Research Report CSSP 3705-8

The panel recognizes that additional efforts will be required if:

- The Panel's recommendations do not have the desired effects and imports are unmanageable.
- The Nation's energy supplies are curtailed.
- The actual energy demand exceeds estimates.

The objective of these studies is to determine the modes of obtaining the maximum energy benefits from greater acceleration of supply and conservation, with the least disruptions to our economic/social/political status—including but not restricted to employment, GNP, and life style.

A wartime provision supply case would give top priority to such items as equipment and manpower, and to the speed-up of legislation. Although such provisions may result in higher costs, environmental changes, and shortages of goods and manpower in the rest of the economy, they may be required in order to provide more energy at an earlier date.

An accelerated conservation case includes stand-by incentives and mandatory measures. Although some of these measures may be severe in their effects on the Nation's economic and social conditions, the need to reduce imports may require activating such measures. The mandatory measures to be studied should include allocation, rationing, fuel taxes, BTU taxes, motor vehicle fuel-economy tax, import restrictions, and other measures.

Public Awareness

Real progress toward solving the Nation's energy problems cannot be made unless there is a general public understanding of the true nature and extent of the energy crisis, particularly our dependence on foreign oil.

So long as the energy problem is viewed and dealt with as a series of unrelated specific problems concerning such things as the foreign oil cartel, high electric bills, shortages of gasoline, environmental protection, local resistance to mining, to power plants and to refineries, automobile pollution and efficiency, nuclear safety, and windfall profits, it cannot be solved.

To deal with this problem, all segments of society must pull together in one general direction. All must make commitments and sacrifices for the common good. Without a common understanding and acceptance of the true nature of the National energy objectives, such a mobilization will not be forthcoming.

To achieve a general public understanding, it is necessary to develop and conduct a nationwide information program. The program should utilize the capabilities and communication channels already in place in the public and private sectors, with the National Government providing clearly articulated goals and policies. The program should deal with facts and should be presented in an objective manner.

The Panel, therefore, makes the following recommendations:

I. Initiate a National Energy Information Program

A national program should seek to achieve a broad distribution and awareness of information concerning such subjects as:

- History and causes of growth of dependence upon foreign oil.
- Current status of domestic energy supply and demand.
- Future demand or requirements for energy in various forms during the next and subsequent decades.
- Nature and duration of lead times for increasing domestic production, conversion and distribution of energy and for reducing domestic demand for energy.
- Identification and nature of constraints on increasing domestic production, conversion and distribution of energy.
- Costs of current domestic energy production, conversion and distribution.
- The role which research and development must play in the energy future.
- Effects of Government intervention on the supply and demand of energy.
- Risks of dependence on foreign energy regardless of its world price.
- Domestic and international effects of importing oil at various prices.
- Identification and nature of conservation actions to reduce future demand for energy during the next and subsequent decades.
- Impact on income, convenience, life style, GNP and the environment from taking various conservation measures.

• Impact on income, convenience, life style, GNP and the environment by increasing domestic production of energy.

Conservation

The Panel supports voluntary conservation efforts by an informed public, which have the advantage of increasing the rate of conservation without imposing serious dislocations or inequities on any sector of the public. Government actions, primarily in the form of incentives, will be needed to assist voluntary conservation. The program outlined below can achieve a reduction of up to 5 Quads, which is included in the total reduction of 17 Quads shown in the Panel's demand planning for 1985. It is impossible to completely separate conservation brought about by higher prices from that due to direct efforts to conserve.

The following Panel recommendations relate to energy conservation in the transportation sector:

I. Develop and manufacture vehicles with substantially improved fuel economy, via joint action of the Federal Government and the automobile manufacturers.

The Federal Energy Administration concluded last spring that aggregate gasoline consumption could be held constant if new automobiles achieved fuel economy improvements of 30 percent by 1980 and 45 percent by 1985 compared to 1974 model cars. The President has proposed a more stringent goal of a 40 percent improvement in average fuel economy by 1980. Achievement of this goal is expected to curb the growth rate in gasoline consumption.

II. Continue the industry practice of providing consumers with information on the fuel economy of automobiles.

The EPA has begun a study to develop a uniform procedure for testing the fuel economy of vehicles to reflect their performance in actual driving conditions. The Panel supports the timely conclusion of that study, so that automobile manufacturers and private testing organizations which provide consumers with information on automobile fuel economy may adopt uniform, comparable, and accurate test procedures.

III. Rigidly enforce the 55 mph maximum speed limit.

IV. Revise transportation regulations to promote the efficient use of energy.

As examples, ICC should change its common carrier rates to encourage truck and railroad backhaul, and to encourage hauling in as direct a route as possible.

V. Allocate a portion of the Federal and State gasoline and diesel fuel tax to support capital construction and improvement of mass transit systems.

The following Panel recommendations relate to energy conservation in the residential and commercial sectors.

VI. Adopt national building standards that achieve maximum heating, cooling, and lighting energy conservation. Such standards should be flexible so as to permit innovation.

VII. Modify VA, FHA and other Federal loan regulations to make them supportive of energy efficiency in housing.

VIII. Provide incentives and low-interest loans for retrofitting of energy-conserving devices in existing residential and commercial buildings.

A paper has been prepared by the Sub-Council on Technology to the National Industrial Energy Conservation Council, Dept. of Commerce, entitled "Commercial and Industrial Energy Conservation". Techniques for reducing energy consumption in commercial buildings are included in this paper. These kinds of measures have resulted in reductions of 20 percent to 35 percent in energy consumed in office buildings.

IX. Continue to support the industry practice of providing consumers with information on the energy consumption of major appliances (labeling).

The following recommendations relate to energy conservation in the industrial sector.

X. Support industry in producing electric power on top of its steam base.

The increased cost of fuel has emphasized the well-known fact that a substantial opportunity for fuel savings exists through increased power generation by industry. Most industrial steam is now generated in low efficiency package boilers

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burning oil or gas. Replacing these with higher pressure and temperature coal-fired boilers, and passing the steam through an extraction or back-pressure turbine before delivering it for its normal industrial use, results in the generation of electricity at an incremental efficiency of approximately double the fuel efficiency of central power stations. A recent study[1]—points out that this conversion may be economically justifiable for over 40 percent of industrial steam usage. If that conversion could occur by 1985, it would result in industrial power generation in excess of 30,000 megawatts and an annual fuel savings of 1.5 Quads. A number of important constraints to realizing this potential should be noted, including: limited availability of equipment, possible limited availability of coal, difficulties in meeting environmental requirements, and a number of institutional problems.

XI. Encourage all companies to participate in an energy conservation program.

The major energy-consuming industries have agreed to a 10-15 percent reduction (1972 base) in energy consumed per unit of product by 1980. This is equivalent to 1.5-2.0 Quads.

Energy management techniques are discussed in a recent paper[2], together with condensed check lists of energy conservation ideas. Additionally, there are some examples of energy conservation accomplishments by seven companies. Dramatic examples range from a 15 percent reduction in energy used by one large company in one year up to a 47 percent reduction in natural gas consumption at one plant.

The following Panel recommendations relate to energy conservation in the utility sector.

XII. Support the use of the most efficient heat disposal methods consistent with valid environmental considerations.

From a technological standpoint, utilities have a number of heat-disposal options available to them including (in order of decreasing energy efficiency): once-through cooling, cooling ponds, spray canals, wet cooling towers and dry cooling towers. The range of energy required to operate such systems runs from 2 percent to 10 percent of the generating station's output. The less efficient methods should be prescribed only when absolutely necessary from an environmental viewpoint.

XIII. Encourage the utility industry to provide steam to industry from central powers stations.

As part of the study[1] described in Recommendation X, steam could be provided to industry from central power stations. The study indicates a potential annual savings of almost one Quad by 1985; however, most of this savings would be reached by implementation of Recommendation X alone.

Fuel Substitution

Conservation through improvement of overall energy efficiency is of primary importance, but conservation of scarce energy sources, even if accompanied by some inefficiencies, also can have significant benefits. The scarcer fuels should be conserved for those uses in which substitution is not practical. For example, substitution for oil is not practical in transportation, the petrochemical industries, and in certain industrial processes. Similarly, substitution is not practical for certain natural gas applications.

Because the domestic supplies of natural gas and oil are limited, measures should be taken to encourage substitution for these fuels to lessen dependence on imports, as well as to improve the balance of trade. Rather than increasing foreign imports, domestic coal should be used both for direct burning to produce heat and electricity and as a feedstock for producing synthetic oil and gas. There are many applications in which natural gas and oil can be replaced by more abundant energy sources. As an example, the bulk of the future growth in all kinds of heating load, in residential, commercial, and industrial structures, can be served by electricity generated from coal, or nuclear fuel, or perhaps by natural gas supplemented by synthetic products of coal origin. The electric utility industry has the potential ability and the technology to expand rapidly with both nuclear and coal-fired generation.

Furthermore, by 1985, synthetic gas and liquids can be produced in quantities sufficient to begin to

[1] "Michigan Energy Industrial Center Study" NSF Grant EN-43724

[2] "Commercial and Industrial Energy Conservation" Sub-Council on Technology to the National Industrial Energy Conservation Council, Department of Commerce.

make a substantial impact upon the national need for a flexible energy supply.

In order that this substitution take place as rapidly as possible, the Panel recommends the following:

I. Provide a favorable climate for the rapid expansion of the electric and synthetic fuels industries.

There are many constraints—environmental, financial, regulatory, etc.—inhibiting the expansion of these industries. It is absolutely necessary to relieve the constraints if meaningful substitution is to be achieved. Specific recommendations are contained in the Electric Utilities, Synthetic Fuels, Financial and Environmental sections of this report.

II. Provide financial incentives and disincentives to encourage the substitution of alternate fuels for natural gas and oil in existing plants, and the use of coal, nuclear and synthetic fuels in new facilities.

New industrial steam generation, heat processing, industrial space heating, and base load electric power generation should be prohibited from using natural gas and oil unless no practical alternatives exist. Existing oil and natural gas-fired base load generators should be converted wherever feasible. Financial incentives, probably through tax relief, should be applied initially, with disincentives held in reserve until substitution trends can be analyzed to determine the success of the program.

III. Encourage the most economical use of domestic energy sources in the residential and commercial sectors.

Market forces should be allowed to determine the relative share of market to be supplied by electricity and natural or synthetic gas or oil.

IV. Promote electrification in those end uses where off-peak power (seasonal or daily) may be employed and where it can be demonstrated that the bulk of electricity can be produced from coal or nuclear power.

Space heating and water heating are examples of end uses that might fall into this category. The availability of off-peak power from nuclear or coal fired generators will vary considerably from region to region.

V. Provide tax incentives and/or Federal support to industry, utilities, and municipalities for energy systems that would use solid waste for power or fuel.

Also see discussion under Chapter 2, Future Energy Sources, Recommendation IV.

VI. Provide tax incentives and/or Federal support to industry, utilities, and municipalities to encourage the utilization of low-grade heat from power plants in urban and industrial heating systems and in agriculture.

2

Energy Sources

Introduction

The Panel has surveyed all energy sources with commercial potential or possible future potential, and this chapter of the report contains its conclusions and recommendations for each energy source. The Panel believes that movement toward U.S. energy independence cannot be accomplished by exclusive concentration on one or two energy sources. Instead, a comprehensive program aimed at developing the full potential of all energy sources, embracing coal, oil, natural gas, nuclear energy, synthetic fuels, shale oil and future energy sources, is needed.

In several areas, particularly offshore oil and natural gas and uranium, the Panel recognizes uncertainties in our knowledge of the available U.S. resource base, and has recommended a systematic attempt to define the nature and extent of these resources. However, within these uncertainties, it is apparent that coal and nuclear energy development offer the greatest potential for major expansion between now and 1985, and so constitute a high priority for Federal Government action. Expediting coal leasing and nuclear plant licensing exemplify the actions needed.

The Panel believes that deregulation of prices of oil and new natural gas is essential. Only in this way can the full costs associated with the development of new production areas and processes be recovered.

The Panel is also concerned that present legislative and environmental constraints on energy sources be reviewed and modified in order to maximize production of all resources consistent with public health requirements. This concern is reflected in the Panel's recommendations. The Panel also has a strong conviction that action on its recommendations should be implemented immediately and necessary steps be taken without delay to utilize these energy sources as efficiently as possible and to develop new sources through strong research and development programs.

Coal

Coal is our most abundant domestic fuel.[1] Estimates of the potential resource base for coal vary widely depending on what recovery rate is assumed. Yet even under the most conservative reserve estimate, several hundred years supply of coal remains at the present rate of consumption.

Despite the abundance of coal, its utilization has remained at near-constant levels. Uncertainties concerning future demand have inhibited the opening of new mines. Many old mines have been shut down because of competition from lower cost domestic and foreign alternate fuels, environmental considerations, and the increased costs brought on by the new mine health and safety regulations. Use of high-sulfur coal, which represents 35 percent of the available resource base, is now being restricted by environmental standards, and the bulk of this coal is located near the high demand centers east of the Mississippi. Not until improved clean fuel technology or improved air pollution control technology is developed will the maximum utilization of such coal be achieved within present or proposed environmental standards.

Coal may be directly substituted for oil and natural gas in certain applications and it can be converted to synthetic liquids and gas. Since domestic reserves of coal are greater than oil and natural gas, it is necessary that substitution for these fuels be made at the greatest possible rate commensurate with economic, environmental and other considerations.

A commitment to the production and consumption of coal must be made to assure the Nation's utilization of its most abundant energy resource. If this commitment is forthcoming in 1975, the Panel believes that the coal industry could produce up to 1.4 billion tons annually by 1985. This expansion, to more than twice the present production rate, would result in the growth of coal's share of the domestic supply of energy from 20 to 28 percent.

In the last five years, 11 percent of the bituminous coal mined in this country moved to export markets. This is a significant portion and probably in the future will be a strongly growing requirement. Much of the coal developed for export might be financed by foreign funds; but, it would still divert materials, equipment, manpower, etc., from the economy.

The Panel's recommendations are:

I. Establish Government policies which provide an economic, regulatory, and environmental climate conducive to the rapid development of coal both with respect to supply and utilization.

Such policies must include protection against sudden and predatory reduction in international oil prices.

- Although expansion of all energy sources is required, a major effort over the next 15 years must be directed toward a two- to four-fold increase in coal production both for direct utilization and conversion to synthetics. High levels of capital investment are involved and the financial risks are great. This production/consumption goal can be achieved only by a sustained, favorable, economic climate and a cooperative regulatory attitude by Government. Mine operators must be assured of long-range markets at prices adequate to cover operating expenses and a return of and on capital at a rate sufficient to attract investment. Environmental regulations must be consistent and realistic in terms both of investment requirements and environmental improvement goals. During transition periods, with uncertainty as to future demand for coal, additional means may be needed to ensure the opening of new mines in a timely manner. This may include such actions as help in financing, guaranteed contracts, and price protection on the product.

The Federal Government must establish an aggressive coal leasing program. A moratorium on Federal coal leasing has existed since 1971. Implicit in this recommendation is the passage of a workable strip-mining law which recognizes the necessity of expanding our Nation's coal production. The present Federal Mineral Leasing Act (1920) should be amended to incorporate provisions for leasing tracts of land containing at least 500 million tons of coal.

- The Government should develop a long-range environmental objective. It should protect the environment and ensure prompt restoration, but should be sufficiently flexible for planned development of mineral extraction and be generally consistent with overall energy resource

[1] See Appendix 7 for domestic reserves of coal, natural gas, and oil.

development. This would include streamlining procedures under NEPA, such as those for environmental impact statements; applying environmental standards in a manner consistent with immediate and long-term national energy needs and the maintenance and improvement of environmental quality; and modifying existing Federal air pollution regulations.

II. Provide impact funds through Federal grants and loans to those thinly populated regions affected by the build-up of projected coal production and coal conversion projects.

A high percentage of the projected coal production build-up and related coal conversion projects will be in areas that are thinly populated (less than one person/square mile). Therefore, they do not now have the facilities (roads, schools, sewers, water systems, social services, etc.) necessary to support the influx of people brought about by these developments.

Providing these facilities, at the right time and in the right place, can be an undue burden for the people of these areas and their State and local governmental units. These local problems are the result fo the national energy crisis.

Precendent for providing impact funds through Federal grants already has been established by the Congress under P.L. 91-511, which was promulgated in support of the Anti-Ballistic Missile Program in the late 1960's.

III. Amend the tax law to provide special tax incentives and disincentives to encourage utilities and industry to switch from oil and natural gas to coal as fuel for making steam or process heat.

In order to reduce dependence on foreign oil and to reduce the overall consumption of oil and natural gas, coal should be burned as the prime fuel for generating steam or process heat. However, conversion of boilers and similar facilities to coal requires an expenditure of capital which does not increase the productivity of the facility. Therefore, to spur such a conversion and to assure that new facilities will employ coal burning equipment, incentives and disincentives are needed.

IV. Undertake accelerated studies to determine the health effects of coal-related hazards on miners, industrial workers and the public. Such studies should be undertaken, or sponsored, by the National Institutes of Health.

V. Expand and support new technical and degree-level education programs for mining engineers, technicians, and skilled miners. Both Federal and State Governments should participate in support of these activities.

With the development of new coal mining resources and technology, there will be an increased demand for mining engineers, technicians, and skilled miners. Established programs should be expanded now in view of the four- to five-year time lag involved in the education of such engineers and mine supervisors. New technical and short-course programs should also be encouraged. Miners' "above-ground" education must also be stimulated; today most training is on-the-job underground, whereas much background information (safety, laws, equipment) can be given in a classroom atmosphere.

Oil and Natural Gas

Present production levels of domestic oil and natural gas cannot be maintained without implementing the Panel's recommendations. Even with such implementation it is likely that the increase in production will be small; without it, the decrease in production probably will be substantial. The most immediate requirement is that the Nation determine the extent to which it can rely on potential reserves in frontier areas for future energy supply.

The Panel's recommendation are:

I. Remove price controls and associated regulations from petroleum so as to attain competitive market prices as expeditiously as possible.

Current regulations and price controls have created a situation in which substantial portions of the crude oil and natural gas liquids produced are sold at prices that are much lower than replacement costs, while other production is allowed to rise to market-clearing prices subject to overall price controls. These factors, coupled with mandatory allocations of crude oil among refiners, lead to many distortions, inequities and disincentives. The higher costs associated with exploration on the frontier and more hostile environments (to meet future needs and to offset

declines in existing areas) require earnings derivable from total production at real competitive market prices. The removal of price controls from petroleum will establish a competitive system and concurrently stimulate exploratory effort for new supplies. To the extent that windfall profits might occur, appropriate taxes could be imposed as discussed in Chapter 3, Finance Section, Recommendation I.

II. Deregulate the wellhead price of new natural gas.

Since 1954, the Federal Power Commission has controlled the wellhead price of natural gas entering the interstate market at artificially low prices. This has resulted in rapid growth in demand and has discouraged investments for new exploratory ventures to develop additional supplies. Intrastate prices, particularly for new gas, have been rising and are at levels substantially above those allowed by FPC for interstate movement. Thus, the interstate market is unable to compete for supplies with resulting dislocations and severe curtailments to customers having no alternate sources of energy. The removal of price controls from new gas will establish a competitive system and concurrently stimulate the exploratory effort for new supplies. To the extent that windfall profits might occur, appropriate taxes could be imposed as discussed in Chapter 3, Finance Section, Recommendation I.

The proposed consumer tax on gas appears to be detrimental to the objective of deregulation and also inequitable in that gas derived from some sources, such as imported LNG and SNG produced from liquids, would be taxed twice. Also, gas produced from coal would be taxed, whereas electricity and liquids produced from coal would not.

III. Conduct large and frequent lease acreage sales in each of the prospective frontier Outer Continental Shelf areas (Atlantic, Pacific, and Gulf of Alaska) and in the Gulf of Mexico at the maximum rates that can be efficiently assimilated by the industry for exploration and development.

It is essential that it be established as soon as practicable whether these areas will be highly productive and, if so, whether they will alleviate the major long-range energy supply problems now generally envisioned. Conversely, it is equally critical that it be established whether these areas offer little, if anything, in the way of dependable new sources for conventional oil and gas.

IV. Develop a framework whereby the best available talents and technology can be brought together to attain the Nation's potential for secondary/tertiary recoveries of petroleum.

This recommendation should be implemented by ERDA working appropriately with industry.

While there is a rather wide range of opinion about the magnitude of the secondary/tertiary production potential, there is little doubt about the desirability of recovering as much oil as is physically and economically possible from every reservoir. Fully effective means (including removal of price controls) on a fully concerted basis must be found to expedite the high risk translation of undemonstrated technology into widespread field operations.

V. Open Naval Petroleum Reserve No. 4 to exploration and development on the same basis as for any other Federal lands.

The basis for this recommendation is the same as for Item III above. If substantial recoverable reserves do exist, in its current form this property cannot readily yield petroleum for defense, emergency, or regular commercial usage.

Nuclear

Nuclear energy is the only non-fossil source of energy which can be utilized on a significant and increasing scale in the United States during the next 10 or 15 years. Its principal application is base-load electric power generation. There is a large potential savings in fossil fuels by using nuclear energy. Without nuclear power even larger amounts of coal will have to be mined, transported and burned, or oil will have to be diverted to power generation. Natural gas is unlikely to be available over the long term for electric power generation even if this were considered an acceptable use of the gas resources. Under these circumstances failure to exploit nuclear power to the fullest may result in electric power shortages in the decades immediately ahead.

Without prompt action it appears difficult to achieve even the FEA "business as usual" unconstrained projection of 234 GWe by the end of 1985.[1]

The following discussion is included in order to illustrate the magnitude of the savings of gas, oil and coal which can be achieved by increased utilization of nuclear power.

One hundred GWe of nuclear power operating at an average load factor of 70 percent would be equivalent to the following quantities of fossil fuels required to produce the same amount of electric power:

- 350 million tons per year of Western coal (at 8,500 Btu/lb.) which would have to be mined, shipped, and burned under acceptable environmental conditions. (This is more than one-half the current coal mining rate); or
- 2.6 million barrels per day of residual fuel oil (at 6.3 million Btu/bbl.) (This is more than one-quarter of total U.S. oil production or about 40 percent of current oil imports); or
- 6.0 trillion cubic feet of natural gas per year (at 1030 Btu/SCF) (This is over one-quarter of the total natural gas consumption in the U.S.).

The U.S. industry capacity for designing, manufacturing, and constructing nuclear power plants is such that by 1985 it could be constructing 40-50 GWe of nuclear power capacity per year. Before the recent severe financial constraints annual orders were actually running more than 40 GWe per year for nuclear power plants to be completed in the early 1980's. This capability, if it could be applied at maximum, would be able to achieve somewhere between 285 and 310 GWe [2] capacity in operation by the end of 1985.

It should be noted that in September 1974, before the "avalanche" of delays and cancellations, the Atomic Energy Commission had licensed or received complete license applications for 94 GWe, and another 125 GWe of firm orders had been placed with vendors and enginneers. Without early action on financing and licensing, the FEA "business as usual" case appears unliekly to be achieved.

Nuclear power should play a significant role in meeting the Nation's energy needs and will be able to do so if vigorous and decisive action is taken.

The Panel's recommendations are:

I. Improve the economic viability of the Nation's electric utilities at once. (see discussion, Chapter 5, Electric Utilities).

II. Simplify the overall licensing process. Shorten it and make it predictable.

This includes Nuclear Regulatory Commission licensing, environmental impact statements and approvals, and various Federal and State licenses and approvals. To an increasing extent the problem is spreading to all forms of power generation and transmission in addition to nuclear plants. At the present time the Nuclear Regulatory Commission requires an "acceptable" license application and it believes it can grant a construction permit in 15 months if there are no interventions—but it has yet to demonstrate this capability.

The collection, analysis, and submission in proper form of the site, environmental, and safety data now take about 3 years and cost upwards of $10 million, not including preliminary plant engineering needed as backup. Real simplication of the requirements, such as some sort of "one-stop" licensing, is needed, with data provided later if necessary, for nuclear plants to be built in the 6-7 years which is possible.

Further, the changes in design and construction criteria by the regulatory agency during construction which continue to extend construction schedules must be essentially eliminated if a 6-7 year schedule is to be achieved.

Further plant standardization and pre-approved sites, while potentially useful ideas for the longer term, will do little to solve the current problem because plants need to be started within the next 3 years to be available by 1985.

III. Reduce uranium supply uncertainties

U.S. uranium supply is a growing concern in two senses. First, production requirements by the early 1980's will be many times present U.S. mining and milling capacity with a present lead time for new

[1] The FEA Report Summary is based on 204 GWe (see p. 50)

[2] The data on the Table on pp. 3 and 13 show 275 GWe as the average for the year, and 300 GWe chosen as the upper limit.

production of 7 to 9 years. Secondly, there is growing concern about the actual size of U.S. uranium resources and the possibility that all U.S. resources which can be produced at low prices ($30 to $50 per pound) will be essentially committed for the lifetime use of plants ordered by 1985.

The production problem stems in part from the financial difficulties of the utilities and probably could be alleviated once the financial issue is resolved by opening up public lands for exploration, assuring continuation of present tax environment, and encouraging, perhaps requiring, utilities to contract for their uranium requirements in advance (perhaps as a condition of a construction or operating license).

In any case much more work needs to be done by government and industry to delineate and evaluate the potential domestic uranium resources and assure nuclear fuel supplies.

Recycling of plutonium can reduce uranium requirements by about 30%. The Nuclear Regulatory Commission should make a very early decision on this.

IV. Put uranium enrichment facilities into operation and achieve the full capacity of the Government-owned enrichment plants.

While possibilities of one or more private enrichment plants in the U.S. continue to be favorable, every step must be taken to assure continued supply, if necessary by expansion of existing Government plants. The Government expansion steps already planned (Cascade Improvement Program and Cascade Upgrading Program) must be carried out without delay.

Additionally, the Government enriched uranium stock-piling program must be fully implemented. This requires getting additional supplies of uranium and power as soon as possible.

It is particularly essential to assure the construction of the additional electric power generating capacity required for the Cascade Upgrading Program mentioned above, since "excess power" in the 1979-83 time period does not look like a reasonable prospect.

V. Pursue vigorous development of the Fast Breeder Reactor.

Recognizing that fusion has yet to reach its scientific feasibility stage, a stage reached by fission about 30 years ago, and that several breeder demonstration plants are now in operation overseas, work on the fast breeder, hopefully benefitting from overseas development, must continue at all possible speed as assurance against possible shortfalls in uranium supply.

VI. Facilitate cooperative efforts by labor, the Federal Government, and industry to increase construction manpower availability and productivity.

An acceleration of the nuclear construction program, especially if combined with construction of other energy-related facilities, will result in greatly increased requirements for skilled construction workers. The base for such workers must be expanded, more training programs initiated, and worker productivity significantly increased while still complying with the Occupational Safety and Health Act and quality control/assurance requirements.

VII. Address the public concern with the environmental effects and safety of nuclear power plants, and the concern with storage of wastes, and safeguarding of fissionable materials.

Broader and more effective public understanding of the safety, environmental, safeguards, and long range storage issues involved in large scale applications of nuclear power must be achieved. Such information must include realistic and balanced facts and informed judgments on the potential risks, costs and benefits associated with the overall nuclear power program. The on-going ERDA/NRC research and development programs should focus on resolving valid uncertainties in these areas.

VIII. Resolve the Indemnity Issue.

The continued orderly development of the application of nuclear power requires an early and adequate resolution of the public indemnity problem. For the past 18 years, the Price-Anderson Act has provided for public indemnity requirements. Unless renewed, this law will lapse in 1977.

Synthetic Fuels from Coal

Production of synthetic fuels from coal holds great promise, and the post-1985 time-frame will show an even greater demand for this use of coal. Abundant coal reserves provide a base for supplementing, with synthetics, diminishing natural gas and petroleum reserves.

However, current uncertainties and constraints make it difficult to assess the additional contributions of synthetic fuels during this period. These factors include applying existing foreign technology, feasibility of new technology, regulatory time delays, economics, and environment.

Meeting the anticipated energy demands with coal must involve use of existing proven conversion technology and rapid development of emerging advanced technology. Methods for the commercial production of synthetic gas, oil, and methanol have been available for many years. However, the use of existing coal gasification methods is being held up due to regulatory delays. Advanced technology for more efficient production of synthetic gas and oil, methanol, and solvent-refined coal is being developed, and with further demonstration could be ready for commercialization by 1985.

The synthetic fuels industry is highly capital intensive. This factor, along with the variable price of world energy, combines to make the synthetics industry an economic uncertainty. If technology and higher energy prices do not resolve the problem, potential Government actions (to ensure a reduction of energy vulnerability) include guaranteeing loans and assurance of long-term markets and floor prices.

