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HEARING

BEFORE THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

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

NINETY-SECOND CONGRESS

FIRST SESSION

ON

ENERGY GOALS AND NATIONAL GOALS

OCTOBER 20, 1971

Serial No. 92–11

PART 1

Printed for the use of the
Committee on Interior and Insular Affairs

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
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NATIONAL GOALS SYMPOSIUM

WEDNESDAY, OCTOBER 20, 1971

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

The committee met at 10 a.m., pursuant to notice, in room 3110, New Senate Office Building, Senator Henry M. Jackson (chairman of the committee) presiding.

Present: Senators Jackson (presiding), Allott, Gravel, Bellmon, Hansen, Stevens, and Randolph.

Chairman JACKSON. The committee will come to order.

This symposium on energy policy and national goals is being held, pursuant to Senate Resolution 45, a resolution adopted May 3, 1971 which authorizes the Interior and Insular Affairs Committee with ex officio representation by members of the Commerce and Public Works Committees and the Joint Atomic Energy Committee to conduct a 2-year study of all aspects of national fuels and energy policy.

At the outset we must continually remind ourselves that energy policy is not an end in itself. Energy is the tool and energy policy is the method of directing the useful employment of that tool. Energy policy must, therefore, be considered against a larger background than simply the problem of meeting society's growing demand for energy supply.

Energy policy should be designed to promote and obtain a broad range of generally agreed upon national goals, many of which are only indirectly related to existing or proposed energy systems.

National goals are by necessity a set of abstract expressions of the desires and aspirations of the American people. They are found in the Constitution, the laws and regulatory practices of government. They are a reflection of traditions, culture, ethics and hope of the American people. The Nation's goals provide a framework for analysis within which existing and alternative policies can be considered and tested.

Energy policy is the means of achieving national goals and one test, perhaps the only test of energy policy, is its contribution for obtaining the social and political conditions expressed on goal declarations.

The committee has invited a number of prominent individuals representing many different points of view to submit papers and to participate as panelists in a discussion of the relationship between energy policy and achievement of our Nation's goals. Copies of the papers have been circulated to all members and ex officio members of the committee for their review and will be printed in the record in full.

The committee welcomes the views of all interested parties on this subject, and the hearing record will remain open to receive additional statements.

We are fortunate to have with us today many of the individuals who have submitted papers and who will summarize their views for the committee. To accommodate the number of participants we have today the Energy Policy and National Goals Symposium will be held in two sessions—this morning and this afternoon beginning at 2 p.m.

To open the proceedings, I will ask that each participant give a brief summary or treatise of his paper. The symposium will then be open to questions and a general discussion of energy policy and national goals.

We have with us this morning Dr. Cambel, vice president for academic affairs, Wayne State University; Carl Bagge, president of the National Coal Association; Mr. Bradshaw, president of the Atlantic Richfield Co.; Dr. Earl Cook, associate dean of the College of Geosciences, Texas A. & M. University; Mr. Frank Ikard, president of the American Petroleum Institute; Mr. Mike McCloskey, director of the Sierra Club; Dr. Fred Singer, professor of environmental science, University of Virginia; Dr. Alvin Weinberg, director of Oak Ridge National Laboratory; Mr. M. A. Wright, chairman of the board, Humble Oil & Refining Co.

Before we proceed, some of our members may have a statement.

Senator ALLOTT. I have no statement I wish to make at this time, Mr. Chairman.

Chairman JACKSON. Senator Bellmon.

Senator BELLMON. I would like to emphasize the importance that I think ought to be placed on the study which begins today. In my opinion, there is no question of greater national importance than the question of where we go in the efforts to find an adequate and dependable supply of energy in this country.

In my opinion, our national security as well as our continued industrial activity raises many environmental questions which are going to have to be determined upon the security and abundance of the energy supply which we have. I feel that to some extent our Nation has been spoiled over these last years because we had an abundance of reliable low-cost energy sources, and many have taken for granted this will always be our condition.

Now, increasingly we have come to realize we are face-to-face with a very serious energy crisis, and unfortunately many who are in the position of making decisions haven't faced up to this reality.

It is my hope that one of the things we can accomplish in these hearings is to make people realize the situations we face now in the energy field. As one who comes from an energy State, I know we no longer have any substantial oil producing capacity. I know our natural gas supplies are not adequate to meet the needs of new customers and it won't be long before we will not be able to meet the needs of old customers. I know our coal industry is not going to be able to enlarge as rapidly as it should.

It is my observation that the industry is somewhat demoralized, and is in need of new direction and encouragement both of a political and financial nature, and I am hoping this study will be able to provide these incentives.

I feel that it is important that for many years the energy industry has been somewhat of a whipping boy for individuals who consider themselves to be consumers' advocates, and yet it is the consumers' best interest that this study is all about. It won't matter as to the supplies if we don't have any supplies available.

So, I feel this study can help us find out where we are so far as energy is concerned, and hope we can decide where we want to go and discover what the options are, and then begin to get direction.

We have lost a lot of time, and I want to congratulate our chairman for having gotten this study underway, and I believe it will render a great service to our Nation that will have an effect on our development for a long time to come.

Senator Gravel (presiding). Thank you very much, Senator.

We will now hear from Dr. Cambel.

STATEMENT OF DR. ALI BULENT CAMBEL, VICE PRESIDENT FOR ACADEMIC AFFAIRS, WAYNE STATE UNIVERSITY

Dr. Cambel. I shall limit myself this morning between the relationship of energy and the environment. I don't mean the physical environment, but the entire environment, economic, social, and everything that is included.

In the material that was submitted to us, mention was made of national goals, and obviously national goals include a healthful environment in which we would like to live.

At one point the details are here in the oral presentation, but by every indicator of national goals we look at, we cannot do so properly unless we have plentiful, cheap, reliable, and clean energy.

I would consider, therefore, that energy should be taken as a social force and that it is a very crucial resource in our lives.

There is much controversy these days that energy is hurting the country, and one often finds conservationists making some very valid judgments. By the same token, we cannot stop the economy of the country; we cannot slow down the the growth of the GNP, which is very closely related to energy, as has been shown before.

Basically, then, our energy will continue to increase, in my opinion, not only because we cannot slow down the growth of the GNP, but because we are not close to having zero population growth.

Both because of the increase in the GNP and the increase in population, I suggest that the growth of energy will continue to increase and will stabilize around 6½ to 7 percent. It is now approximately 5.2 percent. Namely, the rate of increase, I ascribe about 4 to 5 percent to increased standard of living, which all the people want, and I ascribe about 2½ percent to a reduced population growth, but still far away from ZPG.

I am delighted that such an effort is being made to develop a national policy, and I think in doing so we have to develop certain awarenesses.

One of them is that there are certain myths about energy.

Second, I think you will have to develop the courage to change our institutions, our institutional structures and, third, I think we have to reestablish certain programs in energy R. & D. which presently are practically extinct.

To consider how much energy we consume as a person, this is approximately 200,000 calories per day, but those of us who are trying to keep our weight down probably don't go above 2,000 calories per day. So much of it, then, is used in the economic and manufacturing sector.

I contend that there is no shortage of fuels if we assume that there are many types of fuels and that energy being——

Senator GRAVEL. Excuse me. Doctor. If you are referring to pages, or if you are talking about information you have in your document, maybe you can just give us page numbers.

Dr. CAMBEL. I am doing both, Senator. I am on approximately page 14.

Senator GRAVEL. Very well.

Dr. CAMBEL. The shortage is not in the fuel supply, because we have literally billions of years of fuel. Where I think the shortage is is to convert the fuel supply into the proper energy that is useful.

On the other hand, that does not mean that there is no limitation on energy usage. I contend that that limitation is ecological and if we continue producing energy in ever increasing amounts, we will have trouble, as has been shown before. But I think we have a long time to go, provided we know at what rate we should increase.

I suggest that if we increase at the rate of 6½ percent, which I suggested, we will have some major atmospheric problems within the next century, if not less. I would call that so monumental, I would call it a castastrophe. If it is an increase of only 2½ percent, I do not believe the danger is as eminent.

Therefore, what we will have to do is to develop means whereby energy dissipation is minimized, although energy usage is increased.

Second, I come to institutional improvements and I think that we have to make some major changes in our energy institutions and in the Federal Government I would recommend that there be established one or two departments of energy and environment. I said one or two, maybe even more.

I would like to submit it would be healthy to have competition among Government agencies, just as there is in the private sector.

I think we will have to realize that certain aspects of energy work have to be done by the private sector, and certain work by the public sector, and we should learn to separate these, because I think we can make better use of our economic resources.

Furthermore, I would suggest that the Federal Government should consider modifying its antitrust rules, regulatory agency procedures, and taxation to allow the private sector to do more work in the energy sector.

I would also like to find means whereby State regulatory agencies may be modified into regional agencies, because pollution does not know State boundaries. The distribution of energy is not confined to State boundaries, therefore it seems too limiting to devote this only to the State regulatory agencies.

Finally, I would like to indicate certain major areas of research that I believe should be pursued. I consider the major problem to be a lack of understanding of energy management and administration. I think more work needs to be done in systems analysis of the whole energy sector, rather than dealing with its components. I believe we have to do soft research as well as hard research. Most of the previous work is technological hard research. I would submit that more work should be done in the soft area in determining what is socially good.

Finally, I would like to submit that new areas of scientific work be done and that some of the people who are now unemployed from the aerospace industries, electronics, should be invited to come into the energy sector.

I would also like to submit that universities should do more, because our youth today are very imbued with a social awareness and the hope to improve the needs of the country and I think energy provides an opportunity. I think they should be given a positive opening to pursue their studies and at the same time be of service to the Nation.

Thank you very much.

Senator GRAVEL. First of all, I would like to introduce Senator Randolph. Senator Randolph is one of the key sponsors of the study, and we are very happy to have you here.

Thank you, Dr. Cambel. As a matter of format, since we do have such an array of talent, if other participants would similarly confine their remarks to a brief synopsis of their prepared papers, then we could probably engage in a symposium type questioning after all the presentations have been made. This is not to exclude any member here from asking questions at the end of each speaker. In the interest of order and in the interest of a broader discussion, because one question addressed to one might well be answered by another person, I offer that as a format and if there are questions at this time, we will take those. If not, we will move on and try to question at the end.

Senator ALLOTT. Mr. Chairman, I don't have any questions, but I do want to make an explanation. I just received a note that I have to be on the floor in 2 minutes and I will be gone for an indeterminate time, not too long, but I don't want any of the panel to think I am unmindful of what they have to say here.

Senator GRAVEL. Very well.

Mr. Bellmon?

Senator BELLMON. No questions at this time.

Senator GRAVEL. Senator Randolph?

Senator RANDOLPH. Dr. Cambel, it seems others of us must also go to appointments we have. I have a group of West Virginians here and we have an appointment with Secretary Romney. It is a matter of some work to get the appointment set and these people have come several hundred miles.

So, I came by at this moment to say that I shall want to return as quickly as I can to hear the testimony which is given.

Mr. Chairman, only this one thought, and if it is flag waving, I will say that the doctor waved it first. But perhaps it would be good for several of us to do it.

> As analyzed, the citizens of the United States of America take the continued well-being of this country very seriously and not for granted.

I commend you for those words. I remind those members of the committee who are present, our guests and participants who are in the audience, that in another way George Washington uttered that expression when he said:

> Citizens by birth or choice of a common country, that country has a right to concentrate our sections.

So, I just want you to know that I think it is not policy and issue. I think it is important for a man like you, a naturalized citizen, for all of us to express, as you have done, as you go into depth and scope on the problems that we are considering, let it be known that you are intensely interested in this Nation and its future.

Dr. Cambel. Thank you.

(Dr. Cambel's prepared statement follows:)

Socio-Political Aspects of Energy*

by
Ali Bulent Cambel
Executive Vice President
for Academic Affairs
Wayne State University**

*presentation prepared for a symposium on Energy Policy and National Goals before the United States Senate Interior and Insular Affairs Committee

**For Identification Purposes only

INTRODUCTION

As a Naturalized Citizen of the United States of America, I take the continued well-being of this country very seriously and not for granted. Any mention of "National Goals" evokes in me the image of Uncle Sam, with his feet firmly rooted in our Constitution and the Bill of Rights with his eyes gazing at the future's horizon. Without plentiful energy this horizon would become clouded.

I consider it a distinct privilege to be given the opportunity of making a presentation before the Senate Interior and Insular Affairs Committee. I should admit that I am biased about the concept that energy contributes to national welfare. I had the privilege many years ago of directing a study[a] mandated by President John F. Kennedy. Many recommendations contained in that study are reflected in President Richard Nixon's message[b] to the Congress.

Finally I consider it a distinct privilege to speak on behalf of and in connection with Senate Resolution 45[c].

Before commencing my remarks I should note for the record that I am speaking as an individual and not as a professor or as senior executive officer of Wayne State University.

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[a] Energy R & D and National Progress, Ali Bulent Cambel et al. U. S. Government Printing Office, Washington, D.C., 1965.

[b] Clean Energy, Message from the President of the United States, 92nd Congress, Document No. 92-118, June 4, 1971.

[c] Legislative History of Senate Resolution 45, 92nd Congress, U.S. Government Printing Office, Washington, D.C., 1971.

I should note also that the recent concern about energy is a salutary one. When I got into energy more than a decade ago, few, if any persons could see that we were on the brink of a serious problem. I am indeed gratified that in the intervening years energy has been recognized as an entity which can no longer be treated haphazardly. That the United States Senate is taking an active leadership in the resolution of the problems we face is right and proper. Also, it is comforting to know that the Congress and the White House are concurrently directing their attention toward energy problems.

THE IMPORTANCE OF ENERGY AS A SOCIAL FORCE

The Relationship Between Energetics and the total Environment

I shall limit myself to how energetics relate to the environment. By environment I mean the total environment, not just physical pollution. I mean the entire complex of physical and physiological factors as well as the socio-economic, political, spiritual, ethical, and cultural circumstances which surround individuals and groups. Directly or indirectly, energy contributes to all of these. In other words, energy must be considered as a social force. Perhaps it should be considered as one of the social indicators now being proposed.

Enunciations of National Goals and Their Dependence on Energy

Officially, at least, the concept of National Goals goes back about two decades when President Dwight D. Eisenhower established the Commission on National Goals. The Commission's "Goals for Americans" 1960 is well known. I consider it a distinct act of courage on the part of President Eisenhower to raise the question at all because we Americans have always emphasized individual freedom and have traditionally frowned upon manifestations of statism with their "Five (or Ten) Year Plans". For political reasons of national and international character the so-called "goals report" became a sleeper. Nevertheless an ever accelerating interest in the study of goals has more recently become related to terms like "priorities"[a] and "social indicators"[b,c,d].

As yet there is no agreement in the choice of social indicators

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[a]See for example "Goals, Priorities and Dollars" by Leonard A. Lecht, The Free Press, 1966, New York.

[b]Toward a Social Report, U.S. Department of Health, Education and Welfare, U.S. Government Printing Office, 1969, Washington, D.C.

[c]Social Indicators, Reports and Accounts: "Towards the Management of Society" by Michael Springer; The Annals of the American Academy of Political and Social Science, Vol. 388, March 1970.

[d]Social Indicators, edited by Raymond A. Bauer, The M.I.T. Press, 1966, Massachusetts.

but let us take as examples of indicators those discussed in the Cohen Report[a].

Logic would dictate that Chapter I on Health and Illness was well chosen because this is certainly the priority item of any nation. Yet, how can one expect to provide comprehensive health care without sufficient and reliable power to operate a modern hospital containing intricate operating rooms, therapy equipment, etc. Granted the existence of a modern hopsital, how can it be useful to the population sector which needs it the most without a proper transportation system which would carry its ill patients to and from the hospital.

The second chapter addresses itself to Social Mobility and emphasizes the importance of education and job opportunities. How in the absence of abundant energy can we manufacture building materials that are used in the construction of school and office buildings as well as manufacturing. How can we possibly educate people for jobs and keep them employed without the energy necessary to build the facilities and operate the plants which make jobs possible.

The Cohen Report addresses itself next to our physical environment. How possibly can we provide a proper and livable physical environment unless we learn how to provide energy with a minimum of pollution and thermal dissipation.

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[a]Toward a Social Report, U.S. Department of Health, Education and Welfare, U.S. Government Printing Office, 1969, Washington, D.C.

In Chapter IV the Cohen Report deals with jobs and poverty. Considering the former how can one provide jobs unless there are office workers to perform the transactions of buying of manufactured goods and people with jobs who have the money to purchase them. How can one provide services unless someone earns sufficient money in a blue or white collar job to pay for the services?

The fifth item is Public Order and Safety. These too require convenient and reliable sources of energy for maintaining effective and versatile communications as well as quick responding mobile units. Once again energy is of paramount importance.

The sixth chapter deals with Learning, Science and Art. Again, people need jobs to enjoy these. Only with plentiful energy can there be jobs. Further, singling out science, it might be mentioned that certain modern laboratories can be situated only in those localities where electrical energy is plentiful. Even so, such facilities use so much power that they can be operated only in the midnight to morning hours when the drain on the supply of electricity is minimal.

Further, I can testify from experience that educational, cultural, and other related institutions tremble at the prospect of utility cost increases every time they prepare their budgets.

The last chapter in the Cohen Report deals with Participation and Alienation. Even these are related to the energy sector not only because our youth expects education and employment, but because youth is deeply concerned with pollution and resource utilization, two major factors in the utilization of fuels and the generation and distribution of energy.

Clearly energy is a social force.[a]

DEMANDS FOR ENERGY[b]

Along with health, food, shelter, education, and a clean environment, plentiful and reliable energy is a necessity for a productive life.

The Range of Energy Needs

The need for energy is a reality in both developed and emerging nations. In many countries sporadic power failures occur so frequently that a complex urban society with its modern high rise buildings dependent on high speed automatic elevators and year-round air conditioning cannot be established. Without plentiful electricity, modern city architecture could not have achieved its present level of sophistication. The availability of energy is necessary also for the formation of megalopolises studding the country. In turn energy is needed for the motive power of transportation vehicles which must abound if megalopolises

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[a]"Energy and Its Impact of Society" by Ali Bulent Cambel, Paper presented before the 1967 American Power Conference in Chicago, Illinois.

[b]"Impact of Energy Demands" by Ali Bulent Cambel, PHYSICS TODAY, December, 1970, p. 38.

are to be viable. Without plentiful and reliable energy our industrialization would be slowed and there would be little hope for increase in productivity. Our business sector, dependent on high speed data and order processing, and modern communications, would be paralyzed. Even in our agricultural farmlands a power failure would be serious because our food industry depends on machinery. Should a power failure occur on a modern dairy farm, for instance, the entrepreneur farmer would not only take a product loss because his milking machines could not function; in addition the health of his cattle would be endangered because today there are few farmhands who can milk a cow manually.

Energy and Our Changing Lifestyle

Clearly the abundance of energy in the United States has changed our lifestyle as a society and as individuals. We cannot, we must not allow ourselves to conceive of means to reduce the availability of reliable energy and power. Were we to do so, and this must be emphasized, *our hope of improving the living standard of our poor would be diminished* as is so vividly demonstrated in Fig. 1 which shows the close correlation between the per capita energy consumption and gross national product.

The Impetus of Human Aspirations

We cannot forbid peoples to improve their standards of living. Communications media, war travels and population migrations have shown the have nots how the haves live. They too wish to savor the so-called good life. The leadership, whether national, buiness or labor, has promised much to the people. Everywhere on this planet there is a social awakening. Everyone wants a better life. The lid of the treasure box has been lifted. A glimpse of the treasures inside has heightened human aspirations. These aspirations cannot be restrained even if the treasure box lid is snapped shut. Any attempt to do so could create an even more serious credibility gap and resulting turmoil then presently exists.

Expected Increase of Energy Consumption

It is doubtful that we will achieve world-wide ZPG over the next two or three decades and it takes at least five years to design a power plant and put it on the bus. In view of the aforementioned it is patently clear that at least for the immediate future we should expect an annual rate of energy consumption increase corresponding to about 6 1/2%. It should be noted that I am suggesting that the annual rate of increase of energy consumption may be expected to increase further before the need becomes stabilized. My gross estimate of about 6 1/2% should be compared with the 5.1% experienced in 1969.

International Desire for Increased Energy

The demand for electrical energy, motive power and process fuels may be expected to increase all over the world in the years to come. The reasons are simple: (1) People the world over demand improved standards. For one, this means more manufactured products, which means more energy for manufacturing and, in many cases, for when the product (e.g. appliances) is put to use by the purchaser. Improved standards of living means more housing, better transportation, better schools and enhanced facilities for comprehensive health care etc., all of which require more energy. It would appear then, that even with constant population the annual increase in energy should not be less than about 4%. (2) Even as nations battle to curb the population growth, we are still far from achieving Zero Population Growth (ZPG) and the population will continue to increase. Thus, even if we were to declare a freeze on the standard of living, a greater number of people will consume a greater amount of energy. With present technology, the increase in energy production can certainly not be any less than 2 1/2% per annum which is the average rate of population growth of the world.

We Can Have a High Standard of Unpolluted Living if We Plan Properly

In the meantime we cannot deny that in many ways energy is the Dr. Faustus of our age. It presents trade-offs between the right for human comfort and the right to enjoy an environment fit for human living. And herein lies the paradox: Can we provide the material goods and facilities for people to lead the better life while we maintain a reasonable sense of individual freedom to choose one's lifestyle in an environment of cleanliness? I maintain that we can. Indeed, I submit that we must if we are to act as rational and compassionate human beings. To do so we must: First, develop a new awareness about fuels and energy and we must overcome certain myths. Second, and even more important, we must exhibit the courage to reform certain aspects of our institutional structure. Third, we must establish major R & D programs in both the hard and soft sciences as they pertain to the energy sector.

REALITIES ABOUT ENERGY

Although I promised in the beginning that I would not deluge this august group with minute data, some must be cited to put this discussion into perspective. For the sake of brevity this information will be presented in concise outline form.

Whereas early man consumed about 2000 calories per day, the average U.S. citizen today uses more than 200,000 calories per day to feed himself and to account for the consumption by various industries that support him. Thus, if we assume that more than 2000 calories in food intake would contribute to obesity it can be seen that we have increased our energy consumption by a factor of at least 100 in providing the machinery that relieves us of physical burden.

The United States derives its energy from about five primary sources. In approximate and estimated terms their contributions are shown in Table 1[a] below for two dates, 1966 and 1985.

Table 1

	1966	1985
Coal	53.6%	49%
Petroleum	6.0%	2%
Gas	22.0%	15%
Hydro	18.0%	9%
Nuclear	0.4%	25%

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[a]"Ecological Aspects of the Affluents and the Effluents of Energetics" by Ali Bulent Cambel, Archives of Environmental Health, p. 276, Vol. 18, February 1969.

1) THE MYTHS WE CAN NO LONGER AFFORD

(A) Fuel Reserves - It is frequently argued that our energy crisis is due to a shortage of fuels. This is absolutely incorrect. It is true that certain fuels are less abundant than others. It is even true that certain fuels are in dangerously low supply. However, energy is ubiquitous and the sum total of fuel resources is sufficiently large to last mankind for a period of humanly inconceivable length.

In his book "The Last Judgment" the famous J. B. S. Haldane has an announcer from Venus speak the following words: "It was characteristic of dwellers on Earth that they never looked ahead more than a million years and the amount of energy was ridiculously squandered."

If we consider the total fuel picture even Haldane can be seen to be conservative because we have in fact sufficient reserves to last us not for decades, not for centuries, not for millenia, not even for a million years, but indeed for several billion years!

Categorization of Fuels

Presently, the World consumption of energy is about 0.1 Q where Q equals 10^{18} Btu. The U.S. uses about 60% of this total. To provide this amount of energy we have at our disposal a wide spectrum of fuels. In general these can be categorized under either of two classes: (A) depletable and (B) non-depletable. The depletable fuels would include the fossil fuels such as gas, oil, coal and the fissile fuels such as uranium and thorium. The non-depletable or renewable fuels would include solar and tidal energy. (Clearly the non-depletable sources would be available as long as our solar system continues to exist.)

Returning to the depletable fuels, we have according to McKelvey about 22 Q in known recoverable fossil-fuel reserves and about 12,500 Q more in potential fuel reserves. Thus, even if we relied entirely on fossil fuels alone we would at our present rate of consumption have a supply for about one hundred millenia.

Fossil Fuels

Among the fossil fuels we are particularly short on gas. We have a better supply of liquid hydrocarbons. We are blessed with shale oil and coal. Because of the convenience of gaseous and liquid fuels and because of their relative shortage we must take immediate steps to manage and control their depletion.

Fissile Fuels

Concerning the fissile fuels it is estimated that even with an increased annual consumption rate of 15 Q, the uranium and thorium supply would be good for about 3 billion years. While noting these astounding supplies of non-renewable or depletable fuel resources it must be realized, of course, that the ores are not of equal quality and, hence, one might expect that as the high quality ores are used up, the cost of processed fuels will increase.

Other Reserves

In addition to the aforementioned monumental reserves, others also exist.

Fusion Fuel

Although we have not as yet achieved controlled thermonuclear fusion power, it may be estimated that even the minute amounts of deuterium in the seas would correspond to about 10^9 years at an annual consumption rate of 15 Q.

Hydraulic, Geothermal, Tidal, Wind and Thermal Reserves

Concerning non-depletable energy sources and considering the U.S. alone, the hydraulic power is estimated at about 134,000 million kilowatts and geothermal power at about 2.5 million kilowatts. The

It is estimated that the earth absorbs and reradiates about 1500 Q of solar energy annually, about 15,000 times our present energy consumption of 0. 1 Q. I believe, although all scientists do not agree, that not more than 1%, or 15 Q, of the total energy should be reradiated. This figure may be too conservative, but we cannot afford to experiment. We might then ask: in how many years will the world's energy consumption rise from 0.1 Q to 15 Q? This depends on the annual rate of increase. At our minimum rate of 2 1/2% previously discussed it would take several centuries. At the maximum rate of 6 1/2% it would take only decades! Clearly it is necessary that something be done and that it be done quickly if we are to avert ecocatastrophe.

Closely related to the radiation problem is the amount of carbon dioxide that we may safely allow to enter the atmosphere. CO_2, although substantially transparent to ultraviolet radiation, is a strong absorber in the infrared region of the spectrum. An increasing CO_2 content in the atmosphere would increase the temperature of the lower strata. It has been estimated that a 25% increase of atmospheric CO_2, with an associated increase in temperature of about 1/2 deg C to 4 deg C might occur as early as the turn of the century. One need not be very imaginative to envision the threatening chain effect if the amount of CO_2 presently spewed into the atmosphere is not reduced.

A number of preventive suggestions have been made; electric automobiles and nuclear power plants are typical proposals. But the situation is not so straightforward for the cities and about 75% of our world tidal power is estimated to be about 1100 million kilowatts, windpower 20,000 million kilowatts, and thermal gradients about 1700 million kilowatts. Even when these are totaled, they constitute only a minute fraction of the total energy consumption of the U.S. and, hence, we cannot be reliant upon these. However, each of these could and should be used in supplying electric power to their particular localities.

Solar Energy

The most abundant source of renewable energy is solar energy. It is estimated that the Earth intercepts a solar energy beam of 17×10^{13} kilowatts but atmospheric conditions greatly reduce this amount. Nevertheless it is estimated that if 2% of the U.S. land mass were to be used as a collector and if the conversion efficiency to useful energy were to be 10%, solar energy alone would allow a five-fold expansion in America's use of energy.

Clearly America should never have an energy shortage provided we learn to diversify the use of our fuels.

Ecological Limitations

But although our energy consumption is not limited by a shortage of fuel supplies, it is limited by environmental considerations.

population lives on about 5% of this land or in the cities. There is evidence that the pollution and the particulate matter caused by man's activities in cities lead to nuclei that give rise to rain, hail and thunderstorms. These phenomena lower the ambient temperature. Therefore, whereas the temperature tends to rise because of excessive energy dissipation and an increase in atmospheric CO_2, the increase in precipitation is likely to result in lower temperatures. We may suffocate from environmental pollution while remaining in an isothermal state!

(B) The Best Fuel and/or the Best Energy Converter - It is understandable that advertisers and various interest groups will plug for their particular fuel or their particular energy converter. Nevertheless, each of us, citizen, policy maker, legislator, businessman or union leader, must stop asking: "which fuel is best", or "which converter is best"? It is like asking which government is best, city, state or Federal? There is no one best fuel and there is no one best converter. Each fuel and each converter has its figures of merits, each representing an important factor. In making a choice then it is necessary to arrive at an optimum choice for each particular application in time and locale. It is clear that if we want to have cheap, safe and reliable energy we must diversify.

2) INSTITUTIONAL IMPROVEMENTS

(A) The Place of the United States Government - The United States is one of the few countries which does not have a department or agency charged with the overall problem of fuels and energy. On the other hand, there are several departments and agencies which concern themselves with specific fuels. (e.g. the AEC is concerned with fissile fuels and atomic energy; The Department of the Interior with coal and the Department of the Navy with shale etc.) Sporadically one department or another assumes the responsibility for one or more energy converters (e.g. NASA with space propulsion and power devices, the Department of Defense with military units etc.) Then there are various regulatory agencies, the paramount one in the energy sector being the Federal Power Commission. In general, each and every one of these groups has done laudable work but the fact remains that energy programs and policies are uncoordinated and they suffer from spasmodic emphasis and de-emphasis. An industry which is so fundamental to our well-being and prosperity, an industry which is so capital intensive, an industry which is so far flung cannot be treated with casual interest.

Need for a New Department or Agency

Ideally we should establish a Department of Fuels, Energy and Environment. To achieve this, the various functions presently scattered in various areas of the Federal Government would be drawn together.

Only if we do this will the energy sector be considered as the system that it is, rather than a number of unrelated stepchildren with no permanent home. Our energy sector is becoming far too complex and expensive for us to expect it to run smoothly and economically via an array of stalemates between the public, the industry, and the government on the one hand, and stalemates among the subgroups within each of the above.

(B) Participation of the United States Government

The Public and Private Sectors of The Energy Industry

In our socio-economic political system there is a legitimate place for both the public and the private sector.

In Christopher Morley's parody on the Trojan War, he has King Priam comment on the misfortunes brought about by Helen's presence: "Woman's place is in the home" he says. Everyone agrees until Helen of Troy adds, "Yes, but whose home". Unfortunately, the place of the public sector and the place of the private sector are frequently forgotten or confused. Often we find one agency of the government subsidizing programs which the private sector should be responsible for providing, or we find different departments and/or agencies providing support for purposes contradicting one another. We simply have to get ourselves out of the morass in which contradictory actions of regulatory, sponsoring, judicial (particularly antitrust), and taxing agencies entangle the energy industry.

One-to-One Ratio

It is true that energy utilities are generally monopolies and hence must be regulated. Indeed it is unhealthy for any one agency to deal with any one industry. The human element being what it is, the agency sooner or later becomes the handmaiden of the industry just as in biology parasites die if they kill the organism they live on.

Hampering Regulatory Effects

We should re-evaluate our concepts of antitrust because in a complex society there are economies of scale. These are particularly true in the energy sector. In general, the larger the power plant the cheaper the energy.

We should also be aware of the effects of regulatory agencies. For example, the cost of transporting or transmitting energy is about 50% regardless whether we transmit electricity through conductors or coal via railroad. Should I.C.C. and other interstate regulations not be re-considered?

Taxation is another element. We should re-consider the entire picture of taxing producers of fuel, manufacturers of energy conversion devices and utilities providing various forms of energy. Is it an accidental coincidence that most of the R&D in the energy sector is performed by manufacturers of equipment used by the producers of fuel and the utilities marketing the energy in whatever form it may be? In the communications industry, the "manufacturing" and the "utility" aspect frequently overlap. Yet in spite of the jokes on the late night shows, A. T. & T., the Bell System and Western Electric are monuments to scientific inspiration, technological innovation and operational efficiency, economy, and reliability. Undoubtedly A. T. & T. has excellent managerial talent, but is it possible that we castrate managerial ability in the energy industries by insisting on its segmentation by function?

Direct Government Financing

It appears not only desirable but indeed necessary to define the scope of direct government financing. This is, of course, necessary if we are to maintain a happy balance between the public and the private sectors to foster our concepts of free enterprise. Attention to this careful balance is particularly important in the energy sector as it becomes more and more intertwined with environmental problems.

(C) Criteria for Government Support of Research

How, now, is research concerning problems in energy going to go forward? Who is to pursue it?

I cite from Energy R & D the criteria for government initiative in the form of a table.

Who Should Undertake Basic Research

Kind of Research	Private Sector Willingness	Government Initiative
Research with social benefit. Costs exceed the social benefit.	NO	Although the benefit is hard to identify, some results are expected.
Research with results for in the future.	Might attempt but will discount at a rate greater than appropriate for society	Will have greater benefit for society at earlier time.
Research with possible great returns but fraught with uncertainty.	NO risk aversion Inability to diversify	Magnitude of benefits uncertain. Large outlay necessary.

(D) Innovation in the Private Sector

It is generally accepted that in the energy sector manufacturers are more innovative than the utilities. This may well be a fact. What is apparent is the incentive needed for utilities to experiment with innovative ideas. Federal and State governments can provide this incentive by relaxing regulatory antitrust and taxation requirements. Admittedly utilities are local monopolies of some sort and there is no guarantee that they would experiment with innovative ideas given a relaxed situation. Nevertheless they should be presented with the opportunity to do so.

Governmental practices should be changed in such a way that innovation is encouraged while lack of it is penalized rather than continuing in the present pattern which literally makes innovative ideas acts of fiscal and legal irresponsibility for management.

3) PARTICIPATION OF STATE GOVERNMENTS

Energy and Environmental problems are both global and regional; rarely are they limited to the boundaries of any one state. Accordingly, consideration should be given to the establishment of Regional Fuels, Energy, and Environmental Centers. Such groups would cover one or more states or their parts which have related fuel, energy and environment problems.

The regional centers would manifest expertise in fuel, energy and environment systems analysis.

In essence, these centers would be consortia representing several sectors of our body politic. Included would be the private sector and the public sectors, the consumer and academic institutions.

The governing boards of these centers would be picked in a manner reminiscent of the Communications Satellite Corporation.

One half of the staff would be permanent and the other would be rotating. The rotating staff would be picked for expertise from the academic community much in the same manner as research staff are picked for think tanks.

The regional centers would provide exchanges with universities sponsoring faculty and students who are concerned. Faculty members and students sponsored by these regional centers at their institutions would be expected to spend a one year tour of duty at the regional centers (or in appropriate federal agencies) for every five years of sponsorship while at their universities.

Rather than a threat to existing state governments, these regional centers could be an asset. Presently most states chafe under increased demands for services from their citizenry with simultaneous citizen resistance to higher taxes. Concurrently the citizenry demands environmental protection and modern manufacturing processes.

State governments find themselves in a double bind over the jurisdiction of environmental pollution and energy distribution, which inevitably cross state boundaries. One state may enact strict environmental legislation, but problems of a neighboring state with lax legislation or a minuscule regulatory organization will not respect geographic state boundaries. An unbiased regional center with the welfare of all the sectors of society uppermost, could analyze the problems and present possible solutions to the legislators by the state in question.

R & D IN THE HARD AND SOFT SCIENCES

Even a cursory evaluation of the literature indicates that most of the studies undertaken in the energy sector are related to science and technology rather than to social science aspects of the energy and environment sector. Yet, in some ways, what we need most is a better understanding of the administrative and managerial aspects of the problem.

Although the scope of this presentation prevents detailed enumeration of specific R & D projects, I shall briefly delineate classes and/or categories of work which the U.S. must pursue if it is to remain a high per capita GNP and an environmentally clean nation.

Class 1. Research and development in the policy making and management of energy, fuel resources, and environmental effects.

Class 2. Systems analysis and operations research studies to optimize energy production to pollution ratios among various candidate systems for different locales and conditions.

Class 3. Scientific research and technological development to develop converters which, for a given input maximize useful output and minimize unavailable dissipated energy.

Class 4. The enunciation, development, and implementation of legal, legislative, and technological procedures which reward the minimization of the cost of energy to cost of pollution ratio.

Class 5. Soft and hard research to create counter technologies and technological competitions.

A. Perhaps several departments of Fuels, Energy, and Environment should be created. Each would receive the same annual allocation but the productivity of each would be monitored every so many years for maximation of their productivity or their benefit to cost ratio. If the private sector can engage in competition, what is there to forbid us from instituting competition among government agencies and departments having the same mission i.e. the production of the cheapest energy with minimal environmental pollution.

B. Every conceivable fiscal encouragement should be given to manufacturers who develop appliances that exploit the second law of thermodynamics. These applications include microwave ovens and stoves, Recent changing priorities and the national economic readjustment have released considerable talent from technologically oriented systems. This talent should not be wasted or redirected into other professions which might become overpopulated. Many of these highly trained individuals must be utilized in energy related fields for their own and the national welfare.

To quote again from Energy R & D.

> The scarcity of R&D talent in some disciplines in fact, prevents full implementation of many essential programs, and is critical for certain long-range research projects that must be initiated promptly if the payoffs are to ensue within the necessary time scale.

Happily, a few far sighted R & D people who felt change in the wind have already "migrated" into new disciplines, utilizing their superb education and training. As a result, there are miniscule energy related programs which, if expanded and supported financially by either the public or private sector, should benefit the future energy R & D in the nation.

ultrasonic dishwashers and washing machines, electrochemiluminescent lighting panels, thermoelectric refrigeration and air-conditioning units and improved insulation material. In short, energy research and development should be oriented toward less dissipation of energy but not toward curtailing human comfort. We cannot return to the pre-industrial era, we must forge ahead towards the post-industrial era of creativity. Such a hydrocarbon fuel-cell electric supply would compete with the local electric-utility company.

PAST RECOMMENDATIONS, THE PRESENT SITUATION, AND THE FUTURE

One paragraph from Energy R & D and National Progress is as pertinent today as it was when it was written several years ago:

> If the Nation is to have at its disposal a complex of energy resources that can meet constantly changeable needs and choices, the energy planning for the future must provide a dynamically balanced program that makes optimum use of the various energy resources, that maximizes the potential of this country's diverse R&D apparatus, and that emcompasses R&D efforts at different levels of technological advancement.

At that time, several conditions were posed which, if not corrected or adjusted, would hamper or inhibit a long term R & D program for civilian energy. Again quoting:

> Foremost among these conditions is the dearth of R&D talent in many areas. It is futile to urge initiation or intensification of specific R&D if a body of trained scientists and engineers is not available for the assignment.

The last quote is interesting in the light of present trends.

> Young research workers tend to gravitate toward jobs in the more prosperous industries. R&D in such areas as space, defense, and the life sciences has become more fashionable, more glamorous, more exciting, or more remunerative. And some research fields currently have no scientific "status." All these circumstances at the career level are tied to and, in turn, influence educational curricula and training.

No longer are young research workers interested in jobs in the once so prosperous industries. There are new incentives, a drive toward non-status, new dreams. Concern for life on earth has directed thought and research toward biology, behavioral aspects of man and other life forms, and sociology. It is true that this reorientation of youth has been and is affecting educational curricula and training. If the United States is to maintain its leadership in education, scientific programs, and technology, new directions must be sought to coalesce the drive and dreams of the young. Theirs is the future!

Senator Gravel. Our next witness, Mr. Carl Bagge, president of the National Coal Association.

Mr. Bagge?

STATEMENT OF CARL BAGGE, PRESIDENT, NATIONAL COAL ASSOCIATION

Mr. Bagge. Thank you, Mr. Chairman.

I will attempt to summarize the statement filed with the committee.

Let me say first, at the beginning in the introduction, national goals, finally, must be based on broad, consciously articulated agreements without fading into abstractions. Human community in all its forms arises not merely from shared space but from shared values. It is held together by certain compelling ideals that its members understand, accept and consciously seek. Society can afford many forms of diversity but it cannot tolerate serious division on its grand design. To earn common acceptance, therefore, national goals must not only reflect but also respect all of the Nation's significant needs.

This inquiry by the Senate of the United States into current national goals and their relation to national energy policy is most timely. It is urgently needed. Because energy is so basic and critical to shaping the future of the Nation and the lifestyle of its citizens, energy policies have today become the focal point of the current national debate on the kind of society we should develop and toward which we should aspire.

I feel highly privileged, therefore, to have been invited by the chairman of the Senate Committee on Interior and Insular Affairs to participate in this dialogue with many thoughtful and concerned scholars and social critics as well as leaders of industry.

I hope that from this confrontation of ideas and sincere concerns there will emerge a basis for a common expression of national goals. Anything less than that will tend only to further polarize the Nation in this critical area of national concerns and frustrate the need and hope for achieving a sound national energy policy. As participants, I believe we share a special responsibility extending beyond the interests we represent, to seek an accommodation of our views so that a national energy policy may be formed within the framework of jointly held national goals.

The relationship of national goals to energy policy in recent times has not been—and perhaps cannot ever be—a static concept. There have been truly remarkable changes in our national goals, with enormous impact on our energy policies. Both the electric utility and the natural gas industries provide dramatic illustrations, which I can draw from my personal experience as a regulator of those industries while serving for 6 years as a member of the Federal Power Commission.

In November 1964, the Federal Power Commission in cooperation with all segments of the electric utility industry published the first National Power Survey. The purpose of this comprehensive, nationwide survey was to define and articulate the long-range goals of the electric utility industry. Some of the finest talent in Government and industry measured the past performance of the utilities against the foreseeable future. In observing the developing trends in electric generation and transmission and projecting the future supply and demand for electricity, they conceived a vision that was translated into the industry's "goals for growth."

The great goal for that time was to spur the trend toward integration of the Nation's power systems—to move from isolated operations and limited power pools to fully coordinated networks covering broad regions of the Nation. From coordinated regional and interregional planning would come vast economies of scale in generation and transmission, stimulating even more demand, thus assuring the Nation of steady incremental increases of electric power at ever decreasing costs.

This was the vision of the National Power Survey, and the source of the electric utility industry's long-range goal in the mid-1960's.

That bright goal was short lived—it changed abruptly and dramatically only 1 year after the National Power Survey was released. On November 9, 1965, the electric system fell apart in one awesome moment, in a vast numbing power failure that was regarded as a national calamity. At that moment, every American was made insecure about the reliability of his vital power supply.

Those of us who were serving on the Federal Power Commission at that time were summoned before Congress to account for our stewardship of the public trust and to defend the suddenly embattled articles of faith underlying the National Power Survey—the value of regional coordination and integration. These objectives survived testing in the legislative crucible, but the goal of the electric utility industry was significantly altered in the process.

The industry could no longer be preoccupied with the goal of low-cost power; now it must extend its concern to reliability and the quality of utility service. But even as the industry was striving to build the institutional framework needed to cope with the problems of technological reliability, an entirely new objective with profound implications for the utility industry was quickening.

The outlines of the new environment ethic were not even discernible when the industry's goals were defined in the National Power Survey, but its cost impact has already substantially modified the almost religious commitment to the goal of low-cost power. Even more, it has aimed directly at the heart of the industry—the right to expand. The goal of environmental quality has transcended all others in the popular view and has bred critical problems in present power supply and cosmic questions about future demand.

The changes in the electric utility industry's goals have been not only radical in depth, but startling in pace. In the few short years since the publication of the National Power Survey, emphasis has shifted from an unquestioned commitment to ever lower costs to, first, greater reliability and the quality of utility service regardless of costs, and then to an adequate power supply without degradation of environmental values—which, in turn, requires the cost of electric power to reflect the total social cost of its production. And today, State and Federal regulatory commissions, consumers and utility managers alike are prepared to accept a posture that would have been unthinkable only a few years ago.

The natural gas industry also provides a dramatic example of the effect of changing national goals on energy policy. I had the privilege of serving on the Federal Power Commission when the precedent-setting *Permian Basin* decision was issued in 1965. That case was the culmination of efforts initiated since the Supreme Court's *Phillips* decision in 1954 to fix rates for the producers of natural gas. It was the first comprehensive attempt to implement the policy of the Natural Gas Act by extending it to producers. The goal was to prevent the "unjust enrichment" of the producers—at the expense of the consumers—by applying utility-based regulation to the production of gas.

Thus, the goal underlying the Natural Gas Act was to assure consumers the lowest possible price for gas. The rationale for extending the act to producers in the *Phillips* case rested on the premise that this goal could not be achieved without producer regulation because of the lack of effective competition in the producing segment of the industry.

So, as a matter of national policy, gas prices were rolled back and fixed at a level that made gas economically attractive as a utility boiler fuel and in a broad range of industrial uses. Thus, gas increasingly displaced both coal and oil in these markets because of its substantial price advantage. In 1970, for example, the price per million B.t.u. of natural gas at the wellhead was only 68 percent of the price of an energy equivalent amount of coal at the mine. This price spread, despite the limited reserves of natural gas, has effectively encouraged its use in utility and industrial markets.

The demand for gas in these markets has been stimulated further by our new environmental goals, expressed in the Clean Air Act and the proliferating local air pollution regulations. This has brought the gas industry a growth rate beyond its most optimistic projections. Its primary problem, in fact, is that demand now is outrunning supply.

Gas is an economic anomaly. It is an environmentally prized fuel, yet it is still advantageously priced in its least specialized markets, because of artificially established prices for gas sold by producers. Coal and oil, the naturally disadvantaged fuels in our ecology conscious times, must assume additional costs to reach the level of acceptability. But they are presently running on a treadmill so long as the Nation affirmatively encourages the use of gas by setting bargain prices.

This policy has, furthermore, operated as a constraint on the development of the very technology, notably including sulfur dioxide control and fuel conversion, that could redeem the Nation's huge reserves of high sulfur coal and permit the use of high sulfur oil with respect for the environment and necessary regard for the finiteness of our energy resources.

It is obvious now that the well-intended goal of low-priced gas that underlies the Natural Gas Act has actually produced a massive distortion in the most economic allocation of our natural resources.

But this is not all. The economic dislocations spawned by the regulation of natural gas prices are now offering us the worst of both possible worlds. The same price regulation that stimulated gas demand has inhibited gas production—it has diluted the incentive to explore and develop new gas sources to the level of the Nation's need. Since the goal of low-priced gas created this dilemma, it is ironic that we should try to escape it by such expedients as importing liquefied gas at prices substantially higher than those condoned by the regulation of our own domestic gas.

We must retain the goals of protecting the public interest and maintaining a viable gas industry. But we canont remain wedded to a national policy that has obviously failed both goals. To find an effective alternative, I believe we must go to the marketplace.

The thrust of the national policy in the decades of the 1950's and 1960's was to nurture the competitive vigor of gas producers. That was the point of the Supreme Court's holding in the *Phillips* case that price regulation must substitute for the lack of competition in field sales of natural gas. But neither that decision nor the price regulation that followed nullified the long-term forces of the market. The impact of the market was delayed by regulation, but it could not be denied and is now asserting itself.

Today there is simply not enough gas available to satisfy our new national environmental goals even as a short-term substitute for other fuels. There is not enough even to moderate the market price of new supply sources such as imported liquefied natural gas.

Clearly, the goal of Government policy in this decade must be changed from the artificial concept of regulated competition to competition in a free market—and that, in turn, demands reinvigoration of the base supply of natural gas.

Regulation substituted for the lack of competition among sellers of gas at the wellhead. But that is now academic when those sellers do not have an available supply with which to compete for incremental business. And the overriding fact today is that the available base supply, being inadequate to meet current potential demand, can no longer perform its competitive function. Without a plentiful and growing base supply, the interstate market cannot compete for gas supplies with the unregulated intrastate market. How much less can a gas-short nation protect its consumers in an international market?

The Nation's richest opportunity to broaden its gas supply base is conversion of coal and oil shale to gas. With that abundance, it could afford the economic wisdom of permitting gas prices to respond to demand. The Nation could also significantly relieve one unnatural and debilitating form of competition—that between energy and the environment.

I believe that the most significant lesson to be drawn from the recent histories of the Nation's natural gas and electric utility industries is that as national goals change—and abruptly, as many have—energy policies must be adapted to accommodate these changes. Energy policies must respond more quickly to changing national goals. If energy policies are allowed to fossilize or even lag significantly behind new national needs or aspirations, they cannot contribute to the national interest in the broad spheres in which energy has preempted a dominant role.

We may even speculate whether any national energy policy can effectively respond to the quickstep pace of change if it is codified in the political rhetoric of the time and thereby surrenders its flexibility. Perhaps this critical responsibility should be entrusted to the stewardship of a living agency that could constantly monitor all energy developments and adopt energy policy to current conditions and changing national goals.

Pragmatic reflection on the past interactions of national goals and energy policies strongly suggests that the energy plan for the Nation has fallen between the two tools of regulation and response to emergencies of supply. Our energy development has been committed to the conflicting determinisms of superimposed rules and forced change. The Nation has been faced with the impossibility of reconciling policies conceived in a period of apparent plenty with the present exigencies of real scarcity. The only way the Nation can really control its energy future is to act from the strength of energy sufficiency in a free market.

"London by gaslight" represented the pinnacle of progress. After all, Macaulay was as optimistic as his energy means would allow—his real absurdity as a reputed historian was to take the occasion to demean the benighted past, as though he were not as much a captive of his own time as the torch boys of an earlier era.

His mistake was to glorify the present at the expense of the past. It is a reversible fallacy. The pressures of modern civilization have led some contemporary social critics to romanticize the past. But only civilized man can make an ideal of primitivism; for primitive man it was a grim reality. His goals were fiercely immediate—food, shelter and security; his occupation was not to enjoy his environment, but to survive in it. And to help him accomplish his objectives, he used what energy he had. We must believe that the only reason primitive man did not become a conspicuous consumer of enegry was his conspicuous lack of opportunity.

In the progression from the primitive pack to even rudimentary societies, man has steadily sought to multiply energy sources beyond his own muscle power. He has drawn as he could on the energy potential of nature—sun, wind, water, fuels, and animals—to help provide him with the essentials of survival.

As societies grew in strength and complexity, energy applications became more sophisticated, efficient and integrated with man's way of life. Whatever we may prefer from hindsight, man long ago committed his progress to energy. Our society, as it has outgrown its own primitive conditions of frontier individualism, is collectively dependent on a huge network of energy, not only for the refinements, but the essentials of human life.

For common recognition, we need only call the role of the great areas of human concern in which energy contributes a force beyond individual strengths—national security; the production of essential quantities of food, shelter, goods and services; the efficient transportation of people and products; adequate communications; the accommodation of man to his climate; effective health services; and the elevation of the standard of living by reducing the labor required for wages and increasing leisure for recreation, intellectual development and the civilizing arts.

To say this much is not to beg the question of our national goals. It is to respectfully suggest that the energy resources now at our Nation's disposal and those we forsee—not hopefully but evidently—for the future are the essential supports of truly national goals. With sufficient energy and the proper direction of its use, no desirable national goal seems impossible of attainment. But if we, as a nation, permit our national energy base to weaken or if we place arbitrary restrictions on its use through price regulation or allocation to special purposes, we shall have surrendered a national commodity to privilege and perhaps even denied the goals of those to whom the Nation must offer the greatest help.

If one of our national goals is—as it must be—to raise the living standard of those at the lower end of the social and economic ladder, it would be unreasonable to deny them the fullest possible use of the products of energy they urgently need to enhance the quality of life, not to mention the challenge, in many cases, to subsist.

But in the end, social goals are more than common denominators. The Nation must produce enough energy to offer a better life to all of its citizens—the advantages as well as the disadvantaged—if it is to preserve the principle of upward mobility that characterizes a vigorous and free society.

If some of us choose a way of life that depends on an abundant use of energy, that should be our privilege, so long as we are able and willing to pay for it. Others may prefer a simpler life, and they should be free to choose that alternative. The freedom of choice in energy use—subject only to the common good—is part of our fabric of freedoms. Preserving it should be a national goal.

Since man has begun to draw so heavily for his expanding energy use on natural resources, the question has been raised of man's obligation to nature. For the moment, let us note that it is a civilized question that would hardly have occurred to a society that had not progressed so far as ours toward improving the human condition. And the civilized response is not to pit human goals against ecological goals, but to make maximum use of our energy—intensive technology to reconcile them—to improve the extraction and use of energy sources that nature locked into the earth in the beginning and salted with what our civilization calls impurities; to preserve nature's own production cycle so far as human needs and powers will permit; and to recycle the products of nature to avoid the insult of waste.

In our national tradition, Government policymaking is expected to be the instrumentality of orderly progress toward recognized national goals. Government's proper role is not to dictate goals, but to create the best possible conditions to meet the goals that arise naturally from national needs. If existing policies do not serve national goals, we must change not the goals but the policies.

Adequate energy, however we ultimately define adequacy, is an enduring national need, and must be served by policy. The first problem of national energy policy is that we do not have one but many fuels policies. We are only now making a beginning on a comprehensive national energy policy after years of precarious coexistence with an assortment of narrowly conceived and often conflicting fuels policies.

Some of these specific policies have retained their validity in terms of broadening our national energy base, and others have been passed by time and circumstance. While they are sometimes dissonant, from their sum we can at least discern the national goals that inspired them.

The range of existing fuels policies encompasses Federal programs to support scientific research to increase the supply of energy, enhance its use and decrease its cost; to fix the wellhead price of natural gas; to limit petroleum imports; to encourage nuclear generation; to promote by tax and other incentives the exploration and development of various fuels; and to spur regional coordination of electricity generation and long-distance transmission of power.

Allied with these specific fuels policies are conservation laws to prevent waste of valued natural resources, and Government regulatory and antitrust policies favoring interfuel competition.

In addition, there are policies which have been developed without any conscious consideration of their effect on fuels and energy, but which have come to operate as constraints on the attainment of energy goals. The cumulative effect of all these policies must be regarded as our present energy policy.

The national goals that emerge from these fuels policies are national security—reflected in the desire to keep the Nation relatively independent in the production of essential fuel resources—the achievement of low-cost energy through vigorous fuel competition in the marketplace.

But since the policy evolution toward this partnership of security and economy, a third force has appeared and risen to the top of the national priority scale. Although it may still be too early to recognize the full implications of specific environmental goals, collectively they form a national environmental policy that has already had a significant impact on existing national energy and fuels policies.

Energy and fuels policies have aimed generally at expanding both fuel supply and interfuel competition, making availability and price the measures of choice in the marketplace. But national environmental policy has now created a new test of fuel acceptability that is overriding the free play of market decisions—those choices have been narrowed by Government fiat expressed as stringent quality standards for fuels and even absolute prohibitions of their use.

Thus, fuels that national fuels policies have ordained to compete have been ruled out of the marketplace by environmental goals. On the other hand, fuels that could serve the new goals have been effectively foreclosed from the marketplace by existing fuels policies.

This conflict, which has too often been decided in the thin air of crisis, requires a rational, comprehensive approach to policy in both areas—energy and environment. We may think in terms of economic man and ecological man provided we realize that both are fictions—they are the same man viewed in different perspectives. In the real world, man is a consumer, and energy is his staple whether he is trying to preserve himself or nature. If man's use of energy to satisfy basic needs leaves nature in disrepair, the same energy is the only significant means to repair it.

The Nation must reshape its energy policies to broaden its energy base with respect for both nature and the marketplace. That can be done. With a technological commitment to redeem such basic fuels as high-sulfur coal and oil through emission controls and—even better—conversion techniques, the Nation could vastly improve its fuel store. That would, in turn, increase the feasibility and strengthen the rationale for eliminating price regulation of natural gas, which has distorted the market and the reasonable allocation of fuel resources. It has resulted in a merely more sophisticated form of flaring gas by encouraging the short-term expedient of using this specialized fuel under power boilers.

Energy policy must also give renewed emphasis to the immediate enlargement of the Nation's fossil fuel supply rather than allow that objective to stand in the shadow of nuclear development. Nuclear power may well be the great energy hope of the far future, but only our less glamorous fossil fuels can buy the Nation the time it will need to realize the nuclear promise.

But the Nation's fuel production is dependent on more than the stimulation of direct energy policy. The fuel industries do not live in a world of technology alone—they are subject to the demands of commerce and trade, hence the Nation's insistence on interfuel competition. Our antitrust policies, which have grown old in the service of competition, need revision now because the fear of restraint of trade has been superseded in the fuel industries by a more pressing fear of restraint of production. The forced growth of these industries to meet growing demands for energy has imposed individual burdens of huge capitalization on many fuel companies. They must have greater freedom than present antitrust laws permit to seek the financial support they absolutely require to produce more abundantly, and some even to survive in a recognizably competitive form. The danger is not really overconcentration in the fuel industry, it is underproduction resulting from a legalistically induced financial anemia.

In addition, fuel conversion technology has altered the traditional goals of antitrust laws in the energy field.

Government attempts to superimpose its direction as a substitute for market forces invariably results in its overlooking the subtle interrelations and interactions of economic forces and frequently produces sporadic policies aimed at what appears at the time to be the problem. Government certainly must have a role in certain areas where the huge capital investment needed to realize goals exceeds the financial resources of the private sector—for example, national defense, social welfare, urban renewal, and other broad-ranged concerns. But these objectives of Government policy must be considered to be in addition to free-market demands and not a substitute for them.

We believe that the establishment of a realistic, comprehensive national energy policy will assure the development of an adequate domestic supply of fuel and energy which can be primarily relied upon by both present and future generations to meet the demands of the free market as well as the demands created by these emerging national goals.

As part of this assessment of national goals, it must be recognized that we can no longer even think about our contemporary problems in the framework of the past. Contemporary national problems call for responses within the context of a far broader perspective than that which has been employed in the past. This is true not only in the area of development of national energy policy, but in other areas of national concern.

Transportation policy for the Nation, for example, if it is to be relevant to contemporary goals, cannot continue to be formulated with continuing conflicts between maritime policy, surface transport policy, highway construction programs, and air transport policies. The national transportation crisis also cries for resolution in an integrated, comprehensive fashion to serve the new national goals of a highly mobile and urban society. And so it is in every other area involving an interface between Government policies and business enterprise.

Today, Government and industry are being forced to reassess existing policies in both the public and private sector in order to determine their relevancy to the achievement of our newly emergent national goal of preserving and enhancing the quality of life. This has given rise to a wide range of entirely new issues for both Government and industry. The concern of the public today for the quality of broadcasting is the most fundamental issue facing Government and industry in the communications field; the public's concern with the quality of merchandise and products lies at the heart of the issues before the Federal Trade Commission; the public's concern regarding the integrity and quality of electric power and the adequacy of the supply of gas service is the dominant concern of the utility industry and the Government; and the quality of transportation service is an emerging concern of both Government and the transportation industry. Thus, today fundamental questions are being raised concerning the efficacy of our technology, and whether it is being directed into areas which are relevant to contemporary national goals.

All of the substantive issues in each of these areas of national interest share a common concern—the quality of life. Our national approach to these problems requires a vastly broader perspective than that which has been employed in the past and that, in the final analysis, provides the greatest contemporary challenge to both Government and industry; namely, whether governmental and business policies are sufficiently flexible and creative to keep abreast of and respond to our new national goals—the public's new values.

President Nixon, in his state of the Union address, set the tone for the formulation of national goals when he stressed the importance of the "quality of life." Energy is so intimately bound with the quality of the Nation's life that we must quicken our efforts to establish a national energy policy that will combine scope with a unity of purpose—to assure the Nation of adequate energy and wise direction of its use.

Thank you.

Senator Gravel. Thank you very much.

(The prepared statement of Mr. Bagge follows:)

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NATIONAL COAL ASSOCIATION

STATEMENT BY

CARL E. BAGGE
PRESIDENT
NATIONAL COAL ASSOCIATION

BEFORE THE

SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE

A SYMPOSIUM ON ENERGY POLICY AND NATIONAL GOALS

IN CONNECTION WITH SENATE RESOLUTION 45

October 20, 1971

ENERGY POLICY AND NATIONAL GOALS

I.

INTRODUCTION

In a free society, the attempt to formulate national goals reflects concern for the human condition. National goals reveal the kind of society a nation seeks to shape for its people. The credibility of these goals derives from the relevance and adequacy of their response to clearly perceived human needs and humane desires.

In a living society, the only constant is change. The vitality of a society, however, depends finally on its ability to control change, to give it purpose, meaning and direction. No society can accomplish this unless it has a clear understanding of its goals and--equally essential--a powerful motivation to attain them.

Reason reminds us, too, that ends can be projected only from accessible means. That means not to place constraints on the future but to make rational concessions to present realities. National goal-setting therefore must be an art of the possible.

National goals, finally, must be based on broad, consciously articulated agreements without fading into abstractions. Human community in all its forms arises not merely from shared space but from shared values. It is held together by certain compelling ideals that its members understand, accept and consciously seek. Society can afford many forms of diversity but it cannot tolerate serious division on its grand design. To earn common acceptance, therefore, national goals must not only reflect but also respect all of the nation's significant needs.

This inquiry by the Senate of the United States into current national goals and their relation to national energy policy is most timely. It is urgently needed. Because energy is so basic and critical to shaping the future of the nation and the lifestyle of its citizens, energy policies have today become the focal point of the current national debate on the kind of society we should develop and toward which we should aspire.

I feel highly privileged, therefore, to have been invited by the Chairman of the Senate Committee on Interior and Insular Affairs to participate in this dialogue with many thoughtful and concerned scholars and social critics as well as leaders of industry.

I hope that from this confrontation of ideas and sincere concerns there will emerge a basis for a common expression of national goals. Anything less than that will tend only to further polarize the nation in this critical area of national concerns and frustrate the need and hope for achieving a sound national energy policy. As participants, I believe we share a special responsibility extending beyond the interests we represent, to seek an accommodation of our views so that a national energy policy may be formed within the framework of jointly held national goals.

II.

RELATIONSHIP OF NATIONAL GOALS TO ENERGY POLICY

The relationship of national goals to energy policy in recent times has not been--and perhaps cannot ever be--a static concept. There have been truly remarkable changes in our national goals, with enormous impact on our energy policies. Both the electric utility and the natural gas industries provide dramatic illustrations, which I can draw from my personal experience as a regulator of those industries while serving for six years as a member of the Federal Power Commission.

In November, 1964, the Federal Power Commission in cooperation with all segments of the electric utility industry published the first National Power Survey. The purpose of this comprehensive, nationwide survey was to define and articulate the long-range goals of the electric utility industry. Some of the finest talent in government and industry measured the past performance of the utilities against the foreseeable future. In observing the developing trends in electric generation and transmission and projecting the future supply and demand for electricity they conceived a vision that was translated into the industry's "goals for growth."

The great goal for that time was to spur the trend toward integration of the nation's power systems--to move from isolated operations and limited power pools to fully coordinated networks covering broad regions of the nation. From coordinated regional and inter-regional planning would come vast economies of scale in generation and transmission, stimulating even more demand, thus assuring the nation of steady incremental increases of electric power at ever decreasing costs.

This was the vision of the National Power Survey, and the source of the electric utility industry's long-range goal in the mid-1960's.

That bright goal was short-lived--it changed abruptly and dramatically only one year after the National Power Survey was released. On November 9, 1965, the electric system fell apart in one awesome moment, in a vast numbing power failure that was regarded as a national calamity. At that moment, every American was made insecure about the reliability of his vital power supply.

Those of us who were serving on the Federal Power Commission at that time were summoned before Congress to account for our stewardship of the public trust and to defend the suddenly embattled articles of faith underlying the National Power Survey--the value of regional coordination and integration. These objectives survived testing in the legislative crucible, but the goal of the electric utility industry was significantly altered in the process.

The industry could no longer be preoccupied with the goal of low-cost power; now it must extend its concern to reliability and the quality of utility service. But even as the industry was striving to build the institutional framework needed to cope with the problems of technological reliability, an entirely new objective with profound implications for the utility industry was quickening.

The outlines of the new environmental ethic were not even discernible when the industry's goals were defined in the National Power Survey, but its cost impact has already substantially modified the almost religious commitment to the goal of low-cost power. Even more, it has aimed directly at the heart of the industry--the right to expand. The goal of environmental quality has transcended all others in the popular view and has bred critical problems in present power supply and cosmic questions about future demand.

The changes in the electric utility industry's goals have been not only radical in depth but startling in pace. In the few short years since the publication of the National

Power Survey, emphasis has shifted from an unquestioned commitment to ever lower costs to, first, greater reliability and the quality of utility service regardless of costs, and then to an adequate power supply without degradation of environmental values--which, in turn, requires the cost of electric power to reflect the total social cost of its production. And today, state and federal regulatory commissions, consumers and utility managers alike are prepared to accept a posture that would have been unthinkable only a few years ago.

The natural gas industry also provides a dramatic example of the effect of changing national goals on energy policy. I had the privilege of serving on the Federal Power Commission when the precedent-setting Permian Basin decision was issued in 1965. That case was the culmination of efforts initiated since the Supreme Court's Phillips decision in 1954 to fix rates for the producers of natural gas. It was the first comprehensive attempt to implement the policy of the Natural Gas Act by extending it to producers. The goal was to prevent the "unjust enrichment" of the producers--at the expense of the consumers--by applying utility-based regulation to the production of gas.

Thus, the goal underlying the Natural Gas Act was to assure consumers the lowest possible price for gas. The rationale for extending the Act to producers in the Phillips case rested on the premise that this goal could not be achieved without producer regulation because of the lack of effective competition in the producing segment of the industry.

So, as a matter of national policy, gas prices were rolled back and fixed at a level that made gas economically attractive as a utility boiler fuel and in a broad range of industrial uses. Thus, gas increasingly displaced both coal and oil in these markets because of its substantial price advantage. In 1970, for example, the price per million Btu of natural gas at the wellhead was only 68 per cent of the price of an energy-equivalent amount of coal at the mine. This price spread, despite the limited reserves of natural gas, has effectively encouraged its use in utility and industrial markets.

The demand for gas in these markets has been stimulated further by our new environmental goals, expressed in the Clean Air Act and proliferating local air pollution regulations. This has brought the gas industry a growth rate beyond its most optimistic projections. Its primary problem, in fact, is that demand now is outrunning supply.

Gas is an economic anomaly. It is an environmentally prized fuel, yet it is still advantageously priced in its least specialized markets, because of artificially established prices for gas sold by producers. Coal and oil, the naturally disadvantaged fuels in our ecology-conscious times, must assume additional costs to reach the level of acceptability. But they are presently running on a treadmill so long as the nation affirmatively encourages the use of gas by setting bargain prices. This policy has, furthermore, operated as a constraint on the development of the very technology, notably including sulfur dioxide control and fuel conversion, that could redeem the nation's huge reserves of high-sulfur coal and permit the use of high-sulfur oil with respect for the environment and necessary regard for the finiteness of our energy resources. It is obvious now that the well-intended goal of low-priced gas that underlies the Natural Gas Act has actually produced a massive distortion in the most economic allocation of our natural resources.

But this is not all. The economic dislocations spawned by the regulation of natural gas prices are now offering us the worst of both possible worlds. The same price regulation that stimulated gas demand has inhibited gas production--it has diluted the incentive to explore and develop new gas sources to the level of the nation's need. Since the goal of low-priced gas created this dilemma, it is ironic that we should try to escape it by such expedients as importing liquefied gas at prices substantially higher than those condoned by the regulation of our own domestic gas.

We must retain the goals of protecting the public interest and maintaining a viable gas industry. But we cannot remain wedded to a national policy that has obviously failed both goals. To find an effective alternative, I believe we must go to the marketplace.

The thrust of national policy in the decades of the Fifties and Sixties was to nurture the competitive vigor of gas producers. That was the point of the Supreme Court's holding in the Phillips case that price regulation must substitute for the lack of competition in field sales of natural gas. But neither that decision nor the price regulation that followed nullified the long-term forces of the market. The impact of the market was delayed by regulation, but it could not be denied and is now asserting itself.

Today there is simply not enough gas available to satisfy our new national environmental goals even as a short-term substitute for other fuels. There is not enough even to moderate the market price of new supply sources such as imported liquefied natural gas.

Clearly, the goal of government policy in this decade must be changed from the artificial concept of regulated competition to competition in a free market--and that, in turn, demands reinvigoration of the base supply of natural gas.

Regulation substituted for the lack of competition among sellers of gas at the wellhead. But that is now academic when those sellers do not have an available supply with which to compete for incremental business. And the overriding fact today is that the available base supply, being inadequate to meet current potential demand, can no longer perform its competitive function. Without a plentiful and growing base supply, the interstate market cannot compete for gas supplies with the unregulated intrastate market. How much less can a gas-short nation protect its consumers in an international market.

The nation's richest opportunity to broaden its gas supply base is conversion of coal and oil shale to gas. With that abundance, it could afford the economic wisdom of permitting gas prices to respond to demand. The nation could also significantly relieve one unnatural and debilitating form of competition--that between energy and the environment.

I believe that the most significant lesson to be drawn from the recent histories of the nation's natural gas and electric utility industries is that as national goals change--and abruptly, as many have--energy policies must be adapted to accommodate those changes. Energy policies must respond more quickly to changing national goals. If energy policies are allowed to fossilize or even lag significantly behind new national needs or aspirations, they cannot contribute to the national interest in the broad spheres in which energy has preempted a dominant role.

We may even speculate whether any national energy policy can effectively respond to the quick-step pace of change if it is codified in the political rhetoric of the time and thereby surrenders its flexibility. Perhaps this critical responsibility should be entrusted to the stewardship of a living agency that could constantly monitor all energy developments and adapt energy policy to current conditions and changing national goals.

III.

ENERGY: BASIS OF NATIONAL GOALS

Pragmatic reflection on the past interactions of national goals and energy policies strongly suggests that the energy plan for the nation has fallen between the two stools of regulation and response to emergencies of supply. Our energy development has been committed to the conflicting determinisms of superimposed rules and forced change. The nation has been faced with the impossibility of reconciling policies conceived in a period of apparent plenty with the present exigencies of real scarcity. The only way the nation can really control its energy future is to act from the strength of energy sufficiency in a free market.

To suggest that energy is a means rather than an end is to understate the realities of our existing society. Adequate energy must be a national goal simply because it is an essential condition precedent for realizing most of our commonly accepted national goals. It is clear that energy shortages have already changed national goals, but prolonged energy scarcity would constrict the nation's choice of possible goals. Whatever necessity breeds it is certainly not options.

A major deficiency of our nation's energy supply would effectively foreclose debate on the pressing concerns of our time--the acceptable cost of energy, the socially desirable level of demand for energy, the reasonable reconciliation of energy production and environmental protection--everything, in short, but how to conserve and ration energy.

Energy questions may turn on any point but the basic need of enough energy to accomplish our national purposes. The controlling force of available energy on human and social aspirations is as evident in the developing nations of the present as it was in the primitive societies of the past. The operative word here is "available." A society's national goals can live only within that society's means.

It is only after the fact of an Edison, let alone the promises of an Einstein, that we can today smile at the assumption of Thomas Macaulay that the illumination of the streets of

London by gaslight represented the pinnacle of progress. After all, Macaulay was as optimistic as his energy means would allow--his real absurdity as a reputed historian was to take the occasion to demean the benighted past, as though he were not as much a captive of his own time as the torch boys of an earlier era.

His mistake was to glorify the present at the expense of the past. It is a reversible fallacy. The pressures of modern civilization have led some contemporary social critics to romanticize the past. But only civilized man can make an ideal of primitivism; for primitive man it was a grim reality. His goals were fiercely immediate--food, shelter and security; his occupation was not to enjoy his environment but to survive in it. And to help him accomplish his objectives, he used what energy he had. We must believe that the only reason primitive man did not become a conspicuous consumer of energy was his conspicuous lack of opportunity.

In the progression from the primitive pack to even rudimentary societies, man has steadily sought to multiply energy sources beyond his own muscle power. He has drawn as he could on the energy potential of nature--sun, wind, water, fuels and animals--to help provide him with the essentials of survival. As societies grew in strength and complexity, energy applications became more sophisticated, efficient and integrated with man's way of life. Whatever we may prefer from hindsight, man long ago committed his progress to energy. Our society, as it has outgrown its own primitive conditions of frontier individualism, is collectively dependent on a huge network of energy not only for the refinements but the essentials of human life.

For common recognition we need only call the roll of the great areas of human concern in which energy contributes a force beyond individual strengths--national security; the production of essential quantities of food, shelter, goods and services; the efficient transportation of people and products; adequate communications; the accommodation of man to his climate; effective health services; and the elevation of the standard of living by reducing the labor required for wages and increasing leisure for recreation, intellectual development and the civilizing arts.

To say this much is not to beg the question of our national goals. It is to respectfully suggest that the energy resources now at our nation's disposal and those we foresee--not hopefully but evidentially--for the future are the essential supports of truly national goals. With sufficient energy and the proper direction of its use, no desirable national goal seems impossible of attainment. But if we, as a nation, permit our national energy base to weaken or if we place arbitrary restrictions on its use through price regulation or allocation to special purposes, we shall have surrendered a national commodity to privilege and perhaps even denied the goals of those to whom the nation must offer the greatest help.

If one of our national goals is--as it must be--to raise the living standard of those at the lower end of the social and economic ladder, it would be unreasonable to deny them the fullest possible use of the products of energy they urgently need to enhance the quality of life, not to mention the challenge, in many cases, to subsist.

But in the end, social goals are more than common denominators. The nation must produce enough energy to offer a better life to all of its citizens--the advantaged as well as the disadvantaged--if it is to preserve the principle of upward mobility that characterizes a vigorous and free society.

If some of us choose a way of life that depends on an abundant use of energy, that should be our privilege, so long as we are able and willing to pay for it. Others may prefer a simpler life, and they should be free to choose that alternative. The freedom of choice in energy use--subject only to the common good--is part of our fabric of freedoms. Preserving it should be a national goal.

Since man has begun to draw so heavily for his expanding energy use on natural resources, the question has been raised of man's obligation to nature. For the moment, let us note that it is a civilized question that would hardly have occurred to a society that had not progressed so far as ours toward

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improving the human condition. And the civilized response is not to pit human goals against ecological goals but to make maximum use of our energy-intensive technology to reconcile them--to improve the extraction and use of energy sources that nature locked into the earth in the beginning and salted with what our civilization calls impurities; to preserve nature's own productive cycle so far as human needs and powers will permit; and to recycle the products of nature to avoid the insult of waste.

IV.

IMPERATIVES OF ENERGY POLICY

In our national tradition, government policy-making is expected to be the instrumentality of orderly progress toward recognized national goals. Government's proper role is not to dictate goals but to create the best possible conditions to meet the goals that arise naturally from national needs. If existing policies do not serve national goals, we must change not the goals but the policies.

Adequate energy, however we ultimately define adequacy, is an enduring national need, and must be served by policy. The first problem of national energy policy is that we do not have one but many fuels policies. We are only now making a beginning on a comprehensive national energy policy after years of precarious coexistence with an assortment of narrowly conceived and often conflicting fuels policies.

Some of these specific policies have retained their validity in terms of broadening our national energy base, and others have been passed by time and circumstance. While they are sometimes dissonant, from their sum we can at least discern the national goals that inspired them.

The range of existing fuels policies encompasses federal programs to support scientific research to increase the supply of energy, enhance its use and decrease its cost; to fix the wellhead price of natural gas; to limit petroleum imports; to encourage nuclear generation; to promote by tax and other incentives the exploration and development of various fuels; and to spur regional coordination of electricity generation and long-distance transmission of power. Allied with these specific fuels policies are conservation laws to prevent waste of valued natural resources, and government regulatory and antitrust policies favoring interfuel competition. In addition, there are policies which have been developed without any conscious consideration of their effect on fuels and energy but which have come to operate as constraints on the attainment of energy goals. The cumulative effect of all these policies must be regarded as our present energy policy.

The national goals that emerge from these fuels policies are national security--reflected in the desire to keep the nation relatively independent in the production of essential fuel resources--and economics, or perhaps more accurately, economies--the achievement of low-cost energy through vigorous fuel competition in the marketplace.

But since the policy evolution toward this partnership of security and economy, a third force has appeared and risen to the top of the national priority scale. Although it may still be too early to recognize the full implications of specific environmental goals, collectively they form a national environmental policy that has already had a significant impact on existing national energy and fuels policies.

Energy and fuels policies have aimed generally at expanding both fuel supply and interfuel competition, making availability and price the measures of choice in the marketplace. But national environmental policy has now created a new test of fuel acceptability that is overriding the free play of market decisions--those choices have been narrowed by government fiat expressed as stringent quality standards for fuels and even absolute prohibitions of their use.

Thus, fuels that national fuels policies have ordained to compete have been ruled out of the marketplace by environmental goals. On the other hand, fuels that could serve the new goals have been effectively foreclosed from the marketplace by existing fuels policies.

This conflict, which has too often been decided in the thin air of crisis, requires a rational, comprehensive approach to policy in both areas--energy and environment. We may think in terms of Economic Man and Ecological Man provided we realize that both are fictions--they are the same man viewed in different perspectives. In the real world, man is a consumer, and energy is his staple whether he is trying to preserve himself or nature. If man's use of energy to satisfy basic needs leaves nature in disrepair, the same energy is the only significant means to repair it.

The nation must reshape its energy policies to broaden its energy base with respect for both nature and the marketplace. That can be done. With a technological commitment to redeem such basic fuels as high-sulfur coal and oil through emission controls and--even better--conversion techniques, the nation could vastly improve its fuel store. That would in turn increase the feasibility and strengthen the rationale for eliminating price regulation of natural gas, which has distorted the market and the reasonable allocation of fuel resources. It has resulted in a merely more sophisticated form of flaring gas by encouraging the short-term expedient of using this specialized fuel under power boilers.

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We believe that the establishment of a realistic, comprehensive national energy policy will assure the development of an adequate domestic supply of fuel and energy which can be primarily relied upon by both present and future generations to meet the demands of the free market as well as the demands created by these emerging national goals.

V.

CONCLUSION

As part of this assessment of national goals, it must be recognized that we can no longer even think about our contemporary problems in the framework of the past. Contemporary national problems call for responses within the context of a far broader perspective than that which has been employed in the past. This is true not only in the area of the development of national energy policy, but in other areas of national concern. Transportation policy for the nation, for example, if it is to be relevant to contemporary goals, cannot continue to be formulated with continuing conflicts between maritime policy, surface transport policy, highway construction programs, and air transport policies. The national transportation crisis also cries for resolution in an integrated, comprehensive fashion to serve the new national goals of a highly mobile and urban society. And so it is in every other area involving an interface between government policies and business enterprise. Today government and industry are being forced to reassess existing policies in both the public and private sector in order to determine their relevancy to the achievement of our newly emergent national goal of preserving and enhancing the quality of life. This has given rise to a wide range of entirely new issues for both government and industry. The concern of the public today for the quality of broadcasting is the most fundamental issue facing government and industry in the communications field; the public's concern with the quality of merchandise and products lies at the heart of the issues before the Federal Trade Commission; the public's concern regarding the integrity and quality of electric power and the adequacy of the supply of gas service is the dominant concern of the utility industry and the government; and the quality of transportation service is an emerging concern of both government and the transportation industry. Thus today fundamental questions are being raised concerning the efficacy of our technology and whether it is being directed into areas which are relevant to contemporary national goals.

All of the substantive issues in each of these areas of national interest share a common concern--the quality of life. Our national approach to these problems requires a vastly broader perspective than that which has been employed in the past and that, in the final analysis, provides the greatest contemporary challenge to both government and industry; namely, whether governmental and business policies are sufficiently flexible and creative to keep abreast of and respond to our new national goals--the public's new values.

President Nixon in his State of the Union address set the tone for the formulation of national goals when he stressed the importance of the "quality of life." Energy is so intimately bound with the quality of the nation's life that we must quicken our efforts to establish a national energy policy that will combine scope with a unity of purpose--to assure the nation of adequate energy and wise direction of its use.

Senator GRAVEL. The next witness is Mr. Thornton Bradshaw, president of Atlantic Richfield.

STATEMENT OF THORNTON BRADSHAW, PRESIDENT, ATLANTIC RICHFIELD CO.

Mr. BRADSHAW. I think I can summarize this paper in one sentence, that is, it attempts to scotch the rumor that national goals can be achieved without the base of a strong and viable economy. Of course, my paper is much more loftier and statesmanlike than that.

I do compliment the committee for starting these sessions off with a discussion of national goals, because as the chairman said earlier, energy itself is not an end, it is only a means toward achieving the goals which we as a people want to achieve.

Now, in the paper I cover the matter of how we identify national goals in a democracy, what some of the substance of these national goals might be, and finally, what is the relationship of energy to goals.

Now, in a very brief summary of that, national goals are, of course, evolutionary. They change from the stage of development from one nation to another. In the early stages it is one of security, internal or external. At a later stage in a developing nation, the primary national goals may be the achievement of material needs, fulfillment of material needs.

The United States, of course, as a highly developed nation is fortunately in a third stage where we can turn our attention to some less tangible goals. These less tangible goals are, of course, achieving great promise, and should in a nation of this kind.

This is not to say in any way our material goals have been thoroughly obtained. We still cannot be satisfied when 25 million of our people are below the poverty level. We cannot be satisfied when one-third of the children are in need of immediate medical attention, and when there are 60 million people living in conditions of urban blight.

So, we have not attained our goals by any means, but we have attained a large portion of them. For those who have attained it, what kind of goals can we look forward to? There are goals of improved quality of life and a just life. We have seen in this country considerable dissatisfaction among the young, and many others, of course, with our customary values, seeking social responsibility, and I think this has come about because we have this affluence, we have fulfilled many of our material needs, and we can turn our energy toward the attainment of social goals.

The substance of these goals are subjective and intangible. The emphasis is on human values, of course, but I submit an intrinsic part of the determination of these goals must be freedom of choice if we are to remain or keep one of our great heritages.

The characteristics of these goals as they develop are, of course, vague, but regardless of definition they will require a healthy, growing economy as a base. They will require what economists call a surplus if we are to attain these other goals.

We know that some elements of our economy are in conflict with improved human conditions. This results, I believe, from our failure in the past to reflect full social costs into the costs of products. This has resulted in the degradation of the environment. We do not have the mechanism to correct this unless we can assign full social costs of products produced by industry. Then we can let the marketplace determine, and then we have not given up our freedom of choice.

Now, the relationship of all of this to energy. Without suitable energy there is no healthy economy, and these goals, in my opinion, cannot be realized. I am sure you will get much testimony in terms of how basic energy is. The measurement of energy is another way of measuring the development of a nation.

As an example, in most undeveloped nations, some 70 to 80 percent of the people are engaged in agriculture. In the United States, less than 10 percent are engaged. Today, in the United States, we use some 4,000 times the amount of energy from energy sources than could be generated by the entire work force of the United States.

Now, there are those who advocate returning to a simple life. This, in my opinion, is simply not reasonable as long as we have inequities and injustices and national goals to attain.

Now, we have going for us some very large things. First, we have this surplus, this economic surplus out of which we can work. Second, we have this realization of the injustices which must be overcome. And, third, we have the potential of energy in this Nation. We have only to devise a reasonable balance with the environment. We have supplies of clean gas which can be found in the United States. We have supplies of low sulfur fuels which can be found. We are learning how to remove sulfur from high sulfur fuel oil. We are progressing very fast in the area of creating fuels from synthetics, and we are, of course, advancing in the area of nuclear energy.

We must, however, recognize that whether they be national goals or energy subgoals, there will be conflicts in each goal and our job is to resolve these conflicts, compromise on them.

In the area of national goals, for instance, economic growth, which means jobs, this conflicts at times with the environment. In terms of fulfilling the material needs on the one hand and achieving social goals on the other hand, there can be conflicts and we must compromise on the conflict.

In the area of energy, the use of low-cost fuel on the one hand and the use of the less polluting fuels on the other hand sometimes represents a conflict, and it must be compromised.

Sometimes we have the conflict between the lowest cost fuel versus the most secure fuel. So, basically, what I am saying is that delegate compromises are needed in the development of a national energy policy, and in summary I would merely repeat what the chairman started with, energy is not an end to itself, it is, however, indispensible to a growing, healthy economy, and a growing, healthy economy is indispensable to the attainment of national goals.

Thank you.

Senator GRAVEL. Thank you very much, Mr. Bradshaw.

(The prepared statement of Mr. Bradshaw follows:)

THE NATIONAL GOALS AND ENERGY POLICY

STATEMENT OF THORNTON F. BRADSHAW, President
ATLANTIC RICHFIELD COMPANY
before the
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
UNITED STATES SENATE

In appearing before this distinguished committee, I wish first to express my appreciation for this privilege. I would also commend the committee and its chairman on the method selected to approach the challenging task of studying and devising a national energy policy. The need for an adequate policy is very evident and most pressing, yet it is to the credit of this committee that you have elected to forego what would have been an understandable desire or even a temptation to begin by dealing immediately with the complex specifics of an energy policy. A careful examination of our national goals and the processes by which they are developed are essential to your study and display a high degree of social awareness. These investigations should also greatly enhance the likelihood of success attending your efforts. For my contribution to this phase of the study, I will direct my remarks to three areas that seem to me appropriate for this symposium: the processes through which national goals are identified and formulated, the substance of the goals and ways in which they are likely to be achieved, and the relationship of energy to formulation and attainment of the national goals.

The evolutionary nature of our national goals has been made very clear by the thorough and discerning work already completed by this committee and its staff. As a result of these and similar efforts by others, I think it is possible to observe that the national goals of this or any other nation have usually been linked in the past in a significant way to the political and economic development of the society. To be sure, other kinds of factors played and still do play important roles in goal formulations, and such factors may assume greater or lesser importance with the passage of time or existing circumstances. Obviously, the particular array of goals usually first adopted and vigorously pursued by newly formed nations will be those relating to attaining political stability and the removal of internal and external threats to continued national existence. Such goals, while necessary, have been in the past and, regrettably, still today may be pursued in a manner and to an extent that ignores or possibly intensifies the basic needs of the people. Attainment of reasonable national political stability, however, tends to turn the principal thrust of national goals toward the basic necessities of the people. Typically, these goals relate to maximizing the quantity of goods and services, and to distribution of the national economic output.

Types of goals that I have mentioned -- those dealing with national survival and material needs of the people -- seem to be capable of definition in a tangible way, albeit much judgment is involved and honest men will differ widely on definition, standards, and application. If, however, a nation is so fortunate that it is able to provide in a reasonable way for its continued survival as a nation and for the material needs of many of its individuals, then it follows that the nation is ready to identify and develop other kinds of national goals. I am convinced that, although the United States is still far from the long awaited day when we can say in confidence that our national survival is assured and in truth that all of our people have had most of their material needs met fairly, we have progressed to a point where many have recognized or are searching for meaningful goals not principally related to survival or their own material satisfaction.

The United States is one of the major nations of the world that is significantly troubled by the problem of embracing national goals beyond survival and material satisfaction. This is not to say that our nation must not be concerned with and have appropriate goals relating to these needs. Allow me to quote a few familiar statistics. With some 25 million or about 13% of our people having incomes classified as below the poverty level, it is clearly unrealistic to say that material needs are not a primary concern of many. Among these poor, one-third of the children are believed to require immediate medical attention. Moreover, it has been estimated that 20 million persons live in substandard housing, and that another 60 million live in various stages of urban blight.

These few statistics underscore the urgent need to increase our material abundance and to see that this abundance is directed fairly to overcome these and other national problems. Other huge segments of our population, while not falling into the categories I mentioned, are quite justified in viewing their material situations as far from satisfactory. It is apparent that our economy must do more, not less, to satisfy these needs.

While bearing such unfulfilled needs in mind, we can observe that other portions of our population have indeed experienced substantial satisfaction of many of their material needs, and as the economists would say, "each succeeding increment brings diminished marginal utility." If these individuals are not to be fulfilled by more and more goods and services, what then? I think we already have the answer and have known the answer for many years. We will move toward improving the quality of life and toward attaining a just life for all of our people -- in other words, we will move toward increased social responsibility.

Few fail to be impressed with the restless mood that has settled on America, as well as on many other nations. Dissatisfaction with customary values and a traditional way of life seems an endemic trait, especially among the young, but by no means confined to them. Although the reasons may be many and varied, it would seem some basic conditions underlie this unrest. Undoubtedly, advanced economies have attained substantial satisfaction of the material needs of meaningful portions of the societies involved, and this fulfillment makes possible a redirection of a portion of their endeavors to pursuits not involving these needs. At the same time, great progress in mass communications has brought accurate and vivid portrayal of major events directly into our homes. How different to witness an injustice almost first hand, rather than to read or hear a reportorial account! With the knowledge that we have the means to devote a significant portion of our efforts to those ends we choose and with accurate knowledge of unsatisfactory social situations through mass communications, it is no wonder that the fundamental sense of fair play present in most humans is aroused and summoned to action. Hence, I believe that we shall continue to see much progress toward national goals dealing with social responsibility and the improved quality of life -- goals that emphasize human values and relate less to material values.

This brings me to what the substance of newer goals may be. Knowing that these goals are largely subjective and are based in part on intangibles, it is of limited usefulness to recite any particular list, although I do have an opinion on what many of them should be. We have in this nation over, 200 million people and are likely to find over 200 million different value scales, although most would agree on major particulars. However, I believe that we can surmise that our goals will have certain characteristics even though we may not be able to foresee the exact content. Clearly our future goals will emphasize human values -- quality of life will be as important as quantities of goods. A just life will be achieved for all our people. As individuals demand and secure greater control over their own destinies, freedom of choice must be enhanced. This probably will mean that the role of government will become more that of ensuring the necessary conditions for free choice and individual fulfillment, rather than playing a direct role as it must in matters of national survival and assuring material needs. While other characteristics of the future goals are vague, there appear to be some necessary economic prerequisites for the type of goals I have outlined.

This latter point has particular relevance for energy policy. If we are unlikely to arrive at an exact definition of our national goals, and particularly those that will be generally accepted in the future, is there really much we can do now about the conditions that will be necessary to ensure that such goals will be achievable? Certainly without exact definition it is impossible to state what the sufficient conditions will be. On the other hand, I believe that we can predict with confidence that nearly any

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reasonable array of national goals that are oriented toward social responsibility, as well as survival and material needs, will require substantial capacities in the economy to produce many goods and services much beyond the basic material needs. In point of fact, lack of such economic surpluses will preclude meaningful occupation with the problems of social progress, as is the case in many of the less fortunate nations of the world.

When advocating improved economic performance as a necessary condition for achieving social progress, it is important to recognize that certain elements of our economic system presently are in conflict with improved social responsibility. A good example of the type of conflict I have in mind is a common failure to reflect full social costs in the prices of today's goods and services. All of us are familiar with the problems of connecting the social costs of air and water pollution that fall on certain segments of the population with the prices of the goods and services that are sold in the market. Degradation of the environment resulting from this situation is no longer acceptable to most of our society. Therefore, ways must be developed, and developed promptly, to reflect social costs so that our system of free markets can function properly to balance supply and demand at appropriate prices. Introduction of suitable incentives, along with necessary disincentives, will enable our economic system of free individuals operating in free markets to continue to achieve maximum progress towards our goals. It would be easy to yield to the demands of some who insist on their own goals and priorities, but the eventual outcome would probably be less genuine progress than would be achieved in a free society employing a realistic pricing mechanism.

As a final observation on formulation and achievement of national goals, I would stress the role of innovation and experimentation in the evolution of our goals. As observed earlier, goals oriented toward social responsibility can be only partly deduced because diverse and variable human values are involved. In order to shorten what is nearly always a lengthy process of evolution, our corporations, government, and other kinds of existing institutions must take the lead in moving toward humanitarian ends. Such institutions possess within their existing frameworks the necessary resources to devise and try out innovative social programs. True, some of these programs will fail, but others will succeed and point the way toward meaningful advancement. By properly emphasizing human values in the workings of our institutions and by humanizing our technologies, most of our institutions can be and will become efficient vehicles to accelerate the course of social progress. Those that do not, or will not, can expect to be eclipsed by those that develop a social consciousness.