Lastly, water may be a constraint. Synthetic fuel production requires considerable amounts of water. Improved water planning in the arid regions of our western coal reserves will be required (see Environment, Chapter 3, Recommendation V).

Major Federal support and sponsorship will be required to overcome these constraints and uncertainties. The Panel's recommendations are:

I. Develop an integrated, comprehensive program for a viable synthetics industry.

- Construct two advanced-technology coal gasification plants, of commercial train size,[1] utilizing different technologies;
- Construct two advanced-technology coal liquefaction plants, of commercial train size,[2] utilizing different technologies;
- Accelerate pilot-scale projects to develop advanced alternate processes.

An integrated, comprehensive program, similar to the nuclear program, should be instituted to assure the rapid and orderly development of a synthetic-fuels-from-coal industry in the U.S. An ERDA-sponsored and industry-operated program should be directed toward uncovering and assessing technology, economics, and environmental impacts in order to progress to commercialization as soon as possible.

II. Provide a favorable financial climate for a synthetic fuels industry.

Resolving the economic uncertainties in the synthetic fuels industry must be accomplished. With the variable energy price for imported oil and the large capital requirements for synthetic plants, investment is a high risk. To continue to reduce our vulnerability to foreign energy, the Government may need to guarantee loans for financing early synthetic plants, and to guarantee markets and/or prices over the long term to isolate this industry from potential predatory pricing by the oil exporting nations.

III. Streamline regulatory procedures to reduce the time of processing and approval of permits for all synthetic plants, and to ensure that commercial-size gasification plants (utilizing existing technology) are built without further delays.

Currently there are 20 to 30 permits required for a coal gasification plant, requiring at least two years for processing and approvals. Streamlining the number of permits and the time required should reduce this to six months. Consideration should be given to statutory time limits for obtaining permits and securing approvals.

[1] Approximately 250 million cubic feet per day.

[2] Approximately 50,000 barrels per day.

Shale Oil

The magnitude of the resources of shale oil and the critical importance of all domestic fuel supplies to the Nation's energy future make it imperative that at an early date the practical potential of this resource be established. It is in the national interest that at least one commercial scale plant be constructed rapidly.

Although a commercial size plant will resolve many of the uncertainties involved, large industry development will not be feasible until leasing arrangements can be amended. This effort needs to be accomplished concurrently with the construction of the commercial scale plant.

The Panel's recommendations are:

I. Construct and operate, through joint Federal-industry cooperation, at least one commercial scale shale oil plant to establish costs, technology and problem areas inherent in the development of a large industry.

Oil shale representes a very large resource which has been known for many years and for which technology for utilization has been carried forward as far as practicable on a small scale. The economic and environmental climate today is such that the role of shale oil in the Nation's future is problematical. Four operating groups have acquired Federal oil shale acreage in the prototype leasing program, and several organizations with private holdings are potential operators. Through direct negotiations with the various companies or consortia thereof the Federal Government should provide some type of assured financial incentive for the construction of at least one commercial scale plant and a ready channel for clearing all hurdles in plant construction and operation of additional demonstration plants.

II. Modify the acreage limitations of the Federal Mineral Leasing Act (1920) so that allowable individual holdings may be greatly increased.

The current total acreage limitation of 5,120 acres per leasehold is inhibitory. One such lease will accommodate only one plant of the 50-100,000 Bbl/day range, thus preventing an operator from building up larger capacities to carry the high costs incurred in initial entry into an industry. An appropriately sized lease would be one capable of sustaining a shale oil production rate of at least 250,000 Bbl/day for a 20 to 30-year period.

III. Facilitate the exchange of private acreage with Federal acreage to establish viable operating blocks.

A potential operator who owns scattered small blocks of land should be helped to build up a single economically viable block by interchanges on a fair value basis with the Government, since neither scattered private nor Federal holdings are conducive to the development of the industry.

Future Energy Sources

For the purpose of this report, future energy sources include geothermal resources, the burning of municipal wastes, and solar energy applications (solar heating and cooling, solar thermal conversion, windmills, photovoltaic conversion, bioconversion, and ocean thermal conversion). Fusion processes and breeder reactors are considered in Chapter 4. Coal conversion and shale oil are considered in Chapter 2.

These energy sources are not expected to contribute to any major extent to the Nation's energy supply by 1985. Their role beyond 1985 is important, due to the eventual depletion of the world's fossil fuel resources. Continued R. & D. is vital. However, successful commercial implementation of these technologies is far enough away that their development must not be at the expense of the necessary expansion of more available and mature energy sources, such as coal and nuclear.

Orderly development, from proof-of-concept experiments through pilot and demonstration plants, should be pursued so that an early evaluation of the feasibility, economics, reliability, and interaction with interconnected power systems can be made.

The Panel believes that in 1985 the annual contribution will be not more than 0.2 Quads from solar energy sources, 0.5 Quads from geothermal resources, and 0.5 Quads from the burning of municipal wastes.

The Panel's recommendations are:

I. Maintain, through ERDA, a strong solar energy R. & D. program.

The most promising solar application is heating. Of the other solar energy sources the most

promising appear to be solar cooling and solar-thermal conversion. Photovoltaic conversion, bio-conversion, and ocean-thermal conversion are either based on technologies that are presently economically unattractive by orders of magnitude, or on technologies not yet developed and which will require much more work before their viability can be assessed. Windpower will be able to provide a small addition to the supply of energy in certain parts of the country, but it is unlikely ever to become a significant source of national supply.

II. Continue and expand the program for applying current solar technology for heating and cooling of buildings, and provide incentives for installation and use of solar heating and cooling in private homes and businesses.

Of all the solar technologies, it appears that solar heating and cooling have the best potential to impact on energy requirements by 1985. Solar space heating requires only low quality energy (low temperature and pressure) which hopefully can be obtained with already known technology. Some of these systems have been demonstrated, but it may require strong Federal support to help create a viable solar equipment industry.

III. Establish, through ERDA, a program to develop energy storage systems.

Nuclear and coal-fired power plants run most economically at a high capacity factor, but loads vary drastically with time of day, week and year. Efficient energy storage systems will permit maximum utilization of these high capital-cost facilities.

Furthermore, due to the intermittent nature of sunlight, promising solar energy systems cannot be utilized effectively until economical energy storage systems are developed. Efforts should be made to develop new economical means of energy storage utilizing underground pumped hydro, compressed air, steam or other novel systems.

IV. Provide Government incentives to encourage electric utilities and municipalities to develop further utilization of solid wastes as fuels.

The burning of municipal wastes in electric utility boilers is an established fact in at least one location and plans are underway at others to increase the amount of waste burned. This program can be accelerated if incentives are applied by ERDA, HUD, and other Governmental agencies to promote the collection, preparation and burning of waste, and incentives and support payments are removed from alternate or less conserving disposal methods. Furthermore, additional R. & D. should be implemented to investigate other uses of municipal wastes (e.g., gasification). Such a program also can be useful in improving recycling systems, resulting in further savings of energy and in reduction of environmental impact.

V. Promote exploratory drilling and evaluation of identified geothermal resources areas, to be followed by developmental work if warranted.

It is necessary to first determine the extent, producibility and longevity of each type of potential geothermal resource, and the Department of Interior should take the lead in these determinations. Although dry steam is currently being utilized at "The Geysers", little is known concerning ultimate commercial viability and dependability of the potential geothermal resources.

Based upon the probability of ultimate commercial success, hot brines should be given primary emphasis under such an evaluatory program while the geopressured resource potential would appear to be next in ultimate significance. Hot dry rocks appear to be lowest in probability for commerciability. The evaluatory and developmental efforts should also include research in exploration techniques.

VI. Resolve institutional issues that may constrain the expanded development of future geothermal and associated energy resources.

These issues include:

- Legal status of ownership
- Appropriateness of depletion allowances
- Leasing policy
- Licensing problems
- Determination of equitable rate base

These institutional difficulties should be resolved by State and Federal legislation or other appropriate measures concurrent with exploration so that they will not cause a delay in utilizing these resources.

3

Areas of Special Concern

Introduction

The concerns associated with U.S. energy extend beyond the reduction of domestic demand and the definition of available domestic resources. These resources, however extensive, will be valueless unless the capital is available to open up new mines and wells, and to build new fuel conversion and electric power plants. This capital, moreover, must be available at the right time to the industries that need to develop the energy resources.

Environmental protection is an underlying concern of all the energy industries and energy users. Much of the capital expenditure of the energy industries has been absorbed in environmental protection equipment over the last few years. A rapid, ambitious expansion of domestic supply will not occur if present delays of three years or more to satisfy environmental concerns are perpetuated, and if environmental requirements continue to change as rapidly as they have in the past.

Transportation of energy is a similar area of concern. Much of U.S. coal is remote from energy demand, and must be hauled by railroad or pipeline or converted to an alternate energy form which in turn needs transporting. Synthetic fuel and shale oil plants cannot be built without concurrent development of pipelines.

Underlying the other concerns are basic questions of resource availability—men and materials. The energy industries demand specialized skills and specialized construction, both in limited supply at present.

All these concerns are dealt with in this Chapter 3 of the report. In addition, the Panel has recognized two special areas of concern, research and development and the situation of the electric utility industry. R. & D. is of major concern because, quite apart from problems between now and 1985, major technological advances must occur in the energy-producing and energy-consuming segments of the economy in the next 50 years. This fact has been recognized by the

establishment of ERDA and the initiation of an ambitious Federal Government supported energy R. & D. program. The situation of the electric utilities is critical because they are among the most financially precarious of the energy industries, and because so many of the required changes and investments in new energy facilities between now and 1985 must be accomplished by them. These particular concerns are highlighted by treating these two subjects as separate chapters, Research and Development as Chapter 4, and Electric Utilities as Chapter 5.

Environmental Protection

Current laws and regulations designated to protect the environment and recent court decisions impose serious constraints on achieving increases in supply, distribution, generation, efficient utilization and transmission of energy. These increases, however, are essential to meet the Nation's future needs for energy. Protection of the environment is essential, yet it must be balanced with the other needs of the Nation. The Panel is of the opinion that some laws and regulations are unnecessarily restrictive.

Development of our potential domestic energy resources imposes large demands for water at the source. Water problems are particularly acute for our most promising oil shale and coal deposits which are in the western areas of the lower 48 states.

The Panel's recommendations are:

I. Modify existing Federal air pollution regulations to permit continued use of higher sulfur fuel as long as health standards are not exceeded.

Under presently mandated Federal, State and local emission restrictions, low-sulfur fuel or higher sulfur fuel coupled with emission control facilities are required. Available supplies of low-sulfur fossil fuel are inadequate to meet the continuing demand for energy and current emission control technology is not adequate to permit burning of high-sulfur fuels in sufficient quantity. Furthermore, nuclear and other non-fossil energy sources are not available in sufficient quantities to provide an alternative to fossil fuels.

The primary goal of the Clean Air Act is the achievement of ambient air quality levels which protect human health and reduce damage. Federal air pollution standards should be revised as necessary to become standards based on a rigorous definition of human health impacts (See Recommendation II). Wider use of more cost-effective emission control techniques such as mechanical pretreatment of coal, either alone or in combination with tall stacks and intermittent control techniques, for achieving ambient air quality standards, should be permitted. The nonsignificant degradation concept must be resolved to allow for the development of energy resources, power generation and industry growth and the use of high-sulfur fuels where reasonable.

II. Accelerate Federal R. & D. and demonstration efforts for improving air pollution control technology and establish control standards based upon human health impact.

These efforts would include:

- Improvements in process design and reliability including regenerative processes;
- Improvements in by-product (i.e., sludge) disposal capacity for sulfur dioxide scrubbers through additional demonstration programs with industry;
- Development of technology for SOx and NOx control via fluidized-bed coal combustion to permit early commercialization, with the side benefit of improved combustion efficiency, and via coal cleaning;
- Federal air pollution standards should be based on realistic health definitions and public review of the cost/benefit trade-offs associated with varying degrees of control. See Chapter 4, Research and Development Section, Recommendation VIII.

III. Modify existing Federal water quality standards to permit thermal discharge where environmental effects are acceptable.

Existing Federal regulations require that once-through cooling water operations cannot continue unless the discharger can convince the regulatory agencies " . . . that thermal components of any discharge from such source will not adversely affect the protection and propagation of a balanced, indigenous population of shellfish, and

wildlife in and on that body of water."[1] The effect of this regulation upon industry, especially electric utilities, is to require very large, non-productive capital expenditures for facilities that increase the amount of energy consumed on-site. The retrofit of such facilities should be required only as a last resort where adverse effects are clearly demonstrated on a regional basis. These Federal requirements contribute to higher consumer prices. The Federal policy of requiring cooling towers for all new power generating facilities should be re-evaluated.

These requirements would be more palatable if the standards were solidly based on scientific knowledge and justified by broad public support and willingness to pay for the alternatives. Since thermal control processes are both energy and capital intensive, particularly in retrofit applications, and can add enormously to water consumption requirements, their use should be restricted to those conditions where unacceptable ecological damage can reasonably be expected to occur in their absence.

IV. Streamline the environmental impact evaluation and site certification procedures, to greatly reduce the time span presently required for certification.

Major impediments to providing the domestic supply production capacity necessary to meet the demand during the next decade are the currently inefficient and often redundant Federal and local procedures for environmental impact evaluation, site certification, and facility licensing. These procedures have increased the lead times for nuclear and fossil energy facilities from six to seven years to about 10 years. All new energy facilities, as now designed, built and operated have to be recognized as adequately safe, environmentally acceptable and strategically necessary.

- Pre-approval of Sites

Special boards or some comparable mechanism should be established to review proposed sites, assess environmental impact, hold public hearings on site selection and related issues and to secure an approval/disapproval decision within six months after all hearings are completed. Sites that have been reviewed and approved by such a board should be certified without further review, provided that the basic requirements of the National Environmental Policy Act (NEPA) have been satisfied.

- Environmental Reporting

A more efficient review process would be achieved by reducing the volume of environmental data required, reducing duplication of information, adopting uniform criteria, accepting generic reports, and eliminating multiple environmental reports.

- Certification Procedures for Standardized Design

The Government should develop, based on modular generic designs for equipment and plants, a standardized certification procedure that would provide for design requirements and criteria on equipment, systems, materials and related matters.

V. Perform careful assessment of water use to provide a basis for optimum allocation among agricultural and community requirements and energy extraction, conversion, utilization, and reclamation.

A careful assessment of water use must be made. Full allocation does not automatically preclude new development of energy resources, but will require trade-offs among competing water uses.

- Joint Water Use Planning

Joint Federal/State/user water use planning on a regional basis should be undertaken as specified in Public Law 92-500. Such long-term planning would include overall water availability studies, resolution of water "rights" priorities, and site investigations which consider water use as well as thermal, chemical and biological degradation on a case-by-case basis within the overall regional assessment.

- Water Permits

State and local water permit laws should be enacted to give assurance of water availability to the priority uses. Midwestern and eastern states generally have ample water available for conversion, but they have difficulty legally allocating water availability under prevailing laws. In these cases, the states and localities will need to enact water permit laws that can give assurance of water availability to priority uses. The Federal Government should encourage enactment of such laws.

[1] Federal Water Pollution Control Act of 1972, Sec. 316(a)

VI. Modify mobile source emission standards for oxides of nitrogen, hydrocarbons and carbon monoxide to levels and timetables consistent with current data on health needs and objectives for efficient use of energy in transportation.

The Federal Energy Administration's White Paper on energy conservation concluded that the increasingly stringent statutory emissions control standards for 1977 and 1978 will exact fuel economy penalties, no matter what technology is used. Cars now in operation in California, which were built to meet the more stringent emission standards for that state, are experiencing fuel economy penalties of up to 15 percent over cars built to meet the less stringent national emission standards for 1975. While reducing some pollutants, total emissions per mile are increased.

VII. Establish Federal regulations for environmental requirements related to strip mining.

The environmental constraints upon the coal extraction industry could prevent its expansion to meet the predicted future needs of the U.S. Current environmental laws should be reviewed and streamlined to develop a more rational and realistic environmental policy, which can be utilized by the extraction industry for long-range planning.

Separate policies should be developed for western and eastern strip mining, as the environmental issues differ. These policies should include: the return of the land to productive use, evaluation of the impact of mining on water use and availability, and provision for replacement of water sources as necessary.

Finance

The financial needs of the energy industries through 1985 appear to be in the range of $500 to $600 billion (in 1973 dollars) and will very likely constitute a constraint on the ability to increase the supply of domestic energy sufficiently to meet demand over the next 10 to 15 years. Even if financial requirements prove to be substantially lower, there is a significant possibility that they still will constitute a constraint if current trends in the financial markets continue. There is serious question as to the ability of the economy to generate sufficient savings for these capital requirements, while meeting the needs of other industries, local and Federal Governments, and consumers.

Each sector of the energy industries, and each of the principal supply industries, has its particular problems. The most acute, currently, are in the regulated industries, particularly the gas and electric utilities. Therefore, a few of the recommendations, particularly items II, III, V, and X, are primarily aimed toward utilities.

The ability of the energy industries to finance their own expansion must be strengthened. This can be achieved by assuring adequate product prices and by improving cash flow. Additionally, the attractiveness of savings to the investor must be enhanced, and the health of financial markets must be improved.

The condition that could most assist this would be avoidance by the Federal Government of deficit operations which would thus remove Government competition for capital in the marketplace. This would also assist in reducing the rate of inflation, of equal importance to improving financial markets. Increasing internal industrial savings by improving cash flow will also assist in improving the condition of the financial market.

The need for total financing should also be reduced. Here the main targets are: regulatory delays during construction, which can add 10 percent or more to the cost of facilities since the cost of capital must be paid during construction; regulatory delays in rate-setting proceedings, which increase the need for outside capital by delaying implementation of rate increases; and those environmental requirements in which the added cost exceeds the added benefits.

The Panel has not attempted to assess the costs of the recommendations below. High priority must, therefore, be given to determining and disseminating the full costs of the Panel's recommendations, particularly those for Federal financial incentives. The evaluation of such costs will not be simple because of the second and third order effects of the recommendations and the difficulty of estimating the very changes in financial flows which the recommendations are intended to make.

The Panel's recommendations can be broadly classed as those aimed at strengthening the ability to finance, those aimed at improving the health of financial markets and those to reduce financial requirements. These recommendations are:

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Strengthen the Ability to Finance

I. Phase out regulation of fuel prices and utilize procedures to reduce any windfall profits gained due to reevaluating inventories of old resources.

Prices which fully reflect replacement costs and other economic factors enhance financial viability and optimize allocation of resources. Financially viable companies can more easily generate and attract capital. A phase-out period would reduce impact on consumers and provide time for planning to ease effects of potential dislocations.

II. Allow a return on investment in regulated energy industries which is adequate to reflect market conditions.

Currently, a return on equity allowed by regulation is about 12 percent. Such a return is not appropriate in inflationary periods, reflected by high long-term interest rates. The marketplace is reflecting a needed return of 15-20 percent and inadequate returns will continue to deteriorate the utility industry's ability to generate and attract capital.

III. Provide mechanisms to speed up rate proceedings in regulated industries.

Allowing an adequate return will not solve the problem if the effective date is delayed by long regulatory hearings. The use of automatic adjustment clauses, future test periods, or immediate rate relief subject to later review all can help offset regulatory lag.

IV. Increase investment tax credit to 10 percent, and increase the percent of income tax against which it can be credited from 50 percent to 100 percent.

An increase in investment tax credit is of special significance to the utility industry, which receives only 4 percent compared to 7 percent for other industry. This course of action would reduce demand on financial markets through utilization of internal cash as capital and makes the tax credit useful to those segments of capital intensive energy industries whose earnings and, therefore, whose taxes, have been low.

V. Adopt Federal and state tax accounting policies to improve cash flow, such as increasing depreciation rates to 5 percent (i.e., a 20-year life) for long-life capital assets, allowing the cost of plant-during-construction to be included in the rate base, and mandating deferred income tax accounting (normalizing).

This would reduce demand on financial markets by allowing recoupment of investment over the probable economic life in an era of rapid technological change and high inflation. For example, a current depreciation rate of 2-1/2 to 3-1/2 percent for electric utilities is no longer adequate. Allowing plant-under-construction expenditures to be included in the rate base results in reduced financing requirements by having such current costs reflected in the current prices. "Normalizing" tax benefits reduces financing requirements and allocates the tax cost in a consistent fashion to overall rate making policy.

Improve the Financial Markets

VI. Modify tax law to make investment more attractive by reducing capital gains tax rate, making part of gains non-taxable and eliminating limits on capital loss tax deduction.

Without a change in today's climate, a shortage of equity capital can be expected. Enhancing the reward from investment risk will stimulate investor interest, particularly individual investor interest, in equity issues.

VII. Attract new capital by deferring capital gains tax on proceeds reinvested in a primary offering within a stipulated period; by creating a new preferred offering whose dividend is tax exempt to the issuing company; and by deferring tax on cash dividends which are immediately reinvested in a primary offering from the same company.

These alternatives would increase the capital resources from which financial needs could be acquired. They would make investment in equity easier and more attractive than alternate forms of saving.

VIII. Strengthen mechanisms by which bond and equity securities are marketed.

Such mechanisms would include: allowing security firms to set up reserves for bad years, and encouraging less stringent requirements on the securities industry. The last few years have been financially difficult for the securities industry, with many firms going out of business. A strong securities industry is essential to distribute

efficiently the enormous volume of securities which will have to be issued by the energy companies, as well as the remainder of the U.S. economy. The alternatives suggested would tend to improve profitability of the securities industry and, therefore, increase competition and reduce the cost of new issues.

Reduce Financial Requirements

IX. Modify the law to require EPA to include a cost/benefit analysis in each proposed environmental improvement action considering: appropriateness of less expensive alternate technology, whether the degree of improvement desired is economically too costly and a lesser degree of improvement is appropriate, and deferral of the action due to cost.

Improving the environment is a desirable and necessary goal and, therefore, an appropriate use of capital. However, the quantity of capital is limited and diverting of capital from productivity should be discouraged unless clearly necessary.

X. Reduce regulatory delays in licensing and rate case procedures.

Delays in construction of capital projects can add materially to the cost merely from the additional financing cost. Rate case delays result in lost cash flow which must be made up by additional financing.

XI. Encourage greater cost control in construction and in operation by encouraging competitive forces and by providing regulatory premiums for good performance.

In an attempt to achieve energy independence, it will be tempting to mute competitive forces by allocating markets or by protecting certain energy forms. Such actions may decrease the incentives for efficiency. Regulation should foster competition, wherever possible, and should provide an efficiency incentive system. Studies on the latter have been made without success, but a further effort might be fruitful.

Materials, Components, and Equipment

Currently, spot shortages have arisen in availability of materials (such as steel), components (such as valves), and equipment (such as drag lines). In expanding energy resources, a heavy load will be placed on material and equipment suppliers to expand their production capabilities so that both the energy and other sectors of our economy are provided with the industrial components necessary to support normal growth simultaneously with increased deliveries to the energy industries.

Material and equipment suppliers generally have indicated a desire to move ahead with an expansion in their supply capabilities. The principal constraints upon implementation of that expansion are capital, manpower, facilities and raw materials necessary to increase production which cannot be accumulated and committed simply in the hope that there will be a demand for the output. *What is needed is a statement of the Nation's energy policy which, in turn, would permit suppliers to plan and initiate an orderly and economic build-up of capacity to support energy and all other industries.* Such planning should identify and make provision for the differing lead times required by various sectors of the materials, equipment and component industries. Although the overall industrial capability appears to be adequate even for an accelerated energy program, there will be individual shortages which must receive priority attention.

The Panel notes that the Nation now relies upon the import of a substantial amount of certain critical raw materials necessary to sustain the Nation's total industrial and economic effort. For example, one-third of the iron ore used in this country is imported. Therefore, we are also vulnerable to the supply and prices of these imports.

It may become a matter of national security, in terms of the viability of our economy and of energy production, to have provisions for stockpiling imported raw materials needed for certain critical domestic purposes.

The Panel urges the Department of Commerce to provide the focus for a thorough study of this problem, and if necessary, to prepare a plan for stockpiling these critical raw materials.

Transportation

The transportation requirements for the expanded supplies of domestic energy necessary to reduce dependence upon imports are well within industry capability. This, however, presupposes a financial climate that will permit the transportation industries to earn an adequate return on investments in order to attract capital. Risks must be reduced by long-term contracts which include escalation provisions. If the transportation industries cannot attract investment capital, Federal expenditures and/or subsidies will be necessary, such as provisions for direct aid or loan guarantees.

Certain other facts should be considered in any recommended transportation strategy. These are briefly discussed below:

Domestic Oil and Gas Transport

There is already an efficient transportation and distribution system for oil and natural gas in the lower 48 States, and no difficulties are anticipated with the new reserves that are projected. Work is underway on the trans-Alaskan oil line and on shipping facilities for moving this oil to the West Coast. Feasibility studies are underway on possible further movements of Alaskan crude within the United States. Alaskan gas transportation alternates are under consideration. The urgency of the situation dictates that these facilities be completed on a timely basis.

Transport of Oil Imports

Based upon the Panel's assessment, imports will continue to be needed by the U.S. for many years. The United States is the only major importing Nation which does not have ports deep enough to accommodate supertankers. The Nation's harbors, suitable for post-World War II cargo ships of 40,000 to 70,000-deadweight tons, are largely inaccessible to today's 200,000 to 400,000-ton VLCC's (very large crude carriers) and the even larger ULCC's (ultralarge crude carriers) which require water drafts exceeding 100 feet. Even the deepest ports on the West Coast can berth only 100,000-ton ships.

Supertankers must transfer U.S.-bound petroleum into smaller ships offshore for delivery into our harbors or oil must be trans-shipped from foreign ports in the Caribbean. A 400,000-ton supertanker may require as many as seven 70,000-tonners to deliver its 3-million barrel cargo. Such trans-shipment is costly and adds greatly to the possibilities for oil spills. Both Federal and State regulatory bodies need to recognize the necessity for deep water ports and thus to facilitate the implementation of projects as they are brought forward.

Coal Transport

Coal will experience a major shift in supply-demand-distribution patterns as a result of the increase in total production, development of western coal, and the conversion from oil and natural gas to coal.

The improvement of right-of-way required for the movement of vast amounts of coal would incidentally provide first class roadbed for high-speed passenger trains and fast-freight piggy-back trains. Improved passenger and freight trains would tend to reduce the demand for air, automobile, and truck transportation, thereby providing a side benefit of reduced consumption of liquid fossil fuels.

Eastern railroads, which have been permitted to deteriorate over the past two decades, pose a special problem to the Nation.

The Panel's recommendations are:

I. Encourage long-term transportation contracts and commitments.

Long-term contracts promote planning, the orderly development of facilities, more efficient utilization of transportation systems, the timely supply of equipment, long-term capital recovery, and the infusion of new capital into the transportation industry.

II. Undertake an immediate and complete inventory and review of the existing transportation capability as it relates to near- and long-term energy distribution requirements.

This review should be undertaken by the Energy Resources Council in cooperation with DoT Transportation planning should be integrated into national energy planning to establish policies and

priorities. In removing distribution "bottlenecks" equal attention must be given to origin, destination and transportation requirements and capabilities in order to optimize total capacity and efficiency of the "system". The Panel feels, however, that given long-term contracts to mine and haul coal, railroad, waterway, mine and user facilities can be upgraded to implement the loading, unloading and single and intermodal movement of coal in the volumes contemplated, as quickly as coal production can be increased.

An inventory of the quantity and quality of facilities is fundamental to integrated planning. For example, a recent I.C.C. ruling allows 25 percent of eastern railroad trackage to be declared surplus. However, trackage that may now be considered surplus may be needed in the future to carry an accelerated supply of energy materials. Holding costs for such standby facilities during the inventory and after a decision to "hold" current surplus should be equitably allocated.

III. Streamline and integrate I.C.C. and other regulations to provide incentives for more efficient transportation.

I.C.C. permits, environmental impact statements, permits to cross Federal lands, and right-of-way permits are among the many permits to be negotiated to provide facilities and equipment for an accelerated supply of energy. To obtain these permits there is a myriad of state, local and Federal laws to be considered, sometimes having conflicting effects. The process of obtaining these permits presents a constraint which should be eased while taking environmental and other considerations into account.

The streamlining process should include a time limit on answering specific applications.

Regulations which encourage increased use of fuel (due to such things as empty backhauling and fixed routes which are longer than necessary) should be reexamined.

IV. Extend the operating season on the Great Lakes and Upper Mississippi water systems.

Extending the operable season of the main waterways will allow greater shipping capability year-round and lower off-season storage requirements. The U.S. Coast Guard should accelerate support of the use of ice breakers, and maintenance of watches and radio communications.

V. Conduct studies in the optimization and efficient utilization of existing transportation systems for energy-related materials (including facilities and equipment).