I will now focus more closely on how the processes of goal formulation and goal achievement relate to energy policy -- the proximate concern of your committee. This relationship is readily recognized as a very fundamental one: If suitable energy is not available to support the economy whose outputs are directed to accomplishing the national goals, then the goals cannot be realized. Hence, energy availability is clearly a necessary condition, but in no sense a sufficient condition, for achieving our goals -- be they directed to national survival, material needs, social progress, or almost any other matter.

The role of energy in an advanced economy is so basic that it is usually taken for granted until some problem arises to remind us of our dependency. It is not necessary to dwell on the close correlation between energy use and development of society; in fact, per capita use of energy can be a convenient reference to measure the state of development and standard of living. As has been observed frequently, developing nations are obliged to devote 70 to 80% of their work forces to production and distribution of food, which of course is only one of life's bare necessities. In an advanced economy such as our own, the tasks of food production and distribution are accomplished by about 10% of the work force. Freeing many of the workers to devote their efforts to other productive tasks is made possible through extensive use of inanimate energy to multiply human effectiveness manyfold.

History records that in past civilizations life's essentials beyond the survival level were available in most instances only to a very small minority of the privileged elite. Their way of life had to be supported by large groups of exploited humans who existed at essentially a subsistence level. One of the prerequisites for progress from those lamentable conditions has been an abundance of inanimate energy to replace and multiply human energy. The extent to which we now utilize, and depend on, such energy can be dramatized by noting that the quantity of primary fuels now used in the United States contains about 4,000 times the quantity of physical energy that could be developed by our entire work force. Furthermore, utilization of this kind of energy has added much quality to our lives, in addition to quantity, because many modern accomplishments -- such as mass communications that I mentioned earlier -- could never have come to pass even with unlimited human muscle power. Though some have indicated a desire to return to a simpler life, and this may be appropriate for them, most people are happy to be relieved of the monotonous and exhausting tasks that are now performed through use of inanimate energy.

Increased use of present forms of energy has not been entirely an unmixed blessing. Considerable environmental damage has been one unwanted result. Our society has somewhat belatedly recognized the seriousness of this problem and is showing a willingness to modify its use of energy in ways that will minimize environmental impact. It is most gratifying to know that this nation has all the energy resources it will require for many decades and has only to devise appropriate policies to achieve a reasonable balance with the environment. We are fortunate in having available substantial quantities of natural gas -- the least polluting of the fossil fuels -- and we have the promise of much more waiting to be found. We are also fortunate in producing currently nearly half of the free world's output of low sulfur crude oils and in having very large reserves of low sulfur coals awaiting development. We are learning how to remove sulfur and other undesireable materials from our fuels and their end products; how to synthesize new energy sources; and how to make nuclear electrical power plants less of a burden on the environment. In the more distant future, we have the promise of breeder, and possible fusion, reactors producing energy in carefully controlled, pollution-free central facilities, so that the output of energy can be distributed and used in myriad applications without pollution. Nevertheless, while we await fulfillment of this promise our policy efforts must deal with the present and the foreseeable future.

As the task of devising a specific energy policy is approached, it is vital to recognize the conflicts that are inherent in our goals, as well as those present in our energy objectives. From the standpoint of goals, the impact of environmental quality measures on the economy is one such conflict; another is whether we will devote greater portions of our resources to social needs and less to material fulfillment; many others come to mind. In the energy area, there is frequently a conflict between the lowest cost fuel and the least polluting one; a balance must be struck between security of energy supply and the lowest cost; many other examples could be mentioned. Such conflicts mean that both our national goals and our energy policies must be based on delicate compromises, and these compromises must be the result of the best judgment that can be applied after a careful weighing of what can be accomplished with what must be foregone.

I will conclude by stating that we must frame our energy policy with the knowledge that energy, while never a goal in itself, is one of the indispensible means by which our national goals can be attained. We will never reach our goals by restricting the use of energy, but instead we must require that it be used properly and wisely. Our supply of energy must be ample and it must be clean. It must also be secure and of reasonable and realistic cost. If our energy policy has served to create these conditions, then we will be assured that a key element in reaching our goals has been provided. Whether we do reach these goals will then depend on our wisdom in establishing them and in directing our talents to achieving them.

Senator GRAVEL. Dr. Earl Cook.

STATEMENT OF DR. EARL COOK, ASSOCIATE DEAN, COLLEGE OF GEOSCIENCES, TEXAS A. & M. UNIVERSITY

Dr. COOK. Thank you.

In my paper I try to make what to me is a useful distinction between national goals and strategies. Other people use the word "policies" for "strategies." It seems to me national goals really don't change very abruptly, but the public priorities given to those goals do change. An example is environmental quality.

Environmental quality as a public goal is not really a new goal, but it has been given greater priority recently, and there has been greater attention given to appropriate strategies of achieving that goal.

I think, also, that—especially after reading the papers of the other gentlemen at this table, that there already exists substantial agreement on national goals. Goals like freedom of individual choice and opportunity, of national security, of a high material standard of living, high quality of health, high quality of the physical and social environments.

It is much harder to get agreement on appropriate strategies of achieving these goals than it is on the goals themselves. For two fundamental reasons. One, the difficulty of predicting the effectiveness and the total impact of a specific strategy. And two, the fact that strategies often directly threaten economic interest and hardened ideologists.

The most explicit expression of national and personal goals in our society is life, liberty, and the pursuit of happiness. In practical terms, this means we want the longest life, the greatest freedom of individual choice, and the highest feeling of well-being that we can get at the least expense to ourselves.

Applied to the use of energy as public or national goals, this phrase, "life, liberty, and the pursuit of happiness," requires our leaders to seek maximum energy available at the least economic and social costs, and to make it equitably available according to the formula of the greatest good for the greatest number.

I have chosen in my paper to highlight another thing, and that is that strategies must change with the times. They must take into account such factors as accelerating depletion of fossil fuels, evolving technology, shifting resource bases, effects of population increases, and the urban impacts, the environmental impact of energy use, changing values in society and fluctuations in the competitive strength of the United States.

I have sought to illustrate the difference between short- and long-term effect in relation to three existing energy strategies or policies. One of these having to do with the so-called production incentives for fossil fuels.

I submit that because benefits of depletion allowances and supported prices can be realized only by producing and selling oil and gas, that these incentives are really production incentives, rather than discovery incentives. They stimulate production of resources which are limited and nonrenewable and that they hasten the day of dependence on foreign imports or substitute resources.

Granted, for the short term they increase our security and contribute to national economic efficiency. But in the long term, do they actually work that way? I suggest that we look at new ways, new strategies. One of these would be to experiment with new arrangements designed to stimulate exploration and discovery of reserves, but not immediate production. That would require some form of public paper, the costs of keeping resources in the ground while protecting the profit motivated system on which discovery depends.

There is another alternative which is probably much less acceptable to the people of this country, and that would be for the Government to get into the discovery business.

Another short-term strategy that may have long-term bad effects—Mr. Bagge has already mentioned this in his paper—the effects of utility rate regulations, both on electrical power and natural gas. When regulatory agencies allow only a 7-percent return on invested-capital to the utility company which must pay 10 percent on money borrowed for capital improvements, and this 10 percent is a figure which two or three of the companies on the eastern seaboard have had to pay in the last few years, there are only two ways for that company to make up the difference—by rate increases and enlarging its market. This is one of the incentives for the increased use of energy Mr. McCloskey points to in his paper.

The third one is the matter of short- and long-term oil import policies. It seems to me as a bystander that in the last 40 years it has become a firm governmental policy that U.S. companies, especially oil companies alone, unsupported by their government, in this relation with the other countries in which they explore, discover, and produce oil and gas, we don't negotiate with the producing countries as a government whose energy policies are carried out by private companies. We let the companies do the negotiating, and if their costs are escalated by requirements we would consider inappropriate at home, or if their assets are expropriated, that is their hard luck.

I think we should soon need to take a hard look at this policy and consider revising it. It is not an oil company problem, it is a national problem. It would be tragic if we let the nationalism and the desires of producing countries determine our oil import strategies for the future.

What I am trying to say is that we need to try to free ourselves from institutional and ideological constraints if we are indeed to do the best job of choosing among alternative strategies.

Thank you.

Senator GRAVEL. Thank you very much.

(The prepared statement of Mr. Cook follows:)

NATIONAL GOALS AND ENERGY STRATEGIES

by Earl Cook

Texas A&M University

National goals reflect personal goals

A goal is the abstract expression of a felt or perceived need. A national goal reflects a need perceived by the leaders of a nation which they feel will be supported by a majority of the individuals on whom they must depend for implementation of strategies designed to achieve that goal.

National goals conflict and require compromises and trade-offs because personal goals conflict. Furthermore, just as the goals of an individual change with the stage of his development and the circumstances of his life, so do the goals of a nation change as its population grows, its economy matures, its technology develops, and its resource constraints evolve.

National goals resemble personal goals in another way: rarely, if ever, are they expressed in full and explicit fashion. Reluctance to do so has several roots: an awareness that goals, or the priority among goals, may change as circumstances change; a wish to cloak basic desires in nice or even self-deluding language; a hope of avoiding the hard decisions implicit in conflicting goals.

Finally, national goals as expressed in policy are like personal goals in yet another way: they often are determined or strongly influenced by ad hoc strategic decisions not made in the context of clearly expressed goals. American political action is pragmatic and expedient, rather than idealistic and principled. Democratic government inhibits the long view because it reflects the immediate desires of the public and the demands of those who have access to points of decision.

"Life, liberty, and the pursuit of happiness"

The most explicit expression of personal goals in our society is "life, liberty, and the pursuit of happiness". In practical terms, this means we want the longest life, the greatest freedom of individual choice, and the highest feeling of well-being we can get at the least expense to ourselves. In addition to physiological health, which we all want, "well-being" implies comfort, convenience, and the approval of our fellows; in addition, it may include knowledge and power.

Applied to the use of energy in the modern context, acceptance of "life, liberty, and the pursuit of happiness" as public or national goals requires our leaders to seek to make maximum energy available at the least economic and social cost, and furthermore to make energy equitably available according to the formula of the "greatest good for the greatest number".

In other words, we seek high per capita energy availability, broad public access to that energy, reasonable prices even for small increments, convenient conversion devices, and little or no adverse effects on us or our environment from the intensive use of energy. In addition, we want to see these ideal conditions extend throughout our lifetimes and at least far enough into posterity to protect those children born in our lifetimes and for whom we accept some measure of responsibility.

Until rather recently, Americans seem to have assumed that the ideal, or quasi-ideal conditions of energy availability and use were attainable.

Now, environmental and resource-availability problems related to energy use are raising serious questions about the nation's ability to continue increasing its use of energy at reasonable costs to society.

Defects of short-term strategies: production incentives

The conflicts among the goals of full employment, abundant low-cost energy, environmental quality, and national security are becoming obvious. Not so obvious are some of the conflicts between short-term and long-term strategies related to individual goals.

For example, take the strategy of tax incentives and import quotas to increase the rate of discovery of domestic reserves of oil and natural gas. Because the benefits of depletion allowances and supported prices can be realized only by producing and selling oil and gas, discovery incentives are also production incentives. And to stimulate production of a resource which is limited and non-renewable hastens the day of dependence on foreign imports or on a substitute resource. In other words, a short-term strategy for meeting energy needs works in the longer term against energy-resource security. Even in the short term, it may stimulate the use of energy in ways that are harmful to the environment and unnecessary to national well-being.

A more appropriate strategy would be aimed at developing strategic domestic reserves of oil and gas, while continuing to import lower-cost foreign oil as long as it may be available at reasonable cost. Such a strategy would call for experimenting with new arrangements designed to stimulate exploration and discovery of reserves, but not immediate production. It would require some form of public payment of the costs of keeping reserves in the ground, while protecting the profit-motivated system on which discovery depends. Alternatively, the government itself could enter into exploration for oil and gas reserves, and sit on the reserves so developed until they are needed, as already it has done in the case of the Naval Petroleum Reserves.

Defects of short-term strategies: utility rate regulation

Existing patterns of government interaction with private enterprise in the energy field need to be given a fresh look. Strange as it may seem, rate regulation of public utilities can work in the direction of increased consumption of limited resources and stronger environmental impact. When regulatory agencies allow only a 7 percent return on invested capital to a utility company which must pay 10 percent on money borrowed for capital improvement, there are only two ways for the utility to make up the difference: by rate increases or by enlarging its market. There is an economic imperative for that company to solicit new customers and to encourage greater use of energy, no matter what it is used for; it is quixotic to expect a company in that sort of bind to attempt to decrease its sales in order to protect the environment or to preserve resources.

In this case, a helpful new strategy would involve realistic pricing, including experiments with regressive pricing, that would anticipate rather than lag behind the costs of necessary expansion and of environmental protection. The fact must be faced that only an increase in the real cost of energy will put the brakes on consumption; as long as we continue to subsidize the consumption of energy by tax policies, by pricing structures, and by externalizing social costs, we have little chance to bring the system under rational constraints.

Defects of short-term strategies: oil companies and import policy

In the last forty years, it has become a firm governmental policy that United States companies, especially oil companies, stand alone, unsupported by their government, in their relations with the other countries in which they explore for, discover, and produce oil and gas. We do not negotiate with the producing countries as a government whose energy policies are carried out by private companies. We let the companies do the negotiating. If their costs are escalated by requirements we would consider inappropriate at home, or if their assets are expropriated, that's their hard luck, or so we have seemed to say.

We shall soon need to take a hard look at this policy and consider revising it. Even if we substitute electrically charged motors for the internal-combustion engine in the central city, even if we turn massively to nuclear power plants, our need for petroleum will continue to increase. The day is not far off when we shall have to import half of our petroleum requirements, constituting more than a third of our total energy needs. Perhaps the national-security rationale for our oil-import restrictions has been overstressed in the past. But we should not allow that feeling to obscure our view of the major problem of insuring a large inflow of foreign petroleum during the period when we shall need it desperately, the next 50 years. This is not an oil-company problem; it is a national problem. It would be tragic if we let the nationalism of the other producing countries and old-fashioned prejudice against "oil imperialism" at home determine our oil-import strategy.

We need to explore ways of insuring our interest in foreign oil; to consider government-to-government negotiations and contracts; and to look at ways of making international oil companies instruments of national policy, rather than the scapegoats of national failure.

Choosing strategies is harder than defining goals

I have put forth these suggestions, not because they illuminate all or even most of our important energy problems, and not because I think they contain sure-fire solutions, but simply to illustrate my conviction that we need to try to free ourselves from institutional and ideological constraints if we are to do the best job of choosing among alternative strategies for achieving national goals related to energy.

By now my bias in favor of the study of strategies rather than goals will be obvious. Goals are important, but agreement on goals is much easier to achieve than agreement on strategies. Goals affect interests indirectly. Strategies affect interests directly. And so the bloody fights of this world have been over strategies, not goals.

Furthermore, goals may remain relatively static, but strategies must change as conditions change. Our energy strategies must take into account such factors as accelerating depletion of the fossil fuels; evolving extraction, transportation, and conversion technology; the shifting resource base; the effects of population increase and of the urban implosion; environmental impacts of energy use; changing values in society; and fluctuations in the competitive strength of the United States.

Goals may not be easy, but strategies are hard.

[From the *Scientific American*, September, 1971, Vol. 225, No. 3]

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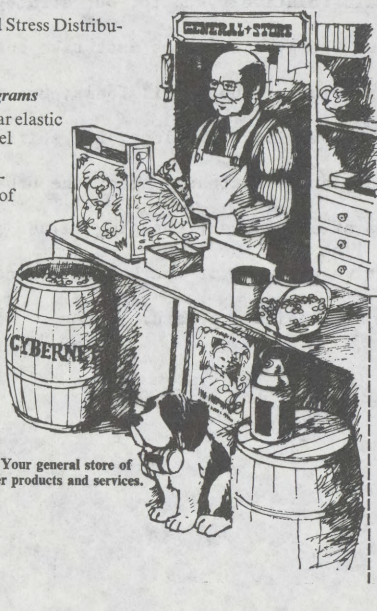

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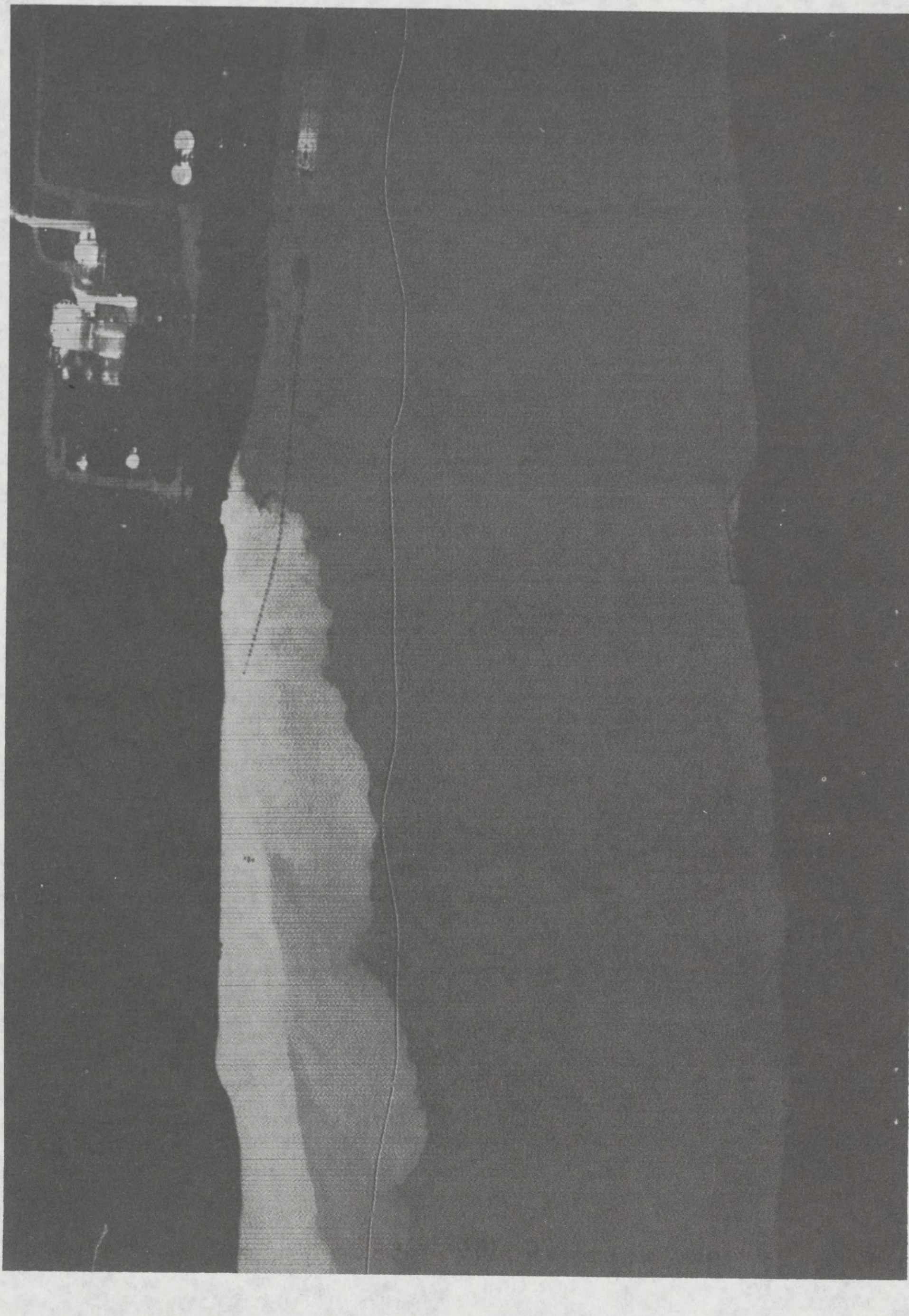

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The Flow of Energy in an Industrial Society

The U.S., with 6 percent of the world's population, uses 35 percent of the world's energy. In the long run the limiting factor in high levels of energy consumption will be the disposal of the waste heat

by Earl Cook

This article will describe the flow of energy through an industrial society: the U.S. Industrial societies are based on the use of power: the rate at which useful work is done. Power depends on energy, which is the ability to do work. A power-rich society consumes—more accurately, degrades—energy in large amounts. The success of an industrial society, the growth of its economy, the quality of the life of its people and its impact on other societies and on the total environment are determined in large part by the quantities and the kinds of energy resources it exploits and by the efficiency of its systems for converting potential energy into work and heat.

Whether by hunting, by farming or by burning fuel, man introduces himself into the natural energy cycle, converting energy from less desired forms to more desired ones: from grass to beef, from wood to heat, from coal to electricity. What characterizes the industrial societies is their enormous consumption of energy and the fact that this consumption is primarily at the expense of "capital" rather than of "income," that is, at the expense of solar energy stored in coal, oil and natural gas rather than of solar radiation, water, wind and muscle power. The advanced industrial societies, the U.S. in particular, are further characterized by their increasing dependence on electricity, a trend that has direct effects on gross energy consumption and indirect effects on environmental quality.

The familiar exponential curve of increasing energy consumption can be considered in terms of various stages of human development [*see illustration on next page*]. As long as man's energy consumption depended on the food he could eat, the rate of consumption was some 2,000 kilocalories per day; the domestication of fire may have raised it to 4,000 kilocalories. In a primitive agricultural society with some domestic animals the rate rose to perhaps 12,000 kilocalories; more advanced farming societies may have doubled that consumption. At the height of the low-technology industrial revolution, say between 1850 and 1870, per capita daily consumption reached 70,000 kilocalories in England, Germany and the U.S. The succeeding high-technology revolution was brought about by the central electric-power station and the automobile, which enable the average person to apply power in his home and on the road. Beginning shortly before 1900, per capita energy consumption in the U.S. rose at an increasing rate to the 1970 figure: about 230,000 kilocalories per day, or about 65×10^{15} British thermal units (B.t.u.) per year for the country as a whole. Today the industrial regions, with 30 percent of the world's people, consume 80 percent of the world's energy. The U.S., with 6 percent of the people, consumes 35 percent of the energy.

HEAT DISCHARGE from a power plant on the Connecticut River at Middletown, Conn., is shown in this infrared scanning radiograph. The power plant is at upper left, its structures outlined by their heat radiation. The luminous cloud running along the left bank of the river is warm water discharged from the cooling system of the plant. The vertical oblong object at top left center is an oil tanker. The luminous spot astern is the infrared glow of its engine room. The dark streak between the tanker and the warm-water region is a breakwater. The irregular line running down the middle of the picture is an artifact of the infrared scanning system. The picture was made by HRB-Singer, Inc., for U.S. Geological Survey.

In the early stages of its development in western Europe industrial society based its power technology on income sources of energy, but the explosive growth of the past century and a half has been fed by the fossil fuels, which are not renewable on any time scale meaningful to man. Modern industrial society is totally dependent on high rates of consumption of natural gas, petroleum and coal. These nonrenewable fossil-fuel resources currently provide 96 percent of the gross energy input into the U.S. economy [*see top illustration on page 137*]. Nuclear power, which in 1970 accounted for only .3 percent of the total energy input, is also (with present reactor technology) based on a capital source of energy: uranium 235. The energy of falling water, converted to hydropower, is the only income source of energy that now makes any significant contribution to the U.S. economy, and its proportional role seems to be declining from a peak reached in 1950.

Since 1945 coal's share of the U.S. energy input has declined sharply, while both natural gas and petroleum have increased their share. The shift is reflected in import figures. Net imports of petroleum and petroleum products doubled between 1960 and 1970 and now constitute almost 30 percent of gross consumption. In 1960 there were no imports of natural gas; last year natural-gas imports (by pipeline from Canada and as liquefied gas carried in cryogenic tankers) accounted for almost 4 percent of gross consumption and were increasing.

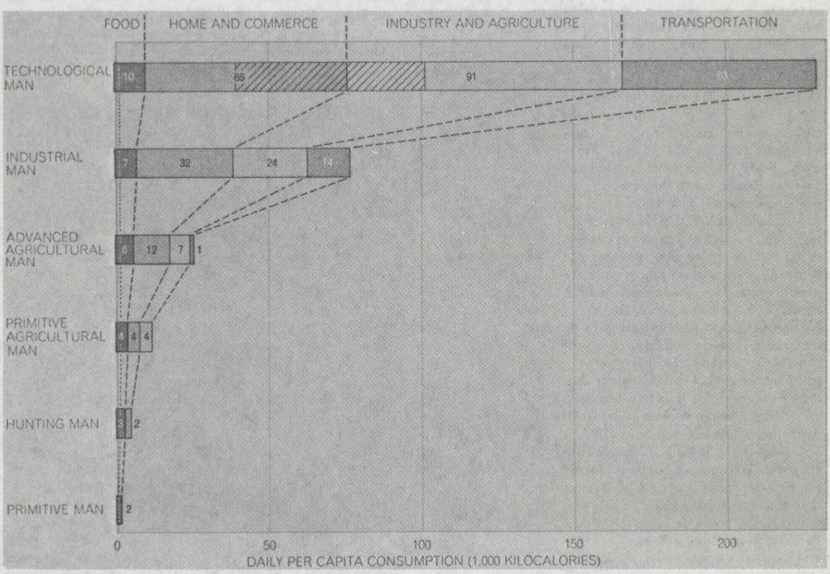
The reasons for the shift to oil and gas are not hard to find. The conversion of railroads to diesel engines represented a large substitution of petroleum for coal. The rapid growth, beginning during World War II, of the national network of high-pressure gas-transmission lines greatly extended the availability of natural gas. The explosion of the U.S. automobile population, which grew twice as fast as the human population in the decade 1960–1970, and the expansion of the nation's fleet of jet aircraft account for much of the increase in petroleum consumption. In recent years the demand for cleaner air has led to the substitution of natural gas or low-sulfur residual fuel oil for high-sulfur coal in many central power plants.

An examination of energy inputs by sector of the U.S. economy rather than by source reveals that much of the recent increase has been going into household, commercial and transportation applications rather than industrial ones [*see bottom illustration on opposite page*]. What is most striking is the growth of the electricity sector. In 1970 almost 10 percent of the country's useful work was done by electricity. That is not the whole story. When the flow of energy from resources to end uses is charted for 1970 [*see illustration on pages 138 and 139*], it is seen that producing that much electricity accounted for 26 percent of the gross consumption of energy, because of inefficiencies in generation and transmission. If electricity's portion of end-use consumption rises to about 25 percent by the year 2000, as is expected, then its generation will account for between 43 and 53 percent of the country's gross energy consumption. At that point an amount of energy equal to about half of the useful work done in the U.S. will be in the form of waste heat from power stations!

All energy conversions are more or less inefficient, of course, as the flow diagram makes clear. In the case of electricity there are losses at the power plant, in transmission and at the point of application of power; in the case of fuels consumed in end uses the loss comes at the point of use. The 1970 U.S. gross consumption of 64.6×10^{15} B.t.u. of energy (or 16.3×10^{15} kilocalories, or 19×10^{12} kilowatt-hours) ends up as 32.8×10^{15} B.t.u. of useful work and 31.8×10^{15} B.t.u. of waste heat, amounting to an overall efficiency of about 51 percent.

The flow diagram shows the pathways of the energy that drives machines, provides heat for manufacturing processes and heats, cools and lights the country. It does not represent the total energy budget because it includes neither food nor vegetable fiber, both of which bring solar energy into the economy through photosynthesis. Nor does it include environmental space heating by solar radiation, which makes life on the earth possible and would be by far the largest component of a total energy budget for any area and any society.

The minute fraction of the solar flux that is trapped and stored in plants provides each American with some 10,000 kilocalories per day of gross food production and about the same amount in the form of nonfood vegetable fiber. The fiber currently contributes little to the energy supply. The food, however, fu-

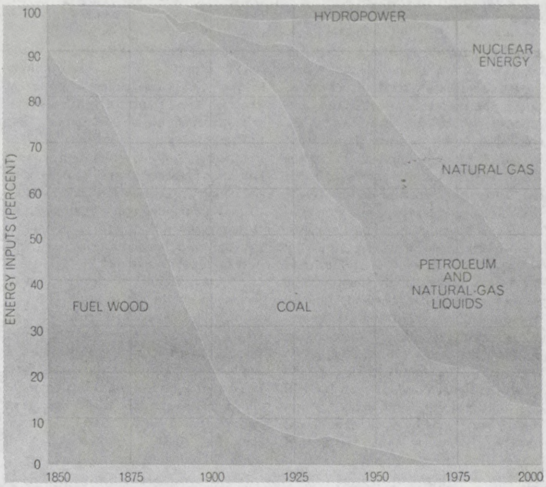


DAILY CONSUMPTION of energy per capita was calculated by the author for six stages in human development (and with an accuracy that decreases with antiquity). Primitive man (East Africa about 1,000,000 years ago) without the use of fire had only the energy of the food he ate. Hunting man (Europe about 100,000 years ago) had more food and also burned wood for heat and cooking. Primitive agricultural man (Fertile Crescent in 5000 B.C.) was growing crops and had gained animal energy. Advanced agricultural man (northwestern Europe in A.D. 1400) had some coal for heating, some water power and wind power and animal transport. Industrial man (in England in 1875) had the steam engine. In 1970 technological man (in the U.S.) consumed 230,000 kilocalories per day, much of it in form of electricity (*hatched area*). Food is divided into plant foods (*far left*) and animal foods (or foods fed to animals).

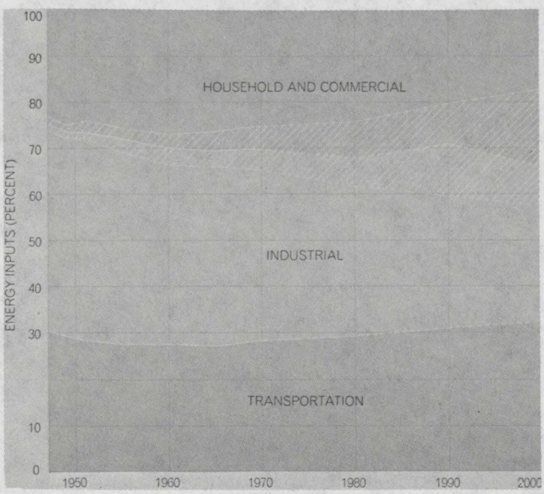
els man. Gross food-plant consumption might therefore be considered another component of gross energy consumption; it would add about 3×10^{15} B.t.u. to the input side of the energy-flow scheme. Of the 10,000 kilocalories per capita per day of gross production, handling and processing waste 15 percent. Of the remaining 8,500 kilocalories, some 6,300 go to feed animals that produce about 900 kilocalories of meat and 2,200 go into the human diet as plant materials, for a final food supply of about 3,100 kilocalories per person. Thus from field to table the efficiency of the food-energy system is 31 percent, close to the efficiency of a central power station. The similarity is not fortuitous; in both systems there is a large and unavoidable loss in the conversion of energy from a less desired form to a more desired one.

Let us consider recent changes in U.S. energy flow in more detail by seeing how the rates of increase in various sectors compare. Not only has energy consumption for electric-power generation been growing faster than the other sectors but also its growth rate has been increasing: from 7 percent per year in 1961–1965 to 8.6 percent per year in 1965–1969 to 9.25 percent last year [*see top illustration on page 140*]. The energy consumed in industry and commerce and in homes has increased at a fairly steady rate for a decade, but the energy demand of transportation has risen more sharply since 1966. All in all, energy consumption has been increasing lately at a rate of 5 percent per year, or four times faster than the increase in the U.S. population. Meanwhile the growth of the gross national product has tended to fall off, paralleling the rise in energy sectors other than fast-growing transportation and electricity. The result is a change in the ratio of total energy consumption to G.N.P. [*see bottom illustration on page 140*]. The ratio had been in a long general decline since 1920 (with brief reversals) but since 1967 it has risen more steeply each year. In 1970 the U.S. consumed more energy for each dollar of goods and services than at any time since 1951.

Electricity accounts for much of this decrease in economic efficiency, for several reasons. For one thing, we are substituting electricity, with a thermal efficiency of perhaps 32 percent, for many direct fuel uses with efficiencies ranging from 60 to 90 percent. Moreover, the fastest-growing segment of end-use consumption has been electric air conditioning. From 1967 to 1970 consumption for



FOSSIL FUELS now account for nearly all the energy input into the U.S. economy. Coal's contribution has decreased since World War II; that of natural gas has increased most in that period. Nuclear energy should contribute a substantial percent within the next 20 years.

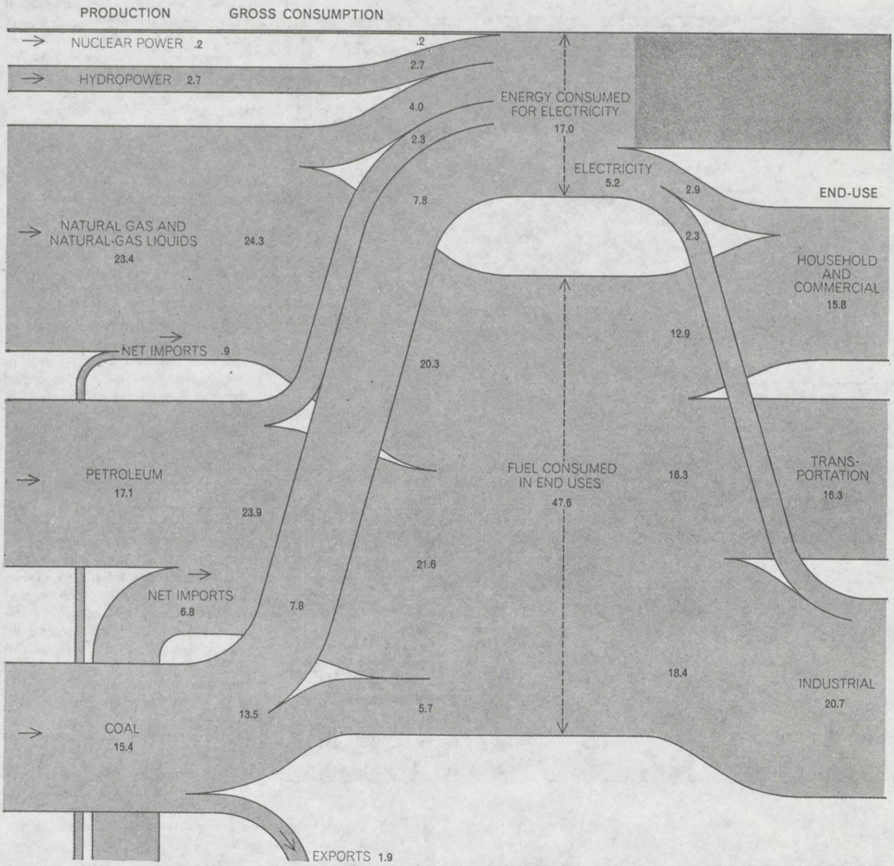


USEFUL WORK is distributed among the various end-use sectors of the U.S. economy as shown. The trend has been for industry's share to decrease, with household and commercial uses (including air conditioning) and transportation growing. Electricity accounts for an ever larger share of the work (*hatched area*). U.S. Bureau of Mines figures in this chart include nonenergy uses of fossil fuels, which constitute about 7 percent of total energy inputs.

air conditioning grew at the remarkable rate of 20 percent per year; it accounted for almost 16 percent of the total increase in electric-power generation from 1969 to 1970, with little or no multiplier effect on the G.N.P.

Let us take a look at this matter of efficiency in still another way: in terms of useful work done as a percentage of gross energy input. The "useful-work equivalent," or overall technical efficiency, is seen to be the product of the conversion efficiency (if there is an intermediate conversion step) and the application efficiency of the machine or device that does the work [*see bottom illustration on page 141*]. Clearly there is a wide range of technical efficiencies in energy systems, depending on the conversion devices. It is often said that electrical resistance heating is 100 percent efficient, and indeed it is in terms, say, of converting electrical energy to thermal energy at the domestic hot-water heater. In terms of the energy content of the natural gas or coal that fired the boiler that made the steam that drove the turbine that turned the generator that produced the electricity that heated the wires that warmed the water, however, it is not so efficient.

The technical efficiency of the total U.S. energy system, from potential energy at points of initial conversion to work at points of application, is about 50 percent. The economic efficiency of



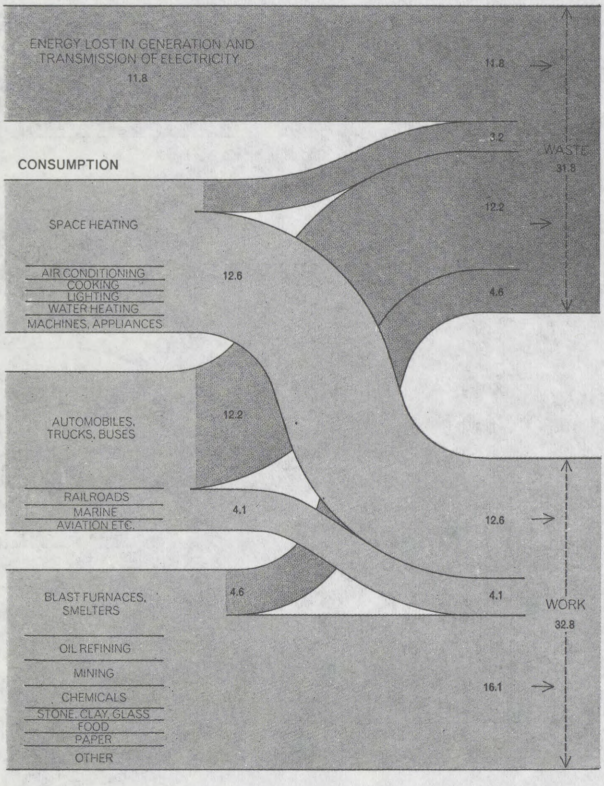
FLOW OF ENERGY through the U.S. system in 1970 is traced from production of energy commodities (*left*) to the ultimate conversion of energy into work for various industrial end products and waste heat (*right*). Total consumption of energy in 1970 was 64.6×10^{15} British thermal units. (Adding nonenergy uses of fossil fuels, primarily for petrochemicals, would raise the total to 68.8×10^{15} B.t.u.) The overall efficiency of the system was about 51 percent. Some of the fossil-fuel energy is consumed directly and

the system is considerably less. That is because work is expended in extracting, refining and transporting fuels, in the construction and operation of conversion facilities, power equipment and electricity-distribution networks, and in handling waste products and protecting the environment.

An industrial society requires not only a large supply of energy but also a high use of energy per capita, and the society's economy and standard of living are shaped by interrelations among resources, population, the efficiency of conversion processes and the particular applications of power. The effect of these interrelations is illustrated by a comparison of per capita energy consumption and per capita output for a number of countries [*see illustration on page 142*]. As one might expect, there is a strong general correlation between the two measures, but it is far from being a one-to-one correlation. Some countries (the U.S.S.R. and the Republic of South Africa, for example) have a high energy consumption with respect to G.N.P.; other countries (such as Sweden and New Zealand) have a high output with relatively less energy consumption. Such differences reflect contrasting combinations of energy-intensive heavy industry and light consumer-oriented and service industries (characteristic of different stages of economic development) as well as differences in the efficiency of energy use. For example, countries that still rely on coal for a large part of their energy requirement have higher energy inputs per unit of production than those that use mainly petroleum and natural gas.

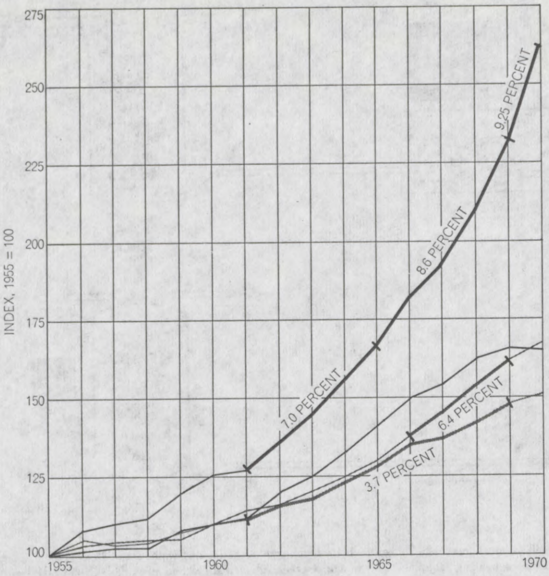
A look at trends from the U.S. past is also instructive. Between 1800 and 1880 total energy consumption in the U.S. lagged behind the population increase, which means that per capita energy consumption actually declined somewhat. On the other hand, the American standard of living increased during this period because the energy supply in 1880 (largely in the form of coal) was being used much more efficiently than the energy supply in 1800 (largely in the form of wood). From 1900 to 1920 there was a tremendous surge in the use of energy by Americans but not a parallel increase in the standard of living. The ratio of energy consumption to G.N.P. increased 50 percent during these two decades because electric power, inherently less efficient, began being substituted for the direct use of fuels; because the automobile, at best 25 percent efficient, proliferated (from 8,000 in 1900 to 8,132,000 in 1920), and because mining and manufacturing, which are energy-intensive, grew at very high rates during this period.

Then there began a long period during which increases in the efficiency of energy conversion and utilization fulfilled about two-thirds of the total increase in demand, so that the ratio of energy consumption to G.N.P. fell to about 60 percent of its 1920 peak although per capita energy consumption continued to increase. During this period (1920–1965) the efficiency of electric-power generation and transmission almost trebled, mining and manufacturing grew at much lower rates and the services sector of the economy, which is not energy-intensive, increased in importance.

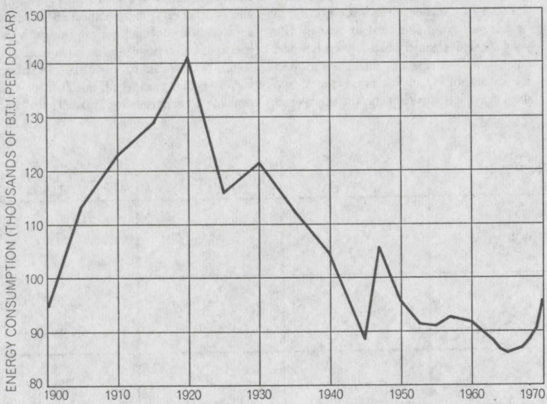


some is converted to generate electricity. The efficiency of electrical generation and transmission is taken to be about 31 percent, based on the ratio of utility electricity purchased in 1970 to the gross energy input for generation in that year. Efficiency of direct fuel use in transportation is taken as 25 percent, of fuel use in other applications as 75 percent.

"Power corrupts" was written of man's control over other men but it applies also to his control of energy re-



INCREASE IN CONSUMPTION of energy for electricity generation (*dark color*), transportation (*light color*) and other applications (*gray*) and of the gross national product (*black*) are compared. Annual growth rates for certain periods are shown beside heavy segments of curves. Consumption of electricity has a high growth rate and is increasing.

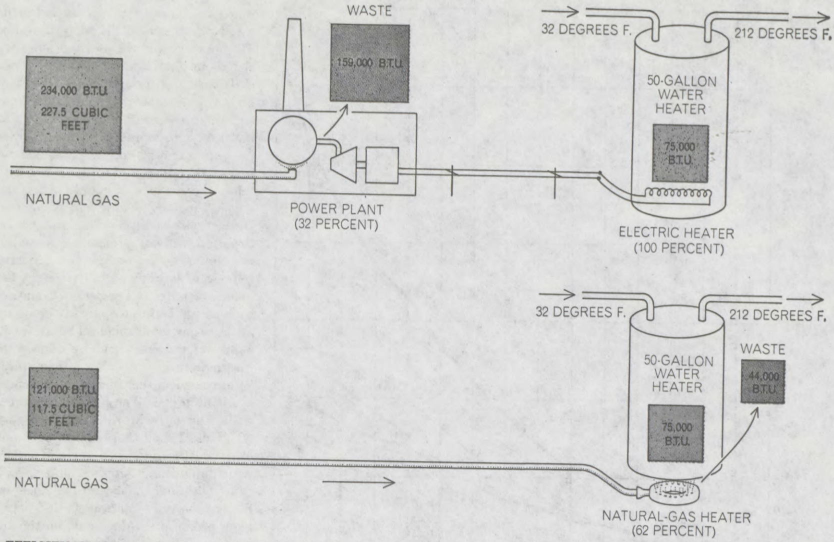


RATIO OF ENERGY CONSUMPTION to gross national product has varied over the years. It tends to be low when the G.N.P. is large and energy is being used efficiently, as was the case during World War II. The ratio has been rising steadily since 1965. Reasons include the increase in the use of air conditioning and the lack of advance in generating efficiency.

sources. The more power an industrial society disposes of, the more it wants. The more power we use, the more we shape our cities and mold our economic and social institutions to be dependent on the application of power and the consumption of energy. We could not now make any major move toward a lower per capita energy consumption without severe economic dislocation, and certainly the struggle of people in less developed regions toward somewhat similar energy-consumption levels cannot be thwarted without prolonging mass human suffering. Yet there is going to have to be some leveling off in the energy demands of industrial societies. Countries such as the U.S. have already come up against constraints dictated by the availability of resources and by damage to the environment. Another article in this issue considers the question of resource availability [see "The Energy Resources of the Earth," by M. King Hubbert, page 60]. Here I shall simply point out some of the decisions the U.S. faces in coping with diminishing supplies, and specifically with our increasing reliance on foreign sources of petroleum and petroleum products. In the short run the advantages of reasonable self-sufficiency must be weighed against the economic and environmental costs of developing oil reserves in Alaska and off the coast of California and the Gulf states. Later on such self-sufficiency may be attainable only through the production of oil from oil shale and from coal. In the long run the danger of dependence on dwindling fossil fuels—whatever they may be —must be balanced against the research and development costs of a major effort to shape a new energy system that is neither dependent on limited resources nor hard on the environment.

The environmental constraint may be more insistent than the constraint of resource availability. The present flow of energy through U.S. society leaves waste rock and acid water at coal mines; spilled oil from offshore wells and tankers; waste gases and particles from power plants, furnaces and automobiles; radioactive wastes of various kinds from nuclear-fuel processing plants and reactors. All along the line waste heat is developed, particularly at the power plants.