This DOT program should also include an evaluation of the potential benefits of inter-modal integration of existing transportation systems, and explore the incentives that may be necessary to accomplish these programs.

VI. Conduct research and development in new transportation motive power systems utilizing new or alternate sources of energy.

This should include coal or coal-derived products. Combustion turbines and electrification should also be investigated.

VII. Expedite approvals for transportation systems from areas of new oil and gas discovery.

For example, proven gas reserves on the North Slope of Alaska amount to 26 trillion cubic feet, or about 10 percent of total U.S. proven reserves. At the estimated production rate of 1.3 tcf/yr., this gas could reduce petroleum imports by 650,000 barrels per day, or approximately 10 percent of imports. Further, the potential for additional reserves is great. Two alternate proposals for transportation have been filed with the Federal Power Commission; i.e., a combination Trans-Alaska pipeline and ocean transport, and an all-pipeline alternate through Canada to the U.S. Certification of one, or both, of these alternatives should be expedited.

Human Resources

Human resources are as important as natural resources in improving the domestic energy supply. Unless special efforts are employed to assure that an adequate number of people with the needed skills are in the right location, increases in the domestic supply of energy will not be forthcoming. Cooperation among labor, Government, industry and education is essential to assure that those people are available.

During the next decade, the Nation will need about 500,000 additional technically competent people to engineer, build and operate the facilities

to supply the direct needs of the energy industry.[1] This total includes about 240,000 more operating personnel (17 percent increase), about 200,000 more skilled construction workers (130 percent increase), and approximately 60,000 more engineers (80 percent increase). Without activating any new programs, current trends indicate that these projections will not be met—specifically in the area of coal miners, skilled construction personnel, and engineering personnel.

Current concerns include:

- Lack of skilled craftsmen to build and operate, and to train others to build and operate, the facilities needed for our total energy and support requirements while maintaining and expanding the rest of the Nation's facilities. Specific concerns are: the amount of time required in apprentice programs, the small growth in the number of skilled tradesmen, and decreasing productivity.

- The lack of engineers and scientists entering the energy fields. Some specific concerns are: declining enrollment in engineering schools, declining interest in science and mathematics, and lack of experienced personnel.

- To merely increase the number of trained people available for energy related fields is a complex task. To achieve the level needed to meet domestic energy requirements in future years is even more complex. As the Nation returns to a stable economic period of low unemployment, the problem will become acute.

The Panel's recommendations are:

I. Strengthen the skills data bank of the Department of Labor and encourage its coordination with the Energy Resources Council to track demand and supply of energy-related skills.

Coordination between DOL and the ERC is important if we are to more accurately pinpoint employment opportunities and provide the basis for projecting future trends with more confidence. Such projections are needed for education, training and retraining to make supply more nearly match demand. Because it takes time for education and training, accurate projections are needed to avoid over-reaction to changes. On the other hand, educational institutions, labor unions, and others providing education and training must respond to the projected needs with a high level of activity.

Such a program should utilize careful planning to avoid severe local unemployment due to abrupt changes in levels of activities, such as occurred in the space-related field in 1970-71. Assurance of continual employment is necessary to attract and hold qualified personnel.

II. Coordinate, through the Department of Labor, efforts of industry, labor and educational institutions to provide training programs.

In order to assure that needed skills will be available, and to shorten the time between identification of needs and availability of trained personnel, a cooperative effort is required. Upgrading of skills through apprentice programs, on-the-job training, and outside education will be necessary and in many instances will require expediting. Increasing productivity should be a prime goal of such a training effort.

III. Expand the support by Federal and State Governments for new technical and degree-level education programs for mining engineers, technicians, and skilled miners (See Coal Section), and all scientists and engineers.

As an example of how scientific personnel can be developed, ERDA should sponsor fellowships and grants to colleges and universities. This approach would develop trained personnel for the energy industry.

IV. Encourage improvement in science and mathematics education in primary and secondary schools.

The number of students entering engineering and science programs in college has been declining in recent years. However, the energy industry will require a significant increase in the number of technically trained graduates if the domestic energy requirements are to be met during the next decade and beyond. The Department of Health, Education and Welfare should promote interest in science, mathematics and energy-related curriculums through information programs and direct curriculum aids. In addition, HEW should work jointly with colleges and universities to promote science and

[1] U.S. Energy Prospects, An Engineering Viewpoint, National Academy of Engineering, Washington, D.C., 1974.

mathematics teacher education to achieve improvement in primary and secondary education.

V. Establish a program of Federal loans and grants to generate employment in labor-intensive energy enterprises.

Two major problems facing the Nation today are unemployment and the need for developing domestic energy resources. A corollary problem is a lack of development of the railroads, particularly the eastern railroads.

To deal with all of these problems simultaneously and to assist the shift from natural gas and oil dependence toward use of coal, the Federal Government should inaugurate a program of employment loans and grants in the energy industries. The program would be similar to former Federal training programs such as On-the-Job Training and would involve loans and grants to employers in exchange for employment.

The extraction, transportation and use of solid fossil fuel are very labor-intensive operations, compared to similar activities for liquid and gaseous fossil fuels, and many workers to be employed in such operations can be obtained from the ranks of those with a minimum of formal education and skill.

Many more people are required at the point of use of coal. Coal-fired power plants, for example, require significant numbers of people to tend storage sites, conveyor belts, remove the ash, etc.

In 1950, railroads (not including car building plants), employed 1.2 million workers. Today that number is .5 million. Even with present increased efficiency, the contemplated growth of coal freight movement will require the hiring of many thousands of new employees. Railroads will require large numbers of section hands to upgrade and continually maintain the roadbed in good condition, often in the areas of high unemployment rates for low-skilled and unskilled workers.

Hopper-car building, in car plants and in the railroads own shops, provides another example of a relatively labor-intensive operation which would increase. Significant numbers of unskilled, as well as skilled workers, are required for assembling and repairing these quite simple vehicles. Many of the jobs resulting from an increase in the demand for hopper-cars would occur in Appalachia where coal is mined and where railroads normally build and maintain these cars.

Coal would be moved to power plants and industries in the more heavily populated sections of the East and Midwest, providing still more employment opportunities in areas with large numbers of unemployed unskilled workers.

In addition to the low rated and unskilled jobs, many skilled jobs (though in aggregate probably still in the minority) would be generated by a shift in emphasis toward solid fossil fuel. Some examples are welders in car plants and shops, machine operators on railroad track gangs, bulldozer operators at storage sites, skilled miners, mechanics and maintenance men in all areas from mine to boiler.

4

Research and Development

Introduction

The urgency in resolving the U.S. energy problems has created a situation in which the rate of evolutionary change in energy technology may be too slow to avoid shortages in the future. Completely new technology must be developed to utilize new energy sources and to increase the efficiency with which we generate and use all forms of energy. The size of the necessary energy R. & D. program, the long time span between concept and commercial hardware, the current urgency of the energy problem, and the potential risks involved make it imperative that an effective mode of cooperation between Government, universities and industry be established.

Throughout this report specific recommendations are presented for research and development and for demonstration of advanced technologies. This section of the report provides recommendations of a more general nature.

Recommendations

I. Establish, by ERDA, priorities and levels of funding, utilizing well-established industrial experience, to assure that programs are relevant to the Nation's needs and are promptly translated into improvement in the supply and utilization of energy. While avoiding specific recommendations as to priorities and funding levels, the Panel wishes to make several general statements which it believes to be relevant.

- Coal is most efficiently used today as a boiler fuel, but the environmental consequences of greatly increased coal utilization will likely require new technology to reduce emission, either at the stack or prior to combustion. In this regard the Panel believes that the development of improved coal combustion technology ranks among the most important programs being pursued by OCR. An intensified research effort on coal mining technology is essential to minimize manpower and financial costs of coal mining. Equally important in

the future will be the need to convert coal to clean solid, liquid or gaseous fuels to supplement our natural resources. (See discussion, Chapter 2, Synthetic Fuels from Coal Section).

- Increased electrification may well emerge in the post-1985 period as the means by which the Nation best accommodates to the changing domestic resource base. Major improvements for using electrical energy in the transportation and residential/commercial sectors will be required. Increases in the efficiency of generation, transmission, distribution, utilization and storage of electric energy must be considered to be among the most important aims of long-term U.S. energy R. & D. Meaningful utilization of the waste heat associated with electric power plant cycles could lead to high energy utilization efficiencies.

- Nuclear power, together with coal, offers the most promise in terms of a long-term solution to the Nation's energy problems, and of relieving pressure on our limited oil and gas resource base. To the extent that R. & D. can improve the public acceptability of nuclear power, such programs should receive high priorities.

- Separate energy R. & D. should be performed on future secondary energy sources other than electricity. For example, hydrogen produced from off-peak power by electrolysis, or directly by thermochemical splitting of water with nuclear heat, may effectively supplement an electric energy supply system by virtue of the desirable storage, transmission, and distribution characteristics of a chemical energy source with a high energy density.

II. Promote and support private sector energy R. & D.

Much technical expertise resides in industry. Industry's past commitment to research has been a major factor in this Nation's technological development and the increasingly dominant position of U.S. industry in world markets. However, increased competition and labor costs have cut profits in many industries, with the result that research not directly related to a company's near-term earnings has become increasingly difficult to justify.

In the energy area corporate expenditures for research and development exceed one billion dollars per year at the present time, excluding research expenditures related to product development and marketing. Most of the research and development in the oil and gas industries and in the generation and transmission of electrical energy (other than nuclear power) has been, and continues to be, done by industry. In recent years, environmental concerns have forced most of these companies to commit a substantial fraction of their research dollar to eliminating the adverse environmental consequences of present technology. The combination of all these factors has made it increasingly difficult for industry to fund comprehensive energy R. & D. programs.

Some actions which the Government might take to assist in accelerating needed energy R. & D. are:

- Provide incentives to encourage development of technology for improving efficiency of energy generation, conversion and utilization;

- Expedite processing of energy-related patent applications;

- Establish favorable tax treatment of energy R. & D. costs;

- Cost-share energy R. & D. with industry where appropriate.

Government cost-sharing of R. & D. with industry may be essential in many areas if industry is to move the most promising technology to the marketplace quickly. However, sufficient incentives must exist for industry to utilize Government support and continue to invest its own resources in energy R. & D., even when the road to commercialization may be long and uncertain.

The public interest is best served by making more of the best technological options available as rapidly as possible, as opposed to insisting that no exclusionary patent protection be available to industry on technology developed with partial support from the Government.

III. Assume primary responsibility by the Federal Government for adequately funding research on long-range, high-risk, but potentially high pay-off programs such as breeder reactors, fusion, solar and geothermal resources.

Government's role in research and development has traditionally complemented industry's in that it has funded a large part of basic research in Government laboratories and universities. It is essential that this support continue. Fission is an example of a complex and costly technological development, originally focused on weapons production, in which the Government has made the major investment. Fusion is progressing in a similar way. The cost and risks of research relating to some of these new energy sources or advanced systems cannot be borne by industry alone and requires major participation by the Government where the options are many, the risk is often great and the pay-off far in the future.

IV. Conduct pilot and demonstration scale projects under industrial management as often as practical, to facilitate rapid transfer of technology and the utilization of manpower skilled in large-scale testing, scaling and evaluation of technology.

The Panel wishes to stress that to be worthwhile any energy R. & D. must eventually be utilized commercially by industry and that this must be fully considered in developing R. & D. programs and in implementing them. Industry will only be able to utilize R. & D. with which it has direct contact and experience and will only invest its money in new developments when it has expectations of an adequate return on its investment in a competitive market.

V. Recognize the role of universities and other not-for-profit institutions involved in innovative energy R. & D. and in the training of professional personnel for the energy industry, the major supplier industries, and the electric utilities, through Federal, State and industrial support of educational and research programs.[1]

VI. Share the cost and risk in technology development where the ultimate commercial value depends on governmental policies and actions over which industry has no control.

Many of the synthetic fuels options for supplementing oil and gas resources will require demonstration of commercial feasibility before the energy industries will be willing to invest hundreds of millions of dollars in plant facilities. Oil shale development and mining and *in situ* recovery of coal and oil shale face similar problems. Such demonstrations must be conducted on a scale sufficient to verify process operability and economics. Furthermore, there must be recognition that Government policy regarding gas pricing and oil import policy, coupled with the inherent uncertainty in estimating the extent of as yet undiscovered oil and gas resources, result in market uncertainties which make it even more speculative for industry to make these large financial commitments.

VII. Assign a substantial role in the national energy R. & D. program to institutions publicly supported by other than Federal funds.

This applies especially to R. & D. needed by the utility industry, which is not restricted by antitrust laws in organizing cooperative R. & D. programs. For example, funds for some utility-related R. & D. are raised through a surcharge on gas and electric service.

VIII. Undertake accelerated studies of the effects of air pollution on public health to establish sound health criteria for environmental regulation of the energy industries.

The Nation needs a rigorous definition of the impact of air pollution on public health. Federal air pollution standards should be based on realistic health definitions and public review of the cost/benefit trade-offs associated with varying degrees of control. The National Institutes of Health and the National Academy of Sciences should accelerate their studies in this regard.

IX. Sponsor further development of energy systems analysis techniques and information systems.

Although FEA expended considerable effort to develop information for Project Independence, the Panel has identified additional relationships that need to be understood—as well as a need for other basic information and development activities. ERDA should sponsor these efforts.

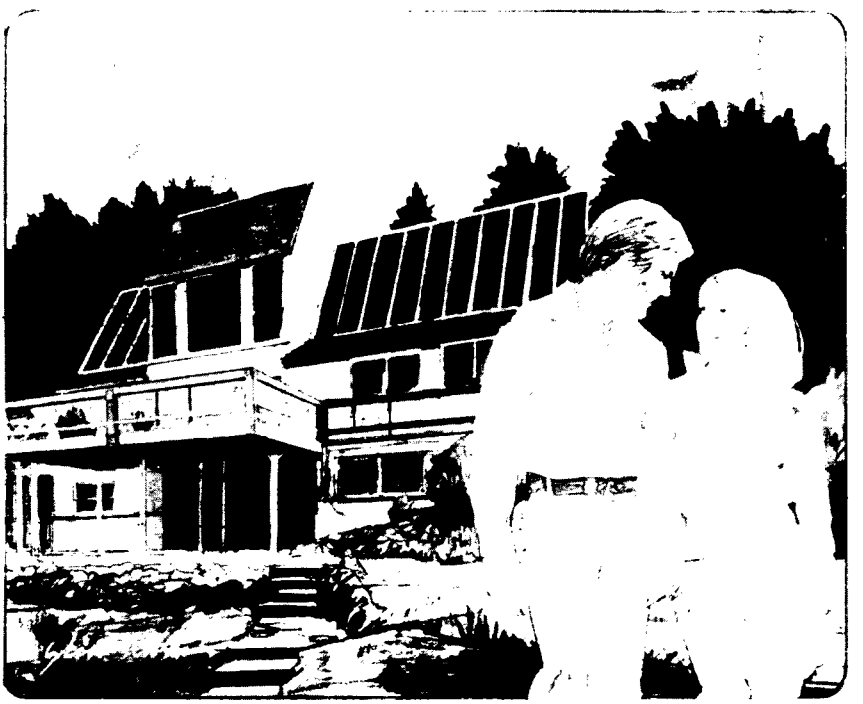
The Panel supports the development of effective systems analysis techniques and information systems that would permit the ERC, ERDA, FEA

[1] For a partial discussion of this recommendation, see: Results of Carnegie-Mellon University Workshop on Advanced Coal Technology "A Program of Research, Development, and Demonstration for Enhancing Coal Utilization to Meet National Energy Needs", October 1973.

and other Government agencies to improve their energy planning. These activities should be coordinated with other Government and private sector groups currently involved in similar work.

- Interactions between energy and non-energy sectors should be further studied with due regard to time dependency or "dynamic" aspects (e.g., effects on GNP, long-term investments and construction lead times) and appropriate information systems should be developed to support such studies. These systems should be able to address themselves to national energy policy issues such as Government regulations, tax-related actions, etc.

- Data related to energy production and energy use are being generated in many different forms and by many different groups throughout the Country. Bringing these data together, in a coordinated and consistent form, and making them accessible to the various user groups requires a study and development program.



5

Electric Utilities

Introduction

There is a need for continuing expansion of the Nation's electric utilities to meet growing demand, even though forecasted growth rates have declined recently. There may also be an acceleration in the use of electricity should a further reduction of other energy sources develop. Three important constraints inhibit expansion: finances, regulations and public acceptance. These three are discussed separately below, but all are interrelated.

The financial constraints are inadequate revenues, inflation, the burden of environmental expenditures, the shortage of internally generated funds, and the shortage and high cost of new money. Electric utilities are the most capital intensive of all industries, requiring approximately $4 of investment for each $1 in revenue.

The regulatory constraints are the lag and inadequacy of rate relief at the State level, environmental requirements, and the extreme slowness of approval of new plant installations. The latter two constraints are evident at both the Federal and State levels and affect generation, transmission and major distribution facilities.

The lack of public acceptance constraint is evidenced by frequent opposition in the media to utility activities, and by the regular appearance of citizen groups as intervenors in hearings for virtually every major plant installation, or in hearings dealing with rate matters.

If utilities are to fulfill their role in increasing the domestic supply of energy, these constraints must at least be reduced so that orderly and timely expansion of facilities is possible.

Many of the following recommendations also apply generally to the Gas Utilities industry, particularly those dealing with rate relief, financing and regulatory delay. Other recommendations bearing on this industry can be found in Sections dealing with oil and natural gas, synthetic fuels from coal, transportation and finance.

Recommendations

I. Provide fast and adequate rate relief.

There is a trend throughout the country for rate decisions by State Regulatory Commissions to take an increasingly long time, even a year or more. Often the approval, if granted, is for an amount less than the needed rate of return. The effect on utilities is that they never "catch up" and their rates of return are too low. Currently, equity return allowed by regulation is about 12 percent, whereas the market indicates a need for 15-20 percent.

The result of inadequate rates of return can be seen in the securities market. The prices of most utility stocks have fallen below book value in recent years.

II. Modify tax measures to increase the internal generation of funds.

A number of measures can be taken by the Federal Government to improve cash flow and decrease the dependence of utilities on the securities market. These include:

- Increase investment tax credit to the level of all industry.
- Allow faster tax depreciation for long-lived assets.
- Permit dividends on new preferred issues to be a tax deduction to the issuing company.
- Implement policies to include, in the rate base, those funds associated with construction work in progress.
- Insure that Federal incentive measures are effective by requiring that normalized accounting be used.

Federal tax incentives and other cash flow increases will not be stimulants to production if regulatory accounting procedures force these incentives to reduce price (flow through accounting) rather than increase internally generated capital (normalized accounting). Further, flow through accounting is a stimulus to consumption rather than production.

III. Adopt a fast, "minimum-stop" procedure for Federal and State approvals of plant installations.

The overall licensing process must be simplified, shortened and made predictable.

A major deterrent to expansion is the multiple agency approval required. Often the time consumed is as much as four years. This delay is greatest for nuclear plants, but fossil plants, transmission lines and major substations are affected similarly.

For nuclear plants the collection of environmental data, preparation of environmental and safety reports, and approval of the construction permit takes three to four years even without significant interventions.

The Panel believes this licensing process can be simplified, shortened, and made predictable by elimination of unnecessary steps, increasing use of standardized and generic approaches, and some sort of "minimum-stop" licensing approval. Single Federal and State approvals would be desirable without overlapping jurisdictions. For example, reactor safety and radioactive hazards would be an appropriate responsibility of Federal regulation, whereas land use considerations would be primarily a State concern. The average time for a new plant could then be 6 to 7 years from project initiation to operation instead of the 9 to 10 years (or more) now required. The shorter lead time would permit more reliable decision-making processes by removing some of the uncertainties inherent in planning 10 years in advance, and would reduce costs.

IV. Insure that environmental regulations for generating stations are justified on a cost/benefit basis.

Restrictive regulations place financial burdens on the public. EPA water quality standards provide a good example. Reports[1] presented to the House Public Works Committee at its hearing in June 1974, showed that the proposed standards could cost $250 annually, per household, by 1983. EPA moderated its final position; however, adoption of the standards will still cost $5 billion by 1983.[2]

[1] AWARE, October 1974, p. 10, extract of testimony of W. Donham Crawford (President, EEI) to House Public Works Committee on June 26, 1974.

[2] AWARE, October 1974, p. 10, "Cost of Proposed Water Pollution Control Amendments".

The Conference Board now estimates, from a recent survey of 212 firms, that pollution control expenditures, for manufacturing industries and utilities combined, will be more than 10 percent of the total capital expenditures in 1974.[1] The trend is increasing.

V. Stabilize environmental regulations.

Stabilized environmental regulations for the life of a project would permit plants to be operated as designed and, once installed, they would not be subjected to fuel substitutions, generation curtailment, or extensive backfitting unless actually required for health, for safety, or due to fuel unavailability.

Changes in environmental regulations frequently result in plant changes and unexpected downtime. The National Electric Reliability Council has concluded[2] that the water quality standards proposed by the EPA in June 1974 could affect 50 percent of the Nation's generating capacity in 1977, and would result in a permanent reduction of 3 percent of the affected capacity, or about 8,500 megawatts. Furthermore, substantial downtime of equipment would be necessary, requiring replacement kilowatt-hours, many of which would have to come from oil.

Action on this recommendation and on recommendation IV above are essential if electric utilities are to enter into long-term coal contracts that are so vital to the expansion of the coal industry. Without the assurance that coal can be burned in a long-term, economical manner, there will be no incentive for utilities to install coal-fired plants.

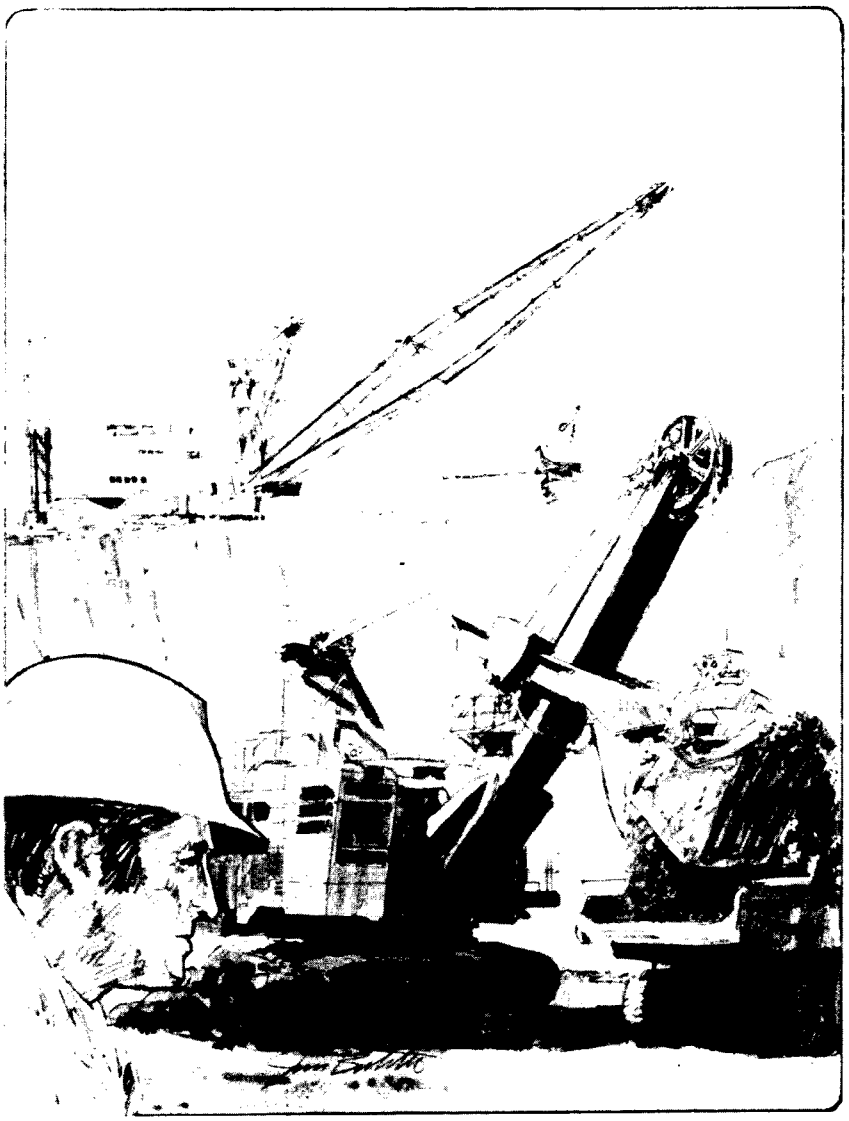
VI. Initiate a joint Government and electric utility public information program.

Although there are some signs that the media and the public are becoming aware that today's nuclear power technology is safe and necessary, there is clearly much information work to be done to show that utility facilities can be expanded without a detrimental impact upon public safety and upon air and water quality. Studies similar to the Rasmussen[3] investigation on nuclear safety must be carried out and widely disseminated. The public also must be satisfied that there is indeed a shortage of domestic natural gas and petroleum, and that expansion of electrical facilities is one readily available method to help relieve that energy shortage. (See Chapter 2, Nuclear Section, Recommendation VII).

[1] ELECTRICAL WORLD, Oct. 15, 1974, p. 107.

[2] "Comments on Effluent Limitations Guidelines and Standards, Steam Electric Power Generating Point Source Capacity," by NERC, 1974, p. II-2.

[3] Reactor Safety Study, WASH-1400 published by the Atomic Energy Commission, 1974.



6

Critique of Project Independence Report Summary

Introduction

The Project Independence Report appeared after the Panel completed its review of a substantial portion of the massive data supporting the Federal Energy Administration's Project Independence.

The Panel found that a reader of the FEA Report could infer that the task of becoming independent from foreign energy sources is far easier than it really is. The Panel also found that certain conclusions reached in the final FEA Report Summary[1] were not supported by data in the interagency task force reports.

It was then decided that because of the expected wide circulation of the Summary a special critique chapter of the Panel's report should be addressed to that Summary. This chapter contains that critique.

Finance

Cumulative investment requirements in the Project Independence Report were calculated by FEA to be $454 billion (in 1973 dollars) for the period 1975-1985. These figures do not include replacement capital costs, investment for tanker fleets, lease bonus payments, and outlays expensed for tax purposes. The last two factors alone would raise FEA's estimates by more than $100 billion (in 1973 dollars).

The FEA approach for determining whether the economy has the capacity to provide the necessary funds is as follows: FEA projected the GNP growth through 1985 at a rate of 3.2 percent to 3.7 percent, for $11 and $7 world oil price per barrel, respectively. The historical ratios of energy investment to GNP and business-fixed investment were then used to evaluate the feasibility of investment levels required by alternative energy strategies.

[1] Project Independence—A Summary—November 1974; 63 pages, plus Appendix.

This approach yielded a cumulative estimate between $379 and $474 billion (in 1973 dollars) available for energy investment between 1975 and 1985.

The FEA Summary states that " . . . the economy can absorb the increased financial costs of reducing vulnerability," a statement based on the described analysis procedure.

The Panel concludes that:

- The FEA analysis of financial requirements is optimistic and omits consideration of substantial factors, such as investment for future energy sources and facilities for scarce materials.
- It is questionable whether the economy will generate sufficient capital through savings, and whether investors will be willing to take equity risks, if current trends continue, if the climate of the financial market is not improved, and if strain on the market created by inflation, the money outflow and other factors is not reduced.
- It is questionable whether the basic economic assumptions underlying the analysis are realizable. These assumptions include: that the Federal Government will be operating at a surplus by 1980, that no external financing will be needed, that there will be no change in the expenditure program or revenue structure of the Federal Government, that there will be smaller deficits in our balance of trade and that $200-$300 billion will be invested by OPEC countries in the U.S. by 1985.

Energy Supply

The interagency task forces provided estimates of supplies of energy for various target years. Because of the analysis system used, these estimates are unconstrained by such factors as finance, labor, environmental considerations, transportation and availability of raw materials and equipment. Unconstrained estimates are of necessity optimistic and must be properly constrained within the analysis system to derive a practical output of actual available energy supply.

The Panel has found that the constrained estimates reported in the Summary document are very optimistic, and would result in abundant domestic energy resources appearing to be available for every policy alternative considered. Consequently, the FEA states in the Summary that, "The implementation of a limited number of major supply or demand actions could make us self-sufficient." This statement is not accurate in the judgment of the Panel. It will take a comprehensive program of supply and demand actions to get us started on the road towards self-sufficiency. To plan otherwise is not prudent.