Yet for at least the next 50 years we shall be making use of dirty fuels: coal and petroleum. We can improve coal-combustion technology, we can build power plants at the mine mouth (so that the air of Appalachia is polluted instead of the air of New York City), we can make clean oil and gas from coal and oil



EFFICIENCIES OF HEATING WATER with natural gas indirectly by generating electricity for use in resistance heating (*top*) and directly (*bottom*) are contrasted. In each case the end result is enough heat to warm 50 gallons of water from 32 degrees Fahrenheit to 212 degrees. Electrical method requires substantially more gas even though efficiency at electric heater is nearly 100 percent.

from shale, and sow grass on the mountains of waste. As nuclear power plants proliferate we can put them underground, or far from the cities they serve if we are willing to pay the cost in transmission losses. With adequate foresight, caution and research we may even be able to handle the radioactive-waste problem without "undue" risk.

There are, however, definite limits to such improvements. The automobile engine and its present fuel simply cannot be cleaned up sufficiently to make it an acceptable urban citizen. It seems clear that the internal-combustion engine will be banned from the central city by the year 2000; it should probably be banned right now. Because our cities are shaped for automobiles, not for mass transit, we shall have to develop battery-powered or flywheel-powered cars and taxis for inner-city transport. The 1970 census for the first time showed more metropolitan citizens living in suburbs than in the central city; it also showed a record high in automobiles per capita, with the greatest concentration in the suburbs. It seems reasonable to visualize the suburban two-car garage of the future with one car a recharger for "downtown" and

	PRIMARY ENERGY INPUT (UNITS)	SECONDARY ENERGY OUTPUT (UNITS)	APPLICATION EFFICIENCY (PERCENT)	TECHNICAL EFFICIENCY (PERCENT)
AUTOMOBILE				
INTERNAL-COMBUSTION ENGINE	100		25	25
FLYWHEEL DRIVE CHARGED BY ELECTRICITY	100	32	100	32
SPACE HEATING				
BY DIRECT FUEL USE	100		75	75
BY ELECTRICAL RESISTANCE	100	32	100	32
SMELTING OF STEEL				
WITH COKE	100	94	94	70
WITH ELECTRICITY	100	32	32	32

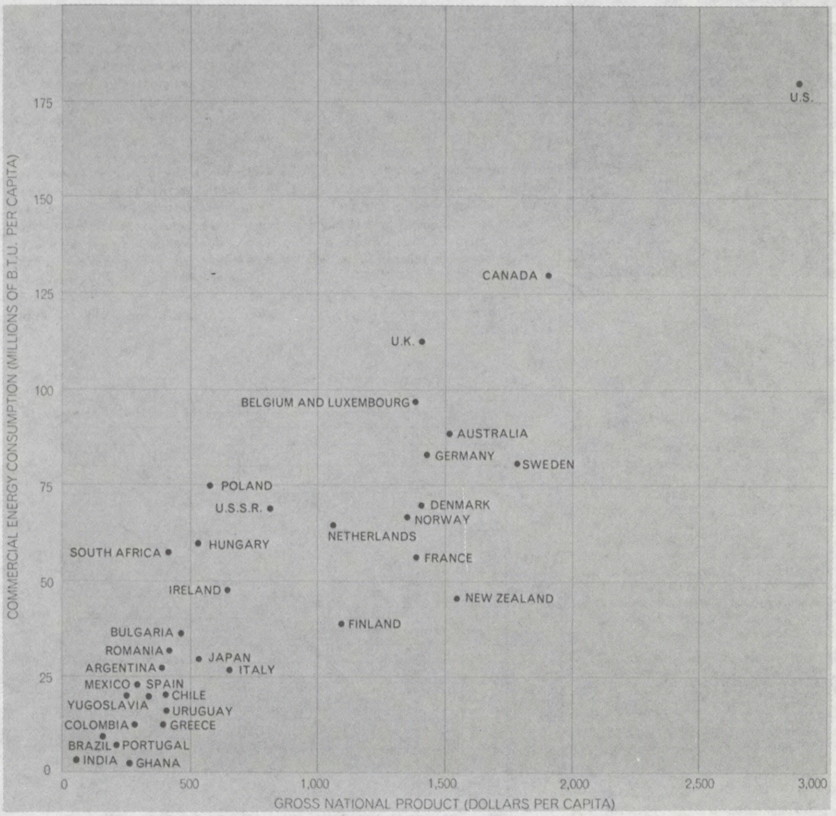
TECHNICAL EFFICIENCY is the product of conversion efficiency at an intermediate step (if there is one) and application efficiency at the device that does the work. Losses due to friction and heat are ignored in the flywheel-drive automobile data. Coke retains only about 66 percent of the energy of coal, but the energy recovered from the by-products raises the energy conservation to 94 percent.

the other, still gasoline-powered, for suburban and cross-country driving.

Of course, some of the improvement in urban air quality bought by excluding the internal-combustion engine must be paid for by increased pollution from the power plant that supplies the electricity for the nightly recharging of the downtown vehicles. It need not, however, be paid for by an increased draft on the primary energy source; this is one substitution in which electricity need not decrease the technical efficiency of the system. The introduction of heat pumps for space heating and cooling would be another. In fact, the overall efficiency should be somewhat improved and the environmental impact, given adequate attention to the siting, design and operation of the substituting power plant, should be greatly alleviated.

If technology can extend resource availability and keep environmental deterioration within acceptable limits in most respects, the specific environmental problem of waste heat may become the overriding one of the energy system by the turn of the century.

The cooling water required by power plants already constitutes 10 percent of the total U.S. streamflow. The figure will increase sharply as more nuclear plants start up, since present designs of nuclear plants require 50 percent more cooling water than fossil-fueled plants of equal size do. The water is heated 15 degrees Fahrenheit or more as it flows through the plant. For ecological reasons such an increase in water released to a river, lake or ocean bay is unacceptable, at least for large quantities of effluent, and most large plants are now being built with cooling ponds or towers from which much of the heat of the water is dissi-



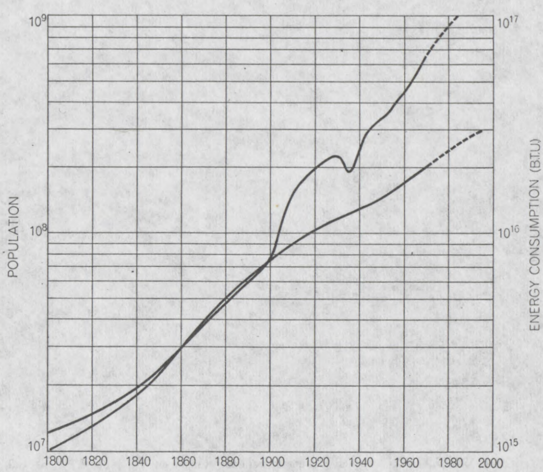
ROUGH CORRELATION between per capita consumption of energy and gross national product is seen when the two are plotted together; in general, high per capita energy consumption is a prerequisite for high output of goods and services. If the position plotted for the U.S. is considered to establish an arbitrary "line," some countries fall above or below that line. This appears to be related to a country's economic level, its emphasis on heavy industry or on services and its efficiency in converting energy into work.

pated to the atmosphere before the water is discharged or recycled through the plant. Although the atmosphere is a more capacious sink for waste heat than any body of water, even this disposal mechanism obviously has its environmental limits.

Many suggestions have been made for putting the waste heat from power plants to work: for irrigation or aquaculture, to provide ice-free shipping lanes or for space heating. (The waste heat from power generation today would be more than enough to heat every home in the U.S.!) Unfortunately the quantities of water involved, the relatively low temperature of the coolant water and the distances between power plants and areas of potential use are serious deterrents to the utilization of waste heat. Plants can be designed, however, for both power production and space heating. Such a plant has been in operation in Berlin for a number of years and has proved to be more efficient than a combination of separate systems for power production and space heating. The Berlin plant is not simply a conserver of waste heat but an exercise in fuel economy; its power capacity was reduced in order to raise the temperature of the heated water above that of normal cooling water.

With present and foreseeable technology there is not much hope of decreasing the amount of heat rejected to streams or the atmosphere (or both) from central steam-generating power plants. Two systems of producing power without steam generation offer some long-range hope of alleviating the waste-heat problem. One is the fuel cell; the other is the fusion reactor combined with a system for converting the energy released directly into electricity [see "The Conversion of Energy," by Claude M. Summers, page 148]. In the fuel cell the energy contained in hydrocarbons or hydrogen is released by a controlled oxidation process that produces electricity directly with an efficiency of about 60 percent. A practical fusion reactor with a direct-conversion system is not likely to appear in this century.

Major changes in power technology will be required to reduce pollution and manage wastes, to improve the efficiency of the system and to remove the resource-availability constraint. Making the changes will call for hard political decisions. Energy needs will have to be weighed against environmental and social costs; a decision to set a pollution standard or to ban the internal-combustion engine or to finance nuclear-power development can have major economic and political effects. Democratic societies are not noted for their ability to take the long view in making decisions. Yet indefinite growth in energy consumption, as in human population, is simply not possible.



U.S. ENERGY-CONSUMPTION GROWTH (*curve in color*) **has outpaced the growth in population** (*black*) **since 1900, except during the energy cutback of the depression years.**

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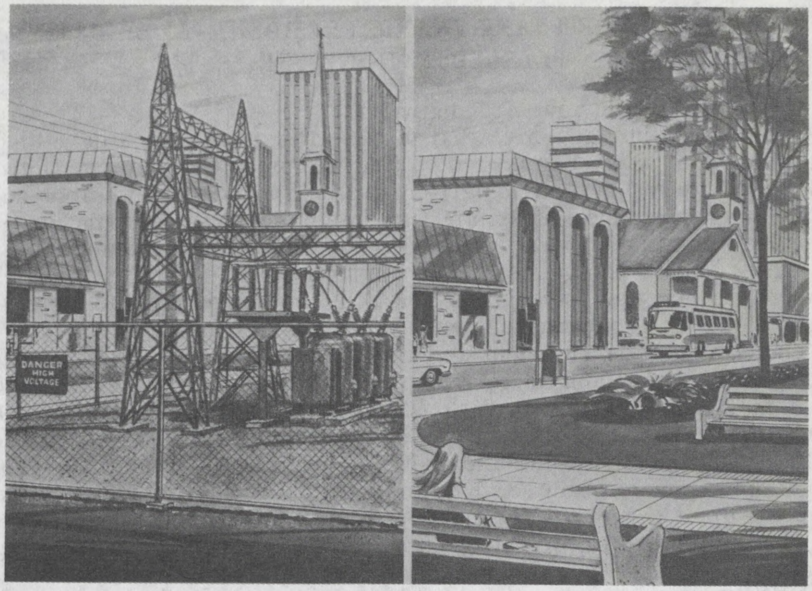

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Senator GRAVEL. Our next witness is Dr. Frank Ikard, president of the American Petroleum Institute.

STATEMENT OF FRANK IKARD, PRESIDENT, AMERICAN PETROLEUM INSTITUTE

Mr. IKARD. Thank you, Mr. Chairman.

By way of summary, Mr. Chairman, in the paper that I have filed with the committee, I indicated in the beginning the major national goals that we feel are particularly relevant to and dependent upon national energy policies. These are full employment, the elimination or efforts to eliminate poverty, and the utilization of the unique talents of every human being, increasing productivity and maintaining our internal and external strength as a nation, and improving and increasing the quality of our environment.

The economic development and prosperity of all the advanced nations has been based on the increasing use of inanimate energy in place of human labor. The close relationship between per capita use of fuels and the per capita real income emphasizes the importance of adequate reliable sources of supplies and energy. The Nation's prospect for economic progress, military security and freedom from diplomatic action depend upon a continuing and dependable flow of petroleum.

The United States, we believe, must protect itself against becoming unduly dependent upon insecure petroleum supply.

High energy usage has provided high living standards, but has also in many instances been responsible partly for adverse effects on man's environment. These negative effects we feel must be fairly and squarely faced, and large sums of money and a great deal of commitment on the part of very competent people is now being committed to combat the environmental problems resulting from energy production and use.

Some critics created the impression that the cure for environmental problems requires the reduced use of energy. Consideration of all the facts, we think, presents an entirely different picture.

First, the very process of cleaning up the environment will require a great deal of additional energy. More energy will be used to treat human waste, recycle waste, to remove sulfur from fuel oil and to compensate for low efficiency in engine design to reduce air pollution.

While concentration of population has resulted in air quality problems, the part played by motor vehicles is already well on the way to being solved.

Third, the impact of energy on air quality depends upon the type of fuel and the way it is used.

Fourth, the State conservation laws and advances in petroleum technology has achieved a great reduction in pollution in the oil producing States, and the oil producing operation.

For the past century, the United States has generally enjoyed abundant suppies of energy produced from domestic sources at attractive prices. During the decade of the 1960's the position in the United States began to change. In 1970, the United States was short on natural gas, importing 23 percent of the oil supplies, and hard pressed to satisfy the current demands for coal, and worried about the adequacy of our electric power generating capacity.

Impending shortages of domestic energy could force the Nation, we believe, to a dangerous dependency on the import energy supply.

However, this undesirable development will occur only as a result of unfound energy policies and not because there is any basic shortage of these fuels. The most desirable options are those that provide increasing quantities of assured supplies of oil and gas at prices which are in the long-run interest of the consumer. It cannot be assumed, I think, that historic policies of overseas oil will prevail in the future. Both economic and political forces are such that the prices are rising for foreign crude oil.

In conclusion, Mr. Chairman, we suggest 10 points, rather specific policy questions which are listed on pages 8 and 9 of our statement

Thank you very much.

(The full statement follows:)

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Frank N. Ikard
PRESIDENT

October 15, 1971

Senator Henry M. Jackson, Chairman
Committee on Interior & Insular Affairs
United States Senate
Washington, D. C. 20510

Dear Mr. Chairman:

It is a privilege for me, as President of the American Petroleum Institute, to respond to your invitation to submit a statement on energy policies and national goals.

The hearings and study being conducted by your committee and the ex-officio members pursuant to S. Res.45 can be of great benefit in clarifying the issues involved in the challenges of assuring sufficient energy supplies. I strongly endorse the decision to begin your study with a review of major national goals and the relationships of energy policies to those goals.

The American Petroleum Institute and its members look forward to the opportunity of participating in many facets of the study envisioned in S. Res. 45 as it develops in the months ahead.

Sincerely,

Frank Ikard

FNI:mpt

A COUNTRY THAT RUNS ON OIL CAN'T AFFORD TO RUN SHORT

October 15, 1971

ENERGY POLICY AND NATIONAL GOALS

A crucial challenge facing the Nation is the need for government policies which recognize that success in attaining major national goals depends upon the increasing use and assured availability of energy.

I. National Goals

The following major national goals are particularly relevant to and dependent upon national energy policies:

* *Full employment with equal opportunity for all.*

* *The systematic elimination of poverty, with wholesome diets and decent housing available for all.*

* *The transference of dull, routine, bottom-of-the-economic-ladder jobs to machines, as far as this is possible, so better use can be made of the unique talents of every human being.*

* *Increasing productivity to make possible a higher standard of living, not only in an economic sense but in the quality of life, with more creative and fulfilling use of expanding leisure time.*

* *A nation strong enough to be secure against attack, to maintain its options in pursuing international policies in support of world peace, and to be free from the fear of economic or military paralysis due to deprivation of imported energy supplies.*

* *An improving and increasingly harmonious environment, with the upgrading of air, water and land through the imaginative use of technology, and the harnessing of energy to correct environmental problems.*

II. Dependence of Major National Goals on Energy

Energy and Economic Progress

The economic development and prosperity of all advanced nations have been based on increasing use of inanimate energy in place of human labor and animal power. Machinery powered by inanimate energy has contributed directly to increased productivity in agriculture, manufacturing, mining, transportation, and service industries. Increased productivity, in turn, has been the basis for rising living standards in this and other developed countries.

The close relationship between per capita use of fuels and per capita real income, which has been evident in the economic development of the United States and other advanced nations, emphasizes the importance of adequate reliable supplies of energy. The reduction of poverty and progress toward satisfying rising economic expectations throughout the world will require vast increases in the supply and utilization of energy.

Energy and Security

The Nation's prospects for economic progress, military security, and freedom of diplomatic action depend upon a continuing and dependable flow of petroleum. The United States must protect itself against becoming unduly dependent upon insecure petroleum supplies. The unreliability of overseas oil has been frequently demonstrated by supply disruptions and political interventions that have threatened consuming nations with major shortages.

Oil exporting countries are exerting increasing control over petroleum supplies as a means of furthering their own objectives in political and economic affairs. Within the past year, some oil exporting countries have threatened to take extreme measures, including total embargo on the shipments of crude oil and products, to achieve their goals. Further difficulties could result from the demands of major oil exporting countries to participate in existing oil concessions.

If the U.S. has no supply alternatives and becomes excessively dependent on overseas supplies of crude oil or refined products, the oil exporting countries will be able to impose exorbitant taxes and other payments. The U.S. could even be faced with an energy shortage.

Energy, especially in liquid form, has been of crucial importance for both conducting military operations and providing support for the industrial base required to support such operations. The advent of nuclear weapons has neither prevented the outbreak of limited wars fought with conventional weapons, nor has it reduced the importance of petroleum for military operations. Indeed, petroleum consumed by U.S. military forces per man in combat operations is still rising. Non-nuclear war is a prospect for the foreseeable future despite all the efforts being devoted to seeking permanent peace. Consequently, the Nation must continue to have assured access to the energy resources needed for military security.

Energy and the Environment

High energy usage has provided high living standards but has also been in part responsible for adverse effects on man's environment. These negative effects have been faced squarely. Large sums of money have been spent to combat environmental problems resulting from energy production and use. Further application of existing technology, new technology, and sizeable expenditures will bring additional improvements.

Control of pollution entails economic costs. Increasingly stringent controls become progressively more expensive with decreasing gains. Since the public must ultimately pay these costs, administrators have a responsibility for informing citizens about available alternatives in terms of time requirements, costs, and benefits. The public should have all relevant information and the opportunity to make intelligent decisions as to the acceptable balance between additional costs and expected improvements in the quality of air and water. It should be recognized that a rush to achieve short-term benefits may result in the delay of sounder long-term solutions that would impose a lesser burden on society.

While the Government has a responsibility for setting realistic environmental standards, to the maximum extent possible the free enterprise system should be relied upon to meet these standards at the least possible cost to the consumer.

Some critics have created the impression that the cure for environmental problems requires the reduced use of energy. Consideration of all the facts presents an entirely different picture.

First, the very process of cleaning up the environment will require additional amounts of energy. More energy will be needed to treat sewage, to recycle wastes, to remove sulfur from fuel oils, and to compensate for the lower efficiency of engines designed to reduce air pollution.

Second, while concentration of population in large metropolitan centers has resulted in air quality problems, the part played by motor vehicles is already well on the way to being solved. The 1970 cars are 60 to 70 per cent cleaner than pre-1963 models. The standards set by the Environmental Protection Agency for 1975 cars specify a 90 per cent reduction in emissions from the 1970 model levels. Cleaner air will result as increasing numbers of motor vehicles are equipped and maintained to meet these standards.

Third, the impact of energy on air quality depends on the type of fuel and on the way it is used. Natural gas, for example, is a highly desirable fuel; it is clean burning and causes little pollution. Also, in home heating and industrial use, great progress had been made in the reduction of air pollution long before recent environmental protection laws were enacted. Pittsburgh and St. Louis provide dramatic illustrations of this progress.

Fourth, state conservation laws and advances in petroleum technology have achieved a great reduction in pollution from oil producing operations. Unfortunately, attention is focused on the few accidental blowouts that have occurred rather than on the overwhelming majority of wells drilled and operated without adverse effect on the environment.

III. U. S. Energy Position and Problems

For the past century, the United States has generally enjoyed abundant supplies of energy produced from domestic sources at very attractive prices. Considering the total quantities of oil and gas that the United States uses, its internal supplies of petroleum hydrocarbons compare favorably as to cost with overseas supplies and are much more secure.

During the decade of the 1960s, the energy position of the U.S. began to change. While demand for energy increased at a rate in excess of four per cent annually, in keeping with the rate of growth in real national product, the capacity to produce domestic fuels did not respond accordingly.

By 1970, the U.S. was short of natural gas, importing about 23 per cent of its oil supplies, hard pressed to satisfy all current demands for coal, and worried about the adequacy of electric power generating capacity. Today there is a growing gap between demand for oil and gas and secure supplies for the Nation. Under a continuation of present energy policies, the prospects are that the energy gap will widen.

Impending shortages of domestic energy could force the Nation into dangerous dependence on insecure imports of energy supplies. However, this undesirable development will occur only as a result of unsound energy policies, and not because of any basic shortages of domestic energy resources. Estimates by government and other informed specialists indicate that domestic resources of oil and gas remaining to be discovered could support substantially higher rates of production. Furthermore, available coal reserves greatly exceed foreseeable requirements. Potential uranium supplies for nuclear power are believed to be adequate, assuming the timely development of breeder reactors. If necessary, large amounts of liquid fuel can be produced from oil shales and tar sands. Synthetic oil and gas can also be made from coal. Each of these alternatives will require substantial time, large amounts of capital, and prices adequate to cover all costs, including those necessary to protect the environment. Some will be more costly than others. It appears likely that it will be necessary to eventually develop and utilize all of these potential energy sources. The outcome, however, will depend upon the economic and political climate that is established by national attitudes toward energy policy.

By contrast with Western Europe and Japan, the United States has greater flexibility in coping with future energy demands. Problems with respect to future domestic energy supplies can be solved if energy policies are modified to encourage larger investments in energy exploration, development, and research. Between 1946 and 1957, U.S. expenditures for petroleum exploration and development increased more rapidly than fixed investments for the economy as a whole. As a result, oil and gas supplies grew more rapidly than demand during that period. By contrast, between 1957 and 1970, expenditures for petroleum exploration and development increased about five per cent, while total new fixed investments in the economy doubled. Consequently, the development of oil supplies lagged behind the growth in demand.

Static outlays for the development of U.S. energy resources during the past decade, in the face of a large increase in demand, resulted from inadequate economic incentives and from rising concern on the part of investors about federal policies and actions. For example, the regulation of gas prices at the wellhead beginning in 1954 and the rollback of prices in agreed-upon contracts retarded oil and gas exploration in this country. Also, the Tax Reform Act of 1969 reduced the incentives to explore for domestic oil, gas, and other minerals. This change in federal tax policy dealt a severe blow to exploratory activity at a time when exploration was already declining.

The most desirable options are those that provide increasing quantities of assured supplies of oil and gas at prices which are in the long-run interests of consumers. It can not be assumed that historical prices of overseas oil will prevail in the future. Both economic and political forces are raising the cost of foreign crude oil. To the extent that imported liquefied natural gas replaces declining supplies of U.S. natural gas, costs of gas will increase while security of supply deteriorates. If these trends were to occur, the advantages of encouraging greater U.S. production of oil and gas will become more apparent than at present.

In addition to the availability of basic supplies, the satisfaction of the Nation's energy requirements involves the construction and use of processing and handling facilities. If the construction of such facilities does not keep pace with demand, the country's position will be weakened. Unfortunately, because of the cumulative effect of rapidly increasing construction costs, environmental concerns, and uncertainty about energy policy, present prospects for additional domestic facilities are falling short of projected increases in the demand for energy.

IV. Energy Policies Required to Meet National Goals.

Increasing supplies of energy are essential for achieving the basic national goals of economic progress, security, and a better environment. A turn-about in public attitudes toward the energy industries is essential to the development of an improved energy outlook for the U.S. The current federal review of energy policies can serve a very useful national purpose. This review can focus attention on the need for action in the public interest to encourage development of secure U.S. supplies of energy. Such supplies must be provided to satisfy increasing requirements, at reasonable costs, and in a manner consistent with environmental objectives.

The following policy recommendations are designed to help assure adequate supplies of secure energy at reasonable costs and will serve the public interest by contributing to the achievement of national goals:

1. Energy policies should be clearly defined and should recognize the essential role of energy in achieving national goals. Policy features should not be changed without due consideration of the long-lead time involved in creating

major increments of energy capacity and the large capital investments required.

2. Energy needs should be met by private competitive enterprise with minimum governmental regulation required to achieve the specific goals of (a) prevention of physical waste, (b) security of supplies, and (c) an improved environment.

3. Oil and uranium import controls should be continued to encourage expansion of domestic supplies. Such controls will contribute to national security and help assure consumers of adequate supplies at reasonable long-run prices. Import controls should not be used for other purposes.

4. Tax provisions appropriate to the unique characteristics of fuels and minerals should be strengthened.

5. Environmental regulations should strike a sound balance between improving the environment and permitting the development, at reasonable cost, of oil, gas, and other energy resources and facilities required to meet the Nation's economic and security needs.

6. Leasing of both federal and state lands for oil and gas exploration and development should be expedited, and federal acreage provisions affecting oil shale leases should be directed toward the efficient development of additional energy supplies.

7. Regulation of natural gas producers should be modified to recognize the binding nature of contracts and to permit prices to be more responsive to the increasingly evident supply shortage.

8. Construction of adequate domestic refining facilities should be encouraged to avoid increased dependence on overseas refining capacity.

9. Health and safety regulations should be carefully designed to minimize hazards to workers and maximize operating efficiency.

10. Diversity of effort by private enterprise in providing energy supplies should be encouraged. Alternative ways of developing energy resources should be tested through competitive efforts.

Senator GRAVEL. Thank you very much, Mr. Ikard.

The next witness is Mr. Michael McCloskey, director of the Sierra Club.

STATEMENT OF MICHAEL McCLOSKEY, EXECUTIVE DIRECTOR, SIERRA CLUB

Mr. McCLOSKEY. Thank you, Mr. Chairman.

My paper does not deal formally and explicitly with the identification of national policy goals, but certain assumptions about goals are certainly implicit in the paper, and are fairly evident.

The paper deals with the basic question of the nature of the so-called energy crisis. It suggests that the problem is rooted in excessive pressure for growth and consuming energy. It suggests further that the present rates of energy growth are unrealistic, are environmentally damaging, and artificially induced.

It argues that these rates cannot long be continued and that our main task ought to be to bring these rates of growth under control, and that there are reasonable ways of doing this.

It examines, first, the question of the essential rates of growth and energy consumption. It asserts that sooner or later these rates of growth have to end. This is demonstratable.

First, it is just a matter of mathematical projection. But before that time comes and that happens, all sorts of other limits begin to successively assert themselves. There are finite reserves of fossil fuels, the reserves of those that can be recovered are even more limited. There is a limited amount of space available for utility plants, and there are heat limits that will ultimately assert themselves, even with fusion.

It suggests that public policy should aim at curbing these rates of growth and energy consumption to avoid even approaching these severe limits of various sorts.

In suggesting that, however, it does not necessarily argue for actually reducing the total amount of energy consumption. Rather, it is directed at the question of explontial rates in energy growth.

It asserts, too, that environmental degradation occurs throughout the process of abstracting, transporting, refining, and consuming fuels, and in the process of consuming and disposing of the products that today are produced with energy.

In other words, it asserts that pollution and environmental degradation occur all along a continuum of the process of using energy; and that these types of degradation constitute a major burden upon the worldwide environment, and that far short of the final limits on energy growth, we will endure an increasingly heavy burden of degradation as it builds up.

It also suggests that this continuum of degradation extends into the future. Many of the types of degradation are extremely long lived and will be with the world as a legacy extending countless generations into the future.

This is particularly evident with nuclear power where the radioactive waste products will be with us for tens of thousands of years beyond the control of generations now foreseeable.

It also observes that pollution and environmental degradation are not merely incidental occurences which are easily correctable, but they are inevitable features of the process itself. While the incidents of this degradation may shift from time to time along the continuum, it is generally apt to be present, and sometimes when we concentrate on curing it at one point, as we are doing in trying to control auto emissions, we may neglect it at another point, as with the prospect of mounting oil pollution of the seas with the trend toward supertankers.

It also suggests that even if we apply the highest state of the art types of controls on pollution, that if there is enough growth in energy, enough new units of polluting apparatuses and units of various sorts, that the total amount of pollution will become intolerable.

This is evident, for instance, in the case of the Four Corners Powerplant where perhaps 98 to 99 percent of the stack pollutants may be removed. Yet with the advancing increase in the number of plants and their very large size, they may still emit enough pollutants that will congregate in the atmosphere and rain down in the desert to approximate the amount of pollution in major cities.

We have to look at the total burden upon the environment and not merely at the controls. We also have to be mindful of the fact that many types of degradation are cumulative in their impacts. We are constantly adding more carbon dioxide to the atmosphere with every day and year. While some of the areas that are strip mined can be restored, the stripped amount mounts each year.

The total decline of the productivity of the sea, as a result of pollution—some of it from oil mounts each year and it cumulatively can't continue indefinitely.

The paper suggests that there are a variety of underlying causes of the runaway rate of growth in energy consumption, but it identifies various aspects of public policy as one of the major sources of the problem. It suggests that there has been a basically pro-growth bias in public policy that has been accumulating historically over the course of time that provides a variety of inducements to energy growth. These are embodied in a web of subsidies that run from providing large discounts for industrial consumers of electricity to the Price-Anderson Act to subsidize and encourage nuclear power to the giveaway of hydropower plant sites and so on.

It concludes by suggesting a variety of changes in public policy and suggests that a shortrun strategy would involve a number of changes. These would include ending or reducing the many biases in public policies which do provide these incentives to energy growth, increasing and strengthening the environmental constraints on energy growth, reducing energy demands by educating the public to understand the importance of conservative use of energy, encouraging intensified research and development on ways of achieving greater efficiencies in energy utilization, finding new and environmentally acceptable energy sources, discouraging growth in industries that are the most profitable consumers of energy, and in establishing a complex of new agencies in Government to plan and regulate these activities.

(The full statement follows:)

AN ENVIRONMENTALIST VIEWS THE ENERGY CRISIS

An Address to the
American Nuclear Society by

Michael McCloskey

Executive Director, Sierra Club
Boston, Massachusetts
June 15, 1971

In discussing any public issue, one is always confronted with the problem of defining what the issue is. What is the nature of the issue embodied in the "energy crisis?"

The industries supplying energy would have us believe that the problem is one of expanding supplies and reducing constraints on growth. As an environmentalist on the other hand, I submit the problem is one of excessive pressures for growth in consuming energy.

I submit that present rates of energy growth are unrealistic, that they are environmentally damaging, and that they are artificially induced. I submit further that these rates cannot long continue, that our main task ought to be to bring these rates of growth under control, and that there are reasonable ways of doing this.

Unrealistic Growth Rates

Present rates of energy growth are unrealistic for a variety of reasons. Basically they are unrealistic because these compounding rates of growth cannot be projected very far into the future before they run up against all sorts of limits - mathematical, physical, biological, and qualitative ones. Let us look at these rates and the limits they confront.

Today we consume fifteen times the energy we did one hundred years ago, though our population has only tripled in that time. Over the past decade the average growth rate in the consumption of energy in all its forms has been more than 4 per cent annually, climbing to about 5 per cent annually over the last five years. Growth has been particularly phenomenal in the electrical energy sector, at about 7 per cent annually in recent years. Projections based on that rate of growth call for a doubling of electric power production about every ten years.

With these growth rates we may soon find that we are running out of space for power plants, to cite just one example. It has been calculated that even with large 1,000 megawatt power plants each requiring an area of only 1,000 feet on a side, in less than twenty doublings - less than 200 years - <u>all</u> the available land space in the United States would be occupied by such plants! In California where power production is expected to double every eight years, if power were to be supplied by 110 megawatt plants on 80-acre sites, the entire land area would be covered in only 122 years. Similar startling projections could doubtlessly be made for other forms of energy use; e.g., at projected rates of growth, how much space will need to be paved over to accommodate our automobile-oriented transportation system by various future dates?

Other limits to proliferating energy use can be cited. For example, by the end of the century, if growth continues as projected at current rates, one-third of our total freshwater run-off might be required for power plant cooling purposes if only once-through cooling is used. If once-through cooling is superceded by cooling ponds and towers, then even more land is needed and the space crunch will come sooner.

Ultimate limits to growth in energy use also obviously exist in the finite nature of our fuel resources. The fossil fuels now provide by far the greatest part of our energy sources, (e.g. ~~almost~~ over 96 per cent in

1969). Whatever the true situation as to immediate supplies, it is obvious that ultimately these nonrenewable resources will be depleted. Optimistic estimates predict that our fossil fuels as a group will be exhausted within a few hundred years at best, possibly much sooner. A recent National Academy of Sciences report, for example, predicts that within another fifty years or so the great bulk of the world's initial supply of recoverable petroleum liquids and natural gas will be exhausted, while recoverable fuel from the oil shales and tar sands might extend the lifetime of the petroleum group to a century or so. With respect to coal, the report estimates that if used as the principle source of energy at projected demands, it will last no more than two or three centuries.

Though nuclear power is expected to play a major role in future electrical energy production, electrical energy is of course only a part of the total energy consumed (presently, about one-quarter). And the supply of uranium 235 from high-grade ores is limited. The NAS report indicates that the production of nuclear power using the present type of reactors and uranium 235 as the principal energy source can be sustained for only a few decades. Another estimate gives high grade uranium ores a lifetime of under fifty years. Breeder reactors could extend these fuels, but it is not clear what the costs may be and operational and environmental problems are unsolved. And a practical method of producing electricity from fusion is still only a possibility.

Hydroelectric power has its own finite limits in the availability of suitable sites, and is of small importance in the supply picture. While only one-fourth of the potential hydro sites have now been developed in this country, these are the best sites and the rest are mainly hypothetical and not economically usable.

Ultimate limits to energy growth will also be set by the problem of dissipating the heat resulting from the productionof energy. It has been said that with energy consumption increasing at 5 per cent a climatological heat limit - the point at which global climate would be drastically altered - could be reached in less than a century.

At projected growth rates, by the year 2000 energy produced may approximate 30 per cent of solar input. Our population centers will turn into giant heat radiators affecting local climates. Increasing attention has also been given to the possible role of two by-products of energy production - carbon dioxide and water vapor - in long-range climatological change. Each year fossil fuel combustion adds to the atmosphere an amount of carbon dioxide equal to about .25 per cent of the total carbon dioxide in the atmosphere. If the present growth rate in fuel use continues, there will be an increase of about 170 per cent in the carbon dioxide level in the next 150 years. Many scientists fear that the "greenhouse effect" (the trapping of heat energy leaving the earth by carbon dioxide in the atmosphere) will have serious repurcussions on the world climate. For differing reasons, concern is also expressed over adding substantial amounts of water vapor to the atmosphere. Though more research is imperative, these considerations may also place ultimate limits on unrestrained energy consumption.

Damaging Environmental Impact

Long before these ultimate limits are reached the environmental impact of unrestrained energy growth may become unbearable. We do not know where the dividing line between environmental deterioration and irreversible catastrophy may lie, but at the least, we can foresee that galloping energy consumption will have a continuing and cumulatively destructive impact upon the environment.

At every stage of energy production and use unacceptable environmental degradation occurs. At the first step of extracting fuels from the earth, defacement and pollution occur in the source area. For example, by 1965, 3.2 million acres of United States land had been surface-mined, 41 per cent for coal. And, as we deplete our high-grade reserves we increase our destruction of the land: the strip-mining method of producting coal has been steadily increasing, from 29 to 36 per cent in the last ten years. Today, strip mine benches in nine Appalachian states extend for 20,000 miles.

Uranium mining and milling has its own special hazards of radioactive wastes, in addition to the usual effects of mineral extraction. A typical uranium mill must dispose daily of about 10 curies of radium in its process wastes, a considerable amount. Of 26 mills operating in 1963, for instance, 10 were still discharging the effluent from their tailings directly into streams. In the late 1950's, for example, consumers of untreated water along the Animas River in Colorado below the Durango mills were receiving 300 per cent of the recommended "permissible" daily intake of radium. The production of uranium has also resulted in the accumulation of mill tailing piles - in sizes up to several million tons in the Colorado River basin, for example. In most cases, for many years no containment measures were undertaken, and these piles were left exposed to erosion by wind and rain.

Fuel extraction has polluted our waters as well as defacing our lands. Coal mining has degraded 12,000 miles of Appalachian streams alone. through mine acid drainage. Extraction of oil also seriously pollutes the source area; the Santa Barbara blowout and Platform "Charlie" in the Gulf are but two familiar examples of marine pollution from offshore oil wells.

The transporting of fuels from the source area to points of utilization and the handling and processing of these fuels, lead to further environmental degradation. Illustrations familiar to everyone are the numerous oil spills from vessels, marine terminals, refineries, storage tanks, pipelines, and so on. About 4,000 oil spills from all sources were reported to the Coast Guard in 1970, and of course many go unreported. Estimates put the actual number of oil spills into United States waters at about 7,500 annually, almost 21 per day.

Oil pollution illustrates not only the hazards of accidental spillage of oil transported as cargo, but also the intentional pollution resulting from current modes of operation within the marine transportation system itself. Current estimates are that approximately ten million tons of oil are spilled each year into the marine environment. Of this amount, two to four million are spilled accidentally, while six to eight million are intentionally dumped at sea, primarily through bilge pumping, tank cleaning and deballasting practicies of the maritime industry. Severe biological damage is reported in main shipping channels as a result (one expert estimates that 40 per cent of all sea life has already been destroyed by pollution of all types).

The extracting, processing and transporting of fuels which will be used to provide energy is only the beginning of energy's environmental impact. The production and use of energy in all its forms has created severe pollution and space problems which threaten to become overwhelming in the near future.

Air pollution is perhaps the most obvious environmental by-product of energy production and use. The fossil fuels presently account for almost all of our energy sources (96.4 in 1969), and the burning of these fuels creates the largest share of many of the common air pollutants. Motor vehicles lead the field, accounting for over 60 per cent of total air pollutants. Power plants, and industrial, residential and commercial use of energy all make their characteristic contributions to air pollution.

The visible or noxious air pollutants have received the most attention. In 1966, 28.6 million tons of sulfur dioxide were emitted; 11.5 million tons of particulates; and about 13 million tons of nitrogen oxides. Power plants, for instance, are responsible for a large share of these pollutants: an estimated 50 per cent, 25 per cent and 25 per cent respectively.

Another serious pollution problem generated by growing energy consumption is the thermal loading of our rivers and lakes. Electric power plants are major offenders accounting for about 80 per cent of the industrial waste heat discharged into our waters. Such plants are about one-third efficient in their use of heat to generate electricity, and most of the remaining waste heat is discharged directly into the cooling water source. The amount of waste heat involved is truely tremendous; for example, a typical 1,000 megawatt fossil fueled plant produces enough waste heat yearly to heat 300,000 Minnesota homes, and a nuclear plant, 400,000. At projected rates of growth, by 2,000, the waste heat from these plants might be sufficient to raise the temperature of our total run-off by an estimated 20° to 33°F. If controls on thermal pollution of our waters are not immediately imposed, we may expect serious short-term impacts on local enviromments as well as disastrous long-range effects.

Other types of energy-associated pollution are becoming of increasing concern as well. For example, some scientists estimate that coal fired power plants put 150 tons of mercury into our air every year. And chemicals such as chlorine, biocides, and various other compounds added during the power generation process are not now being recovered but are released into the nearest body of water. Some of these can cause serious disruption of aquatic environments, as well as rendering certain shellfish unfit for consumption.

The solid waste problems associated with energy production and use are tremendous. For example, by burning coal we produce an estimated 30 million tons of slag and ash every year, of which 8 million enter the air, the rest contributing to our mounting disposal problems. And the solid waste problems created by the soon-obsolescent products of our various industries are truly staggering.

As nuclear power assumes a greater role in the production of electricity, we may have to come to terms with a new and frightening form of pollution, that of radioactivity. It has been predicted that by the year 2000 nuclear power will account for about one-half of our power production. The A.E.C. projects perhaps 600 large nuclear plants in the next several decades - enough to produce every year radioactivity equal to one-half million Hiroshima bombs.

Nuclear plants may justly be called a still experimental form of power production. Though the chances of a major accident have been minimized by industry and government, such a possibility cannot be completely ruled out. The safety record of plants already built gives us cause for concern. By the end of 1968, 17 civilian plants and one military nuclear plant had been completed, and as recently reported in "Science", five of these had been shut down as uneconomic or unsafe; a sixth (Fermi) never operated properly and finally an accident took it out of service; a seventh (Humboldt) has operated within allowable radiation limits only by reducing power output. Others have suffered various difficulties, and in 1969 another was shut down.

Routine low-level radioactive discharges from nuclear plants are another source of conern. While the A.E.C. has just drastically reduced permissible discharges to meet criticisms, concern continues about accumulating radioactivity. At the Hanford installation low level wastes empty into open trenches, and reportedly if ducks drinking from this water were to be eaten by humans they would receive five times the "permissable" dose. In New York. levels in a creek were reported to be 30,000 to 100,000 times higher than A.E.C. limits.

Recent testimony before a congressional committee indicated that by the year 2.000. nuclear plants and associated fuel processing facilities would be producing 470 million curies of krypton 85 annually, representing an increase in radiation exposure of about two millirems per year, or one to two per cent of natural background radiation. This assumes that it is uniformly diluted throughout the atmosphere, but exposures in the U.S. might be as much as ten times higher. Though much research needs to be done, some scientists predict that in 30 years, if growth projections are reached, radiation levels may be high enough to cause serious and unforeseeable effects on living things.

Another problem associated with nuclear energy is the management of the high-level radioactive wastes produced. These wastes are handled, transported and processed (which adds to the risk of accidental catastrophy), and must ultimately be disposed of. The storage problem alone is immense. Can we safely assume that this legacy of long-lived radioactive wastes can be contained by future generations for hundreds and thousands of years to come? One scientist reports that over 100 million gallons of high level wastes are already stored in underground tanks, of which 60,000 gallons have so far leaked into the ground. A "failsafe" storage system must somehow be devised if nuclear power is to be viable in the future.

Finally, we are confronted by grave space problems brought on by spiralling energy production and use. Short of the ultimate limits already noted, the amount of land used for energy-related activities may become environmentally unacceptable in the near future. Such uses include the paving of land for freeways to accommodate our auto-based transportation system and its related "needs", such as parking lots, gas stations and so on; the use of land to build more and more power plants and string more and more transmission lines; and covering our land by industrial installations of all kinds, each consuming energy and many turning out frivolous, wasteful or soon-obsolete "conveniences".

In the process, "open space" is diminished; wildlife habitats are pre-empted; many of our most scenic areas are visually impaired, and wild areas and rivers are destroyed. Difficult questions of optimum siting for those highways and plants which may be absolutely necessary emerge.

A few statistics on power plants and lines will illustrate the problem. In California, where power production is expected to double every 8 years, by the year 2,000 92 new plants of 4,000 megawatts capacity, _far larger_ than any existing now, would be required; this amounts to one for every ten miles of coastline, if sited there as many urge. If 1,100 megawatt plants (San Orofre size) were built, 350 additional plants would be required in California by year 2,000.

There are now 300,000 miles of transmission lines across the nation, occupying 4 million acres; by 1990, 200,000 more might be required, taking up another 3.1 million acres, twice the size of Delaware. Another projection estimates 11 million acres occupied by plants and lines by 1990, with visibility intruding on many more. Clearly this cannot continue.

Artificial Inducements to Growth

It is no accident that we confront such bleak prospects in our energy future. We face cries of immediate fuel and energy shortgages because the energy industry has contrived crisis situations, and the growing amount of interlocking ownership in the fuel industry facilitates this. And finally, the industry has contrived in many ways to have public policy artificially stimulate demand for energy. These factors act in concert to produce the so-called "energy crisis."

In the last few years, we have experienced all sorts of sudden fuel and power shortages. The price of residual fuel oil doubles in a year, ostensibly because of a cut-off in Middle Eastern supplies, despite the fact that most of it comes from Venzuela and other places. A sudden shortage in natural gas develops in 1969 when the gas industry decides to try to pressure the Federal Power Commission to grant it a 60 per cent price increase. The gas industry will not reveal how many wells are capped awaiting higher prices. Coal becomes in short supply because of mysterious difficulties in production and delivery. Despite the fact that the electric utility industry has a reserve capacity of 27 per cent nationally, summer power crises are experienced as plants breakdown and interties fail.

None of these so-called crises is very plausible. The growing monopoly amoung energy companies helps explain how a few large corporations can suddenly contrive these crises. The oil industry has always controlled natural gas companies, but it is now on its way to controlling coal and uranium as well. At least 11 large oil companies have significant interests in coal. The two largest owners of coal reserves are oil companies, one of which is also the largest oil company (Standard Oil of New Jersey). The petroleum industry as a whole accounts for one-quarter of our coal production. At least 18 oil companies have invested in uranium development. The oil industry now holds 45 per cent of all known uranium reserves. A recent investigation by the House Banking Committee showed that 49 of our largest banks have interlocking directorates with 36 of our largest electric companies, with 28 gas companies, 15 coal mining companies, 17 oil companies, 58 coal-carrying railroads, and 27 companies which supply eletrical equipment.

Not only is industry in a position to withhold supplies to wring concessions from government, it has also been fabulously successful in persuading government to stimulate demand in every possible way. For over a century, a pro-growth bias toward energy use has been woven into the fabric of public policy. The rate structures for electricity are distorted to provide discounts for large industrial consumers. Utilities are allowed to promote consumption through advertising charged off to rate payers. Nuclear power is subsidized through A.E.C. activities and the accident insurance afforded by the Price-Anderson Act. Hydro power is subsidized through virtually free licenses to use public water power sites. Public power is subsidized through exemption from income taxes and preferential interest rates. Coal mining is subsidized through failure to enforce strip mining and safety controls, with the result that social and environmental costs are not sufficiently internalized. The domestic oil industry is for all practical purposes subsidized through depletion allowances and import quotas. The auto and oil industries jointly are abetted and encouraged through federal aid highway programs. Bulk fuel transport is encouraged through subsidization of continued barge canal construction. Railroads continue to receive a multitude of forms of federal support.

Controlling Energy Growth

How then do we extricate ourselves from the dilemmas of this contrived pattern of exponential energy growth? While no simple answer exists, an interim strategy can be tried. It consists of making a number of simultaneous changes in public policy to reduce rates of growth. Acting together in a reinforcing fashion, these changes may be sufficient to put the problem in temporarily manageable form. At that point, we can then assess whether cutbacks in actual consumption levels in the long run are also needed.

A short-run strategy would involve the following types of changes in public policy: ending or reducing the many biases in public policies which provide incentives to energy growth; maintaining and strengthening environmental constraints on energy growth; reducing energy demands by educating the public to understand the importance of conservative use of energy; encouraging intensified research and development on ways of achieving greater efficiencies in energy utilization and in finding new, more environmentally acceptable energy sources; discouraging growth in industries that are the most profligate consumers of energy; and establishing new agencies in government to plan and regulate these activities. Each of these changes involves efforts that go well beyond the traditional bounds of energy policy, and all can have profound economic and social impacts. Yet changes are already beginning to occur in all these fields, and the environmental movement is determined to promote them. While each needs detailed elaboration, I will simply try to sketch some of the central ideas here.

(1) We will never be able to cope with the crisis of energy growth until we root out the many incentives in public policy to such growth. What would happen if the diseconomies of all these subsidies were to be removed or reduced? Quite likely the actual impetus behind energy growth would drop

sharply. We would no longer be artificially stimulating a false demand as if energy growth were a clear public good rather than a clear public problem.

(2) At the same time as artificial incentives are removed, positive constraints needs to be asserted to protect environmental values. These include restrictions of various sorts on the modes of developing, processing, and transporting fuels: establishment of onshore and offshore closures to drilling and mining because of overriding environmental values, as in areas for wilderness, parks, refuges, marine sanctuaries, and for future study; strict environmental operating controls on open areas; a ban on strip mining; deferred development of oil shale; stringent controls on marine oil shipping, including controls on the operation and design of super tankers; stricter controls on pipeline specifications and routing; and tighter controls on the handling, processing, and disposal of nuclear waste products. Simultaneously, environmental controls need to be extended further on the facilities which consume fuels: principally power plants, automobiles, and basic industries. Pollution controls on effluents and emissions need to continue to be tightened, with greater emphasis on toxic substance and by-product recovery and closed-plant recycling. With the move toward national land-use controls, the siting of plants, transmission lines, and highways will become increasingly constrained.

The rising costs associated with all of these contraints can be regarded as an internalizing of social costs. As costs rise and are passed on to consumers, demand should slacken and the rate of growth in the drain on energy resources should slacken too.

(3) As the public faces higher energy and product costs, a strong effort needs to be made to promote public understanding of the reasons behind these shifts. As consumers, we all need to begin to understand that we have not been paying the full costs of driving automobiles and of using electricity almost as if it were a free good. Instead of looking upon these rising costs as a new burden upon the consumer, we should look upon them as ending a "free ride" which we have been getting at the expense of the future and of the environment. Moreover, we should encourage even greater understanding of the need to end our wasteful habits in using energy. Changing cultural attitudes toward walking, bicycling, and mass transit can help break the omnipotence of the automobile as a symbol of fashion and prestige. Changing cultural attitudes can also help bring rising residential electrical use under control among the middle class; hopefully there will be a growing trend away from all-electric gadgetry as a status symbol.

Finally, however, it is important that steps be taken to make sure that rising prices do not block the aspirations of the poor. Particularly with respect to electrical rates, special steps should be taken to provide low rates for small residential consumers. Improved mass transit should also help low income urban residents. Other steps may need to be taken too to make sure that the poor are not penalized by these changes in public policy.

(4) Not only do we need to convince consumers to be more conscious of the need to be conservative in their use of energy, we also need to find better ways to conserve fuel supplies and to stretch their use further. Through gassification of coal, for instance, we may be able to achieve better efficiencies in the use of coal. Magnetohydrodynamics could also improve efficiencies in energy conversion. There may also be a limited but useful way to utilize solar energy for household heating in certain parts of the country. It may

also be possible to use the heat from air conditioners and thermal discharges for some useful purposes to reduce energy demand. More research is needed on these and similar projects. The energy industry should be taxed to fund a new federal program for intensive Research and Development on possibilities of this sort. The aim should not be to provide a "technological fix" to allow us to continue our profligate ways, but rather should aim at helping us find ways to conserve our fuel supplies and to minimize the adverse effects of their use upon the environment.

(5) There may be a limited number of basic industries that are key consumers of energy and are also critical sources of many environmental problems. These may include the automobile industry, the aluminum industry, the paper industry, and the fertilizer industry. Because of planned obsolescence, the automobile industry consumes an inordinate share of the world's resources, and it produces vehicles which constitute one of our main sources of air pollution and which require highways that pose an increasing threat to the viability of cities and the integrity of our countryside. Environmentalists are shaping a variety of assaults upon the patterns of operation of this industry. The aluminum industry is a prime consumer of electricity and is a major contributor of litter in the form of disposable beverage cans. Laws to require returnable containers could profoundly effect this industry, and have already been passed in some places. The paper industry also consumes significant amounts of energy and is a major polluter. Cultural trends away from the disposable way of life, built upon paper goods, could cut into the growth of this industry. Finally, if there is a trend away from inorganic fertilizers with emphasis instead on the use of animal manures, this could cut the energy demands of that industry. Through these separate programs of environmental reform, some of the dynamism may also be taken out of energy growth rates.

(6) To assure that many of these efforts are orchestrated, environmentalists are advocating a number of new governmental institutions and programs. In recent testimony before the House Committee on Interstate and Foreign Commerce, the Sierra Club advocated establishment of a new agency within the Interior Department to conduct basic energy studies and to prepare national energy plans. It also called for the establishment there of a separate agency to oversee basic R & D programs in this field. And it called for a third agency in the Department to administer a program of electrical reliability and safety. All of these might be grouped within the Energy Branch that the Administration has called for in its reorganization proposal for a Department of Natural Resources. We called, too, for giving the Federal Power Commission general licensing authority over power plants of all sorts over a certain minimum size, with regional licensing boards composed of panels representing three agencies. To offset this increased authority of the FPC, however, we called for a requirement that various environmental and other agencies certify compliance with their programs before licenses could be issued. In other words, we opposed the so-called "one stop" licensing approach as out of step with our needs, and called instead for maintaining the integrity of our environmental and land planning programs. Basically, our proposal contemplates distributing various functions to the agencies that are most competent to handle them. In this way, each function can be accomplished authentically and will not be prematurely compromised. The functions of planning, research, reliability enforcement, environmental and land use control, licensing, and rate regulation would be vested in different agencies. A way is provided to integrate these functions, but not on the utilities' terms. We are still in the process of working out control programs for other energy sources.

There is no way to know what effect all of these changes might have. However, I would point out three things. First, many of these changes are already beginning to be made, and most have a rationale that allows them to stand apart from any over-all energy control scenario. Second, the strategy of orchestrating these changes allows many factors to be adjusted to help shape the final result. In other words, it allows a lot of room for experimenting to achieve different ranges of change. And third, the practical alternatives are not very inviting. Starkly put, these alternatives may be on the one hand a gruesome day of environmental reckoning when either the energy bubble bursts or the environmental burdens pass the breaking point, or radical and revolutionary institutional change on the other hand when such crises threaten to occur.

And the worst part of the dilemma is that we probably really do not know how far out we are on the environmental limb. Certainly, we should lose no time in pursuing our best option in whatever time remains. Our choice does not need to be one of either blackouts or having the Federal Government tell us to turn off the lights. The more logical course open to us is to turn off the overheated and self-interested forces which are propelling us into the predicament.

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Senator GRAVEL. Thank you very much.

The next person is Mr. Weinberg, director—I am sorry, I skipped Dr. Singer.

STATEMENT OF DR. FRED SINGER, PROFESSOR OF ENVIRONMENTAL SCIENCE, UNIVERSITY OF VIRGINIA, AND CHAIRMAN, COMMITTEE ON ENVIRONMENTAL QUALITY, THE AMERICAN GEOPHYSICAL UNION

Dr. SINGER. Thank you.

My paper starts by reminding all of us of the tremendous subsidy which energy has given us, particular over the last 100 years. This energy subsidy that we have received has increased both our standards of living and the amount of leisure time.

I would like to dramatize this by reminding you that 1 gallon of gasoline, which is worth maybe 25 cents before taxes are added will perform the work equivalent of 25 man-days. In other words, this works out to a man-day of work for one penny. This is the nature of the subsidy that we are dealing with that is being given to our economy by the use of energy.

I hope we keep this in mind as we talk about energy. It is this subsidy that has allowed us to accumulate capital and the free time we have had to use this extra capital after we take care of our basic necessities has been used to develop science and technology and has further increased our standards of living and our prosperity.

As we all know, the results of this investment have been spectacular, and the results have been coming in a very short time scale. I think within the lifespan of most of us we have the development of television, computers, atomic energy, man has landed on the moon, the genetic code has been broken, many diseases have been eradicated.

I believe the key to this is the energy subsidy. But in addition to improving our wellbeing, these new developments have also led to an immense explosion of population throughout the world, and an ever-increasing amount of environmental pollution.

I know it is paradoxical, but our very progress may cause catastrophes, international upheavals, and may even destroy the ecosystem or both. But I do believe if we manage our social institutions wisely and if we apply technology in the right way, we can avoid these dual catastrophes and can achieve a high level of welfare for the human race as a whole.

Now, the key to this utopia, I believe, is a continuing supply of abundant and low-cost energy. I make a distinction between abundance and low cost here, even though we all believe abundance and cost are related by the laws of economics. They are, but through technology they become in some sense independent.

If fuels become scarce, then their costs will certainly rise rapidly. On the other hand, if fossil fuels are largely replaced by nuclear fuels, nuclear reactors, fusion reactors, let's say, then we will have abundant energy but the cost will be very high. In fact, it may become a substantial factor in the cost of finished products, or as a fraction of GNP.

Let me add as a footnote here that at the present time our energy consumption in the United States works out to some large number, 65 times 10 to the 50 in B.t.u. per year, but in order to reduce it to a number that makes sense, if I take the average cost to be 30 cents per million B.t.u., this works out to be 2 percent of our GNP, 2 percent of our GNP spent on raw supplies of energy.

If however, the cost is $1 per million B.t.u., then it works out to be merely 7 percent of our GNP. In other words, the cost of energy is by no means negligible in relation to our GNP. If the cost were to go up appreciably, this would make it very difficult to advance the living standards of the poor and could bring a social upheaval, and it would mean we would have to give up other things in our GNP in order to have the energy that we think we require.

Of course, the worst crisis of all would be created if nuclear energy reactors were not to become available and we were to run out of energy altogether as we exhaust fossil fuel.

I will skip over a large part of my papers which deal with energy facts dealing with the laws of thermodynamics, but I cannot leave this without reminding you on how important efficiency is in the use of energy, and there is one particular device called the automobile, the internal combustion energy which converts chemical energy into mechanical energy with a very low efficiency. Something will have to be done about this.

Let me turn to international policies or strategies. When I stated our aim must be to provide, to assure continuing supply of abundant low-cost energy, there are two major constraints. One is environmental and the other has to do with national security.

Before I turn to these and the so-called practical or political constraints which always exist, let me discuss the ideal situation, the situation of a free market. Let me speak now about efficiency in an economic sense.

Economists mean by "efficiency," economic efficient pricing. This means that the cost of energy should be that arrived at in a free and competitive marketplace. If energy is too cheap, then it is wasted. If energy is officially overpriced, then other inefficiencies are produced as a result.

In general, every institutional restraint, every artificial regulation, will distort the market and result in a lowered economic efficiency and therefore a disbenefit to the consumer.

Now, how does one achieve this ideal situation? Our aim should be to do this with a minimum regulation using the market forces as much as possible.

The first thing I would do would be to strive to develop what I call the perfectly informed consumer. That is the consumer who understands what is best for him. This person does not exist now. Such a consumer would always purchase the lowest cost package. He would not only look at the initial cost of a house when he buys it, but he would also ask about the insulation, cost of upkeep, and thereby he would force the builder to provide better insulation. When he buys the air conditioner, he won't just look at the price tag, but he would also ask about the efficiency and electricity consumption.

As you well know, the consumer today doesn't even look at the price tag. All he looks at is the down payment.

Now, the environmental constraints that I want to discuss I think are so understood that I don't need to go into them here. In any case, I believe they are economic, rather than absolute and fundamental. By this, I mean if we are willing to pay the cost of pollution control and add them to the other cost which make up the cost of energy, then we have arrived at a rational way for the official pricing of energy which includes all of the social costs.

Now that we have legislation that forces us to do it, we have no other choice.

Let me turn to national security considerations, because they distort the energy picture in a different way. The emphasis here, I think, must be on reasonable self-sufficiency and the question, of course, is how can we achieve this at the lowest overall costs. Not only in the short term, but also in the long term.

I believe, of course, that we need a credible reserve of energy and also a credible scheme of conservation. Perhaps we even need a credible rationing scheme, because otherwise we will surely be held up and blackballed by supplies of fuels or at least we will be restricted and restrained in the way we may apply foreign policies to benefit the security of the United States.

Incidentally, I would charge all of these costs that are incurred on behalf of the national security to the Defense Department. I think a recent Secretary of Defense would very much agree, Mr. McNamara, that is, that it is very important to have a proper form of bookkeeping.

If depletion analysis develops supplies for the sake of national security, then I submit the costs should be billed to the Defense budget. If that is not so, then you wouldn't do it.

It is often argued that we must restrict oil imports for the sake of national security. I believe this is such an important question for the national welfare, both now and in the future, that it must be carefully reexamined. Is there a way to import lower cost fuels while at the same time providing in our domestic reserves for the sake of conservation and yet being fair to domestic producers?

Somehow, I believe an answer to this important dilemma must be found.

There are, of course, many other public policy issues which will have to be examined and reexamined by this national energy study, the regulation of domestic oil production, the depletion allowance with respect to gas and oil, price regulation of natural gas, the proper assignment of environmental costs of fuel extraction and energy production. But I particularly hope that you will reaffirm the role of Government participation and investment in R. & D. to develop better ways of producing, transforming and conserving energy, from nuclear fusion power and breeder reactors to magnetic dynamics, high efficiency transmission lines, coal degassification and all the ways of capturing solar power.

I am convinced that energy is of such overwhelming importance to our economy and indeed to world peace and the continuation of our civilization on this planet that we must explore every promising avenue of research. Here I think the Government has a most important role and it is here that your national energy study must define the goals and strategies.

Thank you.

(The full statement follows:)

TOWARDS A NATIONAL ENERGY POLICY*

Introduction

There is probably no single event in human history which has influenced our existence on this planet as much as the discovery of fuels and the use of concentrated forms of energy. Starting about a hundred years ago, human labor and animal labor have been increasingly replaced by machines which burn coal and oil; and this "subsidy" has increased both the standard of living and the amount of leisure time for a sizeable fraction of mankind.

(Perhaps one way of appreciating the tremendous subsidy which we gain from fuels is to recognize that a gallon of gasoline, worth about 25 cents before taxes, will perform the work equivalent of 25 man-days -- in other words a man-day of work for one cent.)

In turn, the accumulation of capital and the availability of free time have allowed us to make investments in science and technology. As we all know, the results of this investment have been spectacular and have become available on an ever-shortening time scale. Within the

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* Comments on Senate Resolution 45: A National Fuels and Energy Policy Study, by Prof. S. Fred Singer, University of Virginia. Charlottesville, Va.

life span of most of us we have developed television, computers, and atomic energy; man has landed on the moon; the genetic code has been broken; and many diseases have been eradicated.

But in addition to improving our well-being and easing our battle against an unfriendly environment, these new developments have led also to an immense explosion of population throughout the world and to an ever increasing amount of environmental pollution. Paradoxical as it may sound, our very progress may cause cataclysmic international upheavals or may destroy our ecosystem, or possibly both. Yet if we manage our social institutions wisely and if we apply technology in the right way, we can avoid these dual catastrophes and achieve a generally high level of welfare for the human race as a whole. The key to this Utopia is a continued supply of abundant and low-cost energy.

Abundance and cost are of course related by the laws of economics, but through technology they are in some sense independent. If fuels become scarce, then their cost will certainly rise rapidly. On the other hand, if fossil fuels are largely replaced, e.g. by nuclear energy in the form of breeder reactors or fusion reactors, then we will have abundant energy; but its cost may be high enough to become a substantial factor in the cost of finished products, or when measured as a fraction of the Gross National Product. Such a development would make it more

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difficult to advance the living standards of the poor and could trigger social upheavals. But the worst crisis of all would be created if nuclear breeders or fusion reactors were not to become available and energy itself became scarce.

Energy Facts

It is useful to review a few basic facts about energy. First of all energy is transformed; starting with primary sources like a chemical source, or solar or nuclear sources, energy must end up ultimately in the form of heat. In the intermediate stage the energy may do useful things; as mechanical energy in the running of machines or as electrical energy in producing light.

The second fact is that the value of energy depends on its temperature; the higher the temperature the larger a fraction of the energy is available for transformation. (This fact expresses the second law of thermodynamics.) For example, there is a great deal of heat energy in the ocean, or in the cooling water from power plants, but it is often at too low a temperature to be available for producing useful work. According to its availability, we speak of high grade and degraded forms of energy.

In every energy conversion process we should aim to lose as little as possible of the energy as waste heat; i.e. we should strive for efficiency.

In electrical systems we have devices, such as electric motors and transformers, which have efficiencies that are of the order of 80 or 90 percent. But, on the other hand, one of our largest energy users, the internal combustion engine, converts the chemical energy of gasoline into mechanical energy with an efficiency of between 10 to 15 percent. Keep in mind that doubling efficiency means reducing by two the amount of fuel required. Efficiency also means conservation. If houses were better insulated so that the amount of energy escaping is reduced by a factor of two, then the amount of fuel would be reduced correspondingly.

Guidelines for National Energy Policies

When I stated that our aim must be to provide and ensure a continuing supply of abundant low-cost energy, there were two major constraints. One is environmental and the other has to do with national security. Before turning to these, and to the many so-called practical political constraints, let me discuss the situation of an ideal free market and speak about efficiency in an economic sense. Economic efficiency is obtained by what the economist calls efficient pricing. The cost of energy should be that arrived at in a free and competitive market place. If energy is too cheap it is wasted. If energy is artificially over-priced, then other inefficiencies are produced. In general every institutional restraint, every artificial regulation, will distort the market and will result in a lower efficiency.

How do we achieve this ideal situation? Our aim should be to do this with a minimum of regulation, using market forces as much as possible. First of all I would strive to develop what I call the "perfectly informed consumer," that is a consumer who understands what is best for him. This consumer will always purchase the lowest cost package. This consumer not only looks at the initial cost of the house but also asks about the cost of upkeep, thereby forcing the builder to provide better insulation. This consumer looks not only at the price tag of an air-conditioner unit but also asks about its efficiency and electricity consumption.

The environmental constraints are well understood, and are in any case economic rather than absolute and fundamental. By this I mean that if we are willing to pay the costs of pollution control and add them to the other costs which make up the cost of energy, then we have arrived at a rational way for the efficient pricing of energy which includes all of the social costs.

National security considerations distort the energy picture in a different way. The emphasis here must be on reasonable self-sufficiency, and the question is: how can we achieve this at the lowest overall cost. I believe that we need a credible reserve of energy and also a credible scheme of conservation. Perhaps we even need a credible rationing scheme; otherwise we will surely be "held up" by foreign suppliers of fuels, or at least restricted and restrained in the way in which we apply foreign policies to benefit the security of the United States. Incidentally, I would charge all of the costs that are incurred on behalf of national security to the Defense Department. This is the only proper form of bookkeeping if depletion allowances are supposed to develop domestic supplies for the sake of national security, then the cost of the depletion allowances should be billed to the defense budget.

There are many public policy issues which have to be examined and re-examined by the National Energy Study: regulation of domestic oil production, the oil import program, the depletion allowance with respect to oil and gas, price regulation of natural gas, the proper assignment of environmental costs of fuel extraction (particularly of such items as strip mining) and of energy production. I hope that you will better define the role of government investments in R&D to develop better ways of producing, transforming and conserving energy: from fusion power and breeder reactors to MHD, high efficiency transmission lines, coal desulfurization, gasification and liquification, and all of the ways of capturing solar power.

Senator GRAVEL. Thank you very much, Doctor. I apologize for almost passing over the agenda of the day.

Our next witness is Dr. Weinberg.

STATEMENT OF DR. ALVIN WEINBERG, DIRECTOR, OAK RIDGE NATIONAL LABORATORY

Dr. WEINBERG. Since my name begins with "W" I would assume that I would be the last on the symposium and all of the big issues had been covered by previous speakers. Indeed, that has turned out to be the case, the importance of energy on our environment, the production, the relative balance between different methods of producing energy.

The big questions involving energy in the environment, the adequacy of our energy supply, social costs of production of energy, the balance between different methods of producing energy, have really been covered by the previous members of the symposium.

So, I decided for the purposes of this symposium to touch on a much smaller issue, which, however, in my mind has very large possible implications, a very specialized aspect of the problem which indeed I present rather tentatively and somewhat speculatively, because I am not all that certain that what I am going to say is, in fact, correct. But I do present it to the symposium for discussion and meditation, possibly study.

I choose as a national goal that I want to focus upon the whole matter of demographic policy within the United States, a matter that is increasing—that is receiving increasing attention in recent years; in fact, the presence in the national goal emphasizes an option to the national growth in this policy with alternate growth centers away from the urban masses.

The aspect of national policy as a national goal that I am concerned with is not the question of how many total people we have in the United States, but rather the distribution in the United States, and the question of whether it is possible to encourage growth of the population in areas that are not now overpopulated.

Can we get away from the eastern seaboard megalopolis by, say, increasing the growth in a State such as Alaska, Mr. Chairman, if you like? I tried to ask whether the imaginative and focused decision and policy with respect to the siting of prime energy plants might have some leverage with respect to achieving desirable demographic distribution in the United States.

What I have in mind is roughly this: If one examines the demographic growth in the United States where new cities have grown up historically, one is much impressed by the fact that the growth is generally occurring at places where there have been either natural public utilities, such as waterways, or man-made public utilities such as intersections of railroads. There is evidence now that intersections and interstate highways have caused an encouraged growth at those places.

Now, with respect to the question of powerplant siting and its relation to demographic growth, I am impressed with the experience we have had in my own TVA region. I think there is little doubt of the fact that TVA has developed energy sources right in this area of Appalachia and has had a good deal to do with development of the area and industrialization of the area, and to some extent the increase in population in that area.

The reason I touch on the question of powerplant siting is because, as you know, there have been a number of studies—one by the Office of Science and Technology—which has pointed to the fact that the question of where we are going to put our primary energy sources is a matter of great urgency.

The estimate is over the next 20 or 30 years we will need 265 new places to put big energy systems. You begin to think about it and it becomes really a very difficult point.

Mr. McCloskey, for example, is projecting that 100 years from now every square foot in the United States is going to be occupied by a powerplant, which I don't think either he or I really believe, but that shows this is really a serious question.

We have done a number of studies at my laboratory in connection with the matter of: Can a rational policy toward powerplant siting actively encourage demographic growth in a way we believe desirable from the point of view of achieving national goals?

In this respect, I think the attitude that I take in my paper is rather different from the attitude that has generally been adopted toward powerplant siting in this respect: When one talks about planning on powerplant siting, one says, well, we expect there are going to be more people here, therefore more energy, and therefore we are going to put the sites there.

This, you see, is kind of a circular kind of thing and encourages more people to go there. Rather, I would argue we ought to at least study the opposite kind of appoach saying we want more people in such and such a place and therefore can we have a public policy that encourages putting powerplants and energy centers in places where we want the more people, rather than doing the opposite way which is putting the energy centers where the people are already, where the people are going to grow, where one is going to create more demographic chaos.

I have one other point that I guess I would like to mention, and it is a rather different one. One that I think Senator Gravel may have expressed himself on some of the tussles that I think he has had with the Atomic Energy Commission in the past. I am sorry that Senator Jackson is not here, because in his own State there has developed at the Hanford Atomic Energy site a trend toward developing what I like to call nuclear parks.

I am much taken by the idea of clustering our nuclear system in large parks such as Hanford. I think on the one hand this will have demographic impact. I think on the other hand it has a number of important advantages, environmental advantages. The lines of transport are internal. I think the general safety of the systems are increased. But I will concede that the idea of nuclear parks is a little extraneous but not entirely from the main thrust of what I have to say.

Well, that summarizes what my paper is about. I go on to say that in thinking about the tasks set by this symposium which was to identify national goals to relate aspects of energy policies to the achievement of these goals, I was influenced by the importance of the rational policy and the plans for powerplant siting as an aspect for energy policy.

I suspect that the two are closely connected, but I don't really know. I table this idea in the hope that in any continuing study that comes out of the Senate resolution 45, the degree of connection between these two is given serious attention.

(The full statement follows:)

DEMOGRAPHIC POLICY AND POWER PLANT SITING[1]

Alvin M. Weinberg

I shall consider one small, but I believe important, aspect of the relation between energy policy and national goals. The national goal I shall focus upon is the rational use of land, and the humane development of an acceptable population policy. The aspect of energy policy I shall speak to is the siting of power plants: in my view, these matters are all interrelated. In addressing myself to this relatively narrow aspect of national energy policy, I assume that other speakers in this symposium will consider such important matters as energy and environment, the adequacy of our energy supply, the social cost of production of energy, and the relative balance between different modes of producing energy.

Much is made these days of the idea that the United States is "overpopulated". Under the prodding of such extreme proponents of the doctrine of overpopulation as Paul Ehrlich (who in his widely read book, Population, Resources, Environment,[2] argues for a U. S. population of 50 million), many have come to believe that, indeed, we have "too many people" in the United States.

This view is anathema to most professional demographers. They point out that there are more acres of woodland in Connecticut today than there were 100 years ago. Anyone who has visited the plains of Kansas or Iowa knows that we have enormous sparsely populated parts of the United States that could accept more people than now live there. On the other hand, there

[1]Submitted to the Senate Internal and Insular Affairs Committee for the Symposium on Energy Policy and National Goals, Washington, October 20, 1971.

[2]W. H. Freeman and Company, San Francisco, 1970.

are few who will deny that our large cities are too large, and too sprawling: that they would be much better places in which to live if their populations were smaller and less dense.

A rational population policy, and a rational policy for distributing our population, seems to me to be an essential long-term National Goal. In fact, the President's Research Staff on National Goals emphasized that a viable option to urban growth and its problems "... is a policy of encouraging growth in alternate growth centers, away from the large urban masses ...".[3] Also, an official of the Department of Housing and Urban Development has suggested that 30% of the 100 million population growth (by 2000 AD) should live in planned new cities: nine cities of about one-half million population, 14 at the quarter million level, and 84 cities of 75,000 people.[4]

We are a democratic country, and we value our human freedom, perhaps more than anything else. Yet there are many who are beginning to question whether a rational demographic pattern in the United States can be established without limiting some of our most strongly held personal freedoms.

I do not know the answer to this question. Yet I would suggest that there may be some ways of encouraging a better geographic distribution of people that would not require coercive action by a central authority. One such action is exemplified by the Rural Development Incentive Act of 1971. This act, which was reintroduced by Tennessee Congressman Joe L. Evins, September 27, provides investment credit to industry in small towns. I think such actions are important and should be encouraged.

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[3]"Toward Balanced Growth: Quantity with Quality", Report of the National Goals Research Staff, U. S. Government Printing Office, Washington, July 4, 1970.

[4]Jerome P. Pickard, Director, HUD Program Analysis and Evaluation Staff, as reported in Professional Builder, 34, October 1969.

Let me suggest another approach based on the strategic deployment of our technologically-based utilities. One can make a case for the idea that new settlements spring up and flourish where the underlying natural or man-made utilities are most convenient. The mill towns in New England capitalized on local water power. Large cities like Chicago grew up around railroad junctions. There is evidence that the redistribution of our population in the United States in the 60's was strongly influenced by the location of our interstate highways. Local abundance of cheap energy has certainly encouraged industrial growth and settlement - for example, the chemical industry around Galveston, Texas, or around Charleston, West Virginia, has been based on cheap natural gas, and the growth of the Tennessee Valley region, on relatively low priced TVA electrical power.

Let me relate all this to energy policy. A pressing question concerning our energy supply for the future is the development of a rational policy with regard to power plant siting. Moreover, the siting of power plants might have impact on the distribution of population in the United States. I would therefore argue that imaginative siting of power plants could and should be used as one means of encouraging a more optimum distribution of our population.

The two recent Office of Science and Technology reports[5,6] on site selection and related environmental matters briefly mention power plant siting as a focal point for industrial development and stimulation for the creation of new cities. These reports, however, apparently do not visualize power plant siting

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[5] "Considerations Affecting Steam Power Plant Site Selection," The Energy Policy Staff, Office of Science and Technology, U. S. Government Printing Office, Washington, 1968.

[6] "Electric Power and the Environment," The Energy Policy Staff, Office of Science and Technology, U. S. Government Printing Office, Washington, August 1970.

as an instrument for achieving a better geographic distribution of our population.

Consider also that United States utilities must somehow find an estimated 265 new sites for power stations larger than 500 Mwe within the next 20 years. During this time our present electrical generating capacity (~350,000 Mw) may well increase to over a million megawatts.

As a response to the two requirements for more energy, and of rational growth of new centers of population, I suggest that the Federal Government designate a few locations as possible sites for the generation of power during the next 50 or 100 years, with the intention of encouraging migration to those areas and possibly the development of new cities there.

II

I cannot pretend that I understand fully the relation between power plant siting and the migration or settlement of people. There are, however, a number of issues which I think may be relevant.

(1) As a general point, I believe there is good evidence that abundance of cheap energy helps develop an area industrially, and therefore tends to promote in-migration to the area. The whole TVA experiment was predicated on this belief, and it is my impression that the 35 years since inception of TVA has lent support to this conception.

At the time TVA was organized, undeveloped water resources were the basis of the cheap energy TVA provided. Later, cheap Appalachian coal supplemented water power, and the Tennessee Valley remains one of the country's low-cost energy areas.

The advent of nuclear power now makes it possible to locate relatively cheap sources of power quite independently of the availability of cheap fossil fuel. This means that, insofar as one would expect the industry and therefore the population of a general area to cluster around sources of prime energy, we now have, or are close to having, the technology for developing less developed parts of our country by strategically locating prime sources of nuclear energy.

(2) Several studies at ORNL suggest that energy centers - power stations producing heat and electricity - might create new social and economic bases where they do not now exist.[7] Depending on the natural and human resources at a particular site, a large nuclear power plant combined with energy-intensive industrial processes and large-scale agriculture can provide profitable opportunities for primary industry entrepreneurs. Secondary supply and service industries and a variety of labor skills naturally would be attracted by the primary manufacturers. Other studies have shown the feasibility of integrating the city's municipal and commercial utility needs - centralized waste disposal, heating and air conditioning - into the energy complex.[8] Some important added advantages of this central, multipurpose concept are the reduced environmental degradation (less smoke and waste heat) and the reduced consumption of our diminishing fuel resources (by using the heat as well as the electricity). Also, our study of urban decentralization concluded that energy centers appear to be an attractive possibility for redirecting growth.[9]

[7] "Nuclear Energy Centers, Industrial and Agro-Industrial Complexes," ORNL-4290, Oak Ridge National Laboratory, November 1968.

[8] "The Use of Steam Electric Power Plants to Provide Thermal Energy to Urban Areas," ORNL-HUD-14, Oak Ridge National Laboratory, January 1971.

[9] "An Introduction to Urban Decentralization Research," ORNL-HUD-3, pp 74-78, Oak Ridge National Laboratory, June 1971.

I recognize that city planning based only on technical and economic factors would have an unhappy outcome. The great importance of many social factors in new city planning certainly outweighs the technical and economic ones. Suffice it to say, all three aspects must be planned simultaneously and the task is extremely difficult.

(3) Another, somewhat different, issue would be the question of whether nuclear power plants should be built singly and separately or should be clustered into parks. The 80-odd nuclear power plants now under construction are located, mostly, to be convenient to the anticipated load centers. In this sense, their location tends to accentuate existing demographic trends. I would like to see a siting policy for nuclear power plants that would encourage migration into areas that are underpopulated. If such a policy were coupled with a policy to <u>restrict</u> the growth of power facilities in already overpopulated areas, this might discourage the growth of population in presently overcrowded parts of the country.

In particular, I would recommend a study of the demographic impact of what I call "nuclear parks". A nuclear park is an area in which are clustered several 1000-Mw nuclear reactors, together with the necessary chemical reprocessing and other ancillary facilities. The park appeals to me as having these advantages:

(a) Lines of transport are internal: Hence shipment of radioactivity would be better controlled than if common carriers are used.

(b) Safety: If an accident occurred, the massive resources of the entire nuclear park would be at hand to confine and reduce the consequences of the accident.

(c) Economy of scale: The cost of electricity at a nuclear park would probably be lower than at an isolated station because many facilities might be shared in common.

(d) Around a large nuclear park could be clustered energy-intensive industry that would capitalize on lower transmission costs. Such industry would tend to draw more people into the area. Thus the nuclear park and industrial complex might be expected to have significant demographic impact.

Nuclear parks also have disadvantages:

(a) The disposal of heat from so concentrated a source may be difficult. This requires careful examination, case by case.

(b) If the parks did not attract industry and they remained far from load centers, transmission costs would be high.

(c) Parks may be more vulnerable than isolated plants to acts of God or of war.

(d) Nuclear park siting would require a restructuring of our utility industry: the utilities might then largely distribute rather than generate electricity.

What impact would establishment of, say, 100 nuclear parks during the next 30 years have upon the distribution of our population? I should think the effect might be considerable if at the same time we placed a limit upon the generation of energy at other sites. But this is a matter that above all requires further study.

III

There are probably many other factors that affect the distribution of population more strongly than does siting of electrical power plants. On the other hand, in thinking about the task set by this symposium - to identify national goals, and to relate aspects of energy policy to achievement of these goals - I was much influenced by my belief in the importance both of a rational demographic policy as a National Goal, and of a sensible plan for power plant siting as an aspect of energy policy. I am convinced that the two are connected; and I would hope that in any continuing study the degree of connection between them is given serious attention.

October 13, 1971

Senator GRAVEL. Thank you very much, Doctor.

Our last and cleanup witness is Mr. M. A. Wright, chairman of the board of Humble Oil and Refining, and another economic constituent of my State.

Mr. Wright.

STATEMENT OF M. A. WRIGHT, CHAIRMAN OF THE BOARD, HUMBLE OIL AND REFINING CO.

Mr. WRIGHT. Thank you.

Of course, I submitted my paper in the abstract and I will summarize without any direct reference to these papers.

National goals have been evolving through time to accommodate the changing needs of our society. I think a current expression of these goals would probably include the desirability to improve the quality of life, to expand the quality of opportunity, to sustain a healthy, growing economy, to provide for national security, to play our appropriate role in the world community.

Now, as has been mentioned earlier today, a very close relationship exists between the state of development of the Nation and the rate at which the citizens consume energy and providing the very essentials of life in this country—food, clothing, shelter and water—in the quality necessary could not be accomplished without the use of substantial quantities of energy, and certainly if we are to continue without current life style, this cannot be done without heavy dependence upon energy.

Today, the United States faces very difficult energy questions. I think the seriousness of this question is indicated by Senate Resolution 45. I think it seems obvious to me that the fragmented and often conflicting individual fuel policies of the past must give way to a coordinated total energy approach. There is a need for all to recognize that many energy related issues must be treated as part of a total unified subject.

The action of this committee in this regard, I think, is extremely encouraging to us in this matter. Our studies have led us to conclude that as a broad principle national energy policy should be designed to assure the United States an adequate supply of energy for both present and longer term needs, and at a reasonable balance between costs, dependability, and protection of the environment.

Furthermore, any lack of self-sufficiency should be offset by contingency plans to cover supply interruptions.

Obviously, while such a broad statement of purpose is desirable, it by itself offers very little practical guidance or significance. Its effectiveness requires specific issues and programs.

In the next few minutes I would like to comment on some of the individual issues in three areas that we believe are important. The first is resource development.

The orderly development of our energy resources is essential for our national goals. As this committee knows, much of the Nation's energy potential is in the Federal domain and therefore Federal land policy is of the utmost importance.

Let me cite two examples where laws or policies need to be modified to recognize the current conditions. In the Federal offshore area, the present objective of Federal oil and gas leasing policy seems to be to limit acreage offering so as to maximize the bonuses per acre.

We feel this approach fails to fully recognize the seriousness of the energy problem. If we are to develop our resources at a rate justified by our national need, what is required in this area is both more frequent and larger lease data. For example, in provinces like the Gulf of Mexico, 1½ to 2 million acre sales would not be unreasonable, and I should point out the forthcoming acreage sale in December is only for 400,000 acres, and this is the order of magnitude in sales of this type.

In new frontier provinces, large areas should be explored promptly. Perhaps as much as 3 to 4 million acres offered in individual sales.

Now, there has been much interest in seeing oil shale development. In fact, I believe this committee is having a hearing here on November 15 on this matter.

Oil shale development will be a high risk capital incentive venture and Federal leasing laws may well hold a key to this development and success. The limitation of the Federal Leasing Act of 1920 of one oil shale lease per individual needs to be modified. This provision effectively limits a company to a single oil shale plant on Federal lands, and eliminates the opportunity to use this experience that is gained on latter ventures on Federal areas.

This can only slow down the oil shale program and limit the progress of it.

A second important area is environmental questions. An environmental question facing society warrants special comment, to be sure; the development and use of energy does effect the environment. What is overlooked is the positive effect energy has on our very existence.

The operations of industry and government, and the behavior of individual citizens should be such that the environment is promptly protected. Where a demonstrated need exists, governments with the cooperation of industry, have an obligation to set firm, reasonable and consistent and attainable environmental standards for air, land and water.

Then industry, local governments and the public must then respond promptly to the achievement of these standards, and it is only fair to say that much progress has already been made in this area.

Environmental considerations should play an integral role in the U.S. energy future. Policy must recognize both energy and environmental objectives.

There are a number of key environmental issues that do need prompt attention and as examples we badly need several things. We need an effective nuclear powerplant siting and licensing procedure which will minimize unwarranted delays in the approval, construction and operation of these plants. We need the development of fuel gas resources technology to make coal consumption acceptable environmentally. We need early agreement on what is acceptable from an environmental standpoint in oil shale development. We need innovative and timely solutions to the many environmental issues that are inherent in the oil and gas operations in sensitive areas, such as Alaska and the Santa Barbara Channel.

Now, it must be realized that further improvements in the environmental protection and the production and use of energy will result in added costs. Each incremental gain tends to be progressively more expensive and consumers must ultimately pay for these improvements in the form of higher product prices.

Industry and government, therefore, have the responsibility to inform the public fully about potential consequences of projects, about the existing alternatives available to minimize environmental impacts and the costs that are involved, thereby providing the opportunity for an informed society to make intelligent decisions about these issues.

The final area I want to mention is security. The most important specific current Government policy in the security of energy is the mandatory oil import program. The oil import matter is an extremely complex one and while these details cannot be adequately discussed in the time available to us today, the primary policy prerequisites of an appropriate oil import program might be summarized as follows:

First, imports in the United States should be controlled, and domestic oil production should be encouraged. Policies should not discourage the growth of domestic refining capacity. Contingency programs should be developed to permit the United States to cope with any petroleum supply emergency that may occur.

Mr. Chairman, there are obviously many other aspects of my paper that I have not touched upon, but I think this highlights my statement.

Thank you.

(The full statement follows:)

STATEMENT ON ENERGY AND NATIONAL GOALS
SUBMITTED TO
SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE
OCTOBER 15, 1971
BY
M. A. WRIGHT
ON BEHALF
OF
HUMBLE OIL & REFINING COMPANY
AND
STANDARD OIL COMPANY (NEW JERSEY)

NATIONAL GOALS

The first national objectives of the United States were inherent in the very founding of the country and were designed to provide guarantees to the individual with respect to life, liberty and pursuit of happiness. Within the framework of those general objectives, more specific national goals have evolved through time to accommodate changing needs and they are implied in the laws and institutions of the nation and the actions and attitudes of its people. A current expression of these goals is as follows:

Quality of life in the nation should be continuously improved. A higher national standard of living, a greater degree of individual freedom, and increased personal security are essential to the continued advancement of society. Protection of the natural environment is a requisite to assure man's continued well-being. Equality of opportunity should be provided all individuals. Equal opportunities for employment, education, and advancement are fundamental to our national purpose. Economic growth is essential if, in fact, the quality of life in this country is to continue to improve and all citizens are to share in that improvement. This growth should be at the maximum rate consistent with the avoidance of inflation, the achieving of full gainful employment, and primary dependence on the private enterprise system. A private enterprise economy, coupled with a free political system, permits the maximum individual freedom in the choice of jobs, goods, and services. National security in all of its aspects -- political, social, and economic -- must be preserved. Appropriate steps should be taken to insure the nation's political integrity, preserve its social and physical well-being, and safeguard the domestic economy. International relationships should be conducted in such a manner that the U.S. can play an appropriate role in the activities of the world community. International economic policies should be founded on the principle of free trade modified only as dictated by national needs of the highest priority.

RELATIONSHIP OF ENERGY TO NATIONAL GOALS

Expanded energy use has contributed to the quality of life that has been achieved in civilized societies. Social gains have been greater and the standard of living higher in those nations where the per capita utilization of energy for peaceful purposes has been at high levels and increasing steadily. With energy and technology man has multiplied his own ability to do work and thus better provide for his needs and extend his comforts. In fact, the very essentials of life -- food, clothing, shelter, and even water -- could not be provided in sufficient quantities to sustain the current population without the use of substantial amounts of energy. Since energy fuels the factories which provide the principal goods and products used by man, is the source of transportation and is the basis for lighting, heating, cooling, and the operations of hundreds of appliances from kitchen stoves to office equipment, the current life style of modern society could not continue without use of vast amounts of energy.

Improved quality of life is also dependent on man's ability to protect his physical environment. As every species before him, man cannot exist without effecting some changes in the natural environment. But the beneficial changes that civilization has occasioned have immeasurably improved life style and have far outweighed any environmental harm that the energy used to effect these changes has caused.

The extent of environmental harm due to society's inherent desire for better life will be largely determined by its collective choices. Science, technology, industry and government have the capability to minimize the adverse environmental impacts of civilization. Sound, well-thought-out social and political judgments will be required to establish environmental standards consistent with society's desires and capabilities. However, the establishment of such standards carries with it the responsibility and obligation to define not only the resultant social benefits but the social costs as well.

Increased energy usage also plays a role in achieving equality of opportunity for the nation's people. Energy through rising productivity provides increased availability of jobs and improved living conditions. For underprivileged and minority groups the assurance of an opportunity to work and the accessibility of desirable living accommodations are essential to achieving social equality.

Energy is essential to national security; without energy there can be no military strength. A measure of a nation's vulnerability is the degree that it lacks energy resources. Conversely, indigenous or assured outside sources of readily available energy help promote the capability to respond effectively to national emergencies and to deter or limit aggressive actions.

As an extension of its impact on national security considerations, energy is also a factor in international relationships. The political and economic status of this nation in the world community is in large measure dependent on the nation's own economic and political health, industrial productivity, competitiveness in world markets, technological development, and military capability. Each of these is influenced by the availability of abundant energy at reasonable prices. To the extent any nation is seriously dependent on another for a vital commodity such as energy, its entire posture in the world community is affected because providing for energy needs becomes a major consideration in the development of foreign policies.

NATIONAL ENERGY POLICY

It is clear that clean, reasonably priced, plentiful energy is indispensable to the attainment of national goals and objectives. National awareness and recognition of this fact may not have been apparent in the past because the U.S. has always been able to provide abundant energy supplies from indigenous sources and at reasonable prices. More recent experience has begun to change that attitude. Today the future outlook for energy in the U.S. is characterized not only by increasing demand, but by increasing foreign dependence, increasing environmental conflicts, increasing costs, and increasing uncertainty. The ad hoc, diffuse, and often conflicting approaches to individual energy issues that have characterized the past will not be adequate for the future. There needs to be full recognition of the fact that all energy-related matters must be analyzed as parts of a total and unified subject which has as its foundation a well defined national energy policy.

Consideration of national goals and the role of energy in their achievement leads to the conclusion that the national energy policy should be to provide the United States with an adequate supply of energy for both present and longer term needs at a reasonable balance between cost, dependability, and protection of the environment. Any lack of self-sufficiency should be offset by contingency plans which account for the probability, magnitude, and frequency of supply interruptions.

ENERGY POLICY ISSUES

The statement or adoption of a basic national energy policy is, of course, not in itself sufficient. Its effectiveness requires the development of a coordinated series of specific policies and programs that address individual energy fuel issues. Identification and discussion of such energy policy issues could be organized in any number of ways, such as by fuels or various policy categories. This paper addresses policy needs under six groupings of related issues: 1) resource development, 2) efficiency of energy utilization, 3) environmental protection, 4) technological development, 5) economic and political factors, and 6) security of supply.

Resource Availability and Development

Much of the nation's energy potential, including offshore oil and gas reserves, oil shale deposits, western coal deposits, and geothermal energy sources, is located on federal lands. Potentially productive acreage in the federal domain should therefore be made available to the industry for exploration and development at a rate and in a manner designed to maximize the timely development of these domestic resources.

The federal government's past practices for leasing offshore oil and gas acreage seem to have been aimed at limiting acreage offerings so as to obtain the maximum bonus revenue per acre offered. Such a policy is not conducive to the development of domestic reserves at the pace required to meet the nation's growing energy needs. In order to increase domestic oil and gas supplies, the frequency of federal lease sales should be increased. These sales should be held on a regular basis with the schedules announced well in advance. The recently announced Interior Department schedule for the next five years indicates about two sales per year, which would be an acceleration of the number of sales over past experience. Of more significance, however, is the amount of acreage to be offered in each sale. The latest sale announced for Louisiana includes only 400,000 acres, which is less than the average of past sales. To achieve the desired results in terms of resource development, acreage in individual sales in the Gulf of Mexico should be in the range of 1.5 - 2.0 million acres.