The following table compares the unconstrained estimates of the interagency task forces with the constrained estimates used as the basis for the FEA Report Summary, for 1985:

Fuel	FEA[1] Task Force Unconstrained Estimates	FEA[2] Summary Constrained Estimates
Coal, billion tons per year	1.1 — 2.1	1 — 0.9
Oil, million barrels per day	15 — 20	15.8 — 19.2
Gas, trillion cubic feet per year	23 — 29	24 — 24.9
Nuclear, gigawatts	234 — 275	204 — 239

[1] These data are obtained from p. 67 of the Project Independence Report, November 1974, approximately 700 pages.

[2] These specific data are obtained from the print out of the computer runs used to develop FEA scenarios. They are listed in the FEA Summary Report, page 46, in equivalent Quads.

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The Panel notes that:

- The cumulative discoveries (oil-in-place) during the 1974-1988 period needed to achieve the FEA estimates of oil supply would amount to about 200 billion barrels of oil for the accelerated development case. This is about one-half of the volume of oil which NPC studies indicate is remaining today.

- To reach a production rate of 16 million barrels of oil per day would require a 1985 discovery rate never achieved in the last 30 years.

- Two of the key physical parameters entering into computations of future gas production possibilities are drilling footage and finding-rate per foot drilled. The total footage drilled in 1985 was assumed to be twice that of 1974 and over three times that of 1971, a very difficult achievement.

- To achieve a gas production of rate of 24 TCF per year would require a new discovery rate accomplished only once in the last 25 years.

- The need for coal production was limited in the FEA analysis because demand projections were met by unrealistically abundant oil and natural gas supplies for each policy alternative considered. The Panel concludes that if more realistic estimates were used for oil and gas supply projections, the role of coal in meeting future demand would be shown to be much greater.

- Without immediate and positive action on utility financing even the BAU case is unlikely to be attained and this is not adequately stressed in the PIR. The advantages of accelerated development of nuclear power go far beyond simple substitution for coal burning as implied in the PIR and strongly indicate the desirability of achieving the accelerated goal to 285 to 310 GWe believed to be possible by the CTAB Panel.

Energy Demand

The FEA projections for energy demand in 1985 tend towards the low side of other existing projections. For example, FEA's accelerated conservation case at a world oil price of $11 per barrel assumes an energy demand in 1985 which is only one Quad more than the Zero Growth Case in the Ford Foundation Study.[1]

These demand estimates are extremely hard to achieve, they imply a great deal of personal sacrifice and disruption, and they are based on very hard decisions that greatly affect the Nation's social and economic conditions.

Demand Management

The FEA Summary concludes that coal use will be demand-limited. The Panel concludes that this determination is due to FEA's unrealistically high forecasts of domestic oil and natural gas supplies, and low forecasts of total energy demand.

Further, it presents as an option that any new residential and commercial energy requirements be met with electricity to the exclusion of oil and gas. Consequently, the need for synthetic fuels from coal and oil shale is de-emphasized.

The Panel believes that maximum development of coal supply for all end uses is essential, and that the distribution of these end uses should be left to the market place.

Imports

An analysis procedure based on low demand needs and high supply estimates tends to minimize the import levels that may actually be necessary for every policy alternative examined by the FEA. The reader then can be left with the feeling that the tasks of becoming less dependent upon foreign energy sources are less complex and less difficult than they are in actual fact.

Environmental Considerations

The FEA Summary, in its emphasis on technical approaches, fails to give adequate weight to political actions and public concerns for minimizing environmental disturbances in meeting critical energy needs. These include: air quality requirements, water resources management and allocation, siting requirements and related socio-economic impact on community resources. In addition, the Summary treats these environmental issues in a piecemeal fashion, primarily as they relate to energy-associated facilities. The Report overlooks the cumulative effect of individual and ostensibly minor actions on a national, regional and state basis. In the development of a national energy program, the impact of environmental issues must

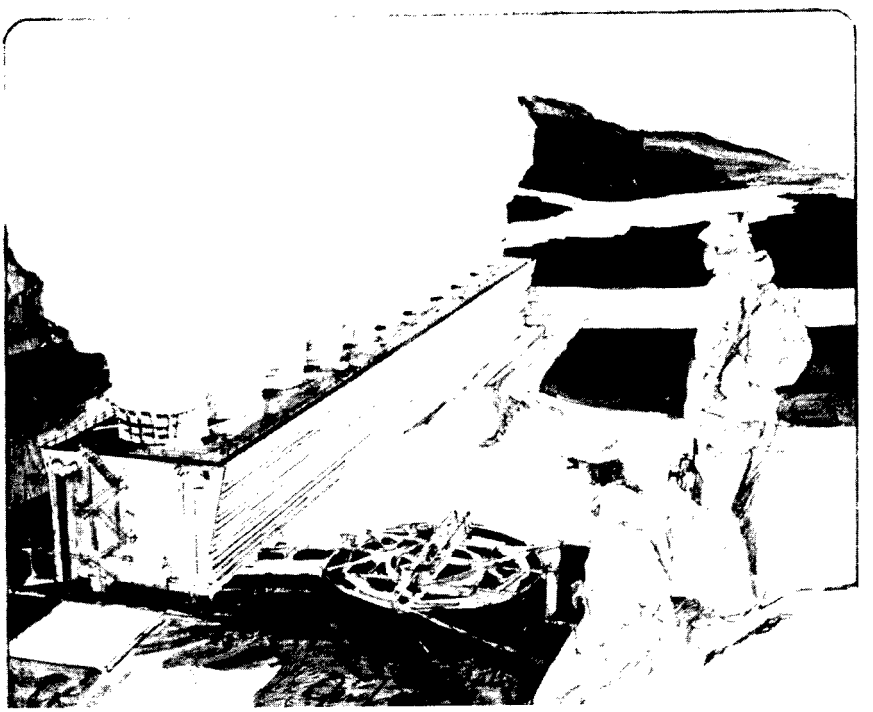
[1] "A Time to Choose: America's Energy Future" Energy Policy Project of the Ford Foundation, 1974.

be carefully evaluated and analyzed with the objective of a proper balance between environmental concerns and national energy needs.

Integrating Network

The Panel has the following concerns:

- The FEA uses in its study approach a static model which takes "snapshots" of the years 1977, 1980 and 1985, to develop its basic framework. Although constraints may be included to reflect time dependency or "dynamic" aspects, it is not clear how these were handled in the analysis.
- The FEA model implies "free market" behavior that does not adequately represent the effects of Government regulations and tax-related actions. Again, constraints may be added to reflect such considerations.
- The demand sectors in the model are defined as requirements for specific fuels. In order to adequately address the fuel substitution problem, the demand sectors must be disaggregated at the functional level (e.g., space heat, air transport, aluminum production) and the efficiency characterisitcs of end use devices must be included along with supply technologies.



7

Panel Organization Membership and Charter

U.S. Department of Commerce Charter of the CTAB Panel on Project Independence Blueprint

1. Establishment

The Secretary of Commerce, having determined that it is in the public interest in connection with the performance of duties imposed on the Department of Commerce by law, hereby establishes the Panel on Project Independence Blueprint, as a subcommittee of the Commerce Technical Advisory Board (CTAB), pursuant to the Federal Advisory Committee Act, 5 U.S.C. App. I (Supp II, 1972).

2. Members and Chairman

A. The Panel is composed of a Chairman, Vice-Chairman, Executive Secretary, and other members selected by the Assistant Secretary of Commerce for Science and Technology.

B. The Panel will consist of approximately twenty members with experience to render service and to advise on the technical, scientific, and policy matters required to perform an in-depth analysis of the nation's energy posture.

C. The Chairman and the Vice-Chairman of the Panel will be designated by the Assistant Secretary of Commerce for Science and Technology from among the members of CTAB. The Vice-Chairman of the Panel will assist the Chairman in the performance of his duties, and will act as Chairman in the latter's absence. The Executive Secretary will provide the liaison between the Panel and the government agencies involved in Project Independence, and will provide administrative direction and supervision of the staff.

3. Objectives and Duties

A. The Panel will provide an independent assessment of the feasibility of the actions and policies resulting from the Project Independence Blueprint. The Panel will represent a central input of private sector views concerning governmental policy decisions designed to expand the domestic supply of energy sources of the United States. The Panel will provide advice and information with respect to the following questions:

- What is the realistic capacity for expansion of domestic energy resources within a given time frame?
- What are the constraints which must be overcome to achieve this expansion?
- What are the costs of expanding domestic energy resources, in terms of capital, materials, and manpower?
- What are the social and environmental implications of such an expansion?

B. The Panel will focus initially on the time frame ending in 1985/1990, since this time frame is most critical in terms of the reallocation of resources needed to minimize dependence on foreign energy sources. Special emphasis will be placed on the feasibility of expansion of the synthetic fuels industries and the effect of such expansion on the nation.

C. The Panel will furnish to the Chairman of CTAB its preliminary evaluations and recommendations with respect to the Project Independence Blueprint basic data, assumptions, and policy recommendations, together with the supporting data and information.

D. The Panel will furnish CTAB a report, suitable for publication, of the supporting data, findings, and recommendations resulting from this study.

E. The Panel shall function solely as an advisory body.

4. Administrative Provisions

A. The Panel shall be designated the "CTAB Panel on Project Independence Blueprint".

B. The Panel shall report and be responsible to the Chairman of CTAB, who is the Assistant Secretary of Commerce for Science and Technology.

C. The Panel shall meet as necessary to discharge its duties, at the call of the Executive Secretary of the Panel, but not less than once a month.

D. The Assistant Secretary of Commerce for Science and Technology shall provide necessary staff support to assist the Panel.

E. The Panel may establish an executive committee and such subcommittees from among its members as may be necessary to deal with the studies undertaken, subject to the provisions of the Federal Advisory Committee Act and the approval of the Assistant Secretary of Commerce for Science and Technology.

F. Funding for this Panel and its staff will be provided by the Office of Coal Research of the Department of the Interior and is estimated at $500,000 which includes approximately nine man-years of effort.

5. Duration

The Panel shall terminate upon completion of the project and submission of the final report, not to exceed two years from the date of this charter, unless it is renewed by proper authority by appropriate action.

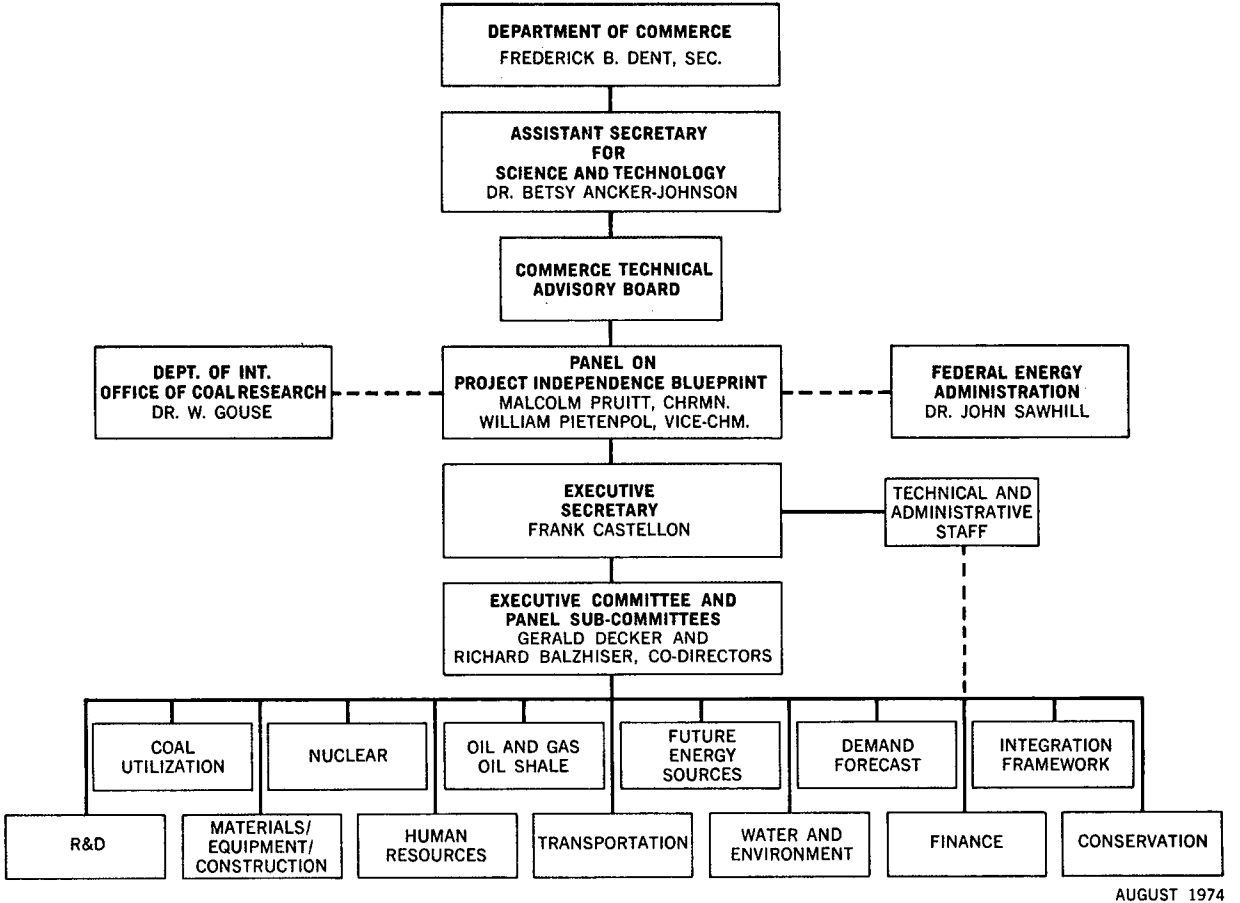
Date: July 2, 1974
(s) Guy W. Chamberlin, Jr.
Assistant Secretary of Commerce
for Administration
for the Secretary of Commerce

In accord with the provisions of Section 9(c) of the Federal Advisory Committee Act, 5 U.S.C. App. I (Supp. II, 1972), this charter was filed with the Assistant Secretary for Administration on July 2, 1974. On the same date, copies were filed with the Chairmen of the Senate Commerce Committee and the House Interstate and Foreign Commerce Committee, respectively, and a copy was also provided the Library of Congress.

On 7-3-74, copies of this charter were also filed with the chairmen of the following Congressional committees:

Senate Interior and Insular Affairs
Senate Public Works
Senate Government Operations
House Appropriations
House Interior and Insular Affairs
House Science and Astronautics
Joint Committee on Atomic Energy

(s) Robert T. Jordan
Management Services Head
Office of Organization and Management Systems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HUMAN RESOURCES
TRANSPORTATION
WATER AND ENVIRONMENT
FINANCE
CONSERVATION

AUGUST 1974

Federal Energy Office
Washington, D.C. 20461

June 6, 1974

Office of the Administrator

Dr. Betsy Ancker-Johnson
Assistant Secretary for Science
and Technology
Department of Commerce
Washington, D.C. 20230

Dear Dr. Ancker-Johnson:

As you know, the Federal Energy Office is currently coordinating a large interagency effort to prepare a Blueprint for Project Independence. The Blueprint, which will be delivered to the President on November 1, 1974, will contain an analysis of future energy supply and demand, alternative energy scenarios, and policy actions needed to achieve the goals of Project Independence. The Blueprint is the major analytical effort within FEO and has our highest priority.

It has come to my attention that the Commerce Technical Advisory Board could serve a useful role in reviewing our analyses. I would like to request that you explore a way in which we can involve CTAB in reviewing Project Independence materials.

I look forward to continuing to work with you and other Commerce Department representatives on this important project.

Sincerely,

(s) John C. Sawhill
Administrator

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Ms. Josephine E. Wilson
Secretary

Special assistance was received from the following members of the Department of Commerce:

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Mrs. Florence Feinberg

Mr. Robert T. Jordan

Mrs. Pearl G. Kamber

Mr. John Morrison

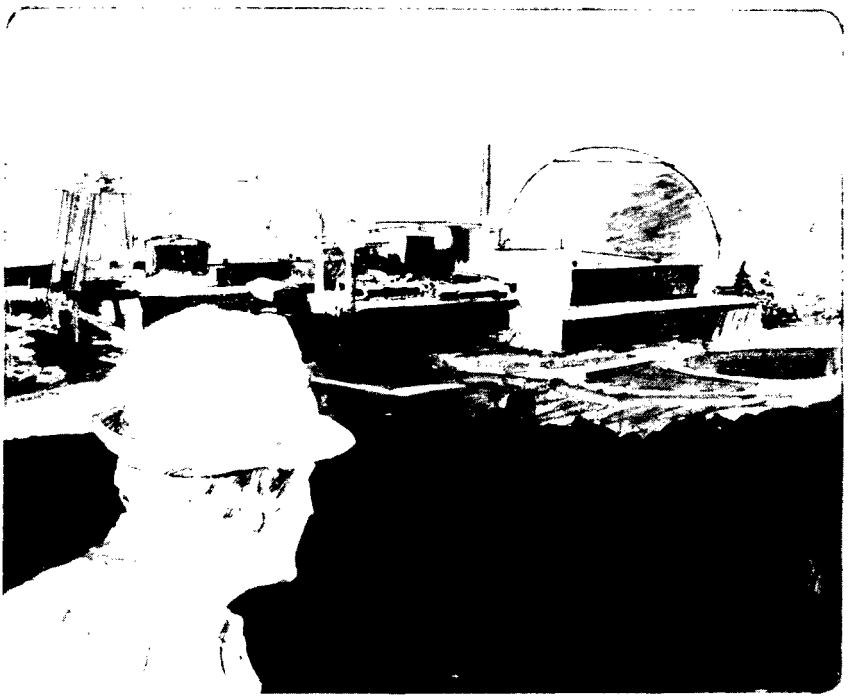
Mr. Michael E. O'Connell

Mr. Glenn Richards

Dr. Bruce Robinson

Mr. John R. Wearmouth

Appendices



Appendix 1. G.L. Decker's letter to S.W. Gouse

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

Commerce Technical Advisory Board
Panel on Project Independence Blueprint

December 13, 1974

Dr. S. William Gouse
Acting Director
Office of Coal Research
Department of Interior
Room 4457
18th & C Street, N.W.
Washington, D.C. 20240

Dear Bill:

As a result of questions during the December 10 CTAB Panel discussion with Secretaries Morton and Dent and subsequent discussions with you, the CTAB Panel feels that it is imperative to outline our differences with the Federal Energy Administration's (FEA) report.

Even though the FEA has done an excellent job—as far as they have gone, there are significant differences in approach, and some honest differences of opinion on the complexity, urgency and lead time required to increase domestic energy supplies.

The FEA report states that the implementation of a limited number of major supply *or* demand reduction actions can make us self-sufficient by 1985. We disagree.

They conclude that self-sufficiency by 1985 can be attained through a program of:

1) Accelerated supply; or
2) Accelerated conservation; or
3) Selected combinations of both.

1. The Panel has concluded that an accelerated supply program is necessary and must be immediately implemented but such a program *will not* provide sufficient domestic energy by 1985 to avoid importation. We expect the import level to be in the range of 6 to 8 MBD.

FEA's report leads to the conclusion that an accelerated supply strategy will result in the discovery of very large quantities of oil and natural gas. It downgrades the role that domestic coal will play.

The Panel believes that coal is a strategic element in future domestic energy supplies and must be developed to the limit of our ability. It believes that FEA is very optimistic in its predictions of oil and gas discoveries and that it is imprudent to place the future of U.S. economic well-being on such an optimistic plan.

2. FEA also believes that self-sufficiency can be attained solely through the imposition of a series of mandatory demand reduction measures, including such things as gasoline rationing and taxes. The Panel believes that such an approach would likely result in a serious downturn in our economy which has become dependent on energy consumption. There is a close relationship between GNP and energy utilization in the U.S. and little is understood about the effects of arbitrarily reducing demand.

The CTAB Panel believes that in the short-term, competitive pricing of energy coupled with voluntary conservation is the wise course. It recommends that the supply and demand trends be carefully monitored and that harsh conservation measures be employed to reduce demand only as clearly necessary after the marketplace fails to achieve the desired result due to higher prices. Only then can implementation of a studied and understandable sequence of mandatory demand reductions be safely undertaken.

3. FEA believes that imposition of various mandatory demand reduction measures coupled with acceleration of certain potential domestic energy supplies will result in elimination of import needs by 1985. This Panel believes that this is merely a combination of certain previously mentioned optimistic supply projections and optimistic conservation actions.

The Panel believes that accelerated supply, voluntary conservation, and stand-by authority for mandatory demand reduction to be implemented as called for by a sound monitoring program is the prudent course of action. It expects that even such

a program will fall somewhat short of eliminating the need for importation of energy in 1985.

The FEA report leaves the CTAB Panel with a feeling that the solutions to our energy problem are easy to accomplish, and gives the appearance of a lack of urgency. The CTAB Panel believes that reducing dependency on foreign energy will be an extremely difficult task requiring an immediate and total sense of urgency. We believe that we must move on all fronts to increase domestic supply or the goal of self-sufficiency will be delayed until the 1990's or perhaps forever.

The Panel expects to complete and publish its *Recommendations on a National Energy Program* in January, 1975. In addition, it is forming two additional Subpanels. One will develop Recommendations for Legislative Implementation of NEP and will get underway within ten days with a plan to report during the 1st quarter of 1975. The second new Subpanel will be formed in January to develop Recommendations for a Public Information Program, dealing with the short and long-term domestic energy situation. Industry can help the Department of Commerce and other government sectors to disseminate such information as can the Labor Movement. It is the Panel's desire to have industry and labor assist to the highest possible extent.

We will continue to keep you informed of our activities.

Sincerely,

Gerald L. Decker
CTAB Panel Director

cc:
Secretary Dent
Secretary Morton
Assistant Secretary Ancker-Johnson
Assistant Secretary Carlson
F. Zarb
J. Sawhill
P. McCracken
E. Zausner
F. Castellon
CTAB Panel

Appendix 2. Reference Energy System

To assist the Demand and Conservation Sub-panel in the integration of the many recommendations that were considered, a Reference Energy System was utilized. Such systems are used to analyze the movement of fuels from extraction to end use. The particular system employed by the Sub-panel was developed by Brookhaven National Laboratories.

The Reference Energy System exhibits the relationships existing between the consuming sectors and energy resources. This system's approach shows the flow of energy including the technical processes that are employed with each fuel for:

- Extraction
- Refining and conversion
- Central Station conversion
- Transmission and distribution
- Decentralized conversion
- Utilization

For example, crude oil is shown being extracted and imported, refined, and then transported via pipe, tanker and truck to ultimate uses as electricity, heat (process and space), petrochemical feedstocks and motor vehicle fuels (auto, truck, airplane, bus, ship, rail). To change fuel form, oil is transported to a central power house and converted to electricity, which is then transmitted over the electrical network to its end use.

Reference Energy Systems are usually constructed using

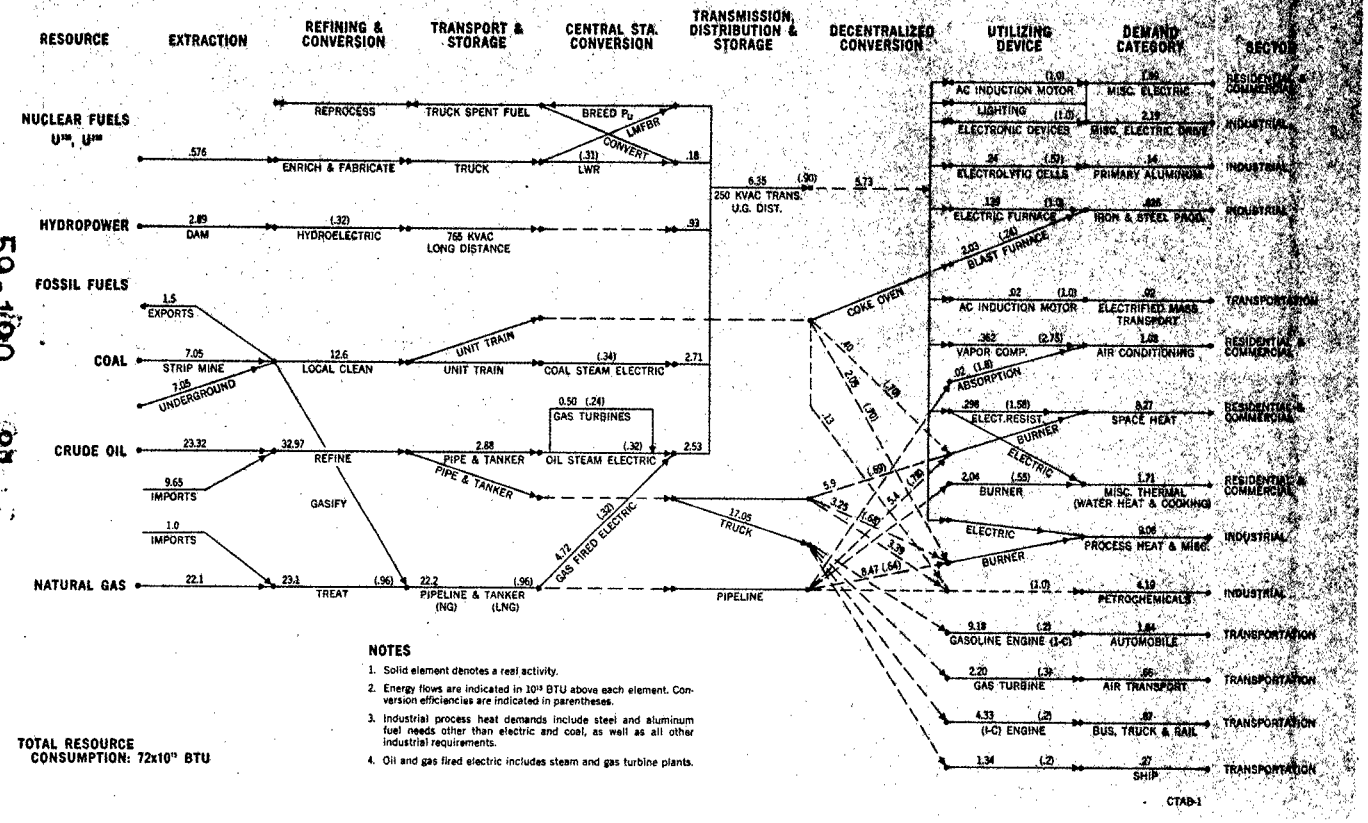
- Existing technology throughout
- Established fuel sources
- Projected energy demand after price effects

This approach, therefore, establishes the baseline for further exploration. The analysis can be used to explore effects of:

- New technology or fuel efficiency
- New fuel sources
- Changes in energy end use
- Various conservation measures
- Fuel substitutions

Attached are two examples—one showing 1972 data and the other showing a base case for 1985 (using approximately 110 quads of fuel resources).

Reference Energy System, Year 1972

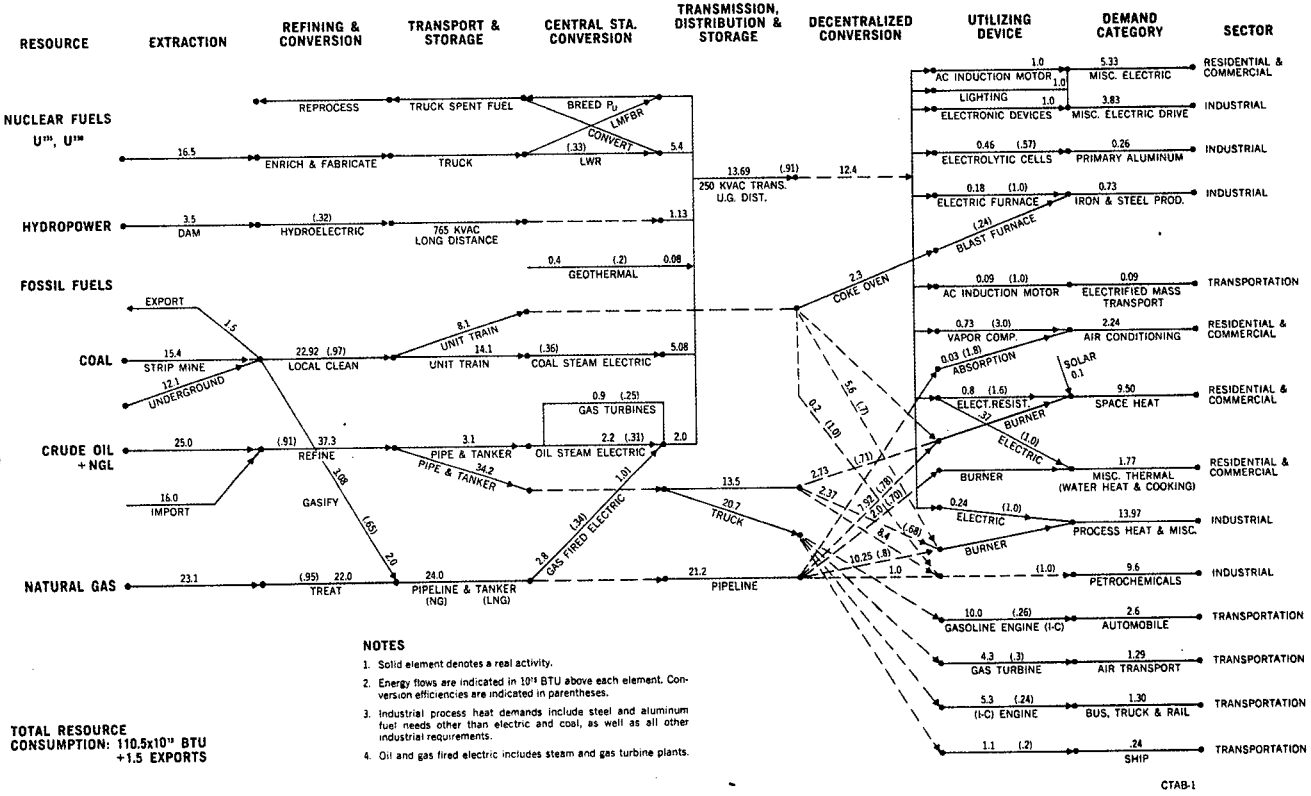


NOTES

1. Solid element denotes a real activity.
2. Energy flows are indicated in 10^{15} BTU above each element. Conversion efficiencies are indicated in parentheses.
3. Industrial process heat demands include steel and aluminum fuel needs other than electric and coal, as well as all other industrial requirements.
4. Oil and gas fired electric includes steam and gas turbine plants.