In frontier areas such as the Atlantic offshore and Alaska, substantially larger sales will be required to bring about the extensive exploration needed within a reasonable amount of time. Offerings of up to 4 million acres per sale are considered appropriate. Additionally, consideration should be given to methods of making large contiguous blocks available to individual companies, e.g. offering acreage in blocks of 4 to 6 leases (5760 acres/lease). This would provide added incentive to individual bidders to accelerate exploration of these large geologic provinces.

The right of the U.S. to authorize exploration and development of petroleum resources in its continental margins is critical to the national interest. The current U.S. proposal before the U.N. on international control of the sea beds beyond the 600 ft. water depth may very well delay exploration of these areas. Such delay is not consistent with the nation's best interest; relinquishment of control of these areas is also not clearly to the nation's advantage.

The Department of the Interior has recently announced tentative plans to initiate development of federal oil shale lands. Although Interior's plan is a first step, a primary problem exists in provisions of the Mineral Leasing Act of 1920, which limit any one company or individual to one federal oil shale lease having a maximum of 5,120 acres. This effectively limits a company to only enough federal reserves to support a single oil shale plant producing about 50,000 barrels per day. Under such a limitation it is unlikely that any company would want to pioneer a full scale plant of this size (which could require about $250 $\overline{M}$ in what might well be an uneconomic venture) if it could not use the knowledge gained to build and operate additional plants.

Legislation should therefore be introduced that would correct this acreage limitation problem and make federal oil shale leases available for development on a continuing basis. As a minimum, removing acreage under active development or production from chargeability against maximum allowed federal oil shale acreage holdings would seem to be a more logical approach. Without such a change, development of U.S. oil shale reserves remains questionable.

Local and national policies with respect to access to land and water spaces should be designed to encourage competitive free enterprise and compatible multiple uses of these areas. At the same time, they need to be sufficiently flexible to adapt to social and technological change. Private industry, the public and government all must share in the responsibility to maintain an acceptable balance between economic development and environmental conservation.

Efficiency of Energy Utilization

Energy policies should encourage improved efficiency in both the development and utilization of energy and energy resources. Improved recovery of natural resources, increased efficiency in generation and transmission of electricity, and reduction of losses or wastes in fuel consumption will all result in increased availability of energy for useful purposes.

Improved recovery of natural resources can be accomplished by such methods as secondary and tertiary recovery techniques for oil reservoirs and nuclear stimulation of certain gas reservoirs. Not only is continually improving technology required to achieve this increased recovery, but sufficient economic incentives are necessary to justify these higher cost methods.

Increased efficiency in the utilization of energy can be achieved by programs which inform the consumer about ways to prevent wasteful energy usage. The recent proposal by the President on household insulation is an example of appropriate government action and other programs may be possible. Each, however, may very likely involve some higher costs for the increased efficiency. These are choices consumers should make and any arbitrary end use control of consumption through government intervention should be avoided.

Environmental Protection

The operations of industry and governments and the behavior of individual citizens should be such that the environment is properly protected.

Where a demonstrated need exists, governments, with the cooperation of industry, have an obligation to set firm, reasonable, and attainable environmental standards for air, land, and water. Industry, local governments, and the public have an obligation to respond without delay and to work vigorously to achieve these standards. Environmental considerations should play an integral role in the U.S. energy future. By the same token, however, harassment and delaying tactics that do not objectively consider the responsibilities of both points of view to satisfy the total needs of society are to be avoided.

There are a number of key environmental issues that do need prompt attention. For nuclear power, these include the development by government of an effective siting and licensing procedure that will minimize unwarranted delays. A prerequisite for establishment of this procedure is the necessity to define the real risk of potential radiation and thermal pollution in order to neutralize objections based on emotion rather than fact. The federal government, because of its expertise, must play a key role in assuring consistent local regulation to facilitate timely construction of nuclear power plants. Of great importance also is the development of safe and acceptable long-term waste disposal systems to handle spent nuclear fuel elements and other radioactive material.

One of the principal environmental issues for coal involves its use in a manner consistent with recent air quality standards. The development of flue gas desulfurization technology and the increased utilization of low sulfur western coal are direct steps for increasing coal usage while improving the environment.

The environmental concern over strip mining of coal is a factor not only in the development of coal resources for conventional uses, but also in the future development of synthetic oil and gas, particularly using western coal. Programs for land restoration to insure minimum environmental effect should be a part of any surface mining operation.

Environmental uncertainties are also evident in the development of shale oil. After extraction, the disposal of the waste rock is a fundamental problem, since the spent rock volume is substantially greater than its original in-place volume. Early agreement on what is acceptable from an environmental standpoint is essential if oil shale is to be developed in the near future.

There is a need to anticipate and develop innovative solutions to the many environmental issues which are inherent in oil and gas operations. Oil and gas exploration and development, laying of pipelines, installation of deep water terminals, and new refinery construction have either been delayed or prevented due to environmental concerns. Alaska, the Santa Barbara Channel, and Delaware Bay are cases in point. Both industry and government have an obligation to expedite resolution of such issues in a manner consistent with reasonable environmental standards.

Environmental protection in the production and use of energy will result in added costs. Each incremental environmental gain tends to become progressively more expensive and consumers must ultimately pay for these improvements in the form of higher product prices. Industry and government, therefore, have the responsibility to inform the public fully about potential consequences, available alternatives, and the costs involved, thus providing the opportunity for society to make intelligent decisions about the issues.

Technological Development

The importance of research and development in the total energy spectrum to the growth, welfare, and security of the U.S. is unquestionable. Technology is the basis for developing conventional energy resources, finding new sources of energy to substitute for old, improving the efficiency of energy utilization, and protecting the environment. Pollution abatement technology is in a period of rapid growth, and with continued development the options for pollution control will expand dramatically.

Development of technology for the production of shale oil and synthetic oil and gas from coal is of critical importance. In the past, both government and industry have participated in basic research and small scale testing. The time has now come for the large scale testing of some of the more promising processes, particularly in the area of coal gasification, and again both industry and government have indicated a willingness to share the funding of this latter work. However, government policies and programs should recognize that private industry should have the responsibility for adding synthetic oil and gas to the nation's energy supply. Industry is already working to that end. But it is equally important to recognize that the manufacture of synthetic fuels will require both new technology and tremendous amounts of new capital investment. Additionally, as pointed out elsewhere, synthetic fuels also involve environmental considerations. All of these factors have costs associated with them so that synthetic fuels will be higher cost fuels, at least in the early years. With experience it is to be hoped that initial costs can be reduced as technology and productivity are improved.

Research and development programs for new forms of power for the long-run, such as geothermal power, the nuclear breeder reactor, nuclear fusion reactors, magnetohydrodynamics and solar energy, should also be encouraged. Both government and industry have the responsibility to see that research effort commensurate with potential contribution is given to such potential new sources of energy supplies.

Economic and Political Factors

An economic and political framework which is conducive to energy development is an obvious prerequisite to meeting both national and energy goals. A first consideration in this regard is encouraging competition to insure that the economic system produces the energy the nation requires most efficiently and at the lowest prices. It is imperative that competition be encouraged by continued reliance on individual initiative and effort provided under the private enterprise system.

Within such an economic system a freely determined market price has several very important roles to play. Price is the natural market mechanism for allocating products in limited supply, for tempering demand growth and for promoting efficiency in the use of scarce materials. Price can be the regulator of supply, stimulating or reducing production as the market requires. Responsive market prices can lead to the most efficient allocation of available resources within the economy and can be an effective stimulus for additional research and development. There is little question but what the recent inflationary trends in the economy dictated some strong measures to regain stability. It must also be recognized, however, that prices do affect long run supply and demand and that undue regulation of fuel prices can produce unwanted results. The impact of artificially low prices for natural gas on both demand and supply is a clear-cut example of this phenomenon. Federal regulation of the price of natural gas should be removed or at least modified to provide recognition of the effects of interfuel competition and environmental regulations on the cost and value of gas.

The tax treatment of fossil fuels and other mineral resources reflects the high risks and uncertainties involved in exploration and development and the large capital investments required. In the past the depletion allowance has been important in attracting capital and in encouraging development of sufficient supplies of energy at reasonable costs. The incentive provided by the depletion allowance serves the public interest and should be sustained.

Diversity of effort in the development, production and sale of energy fuels should also be encouraged. Diversification by fuel producers and others into the various fuel businesses has increased competition by providing new sources of capital, management abilities, technological skills and increased research capabilities, all of which have combined to increase energy fuel supplies. Since, in the future, it will be necessary that each potential domestic energy source be developed to its maximum extent, consumers will be best served by the increased supplies achieved by competition among producers of each form of energy as well as between producers of different forms of energy.

Security of Supply

The continued availability of dependable and secure energy supplies is fundamental to national security. Import policies for energy fuels should not only recognize the demand for additional supplies, but should also encourage the development of domestic energy industries. Government, industry, and the public should be alert to the problems which may arise from individual sections of the country or segments of industry becoming excessively dependent on foreign energy raw materials or products.

With the growing dependence on overseas sources for oil supplies, the future security of U.S. energy supply is a matter of increasing concern and should be an essential element of any national energy policy consideration. The Mandatory Oil Import Program is the most important specific current government policy affecting the security of energy supply.

The oil imports question is an extremely complex one. Its details cannot adequately be discussed in the confines of this paper. It is, however, possible to state the primary policy requisites of an appropriate oil import program.

1) Total hydrocarbon imports into the U.S. should be controlled to avoid excessive dependence on insecure sources.
2) The development of domestic oil production should be encouraged.
3) Policies should not discourage growth of domestic refining capacity by permitting unrestricted import of refined products and processed feedstocks, including heavy fuel oil.
4) The possibility of foreign supply interruptions and the likelihood and frequency of their occurrence should be recognized. Specific programs should be developed by government, with the assistance of industry, which will permit the United States to cope with any such petroleum supply emergencies.

These principles are equally applicable to other energy forms, including gas and uranium, as well as energy in general.

SUMMARY AND CONCLUSIONS

1. Primary national goals are improved quality of life, equality of opportunity for all, continued economic growth and well-being, national security, and satisfactory international relationships.

2. The intimate relationship of energy to each of these national goals requires that a well-defined national energy policy be established.

3. The U.S. national energy policy should be to provide an adequate supply of energy for both present and longer term needs at a reasonable balance between cost, dependability, and protection of the environment. Any lack of self-sufficiency should be offset by contingency plans which account for the probability, magnitude, and frequency of supply interruptions.

4. The basic national energy policy must be supported and implemented through specific programs and policies for individual fuels, which take into account resource development, efficiency of energy utilization, environmental protection, technological development, economic and political factors, and security of supply.

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Senator GRAVEL. Thank you very much, Mr. Wright.

In the interest of time, I would like to ask a question. The problem here is in management problems. The systems to provide the knowledge to be able to make intelligent decisions. This decisionmaking process, of course, is part of the structure.

I notice many of you talk in terms of enlarging the organization. Of course, we have the problem of the organization of Government. The financial example is that the operation of Government has not solved the problem; if it did, it would be solved at this point in time.

So, in setting up the structure, we need something new and creative. In my own experience today in trying to figure out what is happening in this structure, I come to only one law, and that is the National Environmental Protection Act, which is to develop an adversary proceeding process wherein you now have a check on all of the forces in sort of a pell-mell fashion.

That brings me to the question, one to Dr. Singer and one to Mr. Bradshaw. It was Mr. Bradshaw that brought up very pointedly, and I think properly, the absorption of the social costs into the cost of energy if we choose not to absorb that cost elsewhere. You make the statement that we have, or we have legislation to absorb that social cost.

No. 1, what is that legislation, and if so, is there a more or less painful process to effect the changeover from studies which do not absorb that social cost into a position where it will absorb that cost?

Dr. SINGER. The existing legislation on air and water qualities pollution, particularly the standards that have been set and are being set will force all energy producing facilities, all public utilities, for example, to comply with these standards.

This means they will have to encourage expenditures, first of all, on the front end, to make sure that the sulfur dioxide emission is produced, either by purchasing low sulfur fuels or somehow removing the sulfur after combustion. And furthermore, they will have to maintain the effluent water at a current temperature.

There are a number of restrictions put upon them. I am just mentioning some of them. All of these result in additional costs. This means the public utilities will go and raise the rates for the consumers and pass the costs along for the consumers of electricity. So that the costs which up to now had been social costs, which means they had not been paid for but had been borne by society as a whole, will now have to be paid for by those who consume energy, the consumer at the home, the industries and the commercial establishments.

The only alternative I see is not satisfactory, which is to subsidize all of this out of the Federal budget, because this would mean that everybody would pay for it and I believe it is only fair that the consumers pay for the increased costs.

I think it also promotes economic efficiency in the sense that it will, as I see the scenario, rising costs will force the consumer to be more careful about the use of energy, to be more careful about the use of electricity and eventually might achieve this desirable state that Mr. McCloskey referred to where some of the growth which has been wasteful, where manufacturers will find it profitable to increase the energy transforming efficiency of whatever they are manufacturing, because the consumer demands it.

The consumer would not want to pay these additional costs. So, I believe the present cost is the right one.

Senator GRAVEL. Under that course you are speaking of the naked police power of the State. The State dictates this is right and the system must then conform to the criteria which has been set up by the State. In my mind, that doesn't presuppose any planning. Much of the testimony this morning has centered around the concept that we should be at least sophisticated enough as human beings to plan the direction of our goals. What you just stated doesn't talk in terms of planning. The air is going to be this clean and everybody must haul-to to clean the air.

Dr. SINGER. Well, I don't look at this as the police powers of the State. I look at this as the Government carrying out the wishes of the people. The effective standards are set by public hearings and State standards which are then approved by the Federal Government. They amount essentially to the State deciding on what should be the use of their water, what purposes, what should be the limits of impurities that should go into the water, what should be the temperature rises that may be tolerated. It is the job of the Government, then, to promulgate these regulations and see that they are carried out.

However, I think the process we are involved in is a free market process, because the costs, once they are assumed by the polluting agency, in this case the power producing utility, are passed along to the consumer and in such a way that——

Senator GRAVEL. All right. Just looking at the list of people who come to testify, we are amply represented by the oil industry and environmentalist people, and one person representing coal. We will have one witness at some point this afternoon who represents all of the electrical utilities, the people who produce electricity, and then distributes that.

Of course, these people are the ones that are regulated. It would seem to be a disproportionate representation or let's say a concern of the issue in question. Here again we could pass laws setting standards of air, but you can just suppose the question is more intelligent to the electricity bill that you pay monthly to give you a break as you use more energy rather than maybe reverse it.

Of course, these questions are not asked at this point in time and maybe this study will address itself to that area. But we haven't begun to even draft a system to provide the knowledge in all of these areas.

Mr. Wright talked of this; is it more important or beneficial to society to tax at the local level for leases, or just give them the leases and let them go exploit the ground and get the energy? I don't know. I wonder if you—you just addressed yourself to one facet of it.

Dr. SINGER. I agree with some of the speakers here. I agree with Mr. McCloskey that it is not right for the utilities to advertise extensively and press for increasing consumption. I am particularly concerned about the utility for space heating which is a terribly inefficient use, because electricity is such a high grade energy it should not be wasted on just heating. But others may disagree here.

Mr. WRIGHT. Well, as regards leasing, there are a great many different systems around the world. The North Sea where we have a number of European nations controlling it, and up until recently they never had a bidding bond system, and there are many parts of the world where they don't use that.

There is a question on this point as to whether or not we are doing this in the most efficient way. I think it is well worth looking into.

Senator GRAVEL. Do you see the social costs are being cranked painfully into the system?

Mr. BRADSHAW. Yes, painfully and slowly. The import of your question is: should there be government involvement and at what point does it become oppressive in the private enterprise system?

In the Delaware Valley there are half a dozen refineries. Five years ago they were all emitting sulfur into the air and degrading the water of the estuary. There were no standards. Now, under the rules of the game, if any single company were to spend $40 or $50 million to upgrade its refinery so it would reduce the emissions into the air and the degradation of the water, under the rules of our game that company probably would go out of business.

So, that isn't the way. What is the way? Well, the city council of Philadelphia, when they hold hearings, there is pressure from the citizenry to prevent this blight and at that point the oil industry should come in with its professional knowhow and should press for the highest possible standard.

Now, today there are standards in the Delaware Valley. All refineries conform to them. This is a social cost which has been written into the cost of the product and passed on to the consumer, sometimes. At least it has been written in.

Now, as we go up the scale to more complex problems, that is a relatively simple problem, but as we go up the scale to more complex problems and as we realize that the energy issue is a national issue on which the future of this country may depend, then it seems to me the Federal Government has to take the place of the city council of Philadelphia in that situation.

This does mean more government control and more government relationships with industry, and it does mean a changing of the rules of the game for business.

Senator GRAVEL. Would it necessarily mean more government control? I personnally, from my experience, am distressed by the shortcomings of government in this area. This is something that others are experiencing. That is the adversary situation that exists with the pipeline in Alaska today. The delay is taking place as a result of the adversary efforts by environmentalists through the judicial process. It is a lengthy process.

The question is: is it so lengthy and painful to industry that it causes built-in inefficiencies in itself, or is there a way to hasten that process and still arrive at the same goal? So, my question is: Have the adversary proceedings that have taken place relative to the Alaska pipeline been too harmful to industry? One, will they be beneficial in the end, if a pipeline is built and if the oil is transported, will it produce a better and more efficient instrumentation of transportation?

I think the question on that is: can we tolerate it, and as we have no choice, obviously, at this point, is there a better way than the existing adversary process? There is the city council in that area, the only question is that the city council didn't act voluntarily. But in juxtaposition to the Federal Government the system doesn't work that easily, and that is why, through the National Environmental Policy Act, we have given the tools to citizens who now use them in our courts, because government hasn't done the job.

Mr. BAGGE. One of the fundamental points I made in my paper was that we can't think about the problems in the methodology of the past. I tried to document that, however, based on my own experience as a regulator at the FPC, we do process issues in our society to death. As a result of which we are not able to get from here to there.

The whole system doesn't respond to changing national goals and changing national means. If there are any real needs our society has today, it is to try to modify the adversary system of decisionmaking in our society, whether it is in regulatory context or any other.

It seems to me the trouble is that the proposals we have pending in the Congress today, instead of ameliorating the adversary mechanism, is just compounding it. We had recently on the House side the consumer bill which would have pressed the attack very vehemently. Yet if you had taken the consumers and superimposed on all the regulatory agencies an entirely new super-consumer agency to regulate all of the consumer processes, State and Federal, we are merely compounding the problem. Yet we have issues in the environmental area where you take a super-environmental group and put them into the adversary process. This is as we group to try to come to grips with this whole issue.

I would agree with you, Senator, we need a more mature kind of agreement, and I think this can be arrived at if we articulate our national goals here and the hysteria which is involved in the energy field is somehow reduced.

Senator GRAVEL. If you rely, as you suggest, on the market situation and the nonadversary processes, because it could be too disruptive, they you have a situation where there are vested interests, be they oil or utilities or uranium.

Who would now come forward and make a case for the use of solar energy? Who would come forward and make the case for geothermal power when there is no vested interest behind it? If government makes a faulty decision to proceed with the breeder reactor and not with fusion power, because there is no vested interest propelling government or society in that direction, how else can you make the discovery of where the errors are unless in a very painful adversary situation?

Dr. WEINBERG. Senator Gravel, I am sure you must realize this remark of yours would get a rise from me. The thing one must always realize in this matter of deciding an option is that it is not simply a matter of which options seem to be desirable if they were feasible technologically. The real point is to make some assessment as to what is technologically viable and possible.

I think everyone in the nuclear energy business would just love to have fusion and, in fact, as you know, the fusion project for a while was called Sure-Would, and one of the reasons it was called Project Sure-Would was because everybody said if we had fusion it would be awfully nice, and the answer to that was it "sure would." [Laughter.]

The problem was that technology is not at that point even now where a vast amount of money put into it is going to necessarily achieve success. I am certainly in favor of putting more money into fusion. I am very much in favor of some more money in solar energy, because there has been just recently a rather acute development, but when you examine what the state of that acute development is and Professor Minnel has been proposing it, he suggests that the entire U.S. energy system be confined to 5 square miles in Arizona.

So, even if his system works, there are still vast and difficult problems.

With respect to the breeder reactor, you know as well as I do that the reason that we push very hard on that—I don't think that is levering out of the technology or economic aspirations of the people in the energy business, it is really simple that there is here a possibility, and to my mind the only possibility, that I have seen on the horizon of achieving infinite and inexhaustable energy. With none of the other systems can we do that.

Mr. Wright. I would like to come back to one of your earlier questions regarding the Alaskan problem along with similar problems. I think if we back off and look at it in a large prospective, we are going through a period now of evolution in the administration of criteria in regard to the environmental problems. I think in Alaska and a number of other places we have a complexity of government, with the Federal, State, and local, plus the special interest group which includes people who have real dedicated interest in the environment, people in industry who have other points of view that would have to be resolved.

All of these create a situation that has to be resolved. We have to have a resolution of these points of view and the resolution as far as authority is concerned and administration is concerned.

Nothing can be more frustrating than our experience in Alaska, as you well know. Part of our difficulty has been the difficulty of reaching understandings on criteria. What is acceptable? What is not acceptable? This has taken months and months and months, of course, but this isn't the only example.

In Houston, Tex., now we have two very large plants that are essentially shut down because of the conflicting points of view and authority of States and Federal Government. In one case a plant with 4,500 people employed that is ready to start manufacturing was shut down because they have a waste product that they need to dispose of. The State government has given information to inject this in deep wells. The Federal Government has taken a different point of view and says they can incinerate.

Now, they are in a position of saying, we will do anything, we will do either one, but we can't do both because we would be violating either one regulation or another regulation, and we are handcuffed.

Now, we are having these kinds of things happen. These kinds of problems, of course, will be resolved in time, but we have to recognize this sort of thing we need to get on with in order that we don't slow down the progress of this country insofar as going ahead with the growth.

In Alaska we had somewhat the same thing, but on a different scale. But I think this complex of government and administration and criteria is something that needs some real attention.

Dr. Singer. I wanted to commend you, Senator, coming from Alaska as you do, in raising this whole subject of solar power. This is certainly very appropriate to the Southwest. I do believe you are right. There is no vested interest for solar power. Anyone in the United States outside of the few enthusiasts and some engineers and scientists and there is certainly no organization within the government at a high enough level to exploit the case. Yet here is an energy source that is renewable, clean, available without interruption, at least in some parts of the world, and deserving very serious investigation.

If it works, it can produce not just electrical but also hydrogen and artificial fuels which can be applied all over the United States.

Senator GRAVEL. But nobody spends any money on that.

Dr. SINGER. We need an Al Weinberg for solar power, I believe.

Senator GRAVEL. For the record, I would like to hope this study would point in the direction to developing a prototype of systems so that we can have an analysis, an ongoing analysis of energy needs based upon the populations of the Nation and the world, particularly the Nation, and that this information can be fed back to the consumer. I think the community, the private area would be intelligent enough to base its decisions upon the information provided.

Regardless of the cost, I think it would render a great service. Just as we determine the energy needs of a capsule which is launched into orbit and compute this out ahead of time, I think we are sophisticated enough to compute the needs of the people of this country.

Senator ALLOTT. Mr. Chairman, the hour is getting very late. I want to give my colleagues an opportunity here to get into this. I was very much interested, Mr. Wright, in your remarks about oil shale. I agree that part of the problem is the very intricate one which involves clearing up the title to that area. As you know, any efforts to do this are often misinterpreted by those who would misinterpret anything that you did anyway.

I think the Secretary of Interior, in taking the steps that he has, is certainly exerting a degree of courage which we have not had in the past on this, because everyone seems to be afflicted with hysteria concerning anything that goes into energy or oil companies or coal companies, anything of that nature.

It may well be, as you say, that the limitations of the leasing act will have to be revised. I have no doubt about that. One company may have to have more than one lease, just in order to protect its own investment, and the technology that goes into it. Most people don't realize, for example, that when you talk about 50,000 gallons, you are talking about an investment or one operation of 50,000, you are talking in terms of an investment somewhere in the neighborhood of $135 to $150 million.

So, if you talk in terms of, say, a million, you are talking about probably the largest single private enterprise investment that ever has been made in this country.

Mr. WRIGHT. If I might respond for a moment, the oil shale resources are very great in this country and to give an order of magnitude, our crude oil resources are currently booked at 39 billion barrels in this country. We have numerous figures as to what the oil shale reserves might be, depending upon what kind of quality and arithmetic that you use, but I know President Nixon used a figure of 600 billion at one time.

Now, we don't think this is a practical figure insofar as the commercial operation is concerned, but it does indicate that the reserves are very, very great and that this is an important source of energy for the United States.

Now, the problem that we see with the Federal Leasing Act of 1920 is that there is a limitation of 5,120 acres of Federal oil shale lands to any one company or individual. We all know that any new technological process that is put in for the first time has difficulty and problems such as the people did in Canada with the investment. Now, if a firm is going to go into one plant of 50,000 barrels a day on one tract with the anticipation that this pioneer plant will probably be a money loser and he has no further opportunity to go into additional plants with additional oil reserves, why it is very difficult to make that first decision with any kind of justification.

So, when you think of the needs of this country insofar as energy is concerned, when you think of the tremendous reserve out there or potential reserve, if it can be economically developed, why, we need a process whereby it can be an ongoing development. When we are looking ahead to 10 to 15 years and we see imports in the country, let's say assuming nothing else changes, of the order of 10 to 15 million barrels a day and we think any one company can't build but a 50,000 barrel a day plant, it is just inconceivable that you can get enough people to ever develop this reserve.

Senator ALLOTT. I think this poses the problem very well. I want to just touch on a couple of points. First, your point with respect to sales of offshore leases. That is the present relatively small leasing area with the emphasis on the bonus. As I gathered you feel that this may inure to the immediate benefit of the Federal Government, but not necessarily to the identification of long term reserves.

Mr. WRIGHT. I think what we need is a national reserve to develop in an orderly fashion our energy reserves of this country. When you look at the possibility for oil and gas, we have produced about 100 billion barrels of oil to date. We have roughly 40 billion on the books as being available for production, but the national petroleum council exploration group have a national resource figure of something like 300 billion barrels of oil which have been created in the offshore, and we need an opportunity to work in the areas where we think this might best be located.

The most prospective areas in the United States are in the offshore, east-west coast, Gulf of Mexico, and in the more remote areas such as the Arctic. In order for us to develop these energy resources, we need to have the door open so that we can explore and so that we can do this. I think perhaps the Federal Government can do more to solve the energy problem by opening up exploration in these frontier areas than any one thing that they might do and this comes as no cost to the Government.

Senator ALLOTT. On the other hand, Mr. Wright, while I think your statement is true, the minute that any public official, and this means the Secretary of Interior—the last Secretary of Interior would hardly touch these things, particularly oil shale. If he opens this up along lines that you suggest, which would tend to minimize the present income of the Government but maximize the identification of reserves, he would then immediately be accused of engaging in a giveaway to the big oil companies of the United States.

I am putting this out very flatly and that is one of the problems which I think everyone at this table here realizes.

I would like to say to Dr. Weinberg one thing relative to your demographic policy statement, Doctor. One thing I think you have to realize first of all is, in my opinion, at least, that you can't say "this is a good area, here is a lot of land, this would be a good place to have a lot of people living and we will therefore put a powerplant there." You have to have an economic justification for those people living there. They have to be able to make a living and the installation of a powerplant there is not necessarily the means of making a living. But the means of making a living must be there.

You may not have an economic access, for example, to raw materials. I think there is something in what you say, but frankly I don't think this would work out.

Then I would like to point out that in many of our western States, my own State being one, that in general this is true of all of the western States except Washington, Oregon, and California, that from the 100th meridian west, the problem is basically one of water. How much population can you support with the water that is presently available?

Most of these States now are going to the full extent, or exercising the maximum of their ingenuity to support the water needs of populations that they have now, and that they see in the near future.

Third, on this general subject, and I am making statements rather than asking questions because I want to let Senator Stevens and Senator Bellmon get in here—I think this is the subject that Senator Gravel got into deeply—Congress is partially responsible for this. In fact, I think it is to a great extent, responsible for this. I think section 102 of the Environmental Quality Act of 1970 was necessary. At least something of this sort was necessary. But the failure of Congress to put lines around it, the way it could be used, has proliferated a great deal of litigation to the point where it is being used in most absurd instances.

For example, today in Colorado, a town of 12,000 or 14,000, a relatively new city of the last 20 years, is being sued to keep them from running a pipeline for 20 miles to provide the city with adequate water, for municipal purposes, not industrial or agricultural purposes. They actually have a suit brought by a group of people who probably can't represent more than 300 people, although there are probably 100,000 people involved who will be affected by it.

So, I think we ourselves in writing the laws have perhaps written them in such a way—you have the Environmental Protection Agency, you have the Council on Environmental Quality, and frankly even today, although they both have been in effect, EPA for over a year, year and a half, Environmental Quality Council since 1968, we still don't know where the actual powers of one begin and the other takes up.

Then I would like to say, finally, to Dr. Singer, I would be glad to discuss this for several hours, your remarks about governmental research. In my opinion, placing research in Government per se does not guarantee results.

Having served on the appropriations committee for some 14 years now, 13 years, I guess, and having dealt with many of the governmental research projects, I would have to take my hat off for primacy of drive to NASA, in the accomplishment of its purpose as far as governmental research is concerned.

The tendency is that when you have research by grant of contract, the person at the other end knows the longer the contract stretches out the longer he has an income. This is probably saying it pretty roughly, but nevertheless I think it is true.

I will yield to my colleagues here.

Senator STEVENS. I don't have any questions. I believe the gentlemen have contributed greatly to the study that is underway, and I would echo what Senator Allott said. It seems to me those of us who have participated in framing the legislation which created the National Environmental Policy Act had no idea that we were setting up a means whereby those who would want to prevent development could use a tool that we created to assure development would meet the highest standards. These few people could also use that tool to retard development.

I would hope that sometime in this study we would be able to relate the stated goal of full employment to the powers of those few people who are using the courts to retard development.

I would ask the chairman if we could not have some legislative oversight hearings with regard to the environmental protection act to see just exactly where these 102 statements are going and how much the courts have been used to frustrate our purpose in securing definition of the standards that the Government must meet as opposed to building additional fences and building additional barriers to prevent it.

I would have one last comment, that is that the gentleman raises the question of depletion allowances and those incentives built into the law to secure exploration and development of our energy resources, and he relates this to the national security.

I would hope another outcome of this hearing would be that we would differentiate between economic security and national security in a defense sense, because anyone who wants to relate depletion allowance reductions to national security I think ought to follow through and see how much of that energy resource is used by the Department of Defense and how much of it is used to secure economic security for our people.

That is what we are talking about in terms of energy supplies, economic security, and not national security in a defense sense. I just can't understand how we should relate the two, but I do understand that the concept of the social cost of dealing with these programs ought to be borne by those who benefit from them.

I think we would all agree with that as a basic principle as we come to this study. But particularly, I took the occasion on one of my periodic trips home to read through these staff papers and, gentlemen, I don't know if you had the opportunity, but there is a very good basis here for the study we are involved in. I want to thank you for participating because I feel that what we ought to do with these papers, not only the background documents, but the presentation of the panel to the committee, I think we ought to provide them to the universities of the country to stimulate some thought by our young people as they are questioning the goals we have established in the past and questioning the moneys we used to obtain those goals. The young people should participate in trying to define the goals of the future and take the responsibility of assisting us to determine how we can get the energy supplies necessary to meet those goals if they are goals for the Nation as a whole. But I really think you have contributed substantially to the standard.

Senator GRAVEL. Senator Bellmon?

Senator BELLMON. Thank you, Mr. Chairman.

I would like to compliment the panel on what I think has been an excellent series of statements. I haven't had a chance to read them all, but I intend to. I hoped this morning our witnesses might come up with more specific ideas about how we go about meeting the reasonable energy needs of the country and perhaps in your full statements you have gotten into that more.

I would like to ask Mr. Bradshaw a question. You said we should assign social costs to the product in the existing markets. I remember reading recently in one of the news magazines about a situation in Japan where one of the companies discharged a fluid into a stream and made something like 400 people ill. The solution that the Japanese came up with was not to make the company stop dumping the pollutant, but rather to make the people move. The Japanese company making this product is probably marketing it here in competition with the company that meets its environmental standards.

My question is: How do we get around that situation?

Mr. BRADSHAW. You raised the entire issue in terms of how far can we go in terms of assessing our environmental costs of our industries when nations in the world would compete but do not do so. Can we afford to have our copper industry located in Africa and in South America rather than in the western States of the United States? I don't know.

Senator BELLMON. Can we ask Texas for an oil committee in Oklahoma to dispose of its soil water and therefore increase its cost of production when a company on the Persian Gulf doesn't have to do this?

Mr. BRADSHAW. I think we are going to have to.

Senator BELLMON. Where does the Government get into this role of making sure our companies are competing in a game where the rules are the same?

Mr. BRADSHAW. I think in the case of some of the commodities like oil, copper, and so forth, these must be continued protected commodities for the United States, since we will be writing into those commodities much higher costs in the future than we have now, and they are essential for the national welfare.

This will be a national cost that can only be assessed at the national level.

Senator BELLMON. I would like to ask Mr. Bagge a question about his proposal for a living agency to monitor changing energy conditions.

What kind of commission did you have in mind? You have been on the AEC and I have talked with you, and I believe we had as good a performance as we might hope for.

Do you see a better kind of agency?

Mr. BAGGE. On a legislative level, there is no agency in the Congress to which we can turn for the development of nuclear energy established by the Congress following, really, World War II, and the commitment to use nuclear development in the civilian sector.

Apart from that mission oriented agency, there is no single agency such as the Joint Committee on Atomic Energy that gives living, breathing, continuing oversight over energy problems.

So, I think the Congress of the United States, recognizing now that we move from an era of apparent plenty to real scarcity, has to address itself by, it seems to me without appearing presumptious, creating on the legislative level a living body, a joint committee, if you will, oversight committee with respect to all energy, not to have the single focus on nuclear development. I think this is the first step.

I think in the executive department of the Government we have no cohesive overview in the executive department. The administration has a present proposal now to establish a Department of Natural Resources, but nevertheless the Secretary of Interior's responsibilities so far transcend energy, that this is a step in the right direction.

It seems to me the fragmented approach which we as a nation have taken, which the Congress has taken and if we talk in terms of a systems approach, that is a pretty sophisticated concept when we are dealing with this whole issue in a primitive way as a Government apparatus.

So, I would say not in the elite's group, because part of our national goal has concern about elitism. I think we can have plenty more problems by establishing a super-energy agency, but I think in the checks and balances of the Government with the legislative body dealing with energy problems in a cohesive way, with the executive body dealing with it, this is my concept of a living agency.

One of our problems has been when we locked into law fuel policies in the formulation of the National Gas Act and the Power Act, the whole process dosn't respond. That is low-cost power. We have moved from low-cost power after the blackout of 1965 to secure and put pressure on the industry to build in more reliability, and we moved from that to building in environmental sensitivity.

So, the goal of low-cost power did, as it is written in the Power Act, it seems to me, is anachronistic. The way we wrote into the Gas Act, the goal being low-cost gas, has now served to frustrate our national goals.

So, I mean a governmental apparatus that is broad in prospective, first of all, and has a continuing responsibility to oversee energy problems and not deal with it going from one crisis to another. This fundamentally is my view.

Senator BELLMON. You see this being made up more of legislative than executive positions, is that right?

Mr. BAGGE. It has to be both. I am raising the question really in my paper here of whether or not we are talking about an energy policy. If the Congress would articulate an energy policy and lock it into policy, and with these new goals, 20 years from now we will be going through the same period of agonizing reappraisal that we are going through at the present moment in trying to extricate ourselves a good deal of the political rhetoric that was developed in the 1930's which led to our energy policy.

So, I think it is a combination of both on a legislative level, and executive level, and certainly on regulatory level as well.

Senator BELLMON. You are not suggesting that we not have set energy policy, but rather that we have one which would be continually reviewed and changed.

Mr. BAGGE. I would submit when this study is concluded and we have a censensus on an articulated energy policy in its relationship to national goals, that there be established within the Congress a joint committee, oversight committee, which would do for the entire energy spectrum what the Joint Committee on Atomic Energy has done for the development of nuclear power in this country.

Senator BELLMON. Thank you, sir.

I would like to ask Mr. Ikard a question. You sort of startled me when you seemed to suggest in your remarks that we might have to move away from a high energy use to a use of less energy.

Are you suggesting that perhaps we limit the horsepower in automobiles, or we try to keep them from heating their whole houses as we do in air conditioning?

Mr. IKARD. No. I am merely suggesting that there is a point where you might look at the amount of energy that is being consumed. I am not suggesting that point is in the present or in the immediate future.

Senator BELLMON. As a practical matter, how do you limit energy? Are you suggesting that the costs go up so that people are more careful and concerned with it? How do you go about getting people to realize that energy is not a limitless resource?

Mr. IKARD. I would agree with what Mr. Bradshaw and others have said here, that the social part of this must be built into the price and cost. When it is, that necessarily will go up. I would expect at least the average person would expect to know more about his use if that situation occurs, and I think it must occur.

If I may make one comment on another point, with your permission, just so the record won't appear blank on this. With reference to the tax treatment, particularly with reference to percentage of completion which at least as far as we are concerned we did not consider it to be particularly defense oriented, but rather as a capital recoupment which is the income tax and constitutional amendment provided for in the laws, attempt to reach income and without devoting any great discussion of the tax treatment here, I think we all know that through the process of arriving at percentage of completion, various different methods of measuring capital consumption were tried and eventually this method, as inexact as it may be, was devised to measure the amount of capital consumed and capital recoupment.

I know this is a controversial area, but I think that is the reason for it, rather than national security.

Senator BELLMON. Mr. McCloskey, on page 11 of your statement you say that a growing monopoly among energy companies helps us, pointing out a few large corporations to suddenly contrive these problems.

Do you know why it is that an oil company goes into a coal business? In your judgment, why does a company like Continental Oil go into the coal business at all?

Mr. MCCLOSKEY. I don't presume to have any insights as to why the disintegration of companies is occurring, but I was observing that the occurrence of it does put them in a position to act in concert and to influence public policy.

Senator BELLMON. You seem to indicate that the company wants a monopoly in energy. Is this your belief?

Mr. MCCLOSKEY. I wasn't particularly addressing myself to the question of monopoly per se, but I was addressing myself to the interlocking nature of many of these firms and the fact that it did facilitate this kind of cooperation that certainly raises questions about the nature of some of these short term shortages.

Senator BELLMON. Do you know of any company that has ever contrived an energy crisis?

Mr. MCCLOSKEY. In my paper, as you know, I do discuss a number of the short term shortages which allegedly occurred in the last few years, and I——

Senator BELLMON. Could you document one of those crises for the record? I would like to know where you get this conclusion. It would be helpful if you could give us facts that led you to make that statement.

Mr. MCCLOSKEY. I would be glad to elaborate on that.

Senator BELLMON. Mr. Wright, you are, of course, in the energy business. I would like to ask you two quick questions.

One is: Do you believe, with the energy industry in this country operating under the present rules and the laws, that we have the incentives and the price structure we have, and have the energy industry meet the reasonable energy demands of this Nation, say, for the next 20 years?

Mr. WRIGHT. Unless the Nation changes policy wisely, I don't think we can. I think we are operating within the present government policies that we have today. I think it is impossible for it to do this.

Now, I think there are a great number of changes in policy that can be made that can certainly expand our energy sources. Whether we come to 100 percent self-sufficiency, say, by 1980, I would hesitate to promise, but I think we can considerably improve our situation.

Senator BELLMON. You are saying if we change the laws?

Mr. WRIGHT. Certain policies. By this, I am talking about policies regarding the availability of land which I discussed earlier, but also a number of other things which need to be done, such as accelerating the development of nuclear plants, bringing these on stream faster, working out the problems so these can be constructed faster and more efficiently.

We need to have the technology developed so that gas or coal can come into the energy picture with greater strength and more growth. So, we have to look at this energy picture and not only for oil and gas or coal, but we need to work along a number of fronts so that each one of these energy sources can make a real contribution to the problem.

I do think if we put our efforts in this direction we are going to greatly resolve the problems we have before us.

Senator BELLMON. Well, what you said then, is that the companies have the ability and I assume we have the natural resources, and the problem, as you analyze it, is the one of government regulations or of the laws that we now have on the books?

Mr. WRIGHT. To a great extent, yes. It calls for direct governmental action, too.

Senator BELLMON. So, if we do our work, you feel that the energy industry can meet its responsibility?

Mr. WRIGHT. Yes.

Chairman JACKSON (presiding). Senator Hansen?

Senator HANSEN. I am indeed sorry that I was not able to be here to listen to each of the statements made by this very excellent panel.

I compliment the leadership for having brought them together. I do intend to read the papers as quickly as I have time.

We have been engaged in an executive session of the finance committee this morning and I thought my presence there was indicated. I would like to ask, if I may, that we be permitted, if others care to join with me, to submit questions after I have had a chance to read the papers and ask that those questions and answers be included in the record.

Senator GRAVEL. That would be entirely in order.

Thank you, gentlemen.

I think we are to reconvene at 2 o'clock.

(Whereupon, at 1 p.m., the symposium was recessed, to reconvene at 2 p.m., this same day.)

AFTERNOON SESSION

Senator ALLOTT (presiding). The committee will come to order.

This afternoon the panel consists of the following—if any of this is incorrect, please inform me—Mr. George Taylor for Mr. Biemiller, Tom Kimball, Dr. Kinsey, Mr. John McLean, Carl Madden, Robert Mead, Prof. Walter Mead, H. J. Young accompanied by John J. Kearney, and Dr. Zandi.

Are there any others?

I presume some of us at least were here this morning and I believe we will follow the same format that we did this morning.

We have a pending bill on the floor and we don't know when we will be interrupted by that.

I might say, unless any of you feel offended, at approximately 2:20 I will have to leave for 15 or 20 minutes, but I will return, so I don't want you to be offended if I suddenly absent myself.

First of all, without objection, each of the statements of the people this afternoon will be inserted in the record as it is delivered. Then if we can follow this morning's format of having you comment upon your statement, summarizing as much as you conveniently can, but, on the other hand, don't leave out anything that you think is important. We will try to make as much progress as we can this afternoon.

The first witness, then, would be George Taylor, for Mr. Biemiller, legislative counsel, AFL–CIO.

STATEMENT OF GEORGE TAYLOR ON BEHALF OF ANDREW BIEMILLER, LEGISLATIVE COUNCIL, AFL–CIO

Mr. TAYLOR. Thank you, Mr. Chairman.

For the record, my name is George H. R. Taylor, economist in the research department of the AFL–CIO, and secretary of the AFL–CIO Staff Committee on Atomic Energy and Natural Resources.

We have been requested to brief our statement, so I will try to do so within the framework of the time we have available. On behalf of the AFL–CIO, I appreciate the invitation to appear before this committee, and discuss with you the vitally important subject of energy policy and national goals, as the beginning of the broad national fuels and energy policy authorized by Senate Resolution 45, passed on May 3, 1971.

We support the goals of this study, although with a modest appropriation, a small staff, and less than a year between now and September 1, 1972, when its findings and recommended legislation are to be reported to the U.S. Senate, its scope may very well be restricted.

It is important that the Congress take a hand in evaluating and dealing with the crucial problem of energy in America. In order to carry out its constitutional functions responsibility and respectively to new problems or unresolved old ones, to assess policies and programs proposed by the executive, the Congress should undertake more broad and sweeping studies of this nature.

The findings and recommendations stemming from the fullest possible implementation of Senate Resolution 45 should result in a yardstick to measure the President's energy message of June 4, 1971, which in our opinion, is not an adequate blueprint for the Nation's energy policy.

We have been asked to direct our comments today to the relationship between energy and America's own long-range national goals. As the study plan for this resolution correctly states, such policy, existing or proposed "* * * touches at some point on virtually all of the country's national goals."

As an organization of workers, we are understandably preoccupied with maximum and stable full employment at living wages.

Accordingly, and for more than a decade, the policy statements adopted by the AFL–CIO, dealing with natural resources and energy, have reiterated that abundant energy supplies at reasonable prices must be secured for this Nation under policies which aid in achieving the goal of the Employment Act of 1946. That goal was that the National Government, in cooperation with management, labor and the public, do everything possible to achieve maximum and stable employment, and promote free, competitive enterprise.

Over this period, the AFL–CIO has also called for a comprehensive national energy policy to be so conducted as to protect and preserve the environment, guard against monopolization, protect the interest of the consuming public, and overcome duplication of functions and waste among scattered Federal agencies. To this aim, should be added an evaluation of the State, local, and private institutional roadblocks which lie in the way of achieving the best and most enlightened economic and social results from energy development and use.

The basic question to be solved is what major national goals should United States energy policy assist in meeting.

One, maximum employment: This goal, as I have previously stated, lies at the heart of organized labor's consideration of the uses to which energy should be put. There are two major areas of our concern:

First, since energy, in all of its uses, is the material underpinning of a strong economy, it is of enormous importance that problems of supply, future demand, and cost, be dealt with.

Energy technology, like other technologies, has galloped far ahead of social constraints on its use, and institutions established to give them proper direction and exercise proper control in the national interest. Our own unions are in many cases the frustrated victims of technological innovations, both in energy and other fields. Our fears of new technological development throwing workers out of their jobs is one which as long as present conditions prevail will result in resistance to national policies which fail to consider and properly ameliorate such side effects.

When we talk of maximum employment, we also mean maximum employment at a living wage. With nearly 30 percent of our population working at wages at or near the poverty line, the benefits and comforts of a decent standard of living, enjoyed by other Americans, are not only an unattainable dream, but too often a bitter mockery among the poor of the cities and the rural regions as well.