TOTAL RESOURCE CONSUMPTION: 72x10^{15} BTU

REFERENCE ENERGY SYSTEM, YEAR 1985



NOTES

1. Solid element denotes a real activity.
2. Energy flows are indicated in 10^{15} BTU above each element. Conversion efficiencies are indicated in parentheses.
3. Industrial process heat demands include steel and aluminum fuel needs other than electric and coal, as well as all other industrial requirements.
4. Oil and gas fired electric includes steam and gas turbine plants.

TOTAL RESOURCE CONSUMPTION: 110.5x10^{15} BTU +1.5 EXPORTS

CTAB-1

Appendix 3. Symbols and Abbreviations

AEC	Atomic Energy Commission
BAU	Business As Usual
Bbl.	Barrel(s)
Btu	British Thermal Unit
B/D	Barrels Per Day
CTAB	Commerce Technical Advisory Board
DOL	Department of Labor
DOT	Department of Transportation
EEI	Edison Electric Institute
ERC	Energy Resources Council
ERDA	Energy Research and Development Administration
EPA	Environmental Protection Agency
FEA	Federal Energy Administration
FHA	Federal Housing Administration
FPC	Federal Power Commission
GNP	Gross National Product
GWe	Gigawatt
HEW	Department of Health, Education and Welfare
HUD	Department of Housing and Urban Development
ICC	Interstate Commerce Commission
IEP	International Energy Program
JCAE	Joint Committee on Atomic Energy
KVAC	Kilovolts of Alternating Current
LMFBR	Liquid Metal Fast Breeder Reactor
LNG	Liquified Natural Gas
LWR	Light Water Reactor
MEC	Materials, Equipment, and Components
MMBPD	Million Barrels Per Day
MPH	Miles Per Hour
MWe	Megawatt
NAE	National Academy of Engineering
NEC	National Energy Council
NePA	National Environmental Policy Act
NERC	National Energy Resources Council
NLG	Natural Gas Liquids
NOx	Nitrogen Oxide(s)
NPC	National Petroleum Council
NPR #4	National Petroleum Reserve #4
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
OCR	Office of Coal Research, Department of Interior
OCS	Outer Continental Shelf
OPEC	Organization of Petroleum Exporting Countries
PIR	Project Independence Report
P.L. #	Public Law #
Quad	Quadrillion Btu (10^{15} Btu)
R. & D.	Research and Development
SNG	Synthetic Natural Gas
SOx	Sulfur Oxide(s)
TCF	Trillion Cubic Feet
TCFY	Trillion Cubic Feet Per Year
VA	Veterans Administration

Appendix 4. Conversion Factors

In an effort to make this study consistent with other major energy studies, the actual measurement units (tons of coal, barrels of oil, cubic feet of gas, etc.), have been converted to Btu's (British Thermal Units) and expressed as Quads (1×10^{15} Btu's). The Panel recognizes the need for an international unit to be used throughout the world to measure energy. Those which could be considered would include kilocalories (amount of heat required to raise 1,000 grams of water one degree centigrade: 1 kilocalorie = 3.97 Btu's) and Joules (the meter-kilogram-second unit of work or energy equal to the work done by a force of one newton when its point of application moves through a distance of one meter: equivalent to one watt-second: one Btu = 1055 Joules).

Difficulties arise in achieving consistency in conversions since energy is expressed in entirely different measuring units. For example,

1. Petroleum products have different Btu values depending on which product is chosen. Residual fuel oil generally has a heating value of about 6,300,000 Btu's/barrel. For this study, however, crude oil is used and expressed in barrels per day. Each barrel of crude oil equates to 5,800,000 Btu's. One million barrels of crude oil per day equals 2.12 Quads per year.

2. Although natural gas has a nominal heating value of 1032 Btu's per standard cubic foot (SCF), low and intermediate Btu gas has heating values in the 150 to 500 Btu/SCF range.

This report equates gas to 1000 Btu's per standard cubic foot. One trillion cubic foot/year of gas equals one Quad/year.

3. The conversion of coal presents similar problems. In general, the heating value of western coal is less than that of eastern coal—making the heating value of coal in the U.S. vary from about 13,000,000 to 26,000,000 Btu's per short ton. This study uses eastern coal at an average value of 24,500,000 Btu/short ton and western coal at an average value of 17,000,000 Btu/short ton. In 1985, this study assumes that the use of western coal will increase to 40 percent.

4. Throughout the text of this report, electrical generating capacity (normally expressed in gigawatts or megawatts) is represented by an equivalent number of Quads/year of primary energy, namely one gigawatt equals .06 Quads/year.

This conversion was made using a capacity factor of slightly less than 69 percent and a heat rate of 10,000 Btu's/kilowatt-hour[1] These somewhat arbitrary conversion factors were used in this report to convert non-fossil as well as all fossil power generation.

In summary:

Fuel	Common Units	Btu's
Oil	Barrel (Bbl)	5.8×10^6
Gas	Standard Cubic Foot (SCF)	1,000
Coal	Short Ton (T)	$13\text{-}26 \times 10^6$ (Average of 21.6×10^6)
Electricity	(Net) Kilowatt Hour	3,413

Or, another way of viewing these data is:

1 Quad = 46 million short tons of coal
1 Quad = 175 million barrels of crude oil
1 Quad = 1 trillion standard cubic feet (scf) of gas

[1] 1 Gigawatt (10^6 KW) x 24 Hr/day x 365 days/year x 10,000 Btu/kwh x 69% x 1 Quad/10^{15} Btu = .0604 Quads (use .06)

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Appendix 5. Comparisons of 1985 Supply Estimates (10^{15} Btu)

	FEA SUMMARY REPORT (11/74)				FORD FOUNDATION REPORT (9/74)			NATIONAL PETROLEUM COUNCIL 12/72				NATIONAL PETROLEUM COUNCIL 8/74	N.A.E.[1] 5/74	J.C.A.E.[2] 5/74	I.G.T.[3] 12/73	RANGE OF THESE STUDIES	CTAB PANEL STUDY
	$7 Oil Base Case	$7 Oil Acc. Supply	$11 Oil Base Case	$11 Oil Acc. Supply	Historical Growth	Technical Fix	Zero Energy Growth	Case I	Case II	Case III	Case IV	Medium Case				Low—High	
Domestic Oil	22.5	29.9	30.7	35.8	32	30	28	31.7	28.5	24.3	21.4	26.5	26.5	23.3	30.7	21.4— 35.8	25
Domestic Natural Gas	23.9	24.7	24.8	25.3	29	27	25	32.9	28.1	21.9	15.5	21.6	27.2	15.1	30.1	15.1— 31.6	22
Nuclear	12.5	14.7	12.5	14.7	10	8	5	36.9	37.6	37.8	16.1	14.2	17.6	19.9	21.8	5 — 21.8	16.5
Coal	19.9	17.7	22.9	20.7	25	16	14				20.3	19.7	21.2	23.5	22.3	14 — 25	22.7
Synthetic Oil	0	0	0	.1	1.5	0	—	1.5	.2	.2	—	.2	1.3	—	2.8	0 — 2.8	.3
Synthetic Gas	0	0	0	.2	1.5	—	—	2.3	1.2	1.2	.5	1.8	2.3	1.5	3.6	0 — 3.6	3.0
Shale Oil	.6	.6	.6	2.1	2	1	—	1.5	.8	.8	.2	.8	1.0	.2	2.1	0 — 2.1	.5
Hydroelectric	4.8	4.8	4.8	4.8	3	3	3	3.3	3.3	3.3	3.3	3.5	3.2	3.2	4.1	3 — 4.1	3.5
Other—Geothermal, Solar					1	—	2	1.4	.7	.5	.3	.5	.4	.4	—	0 — 2.0	.5
Imports	24.8	17.1	6.5	0	11	7	11	13.4	24.5	34.9	47.3	20.4	—	37.3	7.8	0 — 47.3	14.0
TOTAL SUPPLY	109.1	109.6	102.9	104.2	116	92	88	124.9	124.9	124.9	124.9	108.8	100.7	124.4	125.4	88 —125.4	108.0

[1] National Academy of Engineering.
[2] Joint Committee on Atomic Energy.
[3] Institute of Gas Technology.
NOTE: Due to rounding, fuel supplies may not add up to totals.

Appendix 6. Supply/Demand Estimates (Equivalent Units)

Since the Panel promoted the development of all fuels to cover the Nation's energy demands, its findings and recommendations are expressed in various units (tons of coal, barrels of oil, cubic feet of gas, gigawatts, etc.). To be consistent with other major energy studies, the Panel chose the Btu (British Thermal Unit) as the common unit of energy. Due to the quantity of annual energy requirements in the U.S., the Quad (1×10^{15} Btu) was used throughout this report.

Since a Btu or a Quad is not the most familiar or understandable unit to the American public, this table expresses the Panel's prudent planning bases in other equivalent units. The numbers used to convert Quads to other units are shown in Appendix 4.

The Panel's 1985 demand planning base is 108 Quads. This is equivalent to:

1. 114×10^{18} Joules; or
2. 51 million barrels of oil per day; or
3. 5 billion tons of coal per year; or
4. 108 trillion cubic feet of gas per year; or
5. 31.6 trillion kilowatt-hours of electricity per year; or
6. $206 billion of fuels (at $11 per barrel of oil).

Supply/Demand Estimates (Equivalent Units)

Fuel	Units	Actual Units	Quads[1]	Equivalent in Joules[1] (10^{18})	Oil Equivalent (MMBPD)	Coal Equivalent (MMMTPY)	Gas Equivalent (TCFY)	Electric Equivalent (Trillion KWH)	$Billion[1] (at $11/BBL Oil Equivalent) Yr.
Coal	Billion Tons/Yr	1.2	26	27.4	12.4	1.20	26	7.6	49
Oil	MMBPD	12	25	26.4	12.0	1.16	25	7.3	48
Gas	TCFY	22	22	23.2	10.4	1.02	22	6.5	42
Nuclear	GWe	275	16.5	17.4	7.8	.76	16.5	4.9	31
Synthetics	(in coal)	-	-	-	-	-	-	-	-
Shale Oil	MMBPD	.25	.5	.5	.3	.02	.5	.1	1
Hydroelectric	GWe	58	3.5	3.7	1.7	.16	3.5	1.0	7
Geothermal*	GWe	6	.4	.4	.2	.02	.4	.1	1
Solar	Quads	.1	.1	.1	-	-	.1	-	-
Imports	Quads	14.0	14	14.8	6.6	.66	14	4.1	27
	Totals		108	113.9	51.4	5.0	108	31.6	206

*Includes solid waste
[1] Per year

Appendix 7. Domestic Reserves of Oil, Natural Gas and Coal

	Oil	Gas	Coal
Proven Recoverable with Current Technology and Economics	40 Billion Bbl.	250 TCF	434 Billion Tons
Years Remaining at Current Use Rates	7 Years	11 Years	700 Years
Total Proven Reserves	300 Billion Bbl.	500 TCF	1600 Billion Tons
Years Remaining at Current Use Rates	50 Years	22 Years	2600 Years
Ultimately Discoverable Reserves	600 Billion Bbl.	900 TCF	3200 Billion Tons
Years Remaining at Current Use Rates	100 Years	40 Years	5200 Years

Source: National Petroleum Council / Federal Energy Administration

Appendix 8. Panel Working Documents

This report by the Commerce Technical Advisory Board (CTAB) Panel on Project Independence Blueprint arose out of a detailed review and critique of interagency task forces inputs to the Project Independence Report.

To perform the detailed review, the Panel was organized into Subpanels (see Chapter 7, p. 53) which then interacted with the corresponding FEA-Interagency Task Forces. Each of the Subpanels has prepared preliminary reports summarizing the review and critique effort. These unedited reports are available, in one volume, from the National Technical Information Service.

The title of the compiled works is "Review of Project Independence Blueprint—Panel Sub-Committee Reports on FEA-Interagency Task Forces."

Also included in that volume is a special task force report by the Stanford Research Institute titled "CTAB Panel on Project Independence Blueprint—Restricted Energy Use Scenario".

Although the reader may find the data and views contained in that volume to be informative and not available elsewhere, they do not entirely reflect the consensus view of the Panel.

Mr. ZAUSNER. In reviewing their analysis, we found something very interesting, and that is that on practically every number almost everybody disagrees. For example, the MIT people felt that imports were too high for two reasons: one, they expected demand to be much lower, due to higher prices; and two, they felt supplies would be much higher due to high prices. As you well know, and from the people that have been before you also in the Joint Economic Committee, there is a question, a serious question, on the low elasticities that we have used as to the reduction due to import tariffs and fees. On that same elasticity, other people such as MIT, might feel it is higher, and the price effects are even greater.

Similarly, on the supply side, the CTAB panel spent several millions of dollars and several months to come up with their evaluation which comes out on the opposite side. They feel that demand will be higher than we estimate, not lower. They feel that domestic supplies will be lower than we estimate and not higher, and our estimate of imports is much too low, perhaps as much as by a factor of 50 percent, or even a factor of two. That is the uncertainty inherent in any situation. Any policy we develop has to take account of the fact that there is no right number, Mr. Chairman. And what we attempted to do in the blueprint, if you read through the summary of that report, you will see a major section in the executive summary on uncertainties where we point out that because we do not know enough about reserves, because elasticity estimates are very difficult to do, and for a number of other reasons, there remain major uncertainties.

The challenge, however, is to first get a best estimate, understand where those uncertainties are, and then to formulate a policy which can deal with them. I do not think people disagree with the basic facts we have turned up. Let me just briefly summarize those main ones.

First, in the next 2 or 3 years, we are going to be in a particularly critical situation. Most would agree that oil production will continue to decline. Most would agree that demand in the longer term will be much lower than people have previously forecast, although there is much disagreement on how much lower. I think most would also agree that it would take quite a massive program to turn around our current situation and get to a position where we are invulnerable. Whether we define invulnerability as 3 million barrels a day or 5 or 7, regardless of the number, I think most would agree that it is a massive undertaking. And because there is tremendous uncertainty, we need a balanced program of both increasing energy supply, cutting demand, and having an effective emergency program. I think many in the Congress agree also.

It is interesting to note—and this is an important point—that we now have a common base point. As you know, the Wright/Pastore group developed an alternative program.

They used the estimates and forecasts in the blueprint, but used different policy actions and different proposals so that their program would yield different results. That was an important point in our program. We do not, as you know, attempt to say that this is the only policy to solve the problem. What we tried to do was to put together an analysis of the problem and alternatives in a way that people such as the staff from the Wright/Pastore group could, in fact, put together

a program which differs quite dramatically from ours, and still use the results of the blueprint to estimate the impact of their program versus ours. That, to me, is as important as our being able to use the report to estimate the effect of our own program, because if we do not have a common base, as you well know, there is no way to discuss policy.

I think the blueprint has done that. It is not a final report. We are already under an intensive review to make very major changes in the reestimate results for reasons which I think are worth pointing out. One, the day we started, knowing that we only had 6 months to do that study, it meant that we ourselves had to do less than what we might have wanted. One example is that we assumed that all coal had the same sulfur content, and yet as you know, the sulfur content of coal is a major question as to its use, its environmental effects, and its costs. We are going to be revising the way we estimate coal supply and take account of the sulfur.

The electric utility sector can be much more sophisticated and is much more complicated than we ourselves assumed. Again and again, there are places where we ourselves need to make changes. We estimated nuclear power at a time when many people felt we were overly pessimistic, and yet today it is my feeling that, in fact, we were overly optimistic with respect to how many new nuclear powerplants we might get between now and 1985. We ourselves see this report as only the first step, and we see it as our responsibility in the Federal Energy Administration to develop an ongoing capability to update that report, to be able, a year from now or 6 months from now, to indicate how changes in world oil prices, the financial market, the utility industry situation, and other things have affected that, how new information from the Atlantic might change our estimates of the resource base, and to use that information effectively.

What the blueprint is, is not an answer but a framework, a process we attempt, in a vigorous way, to keep coming back and checking our assumptions, and checking the fact and the effectiveness of our programs and see what they mean.

And we think the framework we have built up, the expertise that we have had to develop, will serve the Government well in terms of future years in evaluating future problems and keeping track of where we are going. That is the major benefit, not the numbers in the study, although the numbers obviously, played a major part in helping the President decide on his specific program.

I think with that, I would close my remarks.

Chairman HUMPHREY. Well thank you very much, Mr. Zausner.

First of all, I do want you to know that I personally feel that the Project Independence Report is a very valuable report. I understand fully that reports of this nature have to be speculative. They are forecasts. There are certain bits of statistical information that are pretty well established. But when you start looking ahead at demand, at production, and at reserves, these are quantities that are very difficult to estimate. And I think it is valuable that other departments of Government examine the report and make their own evaluations, and also that our universities, foundations, and institutes do exactly the same thing, because what is needed in this country is much more information on fuel and energy supply, and a great deal more information on potential demand and proposals as to what we can do to minimize demand or to reduce demand.

I met with a group of Japanese industrialists and financiers just in the past week, and I will never forget what they said to us when we asked them what they were doing about the energy crisis. Needless to say, our crisis in the United States is minimal compared to theirs. And they just said it very simply. They said, "Senator, to us a drop of oil is like a drop of our blood. We care for it." And of course, I think it is fair to say that in the United States we are experts in waste. There is no country that has developed such a capability, such a talent, such an efficiency in waste as we have in this country. And that is a fact, primarily because we have had plenty. It is like living out in my part of the country when we had the forestlands; you know, the waste. We throw away what we call low-grade iron ore which would be the envy of Europe and other countries. We have had this. We are like the boy that eats the watermelon: "Why take anything except the heart as long as there are lots of watermelons."? Therefore, I can understand also why our statistical information is not as good as it ought to be. We have never been compelled to do anything about it.

I think one of the unfortunate things that happened in this country for our long-term welfare was the lifting of the embargo. Had the embargo stayed on another 6 months, we would have been compelled to do what we are talking about. We would have been compelled to get serious. We are not going to do anything effective until there is a real compulsion to do it. It is as normal as any human being. I mean, we just are not—that kind of self-discipline is highly uncharacteristic of a people that has been accustomed to having plenty.

Now, hopefully, we can at least find out what the facts are, and that is what these reports are about. I know you have to go, and I just want to leave you with a little thought that I read in the paper this morning about the ripoff on propane. And I want the Federal Energy Administration to get ready, because I intend to inquire why this happened. A year ago, as chairman of the Consumer Economic Subcommittee, I stated to your Director, Mr. Simon, and then subsequently to your new Director, Mr. Sawhill, that there was a flagrant abuse of the pricing mechanism in the propane gas industry. Now, everybody has an interest in these things, depending on what it does to him. I live in the country in Minnesota, and I know what the price of propane is. And I went around to all of these farm areas out there, to the drying plants and saw what was happening to propane gas. So I want you to get ready, and I want to say in a very friendly but firm manner that I want the FEA to get their lawyers out and find out what has been going on in this business.

Mr. ZAUSNER. As you know, we have had quite a major investigation already, and I will provide you with some information on that.

[The following information was subsequently supplied for the record:]

FEA INVESTIGATION OF PROPANE PRICING

During the height of the Arab oil embargo, propane prices, like those of most other fuels, began to rise. In December 1973, FEA assumed authority for the control of propane prices from the now defunct Energy Policy Office. By February, complaints against several propane companies were brought to the attention of FEA headquarters in Washington. These high prices being reported by consumers were generally attributed to price gouging by retailers and the disproportionate allocation of crude oil costs to propane allowed by the refiners' price rule.

FEA's analysis established that even though propane was bearing a disproportionate share of increased crude oil costs, that impact, when coupled with the very minor pricing violations discovered at the retail level, did not result in the high price level being reported. Accordingly, FEA initiated Project Speculator, an investigative project designed to determine the cause of this price distortion. The selection of targets for investigation is based on an indication that a firm is engaging in business transactions specifically designed to evade FEA's price controls.

To date, FEA has initiated 108 separate investigations in this Project. We have completed the audit/investigative portion of the case in 61 of the investigations and our auditors have cited probable pricing violations of $79,800,797. These investigations are civil matters, carrying such penalties as price roll backs and refunds. The remaining 47 investigations are continuing, and no dollar amount of violation is available.

Chairman HUMPHREY. I know what you are doing with the Justice Department, asking them to look into it. They have a lot of lawyers that like to snoop around. But why don't they start to snoop around where the big cats are instead of where the canaries are? Tell them to get going. And the same thing with the Federal Trade Commission.

Congressman Long and Congressman Hamilton, I want you to know that as chairman of this committee, I am going to turn loose everybody we have around here to find out what is going on. And what is this business that I hear about the oil companies fraudulently pricing oil? Is there any truth to that?

Mr. ZAUSNER. This is a question with respect to the residual oil imports?

Chairman HUMPHREY. Yes.

Mr. ZAUSNER. I think that investigation is still going on. We have issued, in fact, a number of remedial orders to require refunds to the utilities.

Chairman HUMPHREY. What about doing something else to them?

Mr. ZAUSNER. This is going to require them to eventually rebate millions of dollars for overcharges, and obviously if there was a criminal intent, then the Justice Department——

Chairman HUMPHREY. Is this a felony?

Mr. ZAUSNER. Well, my understanding is, and I am not a lawyer, that the way that our regulations work is that the first thing we do is issue a remedial order for rebates. If on top of that we see some obvious, willful violations, then we can impose similar sanctions or refer it to the Justice Department for criminal sanctions. Our first task and our utmost one is to get the money back and get the rebates.

Chairman HUMPHREY. And that is one of the hardest jobs in the whole world to get rebates back.

Mr. ZAUSNER. We have been quite successful in the past in rebates.

Chairman HUMPHREY. Back to whom?

Mr. ZAUSNER. To the consumers.

Chairman. HUMPHREY. Each of the consumers?

Mr. ZAUSNER. Absolutely.

Chairman HUMPHREY. That sure gives a lot of bookkeepers work.

Mr. ZAUSNER. What, of course, you do, Senator, is that if you get a major rebate to the utilities, then the utilities reflect it to their customers in the next billing period. You do not really attempt to adjust last February's numbers.

Chairman HUMPHREY. Well, you just get right on it because we want to make sure that there is something done about it. In the meantime, the committee and this staff have been instructed, as they

have been earlier, to move Heaven and Earth to work with you and to prod you and the Federal Trade Commission and the Justice Department. And if there is anybody here from the Justice Department, and there generally is at every meeting, I think they had better get the message. They are out there charging around trying to look at a chicken cooperative in my State. They really are. They irritate me You get four farmers together to try to see if they can get 1 penny a pound extra for chickens and you have 14 lawyers from the Justice Department's Antitrust Division out there. And these oil companies are running amok throughout the country, and they say, "I know, we'll have to keep an eye on them." And of course, they know a big one when they see it, and they run like a bunch of scared rabbits.

Representative LONG. It is a foul blow.

Chairman HUMPHREY. It is a foul blow. That is right.

Mr. ZAUSNER. Mr. Chairman, I will leave my staff to respond.

Chairman HUMPHREY. Would you ask him up here so that we can ask him questions? Your name again, sir?

Mr. PASTERNACK. Bruce Pasternack.

Chairman HUMPHREY. Mr. Pasternack, we thank you for coming. By the way, I did not ask Mr. Zausner about his previous service. Could we have some information about you both, for the record.

[The following information was subsequently supplied for the record:]

BIOGRAPHY OF ERIC R. ZAUSNER

Mr. Eric R. Zausner serves as Acting Deputy to FEA Administrator Frank G. Zarb in shaping and implementing the programs and policies of the Federal Energy Administration. He was appointed to that position Dec. 18, 1974.

He also serves as FEA Assistant Administrator for Policy and Analysis. In that post, he managed the Project Independence Report, a multi-volume study of America's production and use of energy, which provides the analytical framework for development of a national energy policy.

Mr. Zausner has served with the Federal Energy Administration since its inception in Dec. 1973, as the Federal Energy Office. He served initially as both Assistant Administrator for Economic and Data Analysis and Strategic Planning; and Acting Assistant Administrator for Energy Conservation and Environment.

Prior to his FEA service, Mr. Zausner was Deputy Assistant Secretary of the Interior for Energy. His responsibilities in that post included the development and direction of three new energy staff offices—the Office of Energy Conservation, the Office of Energy Data and Analysis, and the Office of Energy Research and Development—many of whose functions were subsequently incorporated into FEA.

At Interior, Mr. Zausner also presided over the Office of Oil and Gas, the Office of Coal Research, and the energy-related activities of the Bureau of Mines and the Geological Survey, He worked directly with the Assistant Secretary for Energy and Minerals in overall energy policy matters.

Mr. Zausner has served as a Senior Staff Member on the President's Council on Environmental Quality. His responsibilities included the direction of all economic and quantitative analysis and policy development in solid waste and energy.

Prior to his position with the Council, Mr. Zausner served as Chief of the Management Sciences Section, Bureau of Solid Waste Management, now the Office of Solid Waste Management Programs of the Environmental Protection Agency.

Mr. Zausner received his Master of Business Administration degree in Finance from the Wharton School, University of Pennsylvania, and a Bachelor of Science degree in Electrical Engineering from Lehigh University. He resides with his wife, Marjorie, in McLean, Virginia.

BIOGRAPHY OF BRUCE A. PASTERNACK

Mr. Bruce Pasternack presently serves as the acting Deputy Assistant Administrator for Policy in the Federal Energy Administration. In this capacity, Mr. Pasternack is responsible for coordination and development of energy policy, management of the FEA decision process and major FEA policy reports.

Prior to his current position, Mr. Pasternack was Director of the Office of Policy Evaluation and was responsible for policy development and analysis for the President's Energy Message. He also served as the Deputy Project Manager of the Project Independence Report, where he coordinated all policy development, technical review, and administrative matters dealing with the Report.

Mr. Pasternack also served as Executive Assistant to Mr. Eric Zausner, Assistant Administrator for Policy and Analysis. In this position, Mr. Pasternack served as key policy advisor to the Assistant Administrator and developed legislative initiatives for data, analysis, and conservation.

Before joining FEA, Mr. Pasternack was a staff member for energy programs at the Council on Environmental Quality. In this capacity, he served as the coordinator of a Presidential study of the environmental impact of potential oil and gas production on the Atlantic Outer Continental Shelf and the Gulf of Alaska. He also worked on the CEQ strip mining study conducted for the Senate Interior Committee, drafted environmental legislation, and was responsible for environmental monitoring and solid waste activities at the Council.

Mr. Pasternack previously worked as a systems designer and project manager for environmental analyses and information systems at the General Electric Company. He also served as Chairman of the Urban Systems Department Affirmative Action Program.

Mr. Pasternack received a Bachelor of Engineering Degree from Cooper Union in New York, a Masters Degree in systems engineering and operations research from the University of Pennsylvania, and has completed course work for a PhD in environmental management and public administration from Drexel University.

Chairman HUMPHREY. Now, Mr Pasternack, what is your previous service in Government or in private enterprise?

Mr. PASTERNACK. I joined the Federal Energy Administration during the embargo last year, from the Council on Environmental Quality where I was involved in environmental policymaking. Prior to that, I served at General Electric.

Chairman HUMPHREY. Prior to that in the General Electric Co.?

Mr PASTERNACK. That is right.

Chairman HUMPHREY. So you have been in Washington about 3 years?

Mr. PASTERNACK. Yes.

Chairman HUMPHREY. I will bet that you found it very interesting as compared to working with General Electric?

Mr. PASTERNACK. I sure have.

Chairman HUMPHREY. Do you want to go back and have an easy life?

Mr. PASTERNACK. That was a mistake I made. I thought it was an easy life here.

Chairman HUMPHREY. I had a reporter ask me the other day, he asked me what I thought about life here, and I said oh boy, oh boy, I thought that Lincoln freed the slaves, but he forgot some of us around here.

Representative Long, do you want to ask a question?

Representative LONG. No. I think frankly, Mr. Chairman, that I would rather hear the comments. I think I would learn more that way.

Chairman HUMPHREY. Mr. Pasternack, we will place your prepared statement in the record at this point.

[The prepared statement of Mr. Pasternack follows:]

PREPARED STATEMENT OF BRUCE A. PASTERNACK

Mr. PASTERNACK. Thank you for the opportunity to appear before this Committee to discuss FEA's Project Independence Report. I would like to commend representatives from MIT and Battelle Memorial Institute for their thoughtful analysis and evaluation. As Deputy Project Manager of the Project Independence Study, which was an inter-agency effort led by the Federal Energy Administration and involving over 500 professionals, I am proud for what we were able to achieve. In an extremely short period of time, less than 8 months, we defined a very complex problem, performed a new set of analyses, developed a sophisticated energy forecasting and planning tool, uncovered and compiled a tremendous amount of information about energy and its relationship to the economy, exposed all our methodology, findings, and conclusions to public scrutiny, conducted over a dozen public hearings from Boston to Alaska, published over 20 volumes of information on every energy resource, on energy conservation, on research and development, and on such important interlocking factors as materials, equipment, transportation, manpower, finance, water resources, and environment.

The report did not attempt to answer all the questions about energy. It never even set out to do that. We did not attempt to derive an accurate predictor of our energy future—anybody who says he can do that is only misleading himself. We made some mistakes, and with the wisdom of hindsight there are many things that I and others would no doubt change. We probably would not have tried to do as much as we ultimately attempted. We probably would have simplified our analysis and our ambitions. However, with the spirit of trying to do an almost impossible task in an extremely short period of time, we were able to generate the enthusiasm that made the project successful.

When we began the effort in March 1974 our goal was to analyze the supply and demand for energy on a regional basis understanding the interactions between supply and demand and the necessity for transporting energy from its producing location to its consuming area. We analyzed demand for each fuel, for each census region, and for each consuming sector—residential, commercial, industrial, transportation, and electrical generation. We analyzed demand as it is related to the price of energy and to the economy as a whole. We looked at a range of world oil prices from $4 a barrel to $11 a barrel in 1973 dollars. We felt it was beyond our capability to predict with certainty the price of world oil given that in many instances the world oil price is a political, not an economic price. We recognized, and we showed, that the world price of oil dramatically affects both our energy supply and our appetite for energy. And, at higher prices we would only be importing a little over 3 million barrels a day in 1985, while at low prices we could be importing upwards of 20 million barrels a day in 1985.

We also looked at energy supply on a regional basis for each fuel and we assessed in great detail the building blocks, and materials, labor, and other resources required to develop our domestic energy supplies. We projected not only current energy supply, but supply from new areas in Alaska and the Outer Continental Shelf from synthetic fuels and from solar and geothermal energy. We developed supply curbs which showed the degree of production that would occur at varying prices of world oil and of different selling prices for the individual fuels. Once again, there is a market increase in the amount of domestic production as the price of oil stays high. We also looked at two cases, a business-as-usual case which assumed virtually no new federal actions and an accelerated development case which assumed that some of the institutional constraints which may retard domestic production would be removed.

In one of the more important areas of our analysis, we assessed the need for various resources as I mentioned earlier to achieve the levels of production which would otherwise be possible if the economy were unconstrained. We learned many interesting things in this analysis. For example, we learned that fixed and mobile platforms for developing domestic oil would be in very short supply over the next ten years and that production of these platforms would have to be rapidly accelerated in order to have any chance for meeting our projections. We learned that water resources while available in quantity in some of the Western areas of this country, faced many institutional problems and prior uses in that a large scale development of synthetic fuels would be unlikely unless these problems were overcome. We learned that certain environmental standards now in effect could limit the production of oil shale in the State of Colorado. We determined that the availability of labor, while a problem in the next 3–5 years, should not be a major problem in the 1980's if the proper training and the proper planning is accomplished. We also determined that additional oil from Alaska above that which

would be produced from the Prudhoe Bay fields and delivered via the Trans-Alaskan pipeline, would have to be transported to areas other than the West Coast for it to be used.

In performing our analysis, we undertook a rigorous analysis of a whole range of energy conservation options to determine their effectiveness and their cost. Our approach departed from traditional practice by assuming that conservation would take place as a result of price and that any mandatory standards or new conservation measures would have to result in savings above and beyond that which would be caused by higher prices. We also analyzed the international situation with respect to energy and the likely production and import requirements of the various nations over the next ten years. As the Project Independence studies were being conducted, we subjected the early drafts of the various reports to an extensive review by our Project Independence Advisory Committee, by public interest groups, by the Commerce Technical Advisory Board, and by other interested parties. After the report was completed we held a hearing under the aegis of the Energy Resources Council to evaluate its findings and to determine its impacts on energy policy. The major value of the *Project Independence Report* was that it identified the key trends in our energy future and enabled the decision makers both within the Executive Branch and as I have been pleased to learn in the Legislative Branch to concentrate on the major policy issues without arguing over the effects of various individual actions.

There is no question in my mind that our results do not accurately predict the future. There are errors, there are uncertainties, and as our fellow panelists have indicated we have made some mistakes. But, by and large, the report, and the forecast that has been derived, provide the basis for a new national energy policy. It has taught us a number of major points:

Within the next 2–3 years, there is very little we can do to increase domestic energy supply. Our supply is declining and any new fields or new technologies will take some years to develop. Thus, we have no other choice but to embark on a new and stringent energy conservation program. As a result of these findings, the President determined that he would pursue a vigorous energy conservation program.

To achieve our goals of increased independence from foreign oil, the conservation programs we start today must not only take effect today but must also begin to change our long-run patterns in the use of energy. The program proposed by the President, therefore, includes not only measures to reduce demand immediately, but measures such as national thermal efficiency standards, a thermal insulation tax credit, appliance efficiency goals, automobile fuel efficiency goals, and appliance and automobile labeling, to begin to change the structural patterns in our energy use.

The critical variable which is so uncertain in our energy predictions is the actual amount of oil that will be produced in this country in 1985. It depends on a number of factors and it is critical for us to begin to explore and develop our oil in frontier areas in Alaska and the Outer Continental Shelf to determine how much oil is really there.

Coal production while extremely constrained in the short run by manpower, equipment, financial and institutional difficulties, will in the long run be constrained by the available demand for coal and not the ability to produce coal. If the demand is there, the incentives will exist to produce the coal.

Unless we can resolve the financial problems in raising capital for investment in electric utilities, our goals to reduce our dependence cannot be met. In order to build the coal and nuclear plants we need—the plants which are most highly capital intensive and which take the longest to build—electric utilities will have to raise over $300 billion in the next ten years. Their ability to raise this capital is certainly in question at this time. In the long term, beyond 1985, this country is running out of oil and gas reserves. To satisfy our energy needs in the future we must do three things:

1. We must continue the conservation program as we begin today and improve upon them in the future;

2. We must increase production from synthetic fuels which can be replaced to some degree by domestic oil and gas;

3. We must develop the new technologies of solar and geothermal and new forms of nuclear power which do not expend our limited resources.

Mr. Chairman, one of the things we were able to forecast correctly during this study was that when the program would be completed the reviews would be far from unanimous in their approval. We correctly anticipated that we would be

attacked on all sides for bias in all directions. And indeed, the coal industry said we were biased against coal, the oil industry said we had ignored a number of their key problems, the natural gas industry said that we had forgotten about natural gas, the nuclear industry said we were far too pessimistic in our projections of nuclear growth. Some groups said we were too high in our forecast of demand and others said we were too low, and some groups said we were too high in our forecast of domestic supply and other groups said we were too low, and many said we had talked away the problem of growing imports while others insisted we could become independent without taking nearly as many harsh actions as we suggested in the report. The witnesses today have indicated their opinions, the Commerce Technical Advisory Board indicated that they thought our estimates on domestic supply were too high and demand too low and there have been a number of other assessments which I would be glad to make available. In all, though, I feel that we accomplished what we set out to do and that we have focused attention on the key aspects of our energy problem and that the report is an important contribution to our foundation of knowledge.

Chairman HUMPHREY. Why don't we bring the other witnesses up here also, if you will, Mr. Pasternack, just stay here and get your pencil out. First we will have Mr. Globe; Mr. Samuel Globe, and then Mr. Adelman. Why don't you both come to the witness stand. We will listen to Mr. Globe first. And Mr. Adelman, you have some extras with you, don't you?

Mr. ADELMAN. Yes. I wonder if I might be assisted by Professors Jacoby and Hausman.

Chairman HUMPHREY. If you don't mind, I will tell you what we will do. We will listen to you, Mr. Globe, first, and then we will go to you, Mr. Adelman, and then the other gentlemen may make any presentation, or they can just back you up, and then we will have questions.

Mr. ADELMAN. Senator, if you would permit it, I would like to speak for about a minute and then call on my colleagues here, and then speak also briefly. We have divided up the assignment.

Chairman HUMPHREY. Fine. Very good. Shall we start with you, Mr. Globe.

STATEMENT OF SAMUEL GLOBE, BATTELLE MEMORIAL INSTITUTE

Mr. GLOBE. Mr. Chairman and members of the committee, I have a brief statement here which I would like to read first.

In October of 1974 the National Science Foundation requested the Columbus Laboratories of the Battelle Memorial Institute to undertake a critical review of the Project Independence report, which, for brevity, I shall hereinafter refer to as the PIR. This review was conducted under great pressure of time, much of it before the final draft of the PIR appeared. It was done under my direction by a project team of about 40 Battelle staff members, all of whom had worked in some area of energy research. The results of our review are contained in a report to the National Science Foundation dated January 10, 1975, and entitled "A Review of the Project Independence Report."

An earlier draft of the PIR was entitled "The Project Independence Blueprint", and much of its content was carried over into the PIR. However, the PIR differed in significant ways. Though we used the blueprint draft in the first part of our project, please understand that the final contents of our review apply not to the blueprint draft but to the PIR.

As regards the PIR as a whole, whatever may be its shortcomings in assumptions, in conclusions, or in methodology, it represents a praiseworthy undertaking. In a world that is shrinking psychologically, but ever expanding in the demands on its resources, an attempt to take a rational view of the use of those resources is a proper concern of government. Energy is not just another resource; it is the central and seminal resource of our industrialized society. It is essential for the development or recycling of other resources, and indeed for the processes of life itself. A continuation of the type of analysis exemplified by the PIR is greatly to be desired.

Furthermore, although there were areas of disagreement between our reviewers and the PIR, sometimes with details and sometimes with whole sections, we felt that its conclusions were generally correct. The conclusions reached in the four scenarios considered in the PIR—business as usual, accelerated development, energy conservation and demand management, and emergency programs—accord with common sense. Although the PIR took no position of advocacy—and neither did our review—a sense developed among our reviewers that the authors of the PIR looked upon a combination of conservation and accelerated development as a proper course to follow.

While there may be legitimate debate about details or strategy, that combination course seems to agree with intuition and with the national need.

I shall turn now to some specifics. In a number of areas our reviewers agreed generally with the conclusions developed in the PIR, but disagreed with the level of optimism expressed. For example:

One, our reviewers regarded as optimistic the estimates for the finding rate of new oil and for secondary and tertiary recovery of oil.

Two, more generally, we doubted that the predictions under accelerated development for oil and gas could be achieved in view of the high leasing, drilling, and finding rates required, the constraints of equipment and material, and other difficulties.

Three, likewise, our reviewers felt some doubts about the ability to expand coal production as rapidly as predicted under the accelerated development scenario, in view of equipment shortages, capital requirements, et cetera.

Four, in view of the diffuse structure of many American cities, we felt that the PIR is optimistic about the degree to which public transit would replace the automobile.

Five, the PIR appears to be overly optimistic about how much energy might be saved by changes in industrial processes, or in the operation of electric utilities.

In some areas our reviewers felt that the PIR would have benefited from more detailed study. I shall refer briefly to a few of these.

One, the costs associated with the transport of oil and gas could have been presented more accurately.

Two, our reviewers felt that the PRI discussion on finance ignores certain factors, such as the impact of recession or depression, and does not treat sufficiently the potential problems in raising capital.

Three, the discussion of water availability ought to have considered a variety of additional factors, including seasonal variation and interregional conflicts.

Four, our reviewers thought that the chapter on the international situation placed insufficient emphasis on the possibilities afforded the United States for providing leadership to the oil-consuming nations. The chapter also regards OPEC as a totally monolithic bloc, and does not discuss differing interests among its member nations.

Five, the general approach to the economic problems of the energy situation is correctly stated in the PIR, but our reviewers felt that more consideration might have been given to certain factors, such as, for example, the business cycle, and changes in tax base for local governments. Also, they questioned whether the macroeconomic impact of the changing requirements on the automobile industry would be as small as the PIR suggests.

Six, the discussion of social impact deserves consideration of factors other than those produced by economics. Our reviewers thought that, especially under accelerated development, such social factors as health and safety, community character, boomtown problems, and others, need study.

Our review also came up with suggestions, additional to those contained in the PIR, that may be significant for the energy problem. For example:

One, in air transportation, we suggested several changes of policy or procedure that would reduce fuel consumption.

Two, our reviewers offered additional suggestions that have potential for improving the fuel economy of automobiles.

Three, our review suggests that research is desirable on the use of less energy-intensive designs and materials of construction for buildings, and on the application of life cycle accounting in the use of energy for operating buildings.

Four, so-called onsite or total energy plants which by providing electrical and other power from an integrated installation, hold promise for much greater efficiency of fuel usage and deserve more intense study.

Five, our reviewers note an additional advantage in reducing the size of American automobiles; namely, the savings of energy in manufacture of steel.

Six, trained welders, roof bolts for coal mines, and certain ferroalloys in steel production are items that, in addition to those mentioned in the PIR, may be in short supply under conditions of accelerated development.

I hope I do not leave the committee with the impression that we found nothing but fault with the PIR. There were in fact many areas of agreement, both in specifics and in generalities, as for example:

One, the coal market is, as the PIR indicates, demand limited at the present time.

Two, the PIR assessments about geothermal and solar energy are essentially correct.

Three, our reviewers agreed with the likely use of synthetic fuels by 1985.

Four, the country needs greater attention to a conservation ethic, and a public information program on the need and methods of conservation is desirable.

One of the difficulties of reviewing the PIR proved to be the degree of interlace our reviewers found between areas of agreement and areas of disagreement. Since the PIR attacked a problem of enormous

complexity, and was itself produced under great pressure of time, it is no wonder that disagreements will arise, and that some, if not all, aspects of the problem can benefit from additional analysis. Such additional analysis in the development of future plans will certainly benefit the Nation.

Chairman HUMPHREY. Thank you very much.

Mr. GLOBE. That concludes my statement.

Chairman HUMPHREY. We will proceed with the other statements and then come to the questioning. Mr. Adelman.

STATEMENT OF M. A. ADELMAN, PROFESSOR OF ECONOMICS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ACCOMPANIED BY JERRY A. HAUSMAN, ASSISTANT PROFESSOR OF ECONOMICS; AND HENRY D. JACOBY, PROFESSOR OF MANAGEMENT

Mr. ADELMAN. Our assignment, Senator, was to review only the analytic apparatus in the Project Independence report. Our general appraisal, if we are to give one, is stated in the Chinese proverb that the longest journey begins with the first step. This was a critical first step and it was well done.

Our problems with it are the following:

First, that there is very great uncertainty about the relationship among the variables, and this compounds the inadequacy of the data base. Public policy based on any single-point estimate of price, output, imports, or anything is bound to be wrong. And ranges have got to be built into a policy framework.

More specifically, now, given the assumptions that were incorporated, the estimated 1985 imports seemed to be overstated, particularly at the higher prices assumed; that is, $11 per barrel. My colleague, Jerry Hausman, will speak to that.

Our second specific difficulty is that there are factors not incorporated into the analysis which point in the other direction, that of greater imports. These include the financial crisis of the electric power industry, the continuance of oil and gas price regulation, and finally the impact of environmental requirements. All of these push in the direction of higher oil imports. And Henry Jacoby will speak to those.

Third and finally, the international assessment is hardly analytic at all, and not integrated with the rest of the report. It assumes that there will be unlimited supplies from the outside world at a stable price of $7 or maybe $11. I think this is quite a mistake, and will speak to that myself.

May I introduce Professor Hausman.

Chairman HUMPHREY. Please.

Mr. HAUSMAN. Well, I would like to point out some of what we consider to be the analytical shortcomings of the Project Independence report with respect to the supply and demand estimates, because to some extent, of course, they are crucial in deciding how large imports would be, being the difference of supply and demand.

The first thing I would like to point out, the first shortcoming is we think that the Project Independence report may severely underestimate the effect of price deregulation on natural gas supply. In the report the price of natural gas could triple, yet no more supply would

be elicited whatsoever. So speaking from Mr. Zausner's earlier remarks, not only is the elasticity low, it is actually zero. I think many people would find it very hard to accept zero as a reasonable estimate of elasticity of the supply of natural gas.

The second shortcoming which we also think may downward bias the estimates of supply is that no matter how high the oil price rises, that is the world oil price, it may go from $7 to $11, there is no more oil drilling done in the early years of the report, let us say up to 1980. This belies what recently happended where when we had seen a great fourfold or perhaps fivefold increase in the world oil price over the last year, there has been a much greater amount of drilling in this past year than we had seen in previous years. We therefore think the Project Independence report may underestimate the supply responsiveness of oil to a much higher world price also.

Therefore, with respect to supply we think that the report may seriously underestimate price responsiveness and, therefore, underestimate the possible effects of price deregulation in both natural gas and oil.

Chairman HUMPHREY. What are you saying there, that price deregulation would stimulate exploration?

Mr. HAUSMAN. Yes, it would stimulate exploration, we think that it will stimulate both exploration and development of both natural gas and oil.

With respect to demand, we think that the Project Independence report did not fully take into account the effects that regulation of natural gas have had. The Project Independence report comes to the surprising and probably noncommon sensical conclusion that gas and oil, that is natural gas and oil are complements and not substitutes. Putting that in every day terms, that says the blueprint predicts that if the price of oil would go up from $7 to $11, actually less natural gas would be consumed rather than more. In other words, that is sort of like if the price of hamburger goes up, I would predict that the consumer would consume less chicken rather than more chicken. It is very hard to believe that has either a basis in either reality or in economic fact. Therefore, we think the Project Independence report may underestimate the amount of natural gas that will be demanded and supplied at much higher oil prices. We therefore think that natural gas might well play a much greater role in U.S. energy demand and supply than the report indicates that it will. Therefore, again reemphasizing the potential importance of deregulating natural gas so that more can be supplied.

The last point that I would like to bring up is that nowhere does the project independence report integrate the effect of much higher energy prices on macroeconomic variables such as GNP. The report basically assumes that on a first approximation, even if the energy price would rise, this is world oil price, from $4 to $15, making energy much more expensive in the United States, so their first approximation, this would have no effect in GNP in let us say disposable income for consumers. I find this assumption very hard to accept and I, therefore, think much more serious and further analysis needs to be done on the effect of higher energy prices on GNP and disposable income to American consumers.

Chairman HUMPHREY. Very good.

Mr. JACOBY. I might pick up from there.

Chairman HUMPHREY. And your name again?

Mr. JACOBY. Mr. Jacoby, I would like to emphasize a point that Professor Adelman has made on these comments about the possible bias in the analysis which were made and I feel like I should underline this on the assumptions that underlie the basic calculations that are done in the report. And we think it is well worth focusing very hard on what those assumptions are, because buried in those assumptions are some of the most difficult policy questions that this country faces today. Let me just mention the three most important ones.

The report assumes that prices will be deregulated, and because that is an assumption that lies underneath almost all of the calculations, the report, as it stands now, does not give a very clear impression of what would happen if we did not deregulate. And it is our feeling that that is, that failure to deregulate and let prices rise would have a significant impact on the supply of oil and natural gas. Or to put it another way, if the FEA had done that piece of analysis, if they had run a path to 1985, under the patterns of price regulations that are clearly imaginable that we will experience, they would have found higher imports than they did because of the dampening effect of price regulation on domestic exploration and development for oil and gas.

The second point which has already been mentioned, but is worth emphasizing is that the report assumes that financial problems in the energy industries will be solved. The clearest place where this is a problem is in the electric power sector. The problems of this industry are evident to everyone. The Blueprint does worry quite a bit about the electric power sector, and there is quite a bit of discussion of the importance of achieving higher rate of return, so that this industry can afford to invest in capital intensive projects such as coal fired electric powerplants, or nuclear fired electric powerplants. Unfortunately, it is our feeling that the report does not give the proper impression of the significance of this because they never do a calculation of the likely supply of electric power from coal and nuclear, and therefore, the likely imports of oil under perfectly conceivable conditions of serious financial difficulty in this industry. What happens if these problems are not, these financial problems are not corrected? To the extent they are not corrected, once again the numbers are overestimated. The imports are underestimated.

Finally, the report takes into account the effect of different rates of energy growth on the environment. But, under the apparatus as it stands now, it has not been possible to feed back the effects of environmental constraints on the growth of the electric power sector. Once again, though, our assumptions built into the analysis about the pace of development of offshore oil and gas, the pace of expansion of strip mined western coal, and the solution to problems of sulfur regulation, if not solved, if these constraints are not either removed or overcome by technological developments, then once again this would be an influence that would tend to make you believe that they have overestimated domestic energy supply and, therefore, underestimated consumption.

To summarize that, there are buried in the assumptions of the report some critical policy issues, which because this is not brought out and analyzed as some of the major options considered in the study, perhaps are not given sufficient weight or not sufficiently evident to the casual reader of this report.

One final thing I would just mention which cuts in the same direction and relates to what Professor Adelman is going to talk about now. To the extent that there is great uncertainty about the world oil price, rather than relative confidence that people know what it is, that will tend, I believe, to raise the relative uncertainty experienced by investors and consumers, and very likely retard the development of expanded energy supplies. This would be particularly the case for high cost recovery methods in oil and gas, and high cost synthetic processes which are vulnerable under a highly fluctuating international oil price.

Chairman HUMPHREY. All right. Very good.

Mr. ADELMAN. May I continue?

Chairman HUMPHREY. Yes, Mr. Adelman. You want to continue on the international aspects of it.

Mr. ADELMAN. The international assessments starts with the proposition, on which I think there is a general consensus, that the potential supply from the cartel nations is very large, exceeds by far any likely demand for the product in the foreseeable future. It proceeds from that consensus to suppose that the current price around $11 per barrel is not sustainable, and that the world price will gravitate to about $7. At any rate, these two alternative price levels give us the link between the international assessment and the domestic evaluation which we have been discussing.

Now, this vision of a smooth evolution of prices to some stable level is, we think, out of touch with reality. The forces at work are more likely to make the price fluctuate over time, and perhaps pretty severely. A cartel is a rigid and unstable kind of market. As prices rise, there are factors that tend to reduce supply and drive prices still higher. The oil rich exporting countries find their revenue needs are easy to satisfy under these higher prices. They can more easily afford to cut production and put prices even higher.

Also, very high prices generate very high profits which lead governments to tax and perhaps overtax, and thereby reduce output. We have had a very striking example of that in Canada in the past year, and very probably in the North Sea as well. But what holds true in one direction also holds true in the other. Just as rising prices tend to promote still higher prices, so falling prices tend to promote still faster falling ones. If the price begins to erode, which is particularly likely if and when the leading cartel nation, Saudi Arabia, cannot keep production in line with demand by cutting back—at the present moment Saudi Arabia could shut down completely and yet production would be adequate to satisfy demand—where the nations are not able to control output, and where there is even a mild erosion of price, forces are set in motion which set to drive the price far down. The oil rich countries, some of them, have already shown an impressive ability to spend even as fast as they are receiving, much to the surprise of all, including myself. Even a small decline in price would put them in serious difficulties. Further price shading is required to move larger quantities of oil, and so the process feeds on itself again. If the cartel should break, and prices fall considerably, immediate efforts would be made to reconstitute the cartel, and raise prices again. There is no inherent reason why in the short run they should not succeed in doing so. Then the world oil price could over the period to 1985 fluctuate

over a range which is much wider than the $7 to $11 assumed by the FEA. And we have a very different world from the one where we have a price which is stable, and which people believe is stable.

Well, you have to draw two conclusions from this which bear directly on policy. First, a reduction or an increase in import demand by any one country will have no perceptible effect on the world price. There is no analysis in the FEA report to support the persistent notion that our own actions to achieve self-sufficiency could have an appreciable effect in bringing the world price down.

Furthermore, it means that the report as it stands does not provide the analysis to aid decisions on policy issues such as import tariffs, import quotas, subsidies, guarantees for synthetic fuels, et cetera, policy issues which arise in a world of uncertain and fluctuating oil prices. The report does not address this world, and we think it should.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Adelman follows:]

PREPARED STATEMENT OF M. A. ADELMAN ON THE FEA'S PROJECT INDEPENDENCE REPORT

(By M. A. Adelman, Professor of Economics, M.I.T.; Jerry A. Hausman, Assistant Professor of Economics, M.I.T.; Henry D. Jacoby, Professor of Management, M.I.T.; and Paul W. MacAvoy, Henry R. Luce, Professor of Public Policy, M.I.T.)

The Project Independence studies carried out by the FEA during the past year are an important step in the nation's attempt to understand our emerging energy problems and to formulate policies to deal with them. We are happy to have the opportunity to participate in this discussion of the work, and its strengths and weaknesses.[1] The object of our comments is the Project Independence Evaluation System (PIES) which is the overall analytical apparatus developed by the FEA to support their studies.

The system consists of three groups of interrelated models and associated data. The centerpiece of the system is a large linear programming model which is used to estimate domestic energy consumption, production, prices, and imports for different regions of the country. This integrating model uses as input estimates from models of domestic demand and production of oil and gas. Other important inputs include price-sensitive estimates of coal production, estimates of the availability of other fuels (solar, geothermal, hydropower, nuclear), information on transportation costs between regions, and estimates of the associated requirements for equipment, labor, capital, and water. Submodels of the electric utility and refining sectors are included in the integrating model itself.

Once the integrating model has been solved for a given year, the results may be further analyzed to obtain information on macroeconomic and environmental effects, and on resource and financing requirements for the calculated energy production schedule.

The FEA uses the PIES apparatus to evaluate three broad policy strategies that the U.S. might adopt for the next ten years:

(1) A "Business as Usual" strategy, which assumes the removal of oil price controls in 1975, and phased deregulation of natural gas prices.

(2) An Accelerated Development strategy, involving removal of obstacles to the development of offshore oil and gas, synthetic fuels, and nuclear power.

(3) A Conservation Strategy, involving specific conservation initiatives—such as 20 mile-per-gallon auto standards and improved heating and lighting standards for new homes—and "demand management" measures which entail increasing electricity usage, with supply from coal-fired electric power.

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[1] This testimony reflects the preliminary results of a review and evaluation of the Project Independence Report carried out by the Policy Study Group of the M.I.T. Energy Laboratory under contract to the National Science Foundation, Office of Energy R and D Policy. These comments also draw on other work by the Group over the past 15 months, which has been supported in part by grants from the Rockefeller Brothers Fund and several private donors.

Each of the scenarios is analyzed for the years 1977, 1980, and 1985. The basic external condition that influences the analysis is, of course, the price of world oil. The FEA study assumes that the world price will converge on some value in the near future, the precise level of that price being unknown. The comparisons are done under the assumption of world prices of $7.00 and $11.00 (in 1973 prices) delivered to U.S. shores.

The key results of the overall analysis are: if the world price settles at $11.00 in 1973 prices (which is roughly $13 to $14 per barrel in today's prices), then by 1985 under "Business as Usual" we will be importing 3.3 million barrels per day (about half of today's level). If the world price drops to $7.00 per barrel in 1973 prices (or roughly $8 to $9 in 1975 prices), then by 1985 our imports will be up to 12.3 million barrels per day. With conservation or accelerated development measures, these imports can be reduced by various amounts.

OVERVIEW OF THE FEA STUDY

Now since our testimony here is a critical review and evaluation, it does by its very nature tend to focus on specific points of weakness in the material being reviewed. It is well to start, therefore, by putting this work in context and commenting on the overall effort as a whole. Several points are worth mentioning. First, at the time the study began, there was no coherent data base for anslysis of the many facets of the U.S. energy sector, its relation to the economy, and the federal and state policies that influence energy supply and utilization. Scattered data series existed, many collected by federal agencies, but for coordinated analysis such as that mandated for the Project Independence study, a massive effort of data collection and processing was required. No doubt PIES is only a step in the process of creating a data base adequate for federal analysis and monitoring of national policy; but it is a critical step.