Mr. Chairman, I recall that some 35 years ago the Congress and the President decided that people who lived on farms and had been denied central station electric service by private power companies since the dawn of the electrical age were entitled to help from the Federal Government, to be provided with electricity. This national goal was set forth and implemented by the Rural Electrification Act of 1935. Now only a handful of farms in America are without electricity.

But while the comforts and labor saving aid of electric energy are potentially available to nearly everybody, rich or poor alike, the poor can only benefit from a few of the uses because they cannot afford major electrical appliances or pay the utilities bills for their use.

Benefits from energy denied to those who need it the most can and surely will, with other deprivations, add to the simmering social unrest and loss of faith in our democratic institutions.

We therefore urge most strongly that among the fruits of this study there must be developed a means by which energy will contribute most meaningfully to attainment of sustained, high-wage employment, and a decent standard of living for all Americans. We wish it to be fully understood that we don't mean a gimmick standard of living, but one which enables a worker to obtain and enjoy the meaningful and necessary benefits of housing, education of his children, health services, recreation, and security at retirement.

Two, protect and preserve the environment: The combustion of energy fuels causes air and water pollution, creates conflicts over land use policy, complicates transportation, ravages land, and adds to the enormous burden of solid wastes.

This has brought about a new and deservedly serious factor to be considered with regard to the development and uses to which energy is being put. Many people, including our leading environmentalists, have called attention to the abuses of an energy-intensive society. Some, observing the ruthless and exploitive extraction of raw materials from nature, their use without social controls, and their disposal with no regard for ecological insults, have concluded that there is a irreconscionable conflict between energy and the environment. They conclude that America can well drown, weighted down by the latest gross national product report. A runaway technology, they feel, has created this doomsday situation, and therefore it would be an irony to depend upon this same technology to right its own wrongs.

Thus, there have arisen able discussants setting forth the theme of "no growth" of energy development and use, appearing to have adapted Sir John Maitland's aphorism that "all power corrupts" and paraphrased it to state that "all power pollutes."

The AFL–CIO position on this issue has been set forth numerous times over the years. Even if population controls become effective, the next three decades will see an absolute numerical growth in numbers of people. The indispensable energy demands of those additional people must be satisfied in order to help supply their basic physical demands, particularly those of the lower-income groups, and the need to have the material means of sustaining full employment of an increasing labor force.

While there are many unessential products of our civilization that waste raw materials and energy fuels, this fact does not in any way substantiate an argument that decisions made now to limit energy growth can do anything more than create vast and perhaps insoluble problems for the next generation in order to assuage environmental fears of today.

The Congress has already set environmental goals in the fields of air and water pollution, and has begun to attack the problem of solid wastes. Much needs to be done, but the national goals of a clean environment have been stated. As we see it, these goals can and must be reconciled with America's needs for energy. A reoriented technology controlled by wise public policies, we believe, can do the job required.

A reoriented energy technology would move away from energy fuels which pollute to those which pollute less, or are more susceptible to control techniques. It would include shifts from fuels in short supply to those not so threatened.

For example, we believe that fusion power is a better longer range answer to the Nation's future requirements for energy than the present generation of water reactors, or the breeder reactor. The latter raises the question of the production of a material of almost unbelievable toxicity, and the risks of commercial use of a material which is suitable as a nuclear explosive, even though it would conserve the uranium fuel reserve. We believe that efforts to achieve an economically feasible use of fusion power should be greatly intensified.

We also associate land use and land destruction in connection with extraction of energy fuels and their use, with the need to develop policies which will serve people and preserve the land. Expanded use of coal has resulted in strip mining without adequate provisions for reclamation. In our Federal public domain lands, archaic laws such as the Mining Act of 1872 allow acquisition of land held in trust for the people of this Nation, for minerals exploitation, when such lands should at most be leased with only mineral rights granted and strong restriction against environmental damage. That is why we support pending legislation introduced by the chairman of this committee to eliminate this old law and provide for leasing only.

In connection with the Federal domain, organized labor has supported for years the development of the Nation's enormous oil shale resources only in such ways as will preserve the environment. We fought against proposals by the previous administration to allow even prototype leasing for extraction of oil shale until all questions, including environmental, had been properly studied and resolved. Accordingly, we oppose immediate leasing proposals announced in the President's energy message.

Three, protection against monopoly: One of the more cherished national goals, implemented by statute, programs, and court cases by the score, is that of fostering free competitive enterprise and guarding the

American economy in all of its component parts against monopolization.

It is not necessary for me to recite all these, although it should be mentioned that in the growth of the Federal Government' resources development programs over the past century this goal has been enunciated in statutes adopted by the Congress from the General Dam and Reclamation Acts of the early 1900's to the Atomic Energy Act of 1954, and beyond.

But since World War II there has been an ominous trend toward reduction of competition and growth of monopoly in the energy field.

The reduction of competition has not only been among companies, particularly in the petroleum industry, but among energy fuels themselves.

For example, in 1970, of the 25 largest petroleum companies in assets, all 25 dealt in natural gas products, 18 had moved into oil shale, 11 into coal, 18 into uranium, and seven into tar sands.

In the coal industry, four of the largest 15 companies are now oil company subsidiaries, and oil company production of coal is 20 percent of the Nation's total.

Eight of the largest oil company giants have entered the uranium field, all of them in exploration or reserve holding, all except one in uranium milling and mining; two converting uranium concentrate into uranium hexafluoride, four in fuel preparation or fabrication, five in fuel processing, and one has even built a reactor. It is obvious that most of these, if not all, are integrating into all stages of the uranium field cycle.

It is our belief that these developments briefly sketched constitute the formation of energy trusts just as in the late 19th century; that competition is systematically being bought up, just as in the bad old days; and thus, nothing is being done about it.

If this goes on, without strong doses of antitrust medicine, or legislation to break up these giant combines, there will be concentration and entrenched dominance of all energy fuels by a handful of giant corporations, with all the attendant evils—high prices to consumers, undue economic and political power, stifling of healthy competition, and threats to free political institutions.

In developing an energy policy dealing with the newly arrived and dangerous energy trust is one of the first orders of business in connection with your study. Otherwise, the formulation of one national policy might, in the not too distant future, be forced to deal with only two or three, or perhaps even one, national energy industry.

Thank you.

(The prepared statement of Mr. Biemiller follows:)

Statement by Andrew J. Biemiller, Director, Department of Legislation, American Federation of Labor and Congress of Industrial Organizations, at Symposium Dealing With Energy Policy and National Goals, Before the Senate Committee on Interior and Insular Affairs.

October 20, 1971

Mr. Chairman: My name is Andrew J. Biemiller. I am Director of the Department of Legislation, of the American Federation of Labor and Congress of Industrial Organizations. I am also Chairman of the AFL-CIO Committee on Atomic Energy and Natural Resources.

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It is our belief that these developments briefly sketched, constitute the formation of energy trusts just as in the late 19th century; that competition is systematically being bought up, just as in the bad old days; and thus, nothing is being done about it.

If this goes on, without strong doses of antitrust medicine, or legislation to break up these giant combines, there will be concentration and entrenched dominance of all energy fuels by a handful of giant corporations, with all the attendent evils -- high prices to consumers, undue economic and political power, stifling of healthy competition, and threats to free political institutions.

In developing an energy policy, dealing with the newly arrived and dangerous energy trust is one of the first orders of business in connection with your study. Otherwise, the formulation of one national policy might in the not too distant future be forced to deal with only two or three, or perhaps even one, national energy industry.

Thank you.

Senator ALLOTT. The next witness is Tom Kimball.

STATEMENT OF THOMAS KIMBALL, EXECUTIVE DIRECTOR, NATIONAL WILDLIFE FEDERATION

Mr. KIMBALL. Thank you.

Mr. Chairman, this statement is in response to your letter of October 6, 1971, inviting comments upon phases of the comprehensive study of national fuels and energy policy as authorized earlier this year by Senate Resolution 45. We are pleased to have been invited to participate to this extent in the development of what can be one of the most significant and far-reaching studies of our time.

To begin, we congratulate the committee on developing a sound, four-part study plan, one which would identify basic national goals and the possible alternatives which this Nation and the world can consider in attaining both short-range goals—to year 1980—and those of a long-range type—to the year 2020. We also congratulate members of the Senate Committees on Commerce and Public Works, as well as the Joint Committee on Atomic Energy, for their interest and participation in this study. We regret, however, that a Joint Committee on the Environment is not yet finalized and functioning because its members also could make meaningful inputs into the deliberations.

In line with your request, I shall endeavor to focus these remarks on what we consider to be the Nation's major goals, their adequacy for the future, and their relationship to existing and proposed energy policies.

First, as pointed out in the excellent study, "The Evolution and Dynamics of National Goals in the United States," as prepared by Dr. Franklin P. Huddle, the Preamble to our Constitution sets our remarkably concise and sophisticated general goals of great scope: domestic tranquillity, common defense, general welfare, and blessings of liberty. In our opinion, these same basic goals are valid and useful if considered and applied in the present-day context and in anticipation of the future. Throughout the years since that Preamble was adopted in 1787, these goals have survived stresses and strains—and conflicts—but, if properly directed in the light of ever-changing developments, they still can be a cornerstone of the structure of our form of government.

Second, of all of the national goals—either expressed or implied—which have been developed since adoption of the preamble, concern about man's environment is the newest. It also has the greatest relevance for the future except, possibly, for national defense. If we fail to achieve the goal of national defense, we probably will lose all of the other values—liberty, tranquility, and the general welfare—as well.

History has recorded the great movements in this country, movements which often were synonymous with national goals; the initial taming of the wilderness, settling of the West which moved progressively westward from the eastern seaboard, development of fast communications and effective transportation systems to link the Nation, unification of a country torn by civil war, and development of a sound economy based upon progress and growth. Later in this century, the goals shifted to overcoming a deep economic depression, to defeating the Axis in World War II, to stabilizing the world political systems, and to meeting or containing communism, and to conquering space.

Concern about the environment had its genesis in the Dust Bowl days, although the dire plight of many forms of wildlife was evident much earlier when a far-sighted president, Theodore Roosevelt, and some of his successors, took the initial steps to preserve forests and set aside outstanding natural areas as national parks. This era was symbolized by the syndrome that all growth was good and biggest was best. The percentage rise in the GNP was the sole index of material and social progress. It also was the era when the costs of using the environment began to be evident. Steps initially were taken to protect the soil and wildlife in the 1930's but the inadequacies of early efforts at water pollution control did not become generally apparent until the post-World War II period. This was followed by mounting concern over an alarming increase in the numbers of endangered wildlife species, pesticide poisoning, toxic substances, air pollution, noise, and overcrowding in metropolitan areas. Then, this decade has seen the birth of a new environmental or ecological awareness which bloomed into a movement, one which has not yet reached its peak.

Admittedly, conflicts exist over concerns for the environment. To achieve the type of tranquility which we regard as an essential component of a quality type of environment, some lands which might be used for timber or mineral production must be retained as wilderness. Some streams with hydroelectric power or irrigation potentials must remain undammed and free flowing. Some funds may have to be diverted away from other programs to finance efforts to clean up pollution, efforts we regard as truly being in and for the general public welfare and benefit. Some agricultural production, particularly on crops in surplus, may have to be foregone or delayed until alternative means of pest control can be developed for potent pesticides which pose problems of health and safety for humans, the disruption of natural ecosystems and survival for endangered species of wildlife.

In evaluating the present for its potential effects on the future, we must insist that this Nation adopt an approach which recognizes values other than making or saving a dollar, one which modifies the concept that massive and ever-increasing growth and production is not necessarily in the general welfare. Emphasis in trade-offs must not solely be in favor of economic benefits over the intangibles of esthetics. The need for a dam or an SST should stand or fall on its own merits with relation to the environment and not because of the jobs the project might generate.

I recognize that my definition of a "quality environment" is different than that of some other people. I believe this Nation, despite other factors, must provide opportunities for its people to see and enjoy and appreciate their heritage in areas of wilderness, wild rivers, and pollution free lakes and streams, vistas of countrysides and mountains unmarred by mining scars or leapfrogging power or utility transmission lines. However, I also recognize that some other Americans probably would be entirely content and satisfied to work and live totally within offices and apartments, seeking recreation and entertainment in indoor facilities such as swimming pools, bowling alleys, and theaters. It is my opinion, though, that all of us should be united on appreciating the benefits from controlling air and water pollution, on disposing of solid wastes, on curtailing noise, and stabilizing the human population at reasonable levels.

Despite the present trend toward nostalgia, many of us recall parts of the old days which, in reality, were not so good. As a consequence, I believe that the Nation's major goal should include maintaining the highest standard of living for its citizenry that is possible through our most contemporary science and technology, but entirely consistent with the amenities of life. In my opinion, these amenities should feature a viable plant and animal ecology with sufficient open space, parks, historical sites, wildlife, et cetera, the things which make life worth living. Without these amenities, life becomes a struggle for survival.

We should not look toward turning the clock back on technological advances. Man struggled for centuries just to maintain an existence. Ultimately, this struggle was eased to the point where he could use his intelligence for other interests: religion, art, music, literature, and other aspects of culture. If we plan wisely, there is no valid reason why we cannot use technology to free man even more for the pursuit of a quality type of living—if a quality environment can be maintained.

As our population increases, the Nation's high standard of living will involve increases in the amount of energy consumed. There is no sound guarantee that future generations will not desire or demand an ever-increasing amount of energy even if the population is stabilized. So, we must address ourselves to how these demands are to be met or reduced and the policies we formulate in our time well may require some curtailment of the blessings of liberty assured by the Preamble to the Constitution.

There is, of course, a vital relationship between the topic of the discussion and another which apparently will be addressed at a later time: projections of future energy demands. I might say here that we hope and trust that this part of the study will be developed rationally and impartially with input from environmentalists and conservationists, as well as from industry. For example, we should not rely on electric power projection needs developed solely by the electric power industry which, even at the time they caution against blackouts or brownouts, actively promote the sale and use of a bewildering variety of electric gadgets. Without attempting to be discordant or divisive, I must admit that we suspect at least some segments of the electric power industry of having double standards when they urge citizens to sacrifice and curtail the use of home air conditioners and lights without apparently making the same appeals to industries which use far more power and pay much lower rates. For example, do we really demand or need critical power to refine aluminum for such uses as beverage containers?

To elaborate, quite possibly any approach to a national energy and policy program should begin with consideration of the alleged "energy crisis," and an independent evaluation of the extent of it. It is indisputable that there is a need for the production of energy, or that there will be an even greater need in the future. The projected rate of this growth, however, is subject to question. Available statistics predicting a doubling of energy needs each decade come from those industries and agencies which promote and profit from energy production, and an independent study well may reveal a more moderate conclusion or alternatives policymakers may wish to consider. Such a conclusion, it follows, would set the stage for the inquiry: How much time do we have to develop how much power?

And, it must be pointed out, objective analyses of growth rates should not conclude the inquiry on future needs. We still have the option to create more time for ourselves, more time to study all effects, more time to develop maximum safeguards for the adverse effects, and more time to develop alternative sources. How can we create more time in the face of growing needs: By controlling growth. This is not to say that we must live by candlelight, nor institute arbitrary, socialistic limits on energy production. But we should explore more fully the self-regulating economic incentives and disincentives within our capitalistic system which will lead to the natural, gradual reduction in the rate of growth. Such incentives are not at all revolutionary—they are already in operation in other aspects of our economy, and can be made even more effective through Federal policies which promote economic growth and conservation of energy resources.

Here are some alternatives which might be considered.

For one, we should reflect upon a policy of charging rates commensurate with consumption. Under present conditions, the more electrical energy you use the less you pay for it. This, of course, encourages the use of electricity. By making rates at least equal to the proportion of consumption, the major industrial and commercial consumers will begin to pay their way. They might even be induced to become more efficient in their consumption and operations. To the extent industry is efficient, the extra cost will be passed along to the consumer who would naturally favor the most efficient, least expensive product. To the extent price increases reflect the true cost to the environment, these are increases the consumer should pay.

Another alternative relates to the regulation and redistribution of peaking power. Present production is geared to an 8-hour day, 5 days per week. Thus, substantial overloads go to waste two-thirds of the working day and on weekends. Pricing changes to effect a more equal distribution of the load over a 24-hour period is another way to ease the demand.

Another opportunity to ease the demand is by controls of advertising, implemented through pricing, legislation and/or Federal regulation. It is tantamount to insanity to advertise for the increased use of a commodity which allegedly is in short supply and dependent upon dwindling finite resources. New York City is subject to brownouts and blackouts, yet advertisements for electrical appliances in all forms are carried in all media.

Restraints in critical areas should be self-regulating and applicable to manufacturers and sellers of energy consuming items as well as the power industry. If the supply is short, and we all are going to pay for increased supply, it should be unethical to "sell it while it lasts." Then, if self-regulation does not produce the necessary results, governmental regulations will be necessary.

There are other ways of making the best use of technology and rate regulation to promote better uses of energy. Rapid transit moves more people—and usually faster—than individual autos at a better outlay in energy. Conservation of thermal discharges, now considered "waste heat;" auto commuter taxes; building code improvements requiring greater insulation are a few of the other methods by which energy conservation can be promoted.

In summary, therefore, we can make the following specific recommendations which are fundamental to an overall view of the energy problem:

First, we should make an independent, objective study of the real power needs in this country. Concurently, we must implement those economic and other policies which will make power use more efficient and bring its mushrooming consumption under control. We cannot meet the crisis by simply feeding it.

Second, in our opinion, the highest national priority should be directed toward developing the ultimate energy source, the controlled fusion of the atom. This is the source of energy that powers the universe and, regardless of our insatiable appetites for energy, if this technology could be harnessed along with control of radioactivity and waste disposal, our problems about energy and its most adverse effects on the environment would be eliminated. In my view, we should make an immediate commitment to give this development the highest priority, both in terms of financial support and in talent from the scientific community. I say this in recognition of the fact that success well may not be immediate. The observation that a possible breakthrough may be 50 years off with maximum effort is all the more reason to get started now.

Third, in the interim, more conventional nuclear power may provide the best answer for our power needs in the next few decades. Our fossil fuels are finite. They are being used at an increasingly alarming rate. Consequently, we must consider the type of energy which not only consumes fuel but creates it as well; this is, of course, the advantage of the nuclear breeder reactor, a program which should be intensively explored with a suitable financial and scientific commitment. It must be acknowledged, however, that nuclear power and especially the breeder reactor presents radiological problems in process, storage, and waste disposal to which we presently do not know all the answers. It is important that we find these answers before we commit ourselves fully to the program. Our commitment to resolving these problems should be equal to the investment in breeder reactor development.

Fourth, another prime objective must be in developing an inventory of the other sources of energy with the view toward determining a priority of use for limited fossil fuels.

Economics, of course, will and should play an important part in the development and utilization of these types of fuels for energy. Here it is important to insure that the costs of maintaining a suitable environment, such as the expenses of reclaiming areas strip-miner for coal or in assuring the cleanup of oil spills attendant to production and distribution are assessed as a cost of doing business. These costs can be identified or assessed for environmental taxes or performance bonds. It probably should be pointed out here that the supplies of fossil fuels are exhaustable, that they have many other uses in addition to sources of energy. Consequently, if the Nation could rely largely upon nuclear sources for the generation of electrical energy, the carbon-based fuels could be held in reserve for other purposes, including medicines.

To conclude, we have many scientific societies such as the Wildlife Society, Society of American Foresters, American Association for the Advancement of Society, and the Range Management Society which are well-organized and functioning. These scientific societies should be utilized to the fullest extent of their professional competence in order to ensure environmental assumptions are correct in dealing with the development of energy sources.

And, finally, any formulation of a national policy on energy and the environment must provide visibility to the public. Public hearings and strict conformance to provisions in the National Environmental Policy Act offer ideal vehicles for public discussions and inputs into developments of energy systems. Many well informed and conscientious Americans are thinking about where the never-ending projections of energy are taking us, and they have ideas worthy of consideration.

As a matter of fact, the citizen, through the processes of public hearings, forums, educational systems, and mass media can present the positions and attitudes toward final determinations of what tradeoffs are made. These decisions should be made by a fully informed citizenry, with the alternatives, options, and tradeoffs before them for consideration, not solely by industry interested in making a profit or by governmental agencies who may be subservient to political considerations or by the eco-freak or even the organized environmental organizations.

In the final analysis, the arbiters of tradeoffs and social progress, in whatever form it takes, must rest with the people. If so, it would be fully in context with the basic national objectives set out in the preamble to the Constitution and adopted in 1787.

Thank you again for the invitation and opportunity of making these comments.

Senator Burdick (presiding). Thank you, Mr. Kimball.

(Mr. Kimball's prepared statement follows:)

National Fuels and Energy Policy

PAPER PRESENTED BY THOMAS L. KIMBALL, EXECUTIVE DIRECTOR, ON BEHALF OF THE NATIONAL WILDLIFE FEDERATION BEFORE THE SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

October 15, 1971

Dear Mr. Chairman:

This statement is in response to your letter of Oct. 6, 1971, inviting comments upon phases of the comprehensive study of National Fuels and Energy Policy as authorized earlier this year by S.RES.45. We are pleased to have been invited to participate to this extent in the development of what can be one of the most significant and far-reaching studies of our time.

To begin, we congratulate the Committee on developing a sound, four-part study plan, one which should identify basic national goals and the possible alternatives which this Nation and the world can consider in attaining both short-range goals (to year 1980) and those of a long-range type (to the year 2020). We also congratulate members of the Senate Committees on Commerce and Public Works, as well as the Joint Committee on Atomic Energy, for their interest and participation in this study. We regret, however, that a Joint Committee on the Environment is not yet finalized and functioning because its members also could make meaningful inputs into the deliberations.

In line with your request, I shall endeavor to focus these remarks on what we consider to be the Nation's major goals, their adequacy for the future, and their relationship to existing and proposed energy policies.

First, as pointed out in the excellent study, "The Evolution and Dynamics of National Goals in the United States," as prepared by Dr. Franklin P. Huddle, the Preamble to our Constitution sets out remarkably concise and sophisticated general goals of great scope: domestic tranquillity, common defense, general welfare, and blessings of liberty. In our opinion, these same basic goals are valid and useful if considered and applied in the present-day context and in anticipation of the future. Throughout the years since that Preamble was adopted in 1787, these goals have survived stresses and strains--and conflicts--but, if properly directed in the light of ever-changing developments, they still can be a cornerstone of the structure of our form of government.

Second, of all of the "national goals" (either expressed or implied) which have been developed since adoption of the Preamble, concern about man's environment is the newest. It also has the greatest relevance for the future except, possibly, for national defense. If we fail to achieve the goal of national defense we probably will lose all of the other values--liberty, tranquillity, and the general welfare--as well.

History has recorded the great movements in this country, movements which often were synonymous with national goals: the initial taming of the wilderness, settling of "the West" which moved progressively westward from the eastern seaboard, development of fast communications and effective transportation systems to link the Nation, unification of a country torn by civil war, and development of a sound economy based upon "progress" and "growth". Later, in this century, the goals shifted to overcoming a deep economic depression, to defeating the Axis in World War II, to stabilizing the world political systems, and to meeting or containing communism, and to conquering space.

Concern about the environment had its genesis in the Dust Bowl days, although the dire plight of many forms of wildlife was evident much earlier when a far-sighted President, Theodore Roosevelt, and some of his successors, took the initial steps to preserve forests and set aside outstanding natural areas as national parks. This era was symbolized by the syndrome that all growth was good and biggest was best. The percentage rise in the GNP was the sole index of material and social progress. It also was the era when the costs of using the environment began to be evident. Steps initially were taken to protect the soil and wildlife in the 1930's but the inadequacies of early efforts at water pollution control did not become generally apparent until the post-World War II period. This was followed by mounting concerns over an alarming increase in the numbers of endangered wildlife species, pesticide poisoning, toxic substances, air pollution, noise, and overcrowding in metropolitan areas. Then, this decade has seen the birth of a new environmental or ecological awareness which bloomed into a movement, one which has not yet reached its peak.

Admittedly, conflicts exist over concerns for the environment. To achieve the type of tranquillity which we regard as an essential component of a quality type of environment, some lands which might be used for timber or mineral production must be retained as wilderness. Some streams with hydro-electric power or irrigation potentials must remain undammed and free-flowing. Some funds may have to be diverted away from other programs to finance efforts to clean up pollution, efforts we regard as truly being in and for the general public welfare and benefit. Some agricultural production, particularly on crops in surplus, may have to be foregone or delayed until alternative means of pest control can be developed for potent pesticides which pose problems of health and safety for humans, the disruption of natural ecosystems and survival for endangered species of wildlife.

In evaluating the present for its potential effects on the future, we must insist that this Nation adopt an approach which recognizes values other than making or saving a dollar, one which modifies the concept that massive and ever-increasing growth and production is not necessarily in the general welfare. Emphasis in "trade-offs" must not solely be in favor of economic benefits over the intangibles of esthetics. The need for a dam or an SST should stand or fall on its own merits with relation to the environment and not because of the jobs the project might generate.

I recognize that my definition of a "quality environment" is different than that of some other people. I believe that this Nation, despite other factors, must provide opportunities for its people to see and enjoy and appreciate their heritage in areas of wilderness, wild rivers, and pollution-free lakes and streams, vistas of country-sides and mountains unmarred by mining scars or leapfrogging power or utility transmission lines. However, I also recognize that some other Americans probably would be entirely content and satisfied to work and live totally within offices and apartments, seeking recreation and entertainment in indoor facilities such as swimming pools, bowling alleys, and theaters. It is my opinion, though, that all of us should be united on appreciating the benefits from controlling air and water pollution, on disposing of solid wastes, on curtailing noise, and stabilizing the human population at reasonable levels.

Despite the present trend toward nostalgia, many of us recall parts of the "old days" which, in reality, were not so "good". As a consequence, I believe that the Nation's major goal should include maintaining the highest standard of living for its citizenry that is possible through our most contemporary science and technology, but entirely consistent with the amenities of life. In my opinion, these amenities should feature a viable plant and animal ecology with sufficient open space, parks, historical sites, wildlife, etc., the things which make life worth living. Without these amenities, life becomes a struggle for survival.

We should not look toward turning the clock back on technological advances. Man struggled for centuries just to maintain an existence. Ultimately, this struggle was eased to the point where he could use his intelligence for other interests: religion, art, music, literature, and other aspects of culture. If we plan wisely, there is no valid reason why we cannot use technology to free man even more for the pursuit of a quality type of living--if a quality environment can be maintained. As our population increases the Nation's high standard of living will involve increases in the amount of energy consumed. There is no sound guarantee that future generations will not desire or demand an ever-increasing amount of energy even if the population is stabilized. So, we must address ourselves to how these demands are to be met or reduced and the policies we formulate in our time well may require some curtailment of the blessings of liberty assured by the Preamble to the Constitution.

There is, of course, a vital relationship between the topic of this discussion and another which apparently will be addressed at a later time: projections of future energy demands. I might say here that we hope and trust that this part of the study will be developed rationally and impartially with input from environmentalists and conservationists, as well as from industry. For example, we should not rely on electric power projection needs developed soley by the electric power industry which, even at the time they caution against "blackouts" or "brownouts", actively promote the sale and use of a bewildering variety of electric gadgets. Without attempting to be discordant or divisive, I must admit that we suspect at least some segments of the electric power industry of having double standards when they urge citizens to sacrifice and curtail the use of home air-conditioners and lights without apparently making the same appeals to industries which use far more power and pay much lower rates. For example, do we really demand or need critical power to refine aluminum for such uses as beverage containers?

To elaborate, quite possibly any approach to a national energy and policy program should begin with consideration of the alleged "energy crisis", and an independent evaluation of the extent of it. It is indisputable that there is a need for the production of energy, or that there will be an even greater need in the future. The projected rate of this growth, however, is subject to question. Available statistics predicting a doubling of energy needs each decade come from those industries and agencies which promote and profit from energy production and an independent study well may reveal a more moderate conclusion or alternatives policy makers may wish to consider. Such a conclusion, it follows, would set the stage for the inquiry: how much time do we have to develop how much power?

And, it must be pointed out, objective analyses of growth rates should not conclude the inquiry on future needs. We still have the option to create more time for ourselves, more time to study all effects, more time to develop maximum safeguards for the adverse effects, and more time to develop alternative sources. How can we create more time in the face of growing needs? By controlling growth! This is not to say that we must live by candlelight, nor institute arbitrary, socialistic limits on energy production. But, we should explore more fully the self-regulating economic incentives and "dis-incentives" within our capitalistic system which will lead to the natural, gradual reduction in the rate of growth. Such incentives are not at all revolutionary--they already are in operation in other aspects of our economy and can be made even more effective through federal policies which promote economic growth and conservation of energy resources.

Here are some alternatives which might be considered.

For one, we should reflect upon a policy of charging rates commensurate with consumption. Under present conditions, the more electrical energy you use the less you pay for it. This, of course, encourages use of electricity. By making rates at least equal to the proportion of consumption, the major industrial and commercial consumers will begin to pay their way. They might even be induced to become more efficient in their consumption and operations. To the extend industry is efficient, the extra cost will be passed along to the consumer who would naturally favor the most efficient, least expensive product. To the extent price increases reflect the true cost to the environment, these are increases the consumer should pay.

Another alternative relates to the regulation and redistribution of peaking power. Present production is geared to an 8-hour day, five days per week. Thus, substantial overloads go to waste two-thirds of the working day and on weekends. Pricing changes to effect a more equal distribution of the load over a 24-hour period is another way to ease the demand.

Another opportunity to ease the demand is by controls of advertising, implemented through pricing, legislation and/or federal regulation. It is tantamount to insanity to advertise for the increased use of a commodity which allegedly is in short supply and dependent upon dwindling finite resources. New York City is subject to brownouts and blackouts yet advertisements for electrical appliances in all forms are carried in all media. Restraints in critical areas should be self-regulating and applicable to manufacturers and sellors of energy-consuming items as well as the power industry. If the supply is short, and we all are going to pay for increased supply, it should be unethical to "sell it while it lasts." Then, if self-regulation does not produce the necessary results, governmental regulations will be necessary.

There are other ways of making the best use of technology and rate regulation to promote better uses of energy. Rapid transit moves more people (and usually faster) than individual autos at a lesser outlay in energy. Conservation of thermal discharges, now considered "waste heat"; auto commuter taxes; building code improvements requiring greater insulation are a few of the other methods by which energy conservation can be promoted.

In summary, therefore, we can make the following specific recommendations which are fundamental to an overall view of the energy problem:

First, we should make an independent, objective study of the real power needs in this country. Concurrently, we must implement those economic and other policies which will make power use more efficient and bring its mushrooming consumption under control. We cannot meet the crisis by simply feeding it.

Second, in our opinion, the highest national priority should be directed toward developing the ultimate energy source, the controlled fusion of the atom. This is the source of energy that powers the universe and, regardless of our insatiable appetites for energy, if this technology could be harnessed along with control of radioactivity and waste disposal, our problems about energy and its most adverse effects on the environment would be eliminated. In my view, we should make an immediate commitment to give this development the highest priority, both in terms of financial support and in talent from the scientific community. I say this in recognition of the fact that success well may not be immediate. The observation that a possible breakthrough may be 50 years off with maximum effort is all the more reason to get started now.

Third, in the interim, more conventional nuclear power may provide the best answer for our power needs in the next few decades. Our fossil fuels are finite. They are being used at an increasingly alarming rate. Consequently, we must consider the type of energy which not only consumes fuel but creates it as well. This is, of course, the advantage of the nuclear breeder reactor, a program which should be intensively explored with a suitable financial and scientific commitment. It must be acknowledged, however, that nuclear power and especially the breeder reactor presents radiological problems in process, storage, and waste disposal to which we presently do not know all the answers. It is important that we find these answers before we commit ourselves fully to the program. Our commitment to resolving these problems should be equal to the investment in breeder reactor development.

Fourth, another prime objective must be in developing an inventory of the other sources of energy with the view toward determining a priority of use for limited fossil fuels. Economics, of course, will and should play an important part in the development and utilization of these types of fuels for energy. Here it is important to ensure that the costs of maintaining a suitable environment, such as the expenses of reclaiming areas strip-mined for coal or in assuring the cleanup of oil spills attendant to production and distribution are assessed as a cost of doing business. These costs can be identified or assessed for environmental taxes or performance bonds. It probably should be pointed out here that the supplies of fossil fuels are exhaustable, that they have many other uses in addition to sources of energy. Consequently, if the Nation could rely largely upon nuclear sources for the generation of electrical energy, the carbon-based fuels could be held in reserve for other purposes, including medicines.

To conclude, we have many scientific societies such as the Wildlife Society, Society of American Foresters, American Association for the Advancement of Society, and the Range Management Society which are well-organized and functioning. These scientific societies should be utilized to the fullest extent of their professional competence in order to ensure environmental assumptions are correct in dealing with the development of energy sources.

And, finally, any formulation of a national policy on energy and the environment must provide visibility to the public. Public hearings and strict conformance to provisions in the National Environmental Policy Act (NEPA) offer ideal vehicles for public discussions and inputs into developments of energy systems. Many well-informed and conscientious Americans are thinking about where the never-ending projections of energy are taking us and they have ideas worthy of consideration. As a matter of fact, the citizen, through the processes of public hearings, forums, educational systems, and mass media can present the positions and attitudes toward final determinations of what trade-offs are made. These decisions should be made by a fully informed citizenry, with the alternatives, options, and trade-offs before them for consideration, not solely by an industry interested in making a profit or by governmental agencies who may be subservient to political considerations or by the eco-freak or even the organized environmental organizations. In the final analysis, the arbiters of trade-offs and social progress, in whatever form it takes, must rest with the people. If so, it would be fully in context with the basic national objectives set out in the Preamble to the Constitution and adopted in 1787.

Thank you again for the invitation and opportunity of making these comments.

Senator BURDICK. Our next witness will be Dr. Barry Kinsey of Tulsa University.

STATEMENT OF DR. BARRY KINSEY, CHAIRMAN, DEPARTMENT OF SOCIOLOGY AND ANTHROPOLOGY, TULSA UNIVERSITY

Dr. KINSEY. Thank you, Mr. Chairman.

To begin I would like to mention the fact that I am not an expert in energy. My main field of concern is health and welfare, with such issues as poverty and the quality of life. Therefore, my major concern is with those human problems that inhibit the development of energy sources rather than technological.

Someone once said that those people primarily concerned with population control are primarily made up of those who are already born. The same, I think, can be said quite often for those who would like to sacrifice the quality of life for other goals. Most of those concerned about the environment are primarily those who already live fairly well. I very rarely come across that concern when I visit the poor, those in the ghetto. Their primary concern is in a better quality and style of life.

Now, as I indicated in my paper, the primary problem is not one of technology. We already have the technology to produce what we will need. Not that technology isn't important and the seeking of new energy sources relevant, but primarily it is in the application of the knowledge we already have.

Let me illustrate that from another field. The United States ranks somewhere around 16th in infant mortality. No one would argue that that is because we do not have the medical knowledge to rank No. 1. The fault lies in the delivery system somewhere.

Now, in order to analyze this issue, I ask you to look at page 3. Since it is not a matter of technology, but one of value, let's look at what all values are. Not all values have the same meaning. I presented a model here which suggests that values range in hierarchy from those that are called primitive, which means most basic, that come first to those that are relatively inconsequential, and I ranked those a hierarchy from A to E.

There are certain consequences of that model which I think are very important.

One of the consequences is this: You can change the CDE values without changing the middle. This is the reason why a lot of kids who think when they put on a different set of clothes and let their hair grow they really had an impact on society. They really had not any significant impact at all. They haven't changed things in the middle.

Another implication of this is if you change the middle, you change everything else, but not vice versa. For example, one of the things a person acquires in the process of growing up is that you are an American. This becomes a core, part of his identity. He never escapes it. This is the reason why most people who may defect to another country or who may try to escape because of being charged with a crime, eventually want to come back, and most of them do, even though they face a felony charge. Having this identity deeply embedded in their psychic, they can find no meaningful existence outside of it. So, eventually they come back.

This gives you some idea of what I mean by central values.

Another significance of this is if there is a conflict between two values, the more central one will win out over the peripheral one. That is going to have some significance towards policy.

Another implication is, if the people are operating at two different levels in the value system, they can't get along and talk with one another. This is quite often the reason for the generation gap. The new and the old people place a different level of value on a particular goal or objective.

With that in mind, let's very quickly look at two or three values which have been important in our society and which may have impact for energy policy.

One of these is the idea that we are a people of plenty. Traditionally, in our society, we have always assumed that the pie was of unlimited size. Consequently, it is very difficult for our people to believe that there is any need to conserve resources or to create new resources. They simply do not buy it, nor see any need for it. There always has been plenty and there always will be.

As a result, they are quite often unwilling to make sacrifices to achieve these goals of developing an energy policy.

Another simple value of our society has been one of deficiency and practicality. A policy which tends to emphasize short-range goals over long-range goals. In fact, there is a definite bias against long-range planning. Long-range planning is quite often referred to as people in their ivory tower and so on.

There is a certain unbridled optimism which does not permit any realistic assessment of contemporary social issues, including the issue of energy. This is undoubtedly related to another central value in our society, that of progress. The underlying belief that our society has always been one in which things are getting better and will be better in the future.

Another underlying value is that of bigness. We tend to equate quality with quantity. As a result, we possibly had a very important policy with regard to population allocation. Someone in one of the papers suggested that there is a self-regulating mechanism in any social system in which when the costs get too big, there is certain feedback. So that if cities begin to get so big and the problems become so high, the cities quit growing. They used Los Angeles as an example. This is not necessarily so.

We have interfered with that feedback mechanism by subsidizing the growth of big cities at the expense of the countryside and smaller towns. It cost a lot more money to build a mile of superhighway in a city with 6 million people than it does in a city of 200,000. We have subsidized bigness.

Very quickly I would like to suggest that it is very important that we develop national goals. Goals are what unite society. But we have to do this publicly. The energy industry is still living under shadows of the teapot dome scandal. There is a suspiciousness of this industry which probably is more prevalent than it is in almost any other industry.

Therefore, any policy decisions that have to be made will have to be publicized and done without any length of special interest or scandal.

I would like to make two suggestions along this line.

First, I would like to see a series of national seminars by young people in which young people are given some very difficult value choices to grapple with. For example, how do you reconcile the need to solve problems of poverty with the need to creating the energy necessary to do that?

Another thing I would like to suggest is that we not be very quick to give up the adversary system. I realize the adversary system for reconciling value conflicts is sometimes burdensome, as illustrated this morning, but it is about the only thing we have that people have confidence in, and through that process we may be able to avoid the kinds of scandal that created the aura of suspicion and distrust within which we are operating at the present time.

Thank you.

(The full statement follows:)

Values, Priorities, and National Goals

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The most important resource in any society is its citizens: their level of motivation, education, skills, goals and aspirations, values, morales, and commitments. Thus, any examination of national priorities or goals must have as its most basic objective the improvement of the quality of life for everyone. In fact, most of the concern over ecology, the environment, and population control has emerged because of some feeling that despite technological advances and high levels of living, something is missing in the lives of many people. Symptoms of this erosion in the quality of life is seen in the alienation and cynicism of youth, high rates of delinquency and crime, growing withdrawal of persons of all ages from meaningful participation in societal processes - a withdrawal often accompanied by dependence upon alcohol or drugs - breakdown of the family, especially the urban ghetto family, movements for women's rights, and other related societal problems. Most informed people are familiar with some of the attempts to analyze and explain these problems. Such analyses have introduced a new language to the contemporary scene and include such phrases and terms as "future shock," the "end of ideology," "cybernation," and so forth. All these explanations have one thing in common: they emphasize that the rate of change and complexities of modern society have multiplied the number and sources of stress operation upon the individual. All operate upon some type of value added model of social pathology, i.e., that the number of casualities is roughly equivalent to the number of stress factors operating in the environment.

These analyses are valuable in that they permit some determination as to the sources of strain for society and individuals and undoubtedly have resulted in some re-examination of goals, priorities, and utilization of resources. In fact, most of the articles in "Selected Readings on Economic Growth in Relation to Population Increase, National Resources Availability, Environmental Quality Control and Energy Needs," have provided data of this type. These articles analyze a particular problem or set of issues and usually recommend solutions in terms of some pattern of resource reallocation on either the individual, societal, or international level.

Although I do not want to denigrate the importance of these studies or the fact that they are seriously needed in all areas of national policy it should be emphasized that lack of knowledge is not the critical issue. We already know a lot more than we are willing to do. Since this is the case, the basic problem is one of values and not of information. With this is mind, let us look briefly at the nature of values and some of the reasons why many of the programs have failed or, in many cases, have not even been addressed to the real issues.

Rokeach[1] suggests that values and beliefs can be analyzed in terms of levels as outlined in Figure I.

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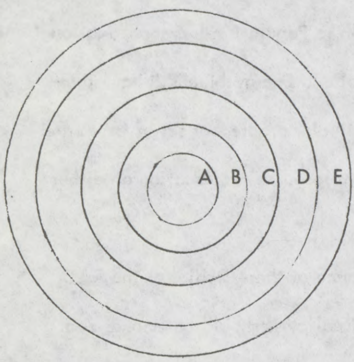
[1] Milton Rokeach, Beliefs, Attitudes, and Values, (Gossey-Bass, Inc., San Francisco 1970).

Figure I.



A. Primitive Beliefs; axiomatic, taken for granted, usually unquestioned: maximum ego-involvement.

B. Primitive Beliefs; individual experience: individual beliefs based upon unique experience, conditions, etc.

C. Authority Beliefs; derived from authority such as institutions, specialists, parental teaching.

D. Derived Beliefs; derived from one's group, associates, ideologies.

E. Insequential Beliefs; personal preferences, tastes, etc.

As indicated in this illustration, values (what ought to be) and beliefs (what is) vary in intensity from those which are taken for granted, never questioned, and in fact which are so vital that their very examination brings stress to the individual or society to those which change quickly with fads and fashions of the times. If this model is a reasonable representation of a belief and value system, individual or societal, then three generalizations can be derived which have profound implications for decision making.

1. Beliefs and values in the C.E.D. area are functionally distinct and may change without altering A. & B.

2. The more central a belief, the more it will resist change.

3. Beliefs in the A. & B. area are not autonomous and changes in these areas affect the entire system.[2]

Several facts become apparent if we examine the implications of this model. First, it is easy to create the illusion of change by basing policies and programs at the peripheral level. This is the basis for much of the pessimism in many of the articles that the more things change, the more they seem the same. An example of such an illusion would be someone who lets his hair grow, changes his clothes and language and assumes that he has had an impact upon the core problems of society. Second, some issues are recognized as so vital that any attempt even to question them brings violent resistance on the part of groups who hold the appropriate values and beliefs. An example might be the issue of civilian review boards of police. These groups apply, quite correctly, a version of the domino theory, i.e., that once an exception is made in the core area, other appropriate changes will follow.

Many other implications of this model of value and belief structure could be developed; however, it is sufficient if the general idea is clear. This is important because my basic premise is that most of the proposals for solving problems of pollution, resource allocation, transportation, health care and so forth will fail unless we are willing to undergo the rather painful--and politically dangerous--process of examining core values

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[2] Ibid., p. 23

underlying policy decisions.

Let us look at some core beliefs and values in our society and discuss briefly some of their implications for the development of a set of priorities and goals for energy policies. One major American value has been discussed by Potter in a book entitled "People of Plenty."[3] As the title suggests, we have always operated under the implicit assumption that there are no limits upon resources, a situation which was verified by the frontier and industrial expansion. When one farm played out, families simply moved to a new location and the fact that a person "wore out 2 or 3 farms" could be a symbol of a productive life. This same theme has been emphasized by Lipset[4] who draws a distinction between status and class politics. Class politics pits one class against another and assumes that one class can gain only at the expense of the other. Status politics, on the other hand, involves individuals and groups striving to enhance their own interest independent of others in the social system. Class politics develop in societies in which people believe in limited resources, i.e., that the economic pie is only so large and that the only way to improve one's own position is by revising the system of allocation.

As a result of this underlying value, most people simply do not see a need for being concerned with the establishment of goals and priorities or to make major investments in seeking new energy sources. In a recent article in The Saturday Review, for example, Ritter[5] argues that if we are to develop resources to solve contemporary problems involv-

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3 David O. Potter, People of Plenty: Economic Abundance and the American Character, (Chicago, University of Chicago Press, Phoenix Edition, 1954).

4 Seymour Lipset, "Sources of the Radical Right", In Daniel Bell, The Radical Right, (Garden City, New York, Doubleday, 1963).

5 Lawrence S. Ritter, "The Dollar and Logic of Reordered Priorities," Saturday Review, Oct. 9, 1971.

ing the cities, pollution, and so forth, some choices will have to be made between guns, butter, and public spending. Failure to do this means that funds will not be available for these problem areas because we cannot deal with the inflationary pressures which would result from attempts to finance all three. The answer according to Ritter must, therefore, involve a drastic cut-back in military and/or consumer spending. Because we have traditionally operated under a different system of beliefs and values, we simply do not understand the basis for these decisions and more importantly, we are not sympathetic to those who would attempt to educate us.

Another core belief in our society is the importance and value of work and activity. One aspect of this belief is that anyone can work if he wants to and that unemployment, with few exceptions, represents some moral failure on the part of the individual. Again, this belief system developed out of a growing society with almost unlimited resources and capacity for industrial expansion. The appropriateness of this belief for a highly industrialized, automated society is being increasingly brought into question. In any case, we have not really faced up to the issue of how to deal with chronic unemployment or to develop meaningful alternatives for those made absolute by technological change. The value placed upon activity and work is important and has probably been one of the reasons why we have developed the high level of living which we enjoy. Thus, the implication that I wish to emphasize from this analysis is not that we should develop a policy which denies the importance of these beliefs, but that we adapt them to modern times. For example, it is apparent from economic forecasts that the major manpower needs in the future will be in the service areas. Would it be possible, therefore, to develop training programs for career development in areas involving community needs?

There is a critical shortage of manpower in the medical field and unlimited opportunity for paraprofessionals in this area.