Moreover, a set of analytical models has been formulated for utilizing these data to forecast future energy conditions. Heretofore there were scattered modeling efforts, both in and out of the government (indeed, given the time constraints, much of PIES had to be a patchwork of analytical models and associated data drawn from other sources), but nowhere within the government had it all been put together into a coordinated framework for analysis. Thus, although there are differences of opinion about the overall design of the PIES system (and below we level strong criticism at specific parts of its current structure), the fact remains that the various pieces have been brought into a coherent system. The PIES can provide a framework for managing data, coordinating judgments, and forcing consistency in the various assumptions required to formulate and assess national energy policy.

Having said that, we must look at the work as it stands and evaluate it from three points of view:

(1) Did the FEA study illuminate the most important questions, and did it adopt the proper set of assumptions and conditions to be analyzed?

(2) Was the analytical apparatus adequate to the task?

(3) Are the correct implications drawn from the analysis?

As you might anticipate, the reviews are mixed, and there is no clear answer to the effect "yes, they did it right," or "no, they did it wrong." But an attempt to answer these questions gives us a feel for how wide a band of error should be put around the FEA estimates, in what directions the possible bias may lie, and where more work must be done in order to do better in the future. Our list of the most important points to worry about is the following:

THE OIL AND GAS SUPPLY ESTIMATES

The supply estimates for domestic oil and natural gas are based on a modified version of a model developed originally by the National Petroleum Council. Under this procedure, oil and gas supply are calculated by assuming the amount of drilling that is profitable in each of 12 regions in each year, multiplying this by stipulated rates of reserves-added per foot drilled to get total reserves, and then assuming that reserves are produced at a certain rate. At higher oil or gas prices more drilling becomes profitable, and production rises. It is a method that is almost totally dependent on the judgment of the analyst feeding in drilling and discovery rates to the computer program.

There are systematic problems with this analysis. The method has been applied in a way that appears to underestimate the likely response of oil and natural gas supply to price changes. This occurs because, under the FEA procedure, an increase in price in 1975 brings about increased drilling only after 1980 or even later.

This belies the activity we see taking place in the domestic petroleum industry today. In particular, the method seriously underestimates the likely level of exploratory activity for natural gas by basing the expected drilling rates on the experience of the early 1970's, when gas drilling was dampened by the effects of field-price regulation.

Taking these considerations into account, one can argue in the case of oil that the responsiveness of investment to price is underestimated in the model. On the other hand, it is not clear whether adequate weight was given to certain opposing influences—in particular, the declining responsiveness of supply to investment because discovery will continue its decline, and because improved recovery out of a given amount of oil in place will come at sharply higher real costs. On balance, then, there is little solid ground for arguing that the estimates are high or low overall. An M.I.T. model forecasts supplies very similar to the FEA results at $7.00, and other estimates are scattered above and below it. But the uncertainty is great, and we would not use the FEA forecasts for policy analysis without considering that the estimate of, say 11.9 million barrels per day in 1985 at $7.00 per barrel, can easily be off by 1.5 million barrels either way. In natural gas, on the other hand, the FEA analysis seems unduly pessimistic. Here the error band is also wide, but would extend from somewhere in the neighborhood of the FEA estimate [11.9 million barrels per day (oil equivalent) in 1985 at $7.00 per barrel] to two or three million barrels per day above this level.

Perhaps as important as the potential errors and biases in the FEA estimating method is the fact that the most important issue of the day, the effects of price controls on the supply of these fuels, was not satisfactorily analyzed. We have argued that the analysis tends to understate the importance of higher prices even in the $7 to $11 range. We also believe that continued price controls on oil and field-price regulations of natural gas would have a significant dampening effect on the domestic supplies of these fuels. Unfortunately, the fact that the study contains practically no analysis at all of the potential significance of price controls, coupled with supply estimates that show very little response to price, gives the erroneous impression that price deregulation is not an important issue influencing future U.S. energy sufficiency. We do not believe the FEA intends to convey this impression, but it is there nontheless, given the structure of the analysis, the particular assumptions made, and the scenarios chosen for detailed analysis.

THE ELECTRIC POWER SECTOR

One of the very good features of the PIES integrating model is the way it handles the electric power sector. The analysis is sound, given its assumptions. Unfortunately, the assumptions tested in the FEA analysis fail to illuminate the most critical problem of this sector and one of the key determinants of its future growth, i.e., the financial health of the investor-owned utilities. It is now apparent that without substantial rate increases allowed by the state regulatory commissions, it is unlikely they will be able to raise sufficient capital to expand their systems to the levels implied in FEA analysis, or with the technology mix assumed, [i.e., heavy investments in capital-intensive coal and nuclear units]. These financial difficulties, if they continue, will lead to reduced levels of system reliability and reduce the desirability of electricity to consumers. This will curtail demands for this form of energy (and thus call into question the "demand management" strategy presented in the Project Independence Report), but may also raise demands for other fuels, most notably imported oil.

Of course, the FEA report discusses this problem; but it does not analyze its quantitative significance. The lack of analysis of this issue—its implications, and what it might be worth to avoid it occurring—is an important shortcoming in the FEA's study as it stands.

THE DEMAND ANALYSIS AND ITS INTERACTION WITHIN THE INTEGRATING MODEL

In estimating the future demands for energy in the U.S., the FEA used a three-step form of analysis whereby (1) aggregate national energy demand was estimated given a forecast of the average energy price, (2) this overall BTU demand was split up among fuels using a separate estimating model, and (3) national demands for specific fuels were divided among regions according to their historical proportions.

When applied to the data for U.S. energy—clouded as it is with regulatory interventions and rapid growth in the network of natural gas pipelines—this procedure did not yield results that were consistent with what one would expect

to be the behavior of this sector under alternative prices. For example, the analysis showed natural gas demand falling in certain use sectors when prices of distillate oil rose. Since these two fuels are close substitutes for one another, one would expect the opposite result. Attempts were made to correct the deficiency (and this effort continues at the present time), but even given these efforts, the interaction of the flawed demand model with the integrating framework leads to an identifiable bias in the results.

In essence, the problem is that, since natural gas demand is assumed not to rise as oil prices rise, then the price of natural gas is never driven to levels that are consistent with the high price of the substitute fuels. In effect, the price of natural gas stays at a level appropriate to a world with $7.00 oil even when the price of oil from the world market (which determines the domestic price) is assumed to be $11.00. This means, in turn, that the price of an average BTU in 1985 with $11.00 oil is understated, and the overall demand is thus overestimated. When these problems are corrected, we expect the FEA will find that oil demand as estimated in the November report is biased upward, both due to the upward bias in overall energy demand, and due to the inaccurate representation of how much of this total demand will show up as a demand for natural gas.

Another problem that tends to an underestimate of the dampening effect of higher oil prices is the fact that the FEA was unable to take account of the fact that overall GNP growth will be affected in some measure by higher oil prices. No doubt, this is not a phenomenon that anyone has modeled very satisfactorily, but the fact that it does exist should be kept in mind when applying the appropriate error range around the FEA's forecast.

THE INTERNATIONAL ASSESSMENT

It appears that the FEA devoted the great bulk of its resources to the *domestic* aspects of the energy problem, and applied only a small fraction to the international phenomena that are the immediate cause of current difficulties and the driving force behind their evolution. The FEA analysis is based on a set of judgmental estimates of oil demand in the world and oil supply from non-OPEC countries, which yields a residual demand for the exports of the cartel. This net demand is then compared with the potential supply from cartel nations (which is very great, and at a cost far below current prices) in order to get an idea of how big a problem the cartel may have in avoiding a flooding of the market with oil, and consequent erosion of price. The analysis assumes that the world price will gravitate to one level or another; it may stay near $11.00 per barrel (in 1973 prices), or more likely it will settle to a price around $7.00 a barrel. These long-term price scenarios then provide the link between the international assessment and the domestic evaluation discussed above.

Unfortunately, this version of a smooth evolution of prices to some stable value is a serious oversimplification of reality. In fact, there are forces at work in this market which make it more likely that the price will fluctuate over time. For example, as prices rise there are factors that tend to *reduce* supply and drive prices still higher. Oil-rich exporters find their revenue needs are easy to satisfy under rising prices, and they can more easily afford to cut production. Outside the cartel, in those nations where oil exploitation is in private hands, rising prices present serious equity problems due to the excess profits that accrue to private corporations. Governments of these countries are led to impose tax schemes which have the side effect of reducing the incentive to expand oil supply. (Our own struggle in the U.S. with this issue is all too evident; the problem is duplicated in Canada, in the nations surrounding the North Sea oilfields, and elsewhere.) To the extent these phenomena lead to reduced supply, it becomes easier to maintain high prices, or further increase them.

On the other hand, it is likely that prices, eventually will turn down from current levels, for in time high prices lead to reduced demand, to gradually increasing supplies from outslde the oil cartel. and thus to a sagging demand from the cartel members. Once price begins to erode—perhaps due to a buildup of excess capacity and an attempt by some cartel members to compete for a larger share of a depressed market—forces are set in motion which tend to drive the price down further. Oil-rich countries will have built up domestic spending programs and high imports under high prices, and if prices fall these governments will be under strong pressure to increase oil production to pay the bills. Further price shading will be required to move larger quantities of oil, and so the process feeds on itself. Naturally, if the cartel should break, and prices fall considerably, immediate efforts would be made to reconstitute the cartel and raise prices again. There is no inherent reason why, over a short-run period, they should not once again be successful.

If in fact it proves true, as we believe it will, that this market and the cartel structure that dominates it are likely to prove unstable, then the world oil price could, over the period to 1985, fluctuate over a range significantly wider than the $7 to $11 range used by the FEA as a basic assumption of their work, and at the very least the price is unlikely to gravitate to a level which is in fact stable, and which people *believe* is stable.

In these circumstances there is no reason to expect that a reduction or increase in import demand by any one country will have any effect on the world price. This is a persistent notion: one of the major conclusions in the Executive Summary of the *PIR* is that our actions to achieve self-sufficiency could have an appreciable effect in bringing the world price down to $7.00 per barrel. But there is no analysis in the FEA report to support this assertion, and we believe it is mistaken.

SUMMARY AND CONCLUSIONS

Considering the state of the data and available models when work began and the short time available, the FEA's Project Independence study is an impressive accomplishment. It seems clear that the government needs the in-house capability to do this kind of analysis, and that these efforts should be continued and improved.

In viewing the results of the work as of today, however, several points are worth keeping in mind.

(1) There is considerable uncertainty in the estimates of domestic supply and demand; net imports, being the residual, is subject to even greater uncertainty. However, given the assumptions behind the analysis, the FEA estimates of U.S. import dependence in 1985 appear to be biased upward. At $11.00 per barrel oil prices, the U.S. is more likely to be self-sufficient in energy that the FEA indicates; at lower oil prices, imports are likely to be smaller than forecast by the current PIES apparatus.

(2) Due to various shortcomings and difficulties in the PIES analysis, it appears that the likely responsiveness of the U.S. energy sector to price increases has been underestimated. Problems in the demand analysis, when corrected, are likely to show a stronger adjustment to price change, and the particular method used to estimate oil and natural gas supply tends to underestimate the effect of price on domestic fuel supply.

(3) The likely underestimate of supply responsiveness, coupled with the fact that the analysis does not deal with the effects of price controls on demand and supply, means that the Report as it now stands gives an inadequate appreciation of the stakes that are involved in current policy discussions about price control or decontrol.

(4) In the set of PIES results presented in the Project Independence Report, it is assumed there are no problems of capital availability that impede desired investments in the energy sector. There are several points where this assumption might be questioned (and where, indeed, the FEA study worries about it), but nowhere is it more limiting than in the case of the electric power sector, where some of our gravest energy problems arise. The study does not indicate the degree to which a faltering of investment in electric power may reduce the use of domestic coal and nuclear energy and increase dependence on foreign oil.

(5) The report focuses on policies to deal with an external world where there may be a threat of short-term market disruption (for example, through boycott) and a foreign exchange drain if prices are high, but where the price is reasonably stable and where investors and consumers have a stable expectation of what it will be in the future. This means the report as it stands does not provide the analysis to aid decisions on policy issues—such as tariffs, import quotas, subsidies and guarantees for synthetic fuels, etc.—that are required in a world of fluctuating uncertain oil prices.

Chairman HUMPHREY. Very good The problem as I see it here is that the policy decisions that are being made today by Government, both the executive and the legislative, are based upon both the assumptions of the PIR and the projections that arise from those assumptions. And of course, this calls into question the policy decisions that are being made because of doubts about the assumptions and the projections and about the statistics which are available. And that is why it is important for us to get your views as to these recommendations, and indeed, not only on the recommendations but the assump-

tions and the observations that are made in the Project Independence report.

I just have a whole host of questions here. But I am goiug to turn much of this over to our colleagues. Like most of us, today I find myself under some other pressures and will have to go to another committee.

Before I turn to you, however, I would like to ask the representative here of the Federal Energy Administration, Mr. Pasternack, would you or Mr. Zausner provide for the committee any recalculations of supply, demand, or import estimates that you may make to correct certain agreed upon flaws or inadequacies in the Project Independence report?

Mr. PASTERNACK. Certainly.

Chairman HUMPHREY. We would like to have you share with us, in other words, what new analysis you make, what new estimates you may make.

Mr. PASTERNACK. We will be happy to do that.

Chairman HUMPHREY. Do you have any idea when you can make those estimates available?

Mr. PASTERNACK. Well, Senator, we are continually reevaluating, and we will have some information that has changed over the last, couple of months which we can provide within the next few weeks, and there will be others that will follow.

Chairman HUMPHREY. If you can provide it as they come on, will you do that then?

Mr. PASTERNACK. Fine. We will be happy to do that.

Chairman HUMPHREY. One of the questions that is on the periphery, but that relates to the whole matter of supply, is what limits there are on oil and gas development because of the limits on equipment. There is a relatively fixed supply of drilling equipment and the like that goes into exploration and development. If, for example, higher prices were to be permitted because of deregulation of old oil and natural gas, would not these higher prices just stimulate the bidding for the limited equipment and drive up the costs for energy development even further without yielding much more in supply? In other words, there are only so many drills available, and it does not seem like their supply can be expanded very quickly.

Mr. ADELMAN. May I speak to that, Senator?

Chairman HUMPHREY. Yes.

Mr. ADELMAN. There is an industry, and an actively expanding industry, producing drilling rigs and other apparatus. As far as I can tell, it is a competitive industry, and I would expect the supply to expand pretty rapidly.

Chairman HUMPHREY. You mean of the equipment?

Mr. ADELMAN. Of the equipment. Currently, the situation is becoming quite easy in ordinary land rigs. It is still a little tight in offshore drilling rigs. But the expectation is that this, too, will ease soon for what I might call ordinary offshore rigs which do not need to meet the very severe climatic conditions of places like the North Sea. Rigs of that kind and drilling platforms will probably remain in short supply for the next 2 years, not necessarily at current levels. After that, I would not care to guess.

Chairman HUMPHREY. But so far as land-based rigs are concerned, you feel that they are plentiful at this time or there is an adequate supply?

Mr. ADELMAN. Yes, sir, and they can be provided in a relatively short time. They are not as big, as expensive, or as complex as your big offshore rigs.

Chairman HUMPHREY. I gather that we are a major supplier worldwide of this equipment?

Mr. ADELMAN. That is correct.

Chairman HUMPHREY. And therefore, I was concerned as to whether or not the export market was very large in addition to the domestic needs. And then that brings me to ask whether we are able to meet this demand, apprarently a rising demand because many countries are now drilling for oil.

Mr. ADELMAN. They are, senator. But their requirements in rigs are very small compared with ours. The great bulk of all rigs are working in the United States, and so even a very sharp increase in foreign demand does not do very much to the total demand for this apparatus.

Mr. PASTERNACK. Senator, if I may add?

Chairman HUMPHREY. Yes.

Mr. PASTERNACK. We were very concerned about the problem of material and equipment. That was one of the reasons we commissioned the study, which if I recall, actually Battelle Institute was involved with in materials and equipment. We looked at something like 30 categories of equipment over the next 10 years, and this study indicated that, in fact, even if you assume very expanded production of offshore drilling platforms, that those were the key items that would be relatively tight over the next 10 years. Most other equipment, be it drilling rigs onshore, or surface mining equipment or other things, would be OK, but offshore platforms were the ones we felt would be particularly tight over the next 10 years.

Chairman HUMPHREY. Well, is that not the place where the new supply is becoming available, according to Mr. Adelman?

Mr. PASTERNACK. That is right.

Chairman HUMPHREY. So what you are really saying is that there are plenty of rigs of certain kinds, and where there is a shortage of rigs, it looks as though new supplies will become available.

Mr. PASTERNACK. Well, Senator, that is exactly the case, that where we need the new offshore platforms, they are in tight supply. One of the reasons they are in tight supply is that historically in this country, there has never been a very strong demand for that equipment. So we assumed that there would be some very substantial growth in this industry to build the offshore platforms if there were incentives through increased leasing and development offshore in the United States. Then we felt given some time, and it takes some time to develop these fields, then we would be able to meet that demand.

Chairman HUMPHREY. And the other thing that I would ask about is incentives. We have got a tax bill up over on the Senate side, and there was one passed over here in the House, and I did not see any extra incentives in that bill, except for the general investment tax credit, to give either a special allocation of scarce materials to offshore drilling, or some special type of tax incentive for the production of offshore drilling equipment. Maybe they do not need any extra incentive because of the demand. But, two or three things have come out here. No. 1 is the problem of capital formation, capital needs in the

energy field, particularly in the electric utility field. Obviously this offshore drilling equipment is very costly too. And, second, this involves very sophisticated technology from what I remember from hearings I participated in on the Ocean Study Commission. We were looking at the new kinds of offshore drilling and equipment that goes down much deeper and, of course, the great difficulty there is in the manufacturing and use of that equipment. What I am getting at is I do not see any Government policy that is directed at this bottleneck. If we really want to get on with energy development, we cannot just go around just assuming that you ought to have competition for capital on an equal basis between "Cracker Jack," "Spearmint Chewing Gum" and offshore oil equipment. I just wondered what ideas you may have as to how governmental policy can help, outside of deregulation—and I gather there is some feeling here about deregulation—but what other policies should we have?

Looking at deregulation, may I say, we have had enough. We have already had a boost in oil prices for us non-oil-producing areas of the United States. I come from the Upper Midwest where we pay a dollar a barrel more for Canadian oil than you do for OPEC oil. We pay a higher price for Canadian crude. Now the next thing I hear is that in order to cure our present illness we should take another belt right between the eyes from increased gas. prices, and on deregulation of old oil. Now, how does that help? How does that help my aching back, my aching economic back out there? Could you give me any indication, doctor?

Mr. ADELMAN. Well, Senator, on the producing apparatus I do not think they need anybody's help at the moment. I think they are doing very well and expanding rapidly because it is profitable for them to do so. And the very sophisticated and costly apparatus is only needed in limited amounts as these operations grow slowly.

Also I think we tend to be just a bit ethnocentric about this in thinking that we are the only ones in the world to build these big, costly rigs and platform. I spent a little time in Norway recently, and I think they supply a very healthy corrective to this view. The amount of building that they have been able to do has astonished the world. Their complaint seemed to be that the bottleneck was the Norwegian Government in limiting the amount of oil exploration and development, and that if they were permitted to expand more rapidly they would find the wherewithal to do so.

Chairman HUMPHREY. I appreciate that observation. I do think we have become a little ethnocentric around here thinking that we are the only ones who can do it, and I have heard about the amazing industrial development in Norway. Of course, it is related to the shipbuilding industry, and they are very good at that.

Mr. ADELMAN. It is the same industry.

Chairman HUMPHREY. It is the same industry, and you are going to find that other countries like Poland that have done a great job in shipbuilding, and also Japan and others are going to be able to do this.

On this matter of output and price, do you believe that a higher price brings greater production? And let me say, gentlemen, the reason I put that question is that most of the projections of oil output show very little increase in production at prices above $7 per barrel. What is your general view on this?

Mr. HAUSMAN. I would like to make two points. First, I would like to address the aching back question which I do not think was quite answered. If you do believe, which I will get to in a minute, that more supply would come at higher prices, we do know that it will create an aching back in New England. My oil prices for my household have more than doubled in the last year, just like they will in Minnesota. However——

Chairman HUMPHREY. You hear more about New England here. Margaret, I just thought you would like to hear that.

Representative HECHLER. I do not believe that.

Chairman HUMPHREY. I do.

Mr. HAUSMAN. Congressman, however, I think there are some correctives for the aching back, just like when you were talking about propane to Mr. Zausner before. No one is saying that the owners of the land where the oil is going to be drilled necessarily have to be allowed to keep all of the money. We know that one thing that the Government can do and does well, perhaps, is to redistribute money which is gotten. So if the people who own the drilling land do get higher prices for their oil, if it does elicit higher supply, I think some people would think the country would be better off, we would be reducing our import level, and the aching back, which is the equity problem that you talked about earlier in your opening remarks, I think can be partially resolved by public policy and by Congress. So therefore, I do not think one should say we cannot afford to let the price go higher because the aching back is going to be too much for consumers to bear. I know at the second round this can partially be alleviated by tax, and other types of redistributive measures.

Chairman HUMPHREY. My time is running out, but I just want to say that I have never seen any of these tax measures that really much relieve the consumer out here. In other words, if I have got to pay 50 cents a thousand, cubic feet for natural gas, as I do today, but it used to be 14 cents; or on propane which is now 33 to 36 cents, I do not get any relief out of that. I do not care what kind of a government program you have, I get a bill every month that has just gone up two and a half to three times, and there is no relief that I have seen at all except for turning off the furnace that relieves that price.

Mr. HAUSMAN. I would agree with that, Senator, certainly. But I am saying that I do not think that has to be the case.

Chairman HUMPHREY. How do you get at it?

Mr. HAUSMAN. Well, I certainly think——

Chairman HUMPHREY. I have been staying up late nights trying to figure that out.

Mr. HAUSMAN. I am not an expert in political realities of the situation.

Chairman HUMPHREY. But even the economic realities.

Mr. HAUSMAN. It certainly seems to me if the price of energy goes up in the United States it is possible to tax off some of this extra rent from the energy producers.

Chairman HUMPHREY. That may be true, but it will just get into the general revenues and be used for something else. But what I am getting at is that it does not help the fellow that is paying the fuel oil bill or the gas bill. I agree with you, we can have a windfall profits tax, but so what? I think we ought to tax the oil companies fairly, just like I do not think they ought to be discriminated against. I

think they ought to pay a fair tax as we tax other people. But my point is how do you help John Swenson out there in Mankato, Minn. that is buying that propane and finds that its gone up 300 percent? And the gasoline that he has got to buy has gone up 50 percent And the natural gas has gone up. You can say to him well, you know, we are taxing the oil companies. I have tried that argument out at home. I just came back from a little tour around the State on every one of these things, and somebody will say, now, Humphrey, when do I get my share? Now, what is the answer to that?

Mr. HAUSMAN. I would say to John Swenson in Minnesota and to Jerry Hausman in Massachusetts, both of our bills have gone up, but since we are both homeowners, and have to itemize our deductions, I do not see why you cannot——

Chairman HUMPHREY. You cannot itemize a deduction for the cost of fuel.

Mr. HAUSMAN. If we wanted to, I do not see why public policy could not be changed to include that, just like we allow me to write off my interest payments for my house, and the Government allows me to take a partial deduction on that, so why could not the Government allow me to take a partial deduction of fuel oil to heat my house?

Chairman HUMPHREY. And then on the grocery bill, and then on the minmum wage? I think theoretically you may be right. Theoretically, but good Lord, where do you stop?

Mr. HAUSMAN. I do not think it has to be on everything.

Chairman HUMPHREY. Well, I mean, on everything that has gone up? I mean, why not then for the lady that goes to the supermarket and says, "Well, look, the price of bacon has gone up and I want to take a little deduction on that." And then the person that is going to build or put a family room on the house says, "My God, I could have built that family room 3 years ago for $5,000 and now they want $18,000. I would like to have a little deduction on that." Well, you just cannot do that, my friend.

Mr. HAUSMAN. Senator, I do not want to do that, I do not want to tax the excess profits of farmers and give it back.

Chairman HUMPHREY. They don't have any.

Mr. HAUSMAN. Exactly. I agree. But if we agree that the oil companies have excess profits, I do not see why we cannot redistribute some of that to those who have to pay for the excess profits through the fuel bills. I am not asking you to rebate chickens but I think in oil it can be done.

Chairman HUMPHREY. I see your point and I think in theoretical practice that is very possible. But a district judge in my State has found that the pharmaceutical companies have overcharged hundreds of millions of dollars on pharmaceuticals, and they are now digging up people out of the cemetery to give them their rebates. Now, you know, really and truly, I mean all of this business about refunds, we went through that in my home with people when I was mayor of Minneapolis, and we had refunds on telephone bills because of court cases, and you couldn't find anybody. They just did not have any receipts. The average guy is not an IBM bookkeeper, and by the time you got through it, this really was a big ripoff on the part of the company because they did not have anybody to reabte it to. Grandpa died and has been dead since 1926. How do we rebate to him?

Now, I will yield. These are the practical problems that we have, and I went through two or three of these when I was the mayor of my city. We had refunds on utilities, and we had refunds on gas, and on telephone, and we could not find anybody. They had one of those cases in the courts for 17 years. Who are you going to refund that to?

Representative HECHLER. Would the Senator yield?

Chairman HUMPHREY. Unless you just want to give it to the church in memory of your mother.

I have got to yield.

Representative HECHLER. I just want to ask you one question, Senator. Why should we not consider a tax credit for example, for the fuel adjustment component in utility costs, which we have in Massachusetts and you may have in Minnesota? This is the passing through of so-called increases in fuel costs without any consideration by a regulatory agency. A straight passthrough. I proposed a bill and put it in the last Congress and in this Congress allowing for a tax credit so that this refund would be done on the current tax basis and would really require no indepth recordkeeping beyond the current tax year.

Chairman HUMPHREY. Well, I guess you could do that. I do not think it is impossible to do. I just simply say that it would be the case then that every entrepreneur, every individual in the country would come up with something, and pretty soon you do not have any tax base if you keep giving up tax credits. Now, I have proposed a $30 billion tax reduction, and that is pretty good. And I did not include anything for fuel, or groceries, and we did not include anything for college educations. And there are a lot of other things that people would like. You know the cost of tuition has gone up, and you could say, well, you know, it isn't like it used to be. We ought to have a little tax credit. I just think there is a limit. I am just trying to put what I think are the political limits on how far you can go on fooling around with your tax structure.

I will give up and turn it over to Congressman Long here.

Representative LONG. Thank you very much, Mr. Chairman.

Mr. Pasternack, I certainly sympathize with the position you and Mr. Zausner find yourselves in with respect to having prepared this report. You had the responsibility of preparing it over a period of many months based on what was obviously inadequate information at the time that you had to prepare it. Also, you had to function in a most volatile and changing situation where you found many of the things that you thought were true today and tomorrow they turned out not to be true. Then when you add two, three, or four gentlemen with the background that these gentlemen have had, and the education they have had, and the experience they have had in this field picking at your report, I think you have really come out very well. And I think they have recognized the problems that you went through.

Professor Hausman raised a question that seems to me might go to the essence of this. Right at the end of your statement, Mr Hausman, you were speaking of the gross national product—of the lack of an adequate adjustment with respect to the gross national product, and of the effect on the gross national product by possible variations in the price of energy. I wish you would go back over that, and then we could ask Mr. Pasternack for a comment. It seems to

me if the point that you made is valid, and if I understood it correctly, it cuts all of the way through the whole report which we have before us.

Mr. HAUSMAN. Yes, Senator. I do not know exactly the level of technical detail that I should go into, but I will try this as a first try. What the Project Independence report does is it basically develops an estimate of what the GNP might be for the years 1974 to 1985. This was developed by an economic consulting company, I believe, in New York. It then allows the price of energy to vary between $4 and $15, although the greatest emphasis in the report is between $7 and $11. Now, energy is an input to almost all manufacturing processes, so we would believe that if the price of energy goes up greatly that is going to have a depressing effect on industrial production due to the higher input costs. For the same reason, if you believe we give a tax credit that is going to inspire investment outputs, it is the same thing, the price goes up and you expect less output.

I think the people who did the blueprint tried qualitatively perhaps to realize what the effects would be, but they never did the next iteration, which was feedback into the effects of industry back into the GNP, and into the macrovariables and see what effect that would have, and iterate the analytical process until they came to the solution. Now, this is indeed a very difficult thing. I do not think they can be faulted since no one else has done it either to date. But to a great extent, I think we have been used to a pretty high growth rate in GNP and disposable income ever since World War II, with the continued high oil price we are not sure what might happen, and this could really have great effects on people's expectations and lifestyles.

Representative LONG. Also, it could with respect to the validity of the report. Is that not correct?

Mr. HAUSMAN. Certainly.

Representative LONG. And recognizing the difficulty that they had in doing it, recognizing the point that you made that it has never been done before to the best of your knowledge, and recognizing that you are dealing with so many variables that you could hardly feed them all into a computer, it is still that one central issue which seems to cut all the way through this. Now, is this a correct assumption on my part?

Mr. HAUSMAN. Yes. I certainly think that is my reading of the blueprint. And I think you have interpreted correctly what I have said, and I hope I have not said anything wrong. The question that arises is I really do not know, nor does anyone, I imagine, exactly how large that might be. This might have a very small effect and not affect people too much, in which case the blueprint might be pretty close to being right in that area. It could have a much larger effect.

Representative LONG. Could I ask Mr. Pasternack if he arrived at a conclusion, and where perchance he sees us going from there to where we are now?

Mr. PASTERNACK. I just wanted to make one point at least to summarize after hearing all of the other panelists here, and to commend them on their work, because I think they have done a very great service in reviewing this report independently. I do feel relatively proud of the fact that we have come out reasonably well.

Representative LONG. As I say, I compliment you on it. I think you have done well.

Mr. PASTERNACK. I have also learned the validity of a law which I heard before I came to Washington which I now see is actually right, and that is a law of compensating errors. We saw that as we developed the report that every time we found one mistake and it moved the numbers one way, then we would also find another one that moved them back the other way. I think in hearing some of the comments of Professor Jacoby and Professor Hausman and others that we say the same thing. One says that our imports are too low because we have not considered enough domestic supply, and another one says the imports are too high, because we felt we had not looked at the price effects.

Representative LONG. I think there is another law that you could give a name to that relates to that, and it is valid, just as the compensating errors law is a valid one. I am sure Senator Humphrey particularly would remember the old bedsprings that used to have individual springs. They usually were not quite related directly, but they were all indirectly related to one another. If you would push one down in this corner, one would jump up somewhere else which you did not expect to jump up. This seems to be true in the economic situation we find ourselves in here today. Recognizing the complexity of your problem, I think the question I raised with Mr. Hausman goes directly to the reliability of the report and the recognition that you ought to move. If you could comment, I would appreciate it.

Mr. PASTERNACK. In fact, we did look at gross national product and personal consumption, and at least investment, employment, and productivity as a result of varying energy prices. We looked at oil at $11 a barrel, at $7, and at $4; and we tried to see what the effects would be of changing these prices if the prices do fluctuate on our gross national product. In the report, there is a table which compares and shows that at $7-a-barrel oil, gross national product in this case says this might be, on the average, a 3.7-percent increase over the next 10 years, and at $11 down close to 3 percent. In other words, there is an effect of higher prices on GNP. Now, what I believe Professor Hausman is saying is the next step that would be very nice to do if we were able to, would be to say all right, we have had higher prices, it has changed our forecasts, and effects on GNP, and now GNP will be growing at 3.2 percent instead of 3.7 percent, and let us go then and feed that back into the development of our earlier forecasts and see how that changes our forecasts of supply and demand.

Representative LONG. Perhaps GNP might not grow at all.

Mr. PASTERNACK. Perhaps, but at least as far as our analysis shows, it does not have that large an effect on GNP. So if you then recycled all of this, and we tried to do that, it was our estimate that the effects would not be that great. They would be only very small effects in our forecast, and again, we then have to do the same thing over, and over and over again until we have homed in on that particular level.

Chairman HUMPHREY. Would the gentleman yield?

Representative LONG. I will be happy to yield.

Chairman HUMPHREY. I wonder if you factored in what the unemployment rate would be?

Mr. PASTERNACK. Yes; we did.

Chairman HUMPHREY. And how close are you to what the Council of Economic Advisers predicts, for example, at the 3-point GNP growth? As I recollect, that would leave us with an astronomical unemployment. What have you done about that?

Mr. PASTERNACK. We did look at the unemployment over the next 10 years and forecast, you know, higher unemployment rates in the short term and declining unemployment rates as the years progressed.

Chairman HUMPHREY. Why?

Mr. PASTERNACK. Why? Well, basically, we felt that over a period of time, the economy was going to rebound from the condition it was in.

Chairman HUMPHREY. Not at 3.2 percent growth rate.

Mr. PASTERNACK. Yes; 3.2 percent growth rate in GNP over about a 12-year period, including the fact that it is down very low now, and it means it would be going up in the future.

Representative LONG. Mr. Globe, one question if I may. You are the only one that really treated the subject of conservation ethic to any degree. I have been one who has had a great belief that the psychological aspects of this whole economic problem has a great deal more bearing on the economy than we think. I have discussed this with Senator Humphrey a couple of times, and I believe it has a great deal more bearing on the economy than we give it credit for having. Is the public losing confidence and putting their $2 in their sock rather than going and spending it on a house or a new car? I find myself suffering from it. My daughter just wrecked the car she drives, and it was over $800 to get it fixed. Two years ago, I would have bought a new car. But this time I did not buy a new car. I got the car fixed. And I found myself being a victim of this psychological attitude.

I think that one of the side effects of a major energy conservation program on the part of the Government would be to show the American people that the Government, the executive branch and the legislative branch, are tackling the problem. It would be something they would come face to face with on a daily basis, and have a daily reminder that we are doing something about it, because we have been working extremely hard on it in Congress and in the executive branch for some months now. But I do not think we have been able to get our message across to the American people. Would not a major effort of conservation have the fringe benefit, in your opinion, of causing a revival of the public confidence in the ability of the Government to help in the resolution of our overall economic problems?

Mr. GLOBE. Mr. Long, I am neither an economist nor a social psychologist, but I certainly believe what you say is correct. And we discuss this matter at greater length in our review. Of course, I was restricted in my time in the statement that I made at the outset. But we do think that a public program with respect to the conservation ethic would be helpful with respect to the energy problem. And I think it may well, very well, have the additional effect that you have indicated.

I might add one other word which harks back to the subject we were discussing a few minutes ago having to do with the cost to society of increasing the cost of energy. I think it is an inescapable fact that if energy becomes more expensive with respect to other commodities—and we discuss this in our review—it is an inescapable fact that this economic cost must be paid somewhere. The question for policy decision is where, and how, to accomplish the distribution of that cost that it is decided must be borne somehow.

Representative LONG. Maybe one of you has a particular view. My time is up, but the chairman has agreed that I can use another minute or two. I have a particular political problem that I think relates to this, and I wanted the views of you on whether or not the political price that I pay for this is worth the gain. It is similar to what happened with respect to the race relations problem when I was in Congress many years ago. We never partcipated in all of this, even though I represented a basic Southern constituency that was not in sympathy with the positions I took. And as a result I got beaten for Congress. But so what? You can't win them all. Anyhow, I am in a similar situation today with respect to this energy problem. I come from the State of Louisiana which is a big oil-producing State. I really have no sympathy for the big oil companies at all. I headed the deep water port facility in Louisiana with the understanding, unfortunately unwritten, that it would not be turned over to the major oil companies, but it would be operated as a public facility. I am afraid that it is now moving in the other direction, and this greatly concerns me. On the other hand, let's look at the oil depletion question, and again I have no sympathy for the majors. But here on the floor of the House week before last we had this whole basic question of oil depletion and the continuation of the oil depletion for the small producers. And I understand what small is. I saw the cartoon in the Washington Post in the last day or two with the guys with the diamond rings.

I understand this, and they are not somebody that you can have any sympathy for because they are making a great deal of money. But they are basically like the Las Vegas gamblers, they roll it all out, and then see how the dice turns up. And I have stuck my political neck out to try to help them for two reasons. One, because of the fact that I am afraid that if this group of independents who find about 80 percent of the oil that is found in the United States are denied the depletion allowance, they are going to be even less able to compete with the majors than they are today. They will go out of business, they will sell out and get the capital gains treatment on what they have now, and we are going to end up with an absolute monopoly of the oil industry, which I think would make it even worse than it is today.

And further, to show how foolish I think the majors are in this regard, they are going to end up getting themselves nationalized in about 5 or 6 years. But you go and try to talk to one of the major oil companies about this, and they think that you are absolutely insane. But I really believe that as a political consequence, both of these are likely to happen.

Is the amount of oil that these independents find, which is somewhere between 75 and 80 percent of the oil that is found, is their continued economic vitality and competitive position with respect to the majors worth the political risk and the political scars that I get on my back for doing this? If I would go home and see everybody they would say: "Good God, you go up there and you sell out to the eastern liberal establishment." Then I come up here and everybody says: "You are down there trying to protect those big oil companies, and that is all you are trying to do." The fact is that I am not trying to do either one of them.

Chairman HUMPHREY. Join the club.

Mr. ADELMAN. If the question is addressed to me, Congressman Long, and I guess it is, I would suggest the package of repealing the depletion allowance, and also of the intangible expensing along with it, and eliminate price controls on old oil and natural gas at the same time.

Representative LONG. But is that not just going to help the majors because they are the ones that own the greatest amount of this oil that is in the ground at the present time?

Mr. ADELMAN. The depletion allowance favors the man with oil in the ground. It is an indirect, and therefore, inefficient way of inducing people to look for new oil. And what I am saying is a price will do it directly—a tax break does it indirectly—and use the efficient instead of the inefficient method.

Representative LONG. But the fact remains that over the years as a result of the tax loophole, gimmick, benefit or whatever you call it, depending on which side you are on, we have developed the method of finding the major part of the oil in this country by financing through this tax loophole. And that is where we find ourselves. If we do away with it arbitrarily, retroactively to January 1 of this year, and cut it out for the independents who find 80 percent of the major oil. how long is it going to take in the present economic circumstances to find a new method of financing the discovery and looking for oil in this country?

Mr. ADELMAN. Well, I do not think it is good tax policy or any kind of policy just to abolish an old arrangement and just pull the rug out from under people. I do think, however, that financing is always a subsidiary problem. The question is not how you are going to use the money you already have. The question is rather how are you going to get the money for a project that looks worth spending money on. Well, that is what banks exist for, and venture capital deals exist for, is that they bring together the good prospect with the people who have the money. And to say, as I note the independents keep saying, but they are wrong just the same, to say that it is the depletion allowance which finances their research is really to put the cart before the horse.

Representative LONG. But isn't the fact of the matter that over the years that has been the way that it has been done in the United States? I mean, it has been done through doctors, lawyers, and investment bankers, and other people that are in the 70-percent income tax bracket by taking their money and going and risking it at the crap tables by drilling an oil well.

Mr. ADELMAN. That is right. You are raising the stakes. You are raising the stake and at the same time saying that the Government is going to take a cut of it.

Now, I think on balance they are as well off and the country is better off.

Representative LONG. I think long range I would not argue the point with you. I think the intermediate problem is the one that causes me a great deal of concern.

Excuse me. Mrs. Heckler.

Representative HECKLER. I have enjoyed this. It is too bad that Senator Humphrey has left because I would like to tell him the difference between the Massachusetts problem and the Minnesota prob-

lem. They may be receiving an aching back in Minnesota, but we are threatened with rigor mortis in our economy. We do cry louder perhaps, but our problems are more intense.

I really appreciated all of your testimony, and I thought Mr. Globe's statement valuing the importance of the energy resources was significant, because we can, and this is why it seems that the economic stress of our constituents due to energy increases is so significant, and has to be addressed by Government I think because there is no other alternative. We can choose to send our children to college, to MIT if we can afford it, or if they are bright enough to get in, and we can also insist they pay their own way, but in terms of energy there are certain essential needs that not only industry but the public faces and, therefore, there has to be a way for Government to address this, it seems to me.

Now, I am very concerned about the availability of capital for utilities. If I were to describe at home my sympathy of the need to recruit capital for utilities I would find myself being booed by any audience. But in fact, we do have to face that problem. And you have touched upon it in your comments.

Now, I am wondering about the reason the FEA report did not go into this issue, and whether it is because perhaps they were assuming a decrease in the inflation rate and the interest rate which might attract more capital. My question is: Assuming that we can diminish inflation to some extent, and if the interest rates continue to go down, would that by and of itself, would those two factors be sufficient to attract capital into this sector? How serious, in other words, do you feel this question of investment, and this is for you, Mr. Adelman, the question of investment in public utilities and attracting investment is? What would the Government do about it? Is it a very serious question? It seems to me that it is, and if it is, what should we do, what would be the best tax policy?

Mr. ADELMAN. I do not think the question there is tax policy. The problem is really regulatory policy and it is the States' for the most part, not the Federal Government. The regulatory system is essentially a return on historical costs which works well enough when prices are reasonably stable. It does not work when prices have gone up, when the prices of capital equipment have gone up especially fast, and when interest rates have gone up along with them.

The result is that at current prices or rates it is impossible to raise the capital needed to expand capacity. And this is the basic constraint or iron cage that we are pressing against today.

Representative HECKLER. Then you would not suggest an investment tax credit in a public utility field which would reflect the real problems in attracting capital to that sector?

Mr. ADELMAN. I do not think it would be adequate. I cannot claim that I have tried to analyze any such proposal, and I would like my colleague, Mr. Jacoby, to take a crack at this. But I do not think an investment tax credit can do it.

Furthermore, part of the difficulties with the utilities today is the result of their having used an investment tax credit in earlier years. This eroded the base and, of course, has given them an even smaller amount of current revenue today. And so what looks like a good idea for using the tax system, you are sorry in the long run that you did.

But there is one, one note that I would like to strike which I am afraid will only serve to thicken the gloom, but we might as well get it out on the table, and it is part of the whole report. The energy industry is looking now at oil, gas, electric power, coal and so on, which have accounted for only about 4 percent of the gross national product in the past, but about 20 percent of private capital investment. They are going to account obviously for a great deal more and everything that is proposed, things that we may favor, indeed, are going to expand that proportion.

We are seeing the result of it already, and that is a continuing inflation in the prices of capital goods, and a strain on interest rates as well, which is not just a temporary stringency, but it is something that we are going to face for a long time. This has a distorting effect which is going to be felt in just about the whole gambit of economic activities, and it may have an effect on the GNP as well, which we have not stopped to explore. So if you and I think things look bad, I am saying they may be really worse.

Representative HECKLER. You do not foresee any decrease in the interest rates?

Mr. ADELMAN. Certainly interest rates have already decreased and may very likely decrease further, especially if the recession bites even further. But putting aside these changes which are caused by general inflation, and by fluctuations in the GNP, what I am saying is that as long as the energy stringency continues, we are going to have a pinch on the supply of capital which will be felt right throughout the economy.

Mr. PASTERNACK. Mrs. Heckler, may I add a couple of points here? I would like to correct what appear to be a misapprehension and a misunderstanding about what we said about electric utilities. We made a statement in our report which says that the most pressing financial problem in the energy sector relates to electric utilities. We estimated that the whole energy industry would require over $450 billion in capital over the next 10 years, and of that $450 billion something like $320 billion would be required by electric utilities for electric power. And in fact, that is the area which has the most difficulty raising this capital. If there are any problems in raising capital, the types of plans that are postponed and cancelled are the coal and nuclear plants which are the most capital intensive, and the ones that take the longest to build.

What we will either see if this trend continues is either a heavier reliance on oil and gas plants, if we can find the oil and gas, or some severe power shortages in the next 5 to 10 years. And of course what they lead you to and led the President to was a very difficult decision, because as you know it is not popular to say the electric utilities need more money, and higher rates, and more things in their rate base. It leads us to a very limited set of regulatory reforms, mandated regulatory reforms in legislation which we have submitted as our Independence Act.

Representative HECKLER. My question was really related to the criticism of point 4 of the cooperative statement [1] in which there is a reference to the FEA study and its worries about investment in public utilities and so forth, and yet you would evaluate, or the critics evaluate the FEA emphasis somewhat differently than the Agency did.

[1] See the prepared statement of Mr. Adelman, beginning on p. 97.

Mr. PASTERNACK. Well, I think what the critics have said is that despite the fact that we were highly pessimistic about the ability of utilities to raise capital and their problems of raising capital, that we were not pessimistic enough.

Representative HECKLER. That is exactly right. I was trying to find out whether the decrease in interest rates and some significant improvement in the fight against inflation would minimize the gloom of the critics?

Mr. JACOBY. May I try and answer that? I think to be fair they have worried a lot about this in the report, and our comment, if I may clarify it slightly, is not that they do not worry about it, that they did not think about it, but it is not run through the machine in a sense. They have a giant machine that they put in problems and they crank out numbers. The fact that they run it through the machine gives them a certain status in the report. This particular report was not given that status, and it was really a reflection of the amount of time they had and the priorities that they set. I think it is fair to say that anything that would lower the cost of capital to a utility will help to some extent. Interest rates come down, and to the extent that the inflation rate is reduced, then the driving engine that is creating this problem is to some extent slowed down. And so that the gloom lightens somewhat. But I think it would take a rather dramatic reversal in inflation, perhaps more dramatic than we can reasonably expect, and more dramatic reduction in interest rates than we can expect to have a great ameliorative effect.

By the same token, it might take a very large investment tax credit to solve this problem, because the origin of the problem is in the State regulatory procedures, and the clearest way to solve the problem would be to allow rates of return, nominal rates of return on historical costs as we now see them perhaps in the range of 16 to 20 percent, whereas now it is hard to imagine anything above 12. Or an alternative would be to redefine the way that that accounting is done so that a rate case is not based on information that is 2 years old.

I think that our gloom is a reflection of what we sense is the extreme difficulty of adjusting that system, that system because you involve I think 44 or 45 State regulatory commissions, and some States have no commissions at all, so it is a legislative tangle of major proportions. One of the suggestions that has been around that would help would be direct Federal involvement in the purchasing of utility bonds, which is once again another way to lower the capital costs. I am afraid that no one has come up with the magic sword that will cut through this knot in what appears to be an easy way. We certainly have no suggestions like that.

Representative HECKLER. We have all been sharing gloom today, but I think our perspective has been one of searching for answers rather than fulfilling the prophecy of gloom. And I am convinced that we will find a way to avoid that fulfillment because first we always have in the past, and also because we simply must. Mr. Pasternack, you have heard all of the critics, and they have been very friendly I think, very gentle. And I did not have the benefit of hearing all of your testimony, but I have scanned it here and will just reflect upon it at length later. I am concerned with the report itself and what the Agency was trying to do. What was the FEA trying to accomplish, trying to prove? Were you trying to set out the options for energy policy, were you trying to develop some rigid projections?

Mr. PASTERNACK. No; and I think that is a very good question. We did not set out to solve the problem in this study. What we saw the study as doing was providing the information from which to argue, and from which maybe to provide some areas of agreement that we did not have in the past. And in fact, as you know, that is the purpose it has served. As Mr. Zausner indicated when he was making his statement at the beginning of this hearing, the Senate Democratic leadership and the House Democratic leadership in their plan under Senator Pastore and Representative Wright actually utilized the data in the report in order to develop their alternatives. And they had different policy options. They did not agree with us on everything by far, but they at least used the same data and worked off the same base.

Representative Heckler. How can experts differ so using the same statistics and the same data? How is it that you could reach so many different conclusions? There are differences in degree, of course, and they are not diametrically opposed in every instance.

Mr. PASTERNACK. In fact, Mrs. Heckler, the differences are not in terms of thrust or concept of where we want to be or even how we would want to get to where we want to be. Both groups, and all of the other plans that have been surfacing over the last month or two, all agree on some basic facts. They agree that we have a problem, that we have no choice in the next few years but to start conserving energy more wisely, that domestic supply is declining, and there is not much we can do about it in the next few years. They also agree that we cannot just look at either supply increasing or simply decreasing our demand. We have got to have some combination.

Now, where the strategy differs is the extent of Government involvement, the extent of controls, the timing.

Representative HECKLER. The really hard questions.

Mr. PASTERNACK. Sure. But in fact, any set of options where you go with a quota system, or an allocation system, gasoline rationing, gasoline taxes, across-the-board increases, all of those can get to the same desired results. It is just a question of what effects you are willing to live with, and what impacts you know you are willing to bear.

Representative HECKLER. Did the FEA bring in any outside experts in the compilation of your report?

Mr. PASTERNACK. Some people say we brought in too many.

Representative HECKLER. Is that right?

Mr. PASTERNACK. We had something like over 40 different consulting groups.

Representative HECKLER. Outside of Government, I mean.

Mr. PASTERNACK. Outside of Government. As I indicated earlier, Battelle Institute, which was one of the groups here, actually worked on a part of this study. MIT was involved at least in reviewing some of our materials as we went along, and in a number of cases we had universities. We also had consulting firms like Arthur D. Little and some of the other major consulting firms. We had both industry and consumer groups looking at the reports, and we tried to bring in as many experts as we could.

Representative HECKLER. Thank you.

Representative LONG. Thank you, Mrs. Heckler.

Mr. Pasternack, both the MIT study and the Battelle study seem to indicate that perhaps the PIR report underestimated the role of natural gas in satisfying demands over the next few years. If so, then

perhaps it overestimated the need for oil, as we were discussing earlier, as a result of that. Do you generally agree with their conclusions, and do you think I am correct in my point?

Mr. PASTERNACK. Well, Congressman, a couple of points on natural gas. One thing that was indicated was that we did not assume any effects of controls on natural gas, we looked at natural gas as being deregulated sometime over the next 10 years. We did, indeed, make an estimate which we put into the summary of our report saying that if natural gas were not deregulated, and were kept at the current prices, which at that time was 42 cents, I believe——

Representative LONG. I wonder if some time in the next month or so, you would talk to your people about getting with us on some recalculations on this, assuming the different stages of deregulation of natural gas, using the additional information that you now have available from MIT and Battelle, and using the different stages of deregulation of natural gas?

Mr. PASTERNACK. We would be perfectly happy to do that. But as I was saying, we did, in fact, estimate what the demand and the supply would be at lower priced, or regulated natural gas. We estimate something like a 40-percent decline in natural gas production if prices remain regulated.

Representative LONG. I do not think there is any question that most everyone here felt that these were perhaps very low, and if you over at the FEA could do a reevaluation of that during the next 30 days, which ought not to be a difficult thing to do, we would be appreciative, and we would like to have it.

Mr. PASTERNACK. We will do that.

Representative LONG. I think we are about through here. Mr. Globe, you had a couple of questions that did not really require major policy considerations on your part, but you indicated in your statement two things that were of interest to me. One, that there were perhaps some substantial savings in the air transport business that might be available. What specifically did you have in mind in that regard?

Mr. GLOBE. Well, these were suggestions more of things that ought to be investigated and perhaps experimented with. But, for example, there is a considerable difference in the fuel efficiency depending upon the size of the plane. The number of Btu's—which is a measure of energy content—per passenger mile, say, is less for a large plane, a 747, one of those, than it is for the smaller planes, and so it is possible to save. Now, to make the thing somewhat more concrete, for example, many of the airlines have been somewhat disappointed in the extent to which they have been using their 747's. They have sold some of them. If the characteristics, if the nature of the fleet were to be changed, and you were to have fewer flights and larger planes—now, of course, you pay a price, that means that flights are not so available—but if you were to do that, then you would have a savings in the utilization of fuel. That is changing the flight mix. And you might find changes by changing the route structure. To do this perhaps depends on regulatory changes, but that is a possibility. You might take certain steps which would increase the load factor, that is the number, the percentage of seats that are filled. At the present time the various airlines compete with each other, and by various policy options, or perhaps by instituting certain taxes, or making other

regulatory changes it would be possible to force an increase in the load factor. Again that would be an inconvenience to the public, but this would save energy.

In general the use of airplanes for transportation of people is not terribly energy efficient, and so this is a place to save a little bit of energy if you were to do some of these steps.

Representative LONG. You also indicated perhaps you had some ideas with respect to fuel economy in the automobile industry that you did not set forth or that were not set forth in the FEA report.

Mr. GLOBE. Yes. There are a few such ideas. I do not want to imply that they are revolutionary. In fact, the PIR was about as complete on this subject of possible changes in automobile design as on any other. But there were a few ideas, like combined engines, a combination of an electric engine with an internal combustion engine which offers the possibility of some additional savings of fuel. It might be possible for example, to make radial steel tires mandatory. That saves a little bit of fuel, and there are a few other ideas of this kind contained in our review which were not contained in the PIR. The PIR does mention steel belted tires I believe, but does not consider the possibility that they would be made mandatory.

Representative LONG. Mr. Adelman, I have been sort of on the fringes of this business and watched it over the years and one thing always has concerned me. I have never understood this, and I am not sure anybody does, but I know you are well recognized as an expert in this field. Perhaps you could shed some light on it for the committee. There have been a number of witnesses before the committee in the last few weeks who have suggested that in a lot of circumstances the international oil companies prefer to import certain amounts of oil in preference to producing it domestically. This, of course, means that they could utilize their tanker fleets, many of which are now lying idle over the world, and avoid friction with foreign producing nations in some instances. And incidentally, they could hold back domestic reserves in the hope of price decontrol, which might well happen. If this is true, then our conservation efforts may be brunted in reaching the objective of importation limits, which is what does concern us. These witnesses have advocated import quotas to force full production from domestic wells. What is your judgment of this problem? Now, is it a manageable problem at all, or is it an unmanageable problem?

Mr. ADELMAN. The problem is that a company will be guided by where it makes the most profit after taxes, and there is no way of controlling this unless you put a physical limit on imports. A tax, that is a tariff or excise, or the combination such as the President proposes is irrelevant. It does not touch on this main problem.

Representative LONG. Yet on the other hand, nearly all of the economists across the spectrum, from liberal or conservative, Democrat to Republican, who have appeared before us in the past 6 weeks have been of the view that had we imposed within a 63-day period the $3 increase in the import duty, plus the decontrol of domestic crude oil, that on the already declining economy the result would have been economically disastrous for the United States. Consequently, under the present economic circumstances it does not appear to be an answer at all.

Mr. ADELMAN. Well what I am saying, Mr. Long, is that if you set aside this very unfavorable effect on the economy and ask simply what does it do about control of imports and national security, the answer

is it does nothing whatever, because it is not addressed to this question of where does a company find it is more profitable to produce. And a foreign government can, I think, without too much difficulty make it worth any company's while to produce more abroad and less at home. And it is for this reason that the import security problem has simply not been addressed by anything that has been proposed thus far.

Representative LONG. That is right.

Mr. Globe, the Ford Foundation energy policy report was prepared by Mr. Freeman. I had the opportunity to hear him over at the Library of Congress one night discussing this matter, and he emphasized energy conservation most heavily as an alternative to all out energy production. He stated, as best I can recollect it, that the conservation route would require substantially less investment per barrel of import production than the energy production route would require. Of course, this assumes that it is obvious that the Government is going to play a large role in regulating production activities and fostering conservation. This tradeoff, so to speak, becomes a question as a relevant matter of public policy and one which I have personally been giving a good bit of consideration to. What is your judgment about the validity of Mr. Freeman's public statements in this regard or his views in this regard?

Mr. GLOBE. Well, I must say to start with I have read the summary review that they put out. I have not read all of the parts of the Ford energy policy project. My personal view of the matter, and I think the view of, the consensus of view of the people who did the review would be that especially that case three, whatever they called it—the very extreme conservation approach—is too extreme and probably untenable. In fact, what I mentioned in my prepared statement was that there is a combination scenario that the PIR suggests, and I think the consensus view by the Battelle viewers is that is probably what we need, that we cannot rely—we dare not perhaps rely—on conservation alone, because it would create too much dislocation within the country, but that it is necessary to have a public policy which stresses conservation and, in fact, this is almost unavoidable for the immediate future. That is one of the points that I think the PIR teaches us.

Representative LONG. Extreme conservation there ends up having about the same economic effect as what I was speaking of before with Mr. Adelman with respect to the rapid increase of import duties and deregulation upon the economy?

Mr. GLOBE. Yes; but so we need this combination and that raises difficult problems of public policy, because things that you might do favor reduction in the demand for energy, may be opposite to the things you might want to do in order to permit some accelerated development, as the PIR calls it. This puts an extra twist into a Gordian knot, as it were, but it has to be faced. So to answer your original question, the extremist view of conservation that the Ford energy policy project suggested probably is too extreme and conservation alone probably, in our judgment, will cause too much dislocation. And the combination in one way or another is what we have to face.

Representative LONG. Gentlemen, let me on behalf of the committee express our sincere appreciation for your taking the time required to prepare your testimony for today, and for coming down and being

with us today. I think you have made a substantial contribution toward what we are trying to do and to explore here, and we are most appreciative.

Do any of you have anything addition that you would like to leave with us? If not, the hearing is adjourned. Thank you again.

[Whereupon, at 12:35 p.m., the committee adjourned, subject to the call of the Chair.]

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