A third major belief system centers around the themes of efficiency and practicality. As Williams suggests "...efficient is a word of high praise in a society that has long emphasized adaptability, technological innovation, economic expansion, up-todateness, practicality, expediency, and getting things done."[6] Efficiency and practicality, however, concentrates upon goals attainable in the situation and solves immediate problems as they arise. Abstract and long range goals are left to politicians, idealists, and others. It is precisely this orientation which created the "win or get out" view of Viet Nam and which acts against any strong public support for long range solutions to pollution, crime, urban decay, or energy needs.

Americans have also had a basic, largely unquestioned belief in progress. This involves acceptance of changes, the idea that changes are tending in a definite direction, and the belief that the direction is good.[7] Because of this belief, people are slow to accept the fact that some of the changes in our society may be bad or that problems are as serious as they really are. They may, in fact, react with great hostility to anyone who points to faults in the system. This has undoubtedly enhanced the generation gap as the young have been too quick to criticize and the old too reluctant to accept the obvious. In any case, this belief further inhibits public interest, acceptance, or even confidence in those who insist that planning for the future is a necessary and important goal.

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[6] Robin Williams, American Society: A Sociologist Interpretation (New York, Knopf, Second Edition, 1960), p. 428.

[7] Ibid., p. 430

It is interesting to note the extent to which even well-educated economists and business leaders have been influenced by this basic belief. It had led to several assumptions which suggest that priority choices do not have to be made. These include, (1) the U.S. is infinitely wealthy and can support all necessary activities, (2) the growth rate is so great that social needs as well as investments for the future can be financed by annual increments, and (3) investments in military, space programs, and so forth will produce a "spill over" in terms of new products, technologies, and resources which will solve future needs.[8]

One final core belief which I would mention is closely related to the idea of progress. This is the belief that success can largely be definied in quantitative terms. Chambers of Commerce jealously watch the census and other statistical indicators to determine relative growth rates in population, geographic area, industrial expansion, and so forth. Policy decisions have been made which, directly or indirectly, favor the growth of large metropolitan centers. As a result, we have the paradox of large, unmanagable urban sprawls and the decay of small communities. No one has seriously asked the question, "how big should cities be?" Is there an optimum size in which resources can be used most efficiently? If it is necessary to limit the size of communities, how can this be done and still preserve individual freedom and mobility which are also important values in our society?

I have not exhausted the list of values which must be considered in establishing a

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[8] See Seymour Melman, "American Needs and Limits On Resources: The Priorities Problem," <u>New University Thought</u>, (Special Issue, 1966-7).

national policy for resource planning. My objectives have been to show that failure to consider these values has led us to make poor policy decisions in the past and to reveal the basis for lack of public support for programs designed to solve public problems at the expense of private consumption. Unless the public can be educated to see the need for establishing priorities and unless these can be related to the core values which people hold, no amount of technological skill will solve the problems under discussion in this seminar.

Let me briefly illustrate this point with an analysis of the poverty issue. The amount needed to erase poverty by any reasonable definition is relatively small. There is strong resistance, however, to any program such as the administration's family assistance plan which even suggests that people will be given "something for nothing." This policy is contrary to a core belief that poor people are less moral than the rest of the population and, as a result, pretty much deserve what they get.

As a final note, I would like to discuss briefly why I include the issue of human resources along with a discussion of national goals and energy needs. As indicated in the model concerning belief and value systems, any changes in core beliefs and values results in disturbances in all other aspects of a person's value system. The result is a general state of anxiety and uncertainity in which persons lack well-defined goals, standards, or guides for conduct. The environmental issue along with Viet Nam and several other issues have brought many of our most sacred beliefs into question with the result that there is a growing confusion over goals at both the individual and national level. The basic role of leadership is to assist the public in developing these goals. Without common goals there are no consensual values which provide the basis for a well-ordered individual or society.

Senator BURDICK. Next on the panel will be John G. McLean, President of the Continental Oil Co.

STATEMENT OF JOHN G. McLEAN, PRESIDENT, CONTINENTAL OIL CO.

Mr. MCLEAN. I am very happy indeed to appear before this committee. I believe this study upon which you are now engaged is of critical importance at this particular juncture in the Nation's affairs and I appreciate very much the opportunity to contribute to it.

Responsive to your request, I will speak briefly to three points. First the national goals; second, the relationship of energy to those goals; and third, some suggestions regarding energy policies which I believe would contribute to an improved national energy posture. Let me begin with the national goals.

I would list them in four categories as follows: first, we want national security; freedom from aggression and coercion by outside powers; we want economic progress to provide a steadily advancing standard of living to a growing population. Third, we want social progress. We want an intelligent and enlightened citizenry capable of advancing human knowledge on a broad scale, of making enduring contributions to art, music, philosophy, religion, science, and many other cultural areas. Fourth, we want to live and work in a satisfactory environment and, furthermore, one which will be so for many succeeding generations.

Now, as a nation, our emphasis upon these various goals can be expected to shift from time to time as circumstances warrant. The listing I have given is in the order of priority that I would assign at this particular moment in our history.

Let me next speak regarding the relationship of energy to these goals. The relationship has always been an important one and I suspect it will be increasingly so in the future years.

Let us consider each of the four goals in turn. Our first goal of national security has two aspects, of which the more imperative is military security.

Government experts are better qualified than I am to specify the energy requirements needed to insure our military security. I would merely note, however, that a solider in the field in Vietnam today requires about twice as much energy support as did a soldier in World War II.

Diplomatic security is a more subtle aspect of our national security. It is important that our diplomatic endeavors be free from coercion from outside influence. Today, however, we have a small group of countries which control about 80 percent of the free world oil reserves, in a position to use their dominant standing in the energy field to force diplomatic advantages from the energy consuming countries.

The only protection we have from coercive action of this kind is to develop ample secure sources of energy of our own. Fortunately, we have the capacity to do that if our policies are directed toward that end.

Our second national goal, economic progress, has a similar close relationship to energy availability. Many persuasive statistical studies have demonstrated the close correlation between a nation's consumption of energy and its level of economic achievement. It is no happenstance that the United States has both the highest standard of living and the highest per capita consumption of energy in the world today.

Inanimate energy is the great multiplier of human efforts. Without it or slave labor, no civilization has even produced much beyond its immediate material needs. Adequate supplies of energy at reasonable costs provide the means by which a civilization can rise above the bare subsistence level.

Our third national goal of social progress has an indirect relationship to energy availability, but one which is nonetheless real. One of our best hopes for relieving much of mankind's poverty and misery lies in accelerating economic progress and that, in turn, depends upon energy availability.

Moreover, without adequate supplies of energy at reasonable costs, our population would have to devote a much larger share of its time to the drudgery of producing the necessities of life, and correspondingly less time would be available for cultural pursuits and social achievements.

Our fourth goal, an improved ecological environment, which we can enjoy and pass on to posterity, is related in both a negative and positive way to energy. The production and use of energy inevitably involves some degree of ecological damage. Our problem is to develop ways and means of keeping that damage to a minimum.

The application of energy, however, provides the means by which we can process sewage, recycle waste materials, reclaim wastelands, and take care of many other highly important ecological problems.

Whether we like it or not, a high standard of living in modern civilization and the pollution of the environment go hand in hand. Large amounts of energy will have to be applied to keep that pollution within acceptable limits.

I come now to my third topic, some suggestions regarding our national policies in the energy field.

Historically, our national policies fostered the development of indigenous resources. Not only did they lead to the development of domestic resources, but they also laid the foundation for a later movement of U.S. capital and technology into the development of energy resources abroad.

Our policy thus contributed to a leading role in foreign oil activities for U.S. companies and gave us a strong posture in international oil affairs. Beginning in the 1950's, however, a subtle but clearly discernable change occurred. Government actions were no longer consistently designed to provoke the development of energy resources. In fact, many Government actions became quite restrictive and had a negative effect on resource development.

That, plus increasing demand and the gradual depletion of the best and most easily assessable of our energy resources, is why we have an energy problem today. Fortunately, our problem does not lie in the availability of the resources themselves. Government and industry experts agree that the United States has vast potential resources of oil, gas, and coal remaining to be developed.

What is needed then are proper policies and incentives to promote the commercial development of these deposits.

Needed, also, is stability and consistency in Government approaches which will promote stability in the investment climate and following our Pacific suggestions.

First, oil import controls. I believe we should maintain a continuing program of oil import controls in order to encourage a continuing program of private capital investment in the discovery and development of our domestic resources. Because of the long leadtimes involved in developing additional energy supplies, there is a high probability that over the next several years imports will have to increase as our requirements grow and domestic availability diminishes.

However, the thrust of the impact control program should be to encourage optimum development of indigenous sources and thereby minimize the growth of imports over the longer term.

Preferential treatment should, of course, be given to imports in the more secure political areas.

Second, price controls. Within the constraints set by security of supplies in an ecologically sound environment, I believe that prices for our various fuels should be determined by competitive sources, demand-supply conditions in the marketplace. This will, first, encourage a shift of capital inputs from one energy field to another as economic conditions warrant, and, second, accomplish effective allocation of scarce energy supplies to the highest value use.

This is particularly true in the case of natural gas; a strategic error made by the Federal Power Commission during the past 15 years of holding natural gas prices at abnormally low levels which had the dual effect of discouraging new discovery and stimulating excessive demand should now be clear to one and all.

Such price control should be relaxed as rapidly as possible before more damage is done. Programs for exploration of new gas supplies, the importation of liquified natural gas, the gasification of coal and naptha could all be materially accelerated by a clear policy determination that prices for gas from these new sources would be allowed to seek their own levels in response to competitive market conditions.

Third, Federal leasing policy.

It is essential that the vast energy resources of Federal lands be made available at cost conducive to rapid development. As the President's June 4, 1971, message on energy to the Congress noted:

> Over half of our Nation's remaining oil and gas reserves, about 40 percent of our coal and uranium, 80 percent of our shale, and some 60 percent of our geothermal energy sources are now located on Federal lands.

Recognizing the need to accelerate offshore development, the President directed the Secretary of the Interior to "increase the offerings of oil and gas leases." Secretary Morton's subsequent announcement of a tentative 5-year schedule calling for at least two major offshore lease sales per year was an encouraging step in the right direction. Within the context of adequate safeguards to protect the environment, every effort should be made to carry out the proposed step-up in leasing.

In addition to making more acreage available, new leasing methods should be devised which will give proper weight to the public's interest in rapid development of adequate, secure energy supplies. The current procedure for awarding leases has maximized payments to the Federal Treasury, which once may have been a desirable goal. However, this system may no longer be in the public interest in view of the Nation's growing requirements for secure supplies of energy at reasonable costs. Under prevailing practices, companies are forced to expend enormous sums for lease bonuses; such funds could be better employed for exploration and development activities.

A possible new approach to stimulate exploration and development of energy resources on Government lands in frontier areas would be to adopt a system of work program bidding—that is, companies submit programs to invest specified sums to explore and develop leases in a given period of time. This approach has been used with considerable success by Great Britain as a means of accelerating development of its North Sea gas resources.

In the case of oil and gas, this procedure could be applied to leasing of frontier areas and might be combined with compulsory early relinquishment of part of the acquired acreage after a specified period of time. Such a program would encourage early and extensive exploration of the leased area.

In the case of shale oil, work program bidding could stimulate technological research on mining and processing techniques. A viable program would have to insure that a company successful in its research endeavors would have access to sufficient government acreage to permit a substantial commercial application of this new technology. This is a serious deficiency in existing leasing arrangements.

Finally, the attractiveness of resource development on Government lands would be further enhanced if lands were available for leasing for multiple uses. Under this system, leasing for one mineral would not preclude concurrent or subsequent leasing for other minerals.

Four, improve taxation incentives. Unfortunately, for the Nation's energy supply position, the percentage depletion allowance on petroleum was cut in the Tax Reform Act of 1969. This significantly reduced incentives for the development of domestic petroleum resources. To stimulate exploration for oil and gas, taxation incentives should be materially strengthened.

Five, encourage research into the production and use of energy. Research into a broad range of energy matters may provide the means to increase energy supply at reduced costs. The breadth and diversity of suitable research topics afford ample opportunities for both private and public sponsorship.

In general, publicly financed activities should be directed to (a) environmental improvement, (b) pilot programs to develop the technology so that low-grade, presently noncommercial domestic resources could be commercially developed, and (c) the more theoretical areas of research.

Three areas for augmenting energy supplies that seem particularly appropriate for Government-sponsorship research are: Perfection of a stack gas control device which would permit the use of high sulfur coal without violating pollution control standards; conversion of shale oil and coal into synthetic fuels; and development of a beeder reactor.

Six, encourage freedom of entry by companies into alternative energy businesses. Another means of promoting adequate domestic energy supplies at lowest possible cost would be to encourage a diversity of corporate effort in the development of the country's natural resources. Such a policy would foster competition and a greater flow of capital into energy activities. Competition in the various energy fuel industries is necessary to meet the goals of adequate fuel supplies, low prices, and rapid development of new technologies. Vigorous competition, in turn, requires freedom on the part of private companies to enter the various fuel industries, within the framework of our antitrust laws.

At this point, Mr. Chairman, you will note that I diverge and take considerable exception to the statements of Mr. Andrew Biemiller when he comments that the diversification of corporate activities into the various energy fields constitutes the formation of antitrusts such as in the last 19th century.

We welcome an objective examination of the facts on this point. I think any objective observer will find that the diversification of corporate activties across the various energy fields is not only stimulating competition in a very healthy way, but it is furthermore promoting the aggressive development of some badly needed energy resources.

Capital requirements for providing future energy supplies will be enormous. The National Petroleum Council in its report, "U.S. Energy Outlook, An Initial Appraisal 1971–85," estimated that $174 billion will be needed in the 1971–85 period for fossil and nuclear fuel operations, exclusive of retail marketing activities.

Recent experience has demonstrated the beneficial effects of freedom of entry in regard to meeting capital requirements. For example, the entry of gas transmission companies into gas exploration and synthetic gas manufacture will mitigate to some extent the severe shortage of natural gas. Participation in the coal business by oil companies accelerated investment in coal operations and helped avert a threatened shortage of coal last year. Entry into uranium exploration by companies that had previously been both inside and outside the energy business has contributed to the discovery of substantial new reserves, thus helping to assure adequate fuel supplies for nuclear powerplants.

Besides providing additional capital investments, freedom of entry across the several energy fields will be helpful in other ways. Flexibility in the use of limited skilled personnel, for example, will be encouraged. Skilled people can be shifted into areas where their talents can be put to the best use. Diverse talents from different fuel businesses can also be blended in such important areas such as research and development. This is particularly true in the case of synthetic fuels.

Ultimately, the availability of long-term energy supplies of the United States will depend on the effective mobilization of these diverse talents of skilled people in the different energy industries to develop the Nation's vast reserves of coal and shale. The development of these energy resources will require new gasification and liquefaction technologies, as well as very large capital outlays. For example, about $500 million investment is required to provide 100,000 B/D of synthetic crude capacity from oil shale. Inevitably, a long time will elapse from initial investment to commercial operations.

These essential characteristics necessarily require large experienced companies to undertake the pioneering task of developing coal liquefaction and shale reserves. This fact should be recognized by the Government and the public. Oil, gas, and coal companies are particularly well qualified to undertake these pioneering development activities and should be encouraged to do so.

Seven, set realistic environmental standards. The energy policy objective in this case should be to minimize air, water, and radiation pollution in the production and use of energy while at the same time considering the effect of pollution regulations on other national goals.

To implement this policy objective, more rationality and less emotion are needed in Government regulations. Such an approach should include (a) thorough public hearings on all aspects of the proposed regulation, (b) cost-benefit analysis of the regulation under consideration, and (c) an evaluation of the technical feasibility and optimum timing before the regulations are set.

Strong Federal intervention and coordination is therefore necessary; generally speaking the Federal Government should play its primary role in establishing requirements and objectives. The task of devising ways and means of achieving the desired ends should be left as much as possible to private enterprise.

Mr. Chairman, thank you very much.

Senator BURDICK. Thank you for your contribution.

Senator RANDOLPH. Mr. Chairman, I know the procedure is not to question one of the panelists, is that correct?

Senator BURDICK. Not until all are finished.

Senator RANDOLPH. What if I have to leave and not be able to have a word with the present witness?

Senator BURDICK. The able chairman of the Public Works Committee will have an exception.

Senator RANDOLPH. Thank you, Mr. Chairman. I appreciate your indulgence.

Mr. McLean, on page 9 I refer to these words of your statement to the committee:

> Three areas for augmenting energy supplies that seem particularly appropriate for Government-sponsored research are perfection of a stack gas control device which would permit the use of high sulfur coal without violating pollution control standards, conversion of oil shale and coal into synthetic fuels and development of a breeder reactor.

You will forgive me, I wanted to say oil shale instead of shale oil, because that is the way Senator O'Malley and I talked about it in the days we coauthored the Synthetic Liquid Fuels Act and had a program of this kind.

But these fields that you are mentioning, what sort of program dollarwise are you suggesting or recommending that the Congress, in its judgment, provide?

Mr. McLEAN. Senator, I had not fixed on any particular dollar figure but in view of the magnitude of the job to be done, I think we are talking of tens of millions of dollars instead of $1, $2, $3, or $4 million. I think we could well devote $10, $15, or $20 million to these areas to very good advantage.

Senator RANDOLPH. Do you suggest, Mr. McLean, or would you partially agree with the Senator now questioning you whether it would not be more helpful to our country and to our people and frankly our position among the people and countries of the world, over the long look, if we took certain amounts of money that are not now being, I believe, spent, as well as they could be in this type of program. I refer to foreign aid and certain of its aspects. What is your feeling?

Mr. McLEAN. I hesitate to pass a judgment on the foreign aid programs because this is outside of my field of expertise. I would merely submit that the research programs are important and that we can best play our role in the world affairs if we have a strong U.S. Nation to begin with and that is going to take energy and it seems to me for these reasons this is important. But I would hesitate to recommend from which other Government programs you take the funds. I think that judgment is better made in the Senate and the Congress.

Senator RANDOLPH. Of course, our constituents, you know, contact us about cutting these different types of programs and appropriating the money based on priorities that are important to them. That is why I am asking you the question.

Mr. McLEAN. Senator, unfortunately I am a fairly strong supporter for some of our foreign aid programs on a highly selective basis.

Senator RANDOLPH. I like that last part.

[Laughter.]

Mr. McLEAN. You and I could get together there.

Senator RANDOLPH. What about the space program, do you think that the funding could be reduced and applied more directly to some of these matters that concern, possibly, the day-by-day existence of the American people?

Mr. McLEAN. Senator, I suspect it could, but I would like to see us maintain a very substantial space exploration program too.

I think there are some scientific and technological objectives to be realized there that are going to be very important in the longrun future of the Nation.

Senator RANDOLPH. What you are saying then, is that we have to fund the other programs and we have to raise taxes to fund these programs that you recommend, is that correct?

Mr. McLEAN. I don't think you need to go that far. I think if you and I could sit down with the budget together and go through a budget-cutting exercise, we could find some places to cut the budget to find some money.

Senator RANDOLPH. Well, you know management of the budget is going to take care of the problem at the present time. The President and the administration are withholding approximately $14 billion, $500 million that has been not only authorized by the Congress but appropriated by the Congress and obligated to space. So, we have money that doesn't flow out, as you understand, into these projects. That is another subject that I don't want to go into.

I am intensely interested in your suggestions here, I think they are made after careful study. That is why you give them to us, but they can't be done without large sums of money. It is good to say they ought to be brought to being and we ought to fund them, but frankly we have got to have your expertise and your guidance and I appeal to you, those of you who believe as do I in this matter, that you show us why this sort of work of necessity must be done and what you believe it will cost. Because in the final analysis, the American people will pay for all of these programs, is that not true?

Mr. McLEAN. That is true.

Senator RANDOLPH. I thank you, Mr. Chairman.

(The full statement follows:)

STATEMENT ON

NATIONAL GOALS AND

ENERGY POLICIES

SUBMITTED TO

SENATE COMMITTEE ON

INTERIOR AND INSULAR AFFAIRS

BY

JOHN G. McLEAN

PRESIDENT, CONTINENTAL OIL COMPANY

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NATIONAL GOALS AND ENERGY POLICIES

Sufficiency and security of the nation's energy supplies are matters of increasing concern. The National Fuels and Energy Policy Study by the Committee on Interior and Insular Affairs should make an important contribution toward resolving that concern. Rightly, the Committee's inquiry aims first to define national goals and then to assess the proper energy policies to attain them. One of the Committee's background papers quoted an observation by Abraham Lincoln which provides helpful perspective for all of us at these hearings. "If we could first know where we are, and whither we are tending, we could then better judge what to do and how to do it."

This discussion of relationships between the nation's goals and energy policies is divided into three parts: (1) an examination of national objectives, (2) an analysis of the relationship of energy to these objectives, and (3) an outline of appropriate energy policies to help achieve the nation's goals.

I. NATIONAL GOALS

In the past, the United States has had national goals that were defined by a consensus of the public and, therefore, widely accepted. In the broadest terms these goals were the security, growth and prosperity, and general well-being of the nation. Currently, there is more emphasis on stating these goals explicitly; but when they are enumerated, the list turns out to be quite similar to the national objectives that were at least implicitly agreed upon in the past.

This country has had an unparalleled record in achieving these broad goals. Although there is much left to be done, we can take satisfaction from our high level of economic development and the diffusion of wealth throughout the population. Looking at this achievement in an historical context, three factors of overriding importance stand out: (1) the country was settled by active, energetic people, (2) the nation was richly endowed with resources and (3) the country opted for a political-economic system which encouraged the full development of our resources. Under this system of private enterprise plus stable and generally equitable governmental fiscal and regulatory policies, technical innovations and the discovery and development of natural resources have been encouraged.

In the current period of widespread dissension, which is marked by doubts about the nation's capabilities of coping with its problems, a reassessment of our national goals is appropriate. The following is one person's list of national objectives, in order of priority.

National Security

Security is our number one goal and a primary determinant of the well-being of the nation. The most obvious need is for military security from aggression from outside forces. Less obvious, but also of vital importance, is what might be called "diplomatic security." The exercise of world leadership to promote peace must not be subject to coercion by outside suppliers of vital materials. The adverse effect of potential veto power by outside interests on U.S. policy has been recognized since the early days of the Republic. Economic security is a third subdivision of national security.

Economic Progress

A second major goal of the nation is economic progress. This objective can only be realized within the context of security. Threats of aggression from outside powers and overdependence on imports of critical materials could impair the climate for capital investment and thus retard the nation's economic progress.

A rising gross national product is essential if we are to achieve:

1) A reduction in unemployment and poverty: While the U.S. has made great economic progress, millions still live in poverty and much remains to be done. Our problems in this area will be accentuated as our population increases.

2) A rising standard of living: Improvements in material well-being can only be accomplished through increased production of goods and services at the lowest possible costs. Hopefully, consumers should have the freedom to make choices from a wide range of options as to how they live and how they spend their money.

Social Progress

A third major goal of the nation is social progress. We want an intelligent and enlightened citizenry--a citizenry capable of advancing human knowledge on a broad scale and of making enduring contributions in art, music, philosophy, religion, science, and many other cultural areas.

Clean Environment

A fourth national goal that has emerged quite strongly in recent years calls for improvements in the environment in which we live and work. This requires an increased effort to avoid polluting our air and water. Here again, our problems will inevitably increase as our population expands.

II. RELATIONSHIP OF ENERGY TO NATIONAL GOALS

Energy has always played a key role in achieving our national goals. This role will likely be even more important in coming years.

National Security

National security has at least three distinct aspects and energy is related to all of them.

Military Security. With increasing mechanization and more sophisticated weapons, there has been a growing use of energy--particularly petroleum--in recent military conflicts. Despite the development of nuclear weapons, the nation continues to be involved in conventional warfare. And if, unfortunately, conflict does occur in the future, everyone surely would hope it can be contained to the use of conventional rather than nuclear weapons. The country's security thus requires availability of energy, especially petroleum, for emergency military situations.

Diplomatic Security. Importation of energy is one of the most sensitive areas in which a nation is subject to pressure from outside sources. Oil exporting countries are showing an increasing tendency to use energy resources as a means of influencing the foreign policies of importing countries. Consequently, in this country's quest for peace, our diplomatic endeavors must be free from coercive outside influences that might arise from excess dependence on energy imports.

Economic Security. The strength of the nation, and indirectly its security, is dependent in part on its economic health. Adequate energy, an essential element in the industrial base of the nation, thus underpins the economic health and in turn the security of the United States. Foreign energy supplies are not only vulnerable to interdiction for military and diplomatic reasons, but also they are subject to erratic changes in prices. For security reasons as well as economic progress, it is essential that the country have a continuity of energy supplies at reasonable costs.

Economic Progress

A close correlation has been demonstrated in many persuasive statistical studies between a nation's consumption of energy and its level of economic achievement. For example, in 1969 per capita energy use and per capita real GNP in the United States were approximately ten times greater than in Latin America, a relatively less economically developed area. Energy is a vital ingredient in all phases of our economic life--it provides power for our industry and transportation systems, as well as heat and light for our homes.

Economic progress is due to rising productivity and improved efficiency in use of resources. Increasing use of machines powered by inanimate energy is the principal basis for rising productivity. In addition to productivity gains, energy-using industries have contributed to economic progress by more efficient utilization of energy.

It is through economic progress (based to a significant degree on rising energy consumption) that we achieve our goals of reducing unemployment and poverty and raising the standard of living. In the final analysis, increasingly efficient energy use is essential for improved material well-being

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of all U.S. citizens. It is no mere happenstance that the U.S., which has the highest standard of living in the world, has the highest per capita consumption of energy.

Social Progress

The citizen's well-being depends, in addition to material things and freedom of choice, on non-material factors as well. However, recent emphasis on non-material things frequently overlooks that many of the good things in life have a material foundation and require the efficient production and utilization of energy. Without adequate supplies of energy at reasonable costs, our population would have to devote a much larger share of its time to the production of the bare necessities of life and correspondingly less time would be available for cultural pursuits.

The close relationship of material and non-material aspects of society is apparent in our nation's past economic and social progress. For example, it is frequently cited that in the late 18th century, 90% of the population had to work on farms in order to produce sufficient food for the nation. Now only 5% of the population works in agriculture. But these are sterile statistics until we consider their implications. In the late 18th century, after tilling the fields most families had little time left in which the young could be free for schooling. The combined efforts of even large families, without the use of energy, could not create the margin to support their sons through the years to learn medicine or dentistry. The productive capacity of the nation was largely committed to providing the material necessities and left scant margin to realize cultural achievements.

As a second example, health and pleasure, which are certainly non-material goals, are becoming inextricably intertwined with the use of energy. The health of patients in intensive care units is meticulously monitored through sophisticated instruments run by electricity 24 hours a day. Pleasure--the freedom and opportunity to fulfill yourself in your own individual way--is not entirely a non-material pursuit. For a walk in distant high mountains involves the use of energy to get there by car or plane. A night baseball game at Yankee Stadium requires energy equivalent to 750 million candlepower. Many Americans travel throughout the world to be reunited with relatives and to gain perspective from earlier civilizations. Adequate energy supplies at reasonable costs make this possible.

Clean Environment

The production and use of energy inevitably involve some degree of ecological damage. Control of water, air, radiation and other forms of pollution caused by energy production and use is thus a vital part of the nation's commitment to an improved environment. With the proper technology and thoughtful regulation, this goal can be accomplished. In fact, a better environment will involve more, not less, energy. Removing pollutants from fuels, processing sewage more fully, and recycling waste are all new major missions for the U.S. economy; these efforts all require substantial amounts of energy.

III. ENERGY POLICIES TO IMPLEMENT NATIONAL GOALS

The government plays a crucial role in energy policies. This role can be divided into four categories: (1) regulation, (2) taxation, (3) landowner and (4) sponsor of research. The government's influence in all four of these sometimes contradictory roles has been increasing and will likely become greater in coming years.

Historical Perspective

Historically the government's role in energy policies has been designed to foster the development of indigenous resources. As noted earlier, this policy has been quite successful. Not only did it lead to development of domestic resources, it laid the foundation for later movement of U.S. capital and technology into foreign exploration and development of resources. This policy has thus contributed to the dominance of foreign oil activities by U.S. companies and has given us a strong posture in international oil affairs.

Changes in 1950's

A subtle but clearly discernible change has occurred since 1950 in the government's activities in the energy field. Government actions are no longer clearly designed to promote development of energy resources. In fact, many of the activities are quite restrictive and have a negative effect on resource development. The following are examples of government activities affecting energy since the mid-1950's:

A. Regulation

-- The Federal Power Commission has been holding down the price of gas, thereby stifling exploration incentives and, at the same time, stimulating consumption.

-- To maintain a strong domestic petroleum industry, import controls were imposed in 1959, a favorable development in regard to domestic resource development. Subsequently, these controls have been weakened. And in 1969, recommendations for drastic changes by the Cabinet Task Force on Oil Import Control created considerable uncertainty about the future of the import control program. This uncertainty, in turn, contributed to diminished exploration activity.

-- Siting problems have developed for refineries, nuclear power plants, and petroleum terminals.

-- An improved environment is desirable, but environmental controls make it more difficult to develop and use energy resources. Proposals to tax sulfur in fuels and to regulate lead in gasoline are examples of this trend.

B. Taxation

-- The Tax Reform Act of 1969 cut the percentage depletion allowance and included depletion as a preference item subject to a minimum tax. These changes substantially reduced exploration incentives.

C. Landowner

-- Leasing policies of the government for oil and gas are deterring exploration in three ways: (1) the small amount of acreage, made available at infrequent intervals, limits exploration in some of the most promising areas in the U.S., (2) the system of competitive bonus bidding drains off capital needed for exploration, and (3) environmental regulations are hindering the development of discoveries in some areas.

-- Government leasing policies for shale oil have been unworkable and are postponing the development of this resource.

Recent Developments

Recently some government actions have been more encouraging in regard to the development of natural resources. This trend perhaps reflects a realization that the disincentives toward energy resource development since the mid-1950's may have been detrimental to the national interest. The following are examples of a more positive attitude:

1. The recommendations of the Cabinet Task Force on Oil Import Control for a drastic overhaul of the petroleum import program were rejected.

2. The Federal Power Commission in recognition of the gas supply shortage has granted some modest price increases for natural gas at the wellhead.

3. The President's June 4, 1971 message on energy included several proposals that would encourage the development of energy resources.

4. The hearings of this Committee are a favorable indication of the growing awareness of the nation's energy problems.

Future Energy Policies

Government and industry experts agree that the U.S. has vast potential resources of oil, gas and coal remaining to be developed. What is needed, then, are proper incentives to find and develop these resources. Needed also is stability in the investment climate and in government regulations. Regulations should be formulated only after thorough consideration of the options available through various technological approaches. Regulations should stress goals rather than defining specific methods to achieve them. Because of long lead times in the development of energy resources, companies should be apprised of regulations as soon as practical, and later reversals in rules and regulations that are disrupting should be avoided.

The following are specific energy policy recommendations that will encourage the development of adequate energy supplies at attractive prices:

1. Maintain Import Controls

Petroleum import controls should continue at levels which will promote the development of domestic sources of supplies. With the disappearance of excess producing capacity, imports to the area east of California should be limited to the amounts needed to meet requirements, as is the case now on the West Coast. Such a system would assure a market for domestic supplies developed anywhere in the U.S. Security would also be enhanced if imports were drawn preferentially from the more secure foreign sources.

2. Let Market Forces Set Prices

Competitively set market prices would permit the forces of supply and demand to determine prices which would (a) stimulate production of additional energy resources and (b) allocate energy supplies to the highest value uses. Changes are particularly needed for natural gas, the price of which has been held at artificially low levels by federal regulation. Price controls in this case have substantially reduced exploration incentives and, at the same time, have encouraged expansion of demand.

Programs for (a) the importation of liquefied natural gas, and (b) the gasification of coal and naphtha would be materially accelerated by a clear determination that prices for gas from these sources would be allowed to seek their own level in response to competitive market prices.

The government should resist the temptation to use the import control program as a price control mechanism. The purpose of import controls should be to stimulate development of indigenous energy sources and hold down dependence on foreign supplies.

3. Change Leasing Policies on Government Land

It is essential that the vast energy resources of federal lands be made available at costs conducive to rapid development. As the President's June 4, 1971 message on energy to Congress noted, "over half of our nation's remaining oil and gas reserves, about 40 percent of our coal and uranium, 80 percent of our shale and some 60 percent of our geothermal energy sources are now located on federal lands."

Recognizing the need to accelerate offshore development, the President directed the Secretary of the Interior "to increase the offerings of oil and gas leases." Secretary Morton's subsequent announcement of a tentative five-year schedule calling for at least two major offshore lease sales per year was an encouraging step in the right direction. Within the context of adequate safeguards to protect the environment, every effort should be made to carry out the proposed step-up in leasing.

In addition to making more acreage available, new leasing methods should be devised which will give proper weight to the public's interest in rapid development of adequate, secure energy supplies. The current procedure for awarding leases has maximized payments to the Federal Treasury, which once may have been a desirable goal. However, this system may no longer be in the public interest in view of the nation's growing requirements for secure supplies of energy at reasonable costs. Under prevailing practices, companies are forced to expend enormous sums for lease bonuses; such funds could be better employed for exploration and development activities.

A possible new approach to stimulate exploration and development of energy resources on government lands in frontier areas would be to adopt a system of work program bidding (i.e., companies submit programs to invest specified sums to explore and develop leases in a given period of time). This approach has been used with considerable success by Great Britain as a means of accelerating development of its North Sea gas resources.

In the case of oil and gas, this procedure could be applied to leasing of frontier areas and might be combined with compulsory early relinquishment of part of the acquired acreage after a specified period of time. Such a program would encourage early and extensive exploration of the leased area.

In the case of shale oil, work program bidding could stimulate technological research on mining and processing techniques. A viable program would have to insure that a company successful in its research endeavors would have access to sufficient government acreage to permit a substantial commercial application of this new technology. This is a serious deficiency in existing leasing arrangements.

Finally, the attractiveness of resource development on government lands would be further enhanced if lands were available for leasing for multiple uses. Under this system, leasing for one mineral would not preclude concurrent or subsequent leasing for other minerals.

4. <u>Improve Taxation Incentives</u>

Unfortunately for the nation's energy supply position, the percentage depletion allowance on petroleum was cut in the Tax Reform Act of 1969. This significantly reduced incentives for the development of domestic petroleum resources. To stimulate exploration for oil and gas, taxation incentives should be materially strengthened.

5. <u>Encourage Research Into the Production and Use of Energy</u>

Research into a broad range of energy matters may provide the means to increase energy supply at reduced costs. The breadth and diversity of of suitable research topics afford ample opportunities for both private and public sponsorship. In general, publicly financed activities should be directed to (a) environmental improvement, (b) pilot programs to develop the technology so that low grade, presently non-commercial domestic resources could be commercially developed, and (c) the more theoretical areas of research. Three areas for augmenting energy supplies that seem particularly appropriate for government-sponsored research are: perfection of a stack gas control device, which would permit the use of high sulfur coal without violating pollution control standards; conversion of shale oil and coal into synthetic fuels; and development of a breeder reactor.

6. Encourage Freedom of Entry by Companies Into Alternative Energy Businesses

Another means of promoting adequate domestic energy supplies at lowest possible cost would be to encourage a diversity of corporate effort in the development of the country's natural resources. Such a policy would foster competition and a greater flow of capital into energy activities. Competition in the various energy fuel industries is necessary to meet the goals of adequate fuel supplies, low prices, and rapid development of new technologies. Vigorous competition in turn requires freedom on the part of private companies to enter the various energy fuel industries, within the framework of our anti-trust laws.

Capital requirements for providing future energy supplies will be enormous. The National Petroleum Council in its report U.S. Energy Outlook, An Initial Appraisal 1971-1985 estimated that $174 billion will be needed in the 1971-1985 period for fossil and nuclear fuel operations, exclusive of retail marketing activities. Recent experience has demonstrated the beneficial effects of freedom of entry in regard to meeting capital requirements. For example, the entry of gas transmission companies into gas exploration and synthetic gas manufacture will mitigate to some extent the severe shortage of natural gas. Participation in the coal business by oil companies accelerated investment in coal operations and helped avert a threatened shortage of coal last year. Entry into uranium exploration by companies that had previously been both inside and outside the energy business has contributed to the discovery of substantial new reserves, thus helping to assure adequate fuel supplies for nuclear power plants.

Besides providing additional capital investments, freedom of entry across the several energy fields will be helpful in other ways. Flexibility in the use of limited skilled personnel, for example, will be encouraged. Skilled people can be shifted into areas where their talents can be put to the best use. Diverse talents from different fuel businesses can also be blended in such important areas as research and development. This is particularly true in the case of synthetic fuels.

Ultimately, the availability of long-term energy supplies of the U.S. will depend on the effective mobilization of these diverse talents of skilled people in the different energy industries to develop the nation's vast reserves of coal and shale. The development of these energy resources will require new gasification and liquefaction technologies, as well as very large capital outlays. (For example, about $500 million investment is required to provide 100,000 B/D of synthetic crude capacity from oil shale.) Inevitably, a long time will elapse from initial investment to commercial operations. These essential characteristics necessarily require large experienced companies to undertake the pioneering task of developing coal liquefaction and shale reserves. This fact should be recognized by the government and the public. Oil, gas, and coal companies are particularly well qualified to undertake these pioneering development activities and should be encouraged to do so.

7. Set Realistic Environmental Standards

The energy policy objective in this case should be to minimize air, water and radiation pollution in the production and use of energy while at the same time considering the effect of pollution regulations on other national goals.

To implement this policy objective, more rationality and less emotion are needed in government regulations. Such an approach should include (a) thorough public hearings on all aspects of the proposed regulation, (b) cost-benefit analysis of the regulation under consideration, and (c) an evaluation of the technical feasibility and optimum timing before the regulations are set.

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Senator BELLMON. (presiding). In the absence of the chairman, I will call Mr. Carl Madden as our next witness.

STATEMENT OF CARL H. MADDEN, CHIEF ECONOMIST, CHAMBER OF COMMERCE OF THE UNITED STATES

Mr. MADDEN. Thank you, Mr. Chairman, it is a privilege to appear in this important study of energy and energy policy.

My name is Carl H. Madden. I am chief economist of the National Chamber of Commerce of the United States. I am not an expert on energy economics and therefore my remarks will be concerned primarily with principles that seem to be important in raising the fundamental questions which a study such as this must raise in order to gain fundamental insight into the appropriate national energy policy.

Senator BELLMON. If I could interrupt, I would like to say it wasn't that the committee sought to call just experts, we want a broad look at the problems.

Senator RANDOLPH. Yes, the expert is seldom right, but never in doubt.

[Laughter.]

Mr. MADDEN. The United States of America is a Nation-State which has been a creature of western civilization, but which now exists in a "world-neighborhood" of nations drawn together by collapsing space and time. The people of the United States of America, occupying 6 percent of the world's land area, who have lived through periods of isolation from the world into an era of world leadership, now live on a planet perceived as "Spaceship Earth" as a result of their own explorations and discoveries.

As a creature of western civilization, the United States has been impelled in its pursuits of goals by a continuing search to enlarge human possibilities through the light of knowledge in a climate of freedom.

The increase in knowledge, since the days of Jefferson and Hamilton, has frustrated the specific goals of each but enlarged both the realm of choice and the means of making choices. Even so, the willingness of our country, in the main, to obey the Jeffersonian dictate: "For here, we may tolerate error, so long as reason is left free to combat it," has left broadly intact the framework goals of human freedom in the pursuit of knowledge throughout a post-renaissance epoch marked by war, violence, and dictatorship. This is an accomplishment not to be dismissed lightly.

In such a society any discussion of goals is tentative and not definite. National goals are more than a set of abstract expressions of desires and aspirations. They provide more than a framework of analysis. They are not only future-oriented, they are oriented to the past and the present. Although they may be competitive and contradictory, and may change with time, there is something about a nation's goals, in a nation founded as this one was, that should be permanent and adaptable to the shifting sands of taste as well as to the new perspective created by deepened understanding of the physical universe.

In other words, the goals of a people reflect their beliefs and aspirations as well as their resource limitations and their preference of activity. Perhaps the goal of highest priority is that of liberty of individuals to revise goals in recognition of new knowledge freely sought and tested by rational methods. Such goals are mutually interacting throughout the range of human consciousness, even impelling subconscious choice eventuating in aesthetic judgments. Energy policies are means to goals, but then, so are economic policies; both are means to human welfare.

Indeed, it is the profundity of the subject of national goals which frustrates efforts to agree on their substances, to price their attainment, or to achieve their authorizative statement. The adequacy of the Nation's goals for the future can at best be stated only in terms of assumptions and the state of the art of prediction, a wobbly art with few masters. The Nation needs, not one but many institutions for the study of the future. Since infinite possibilities inhere in the future, no one institution should have the only pipeline to it.

The question of a national energy policy goes directly to the heart of national goals issues. Liberty continues to be a valued and in itself in western civilization, notwithstanding the challenges portrayed in 1984, and those most recently issued by Harvard Professor B. F. Skinner. Economic freedom since the decline of feudalism and the rise of commercialism and the industrial revolution has been viewed as vital to liberty, to the efficient use of scarce resources, and to economizing the use of coercion to accomplish given purposes.

Economic efficiency is looming larger and being redefined because of the growing understanding of an emphasis on environment and quality of life. We are beginning to perceive, through admittedly rather dimly thus far, the cost as well as benefits of widely urgent environmental improvements. These pressures challenge the myths of the affluent society, which implicitly devalues the reality of genuine scarcity and the importance of the derivative need for economizing in the use of resources.

The market economy—with price flexibility and resource mobility, with opportunities for great profits and the risks of great losses and bankruptcy—is the organizing mechanism of a free society. Through the market the essential task of economic calculation is performed, including the feedback of the cost-benefit relationships of relative valuations. Economic calculation, the Achilles Heel of a command economy, is essential to rational economic decisions. A continuing goal should be the improvement of the market mechanism and its functioning. Other economic goals have included economic growth, and a reasonable degree of economic stability and economic security. The market mechanism provides the setting in which many contradictory goals can be reconciled.

The Employment Act of 1946 emphasizes maximum employment, production, and purchasing power. The Employment Act thus is far from being oriented toward long-range goals, and indeed perhaps more decisions meant to implement it have been short term and ameliorative in intent rather than being long range and directed to basic measures to establish conditions conducive to achieving the purposes of the act. One can but ask if such attention and thought have been devoted to long range goals, and the strategies that permit the voluntary coordination and cooperation of free people to those ends. Is the Employment Act of 1946 simplistic?—or has it been applied simplistically?

Shall we have to rethink relatively limited goals, and incorporate them in more complex national and world models that subsume both ecological and economic principles? Can we internalize and privatize social costs so that competitive markets can be relied upon to effect voluntary cooperation in the pursuit of broader goals? The needed kinds of institutional arrangements should be investigated.

Many, if not most, advances in knowledge are rooted in methodology. The methodology of determining the effects of the interdependence of mutual goals appears to be open for significant improvement through the use of the computer. Social policies are now based on mental models of social systems. But social systems are complex. To deal with this complexity we have, up to now, relied on the collective intelligence built into the structure of society and its institutions. However, such a reliance depends in the end on the melding of intuitive judgments. But in dealing with complex systems, intuitive judgment is more likely than not to worsen matters. The computer allows us to simulate the interacting effects of our assumptions through many time periods.

Recent simulations at MIT of world developments, prepared by Profs. Jay W. Forrester and Dennis Meadows, show the need to ask questions of more significance to mankind's survival than the questions that preoccupy many of us. The project attempts through a set of computer simulation models to identify long-term global prospects and evaluate alternative policies for their effects over the next 50 to 200 years. The major model asks the question, What are the interrelations between global population growth, pollution, food production, natural resources depletion, and economic development?

The implications of these models suggest not that we are approaching a golden age, but that we are living in it, and that it will end soon. Preliminary conclusions are:

One, there is no possibility of sufficient technological and cultural progress occurring in the next 100 years to sustain as many as 14 billion people on our globe. Since the doubling time of population is currently 32 years and decreasing, this means that sometime within the next 60 years population growth will undergo a profound deceleration, perhaps accompanied by or caused by vast disasters.

Two, there is no possibility of bringing the vast majority of those living in the developing countries up to the material standard of living enjoyed by the developed nations.

Three, there is a strong probability that the western nations will witness a market decline in their own material standard of living within the next three or four decades.

Four, there is no unique, optimal long-term population level. Rather, there is an entire set of tradeoffs between personal freedom, material and social standards of living, and the population level. Given the finite and diminishing stock of resources on this globe, we are inevitably compelled to recognize that more people implies a lower standard of living.

Five, there is, in theory, no fundamental human value which could not be better achieved through a substantial lowering of the global population base.

Six, there is a very strong probability that the transition to global equilibrium will involve a traumatic decline in population.

Several things can be said about these conclusions. For one thing, they are in general accord with other attempts to trace out global developments. For another, all such attempts have assumed that technological progress takes the form of increased productivity as conventionally defined, including conventional definitions of the nature of output, and conventional definitions of costs—and therefore of income and wealth. And in the third place, the conclusions flow from the existing state of the art in computer simulation.

In evaluating such conclusions, it is worth keeping in mind that, as Meadows says, "The first version of the main model is very simple and has not been empirically validated." The science fiction writer, Arthur C. Clarke, has often cautioned against categorical negative predictions by scientists, and the caution has enough empirical evidence to support it to be worth mentioning.

Forrester's conclusions, even so, are suggestive of new, significant questions. Among the implications for policy that emerge are:

One, industrialization may be a more fundamentally disturbing force in world ecology than is population. Medicine and health are included here as a part of industrialization.

Two, within the next century man may face a four-pronged dilemma—suppression of modern industrial society by a natural resource shortage; decline of world population as a result of changes caused by pollution; population decline from food shortage; or population decline from disease, social stresses, or war.

Three, we may now be living in a golden age better than what has come before, or is to come in the next century or so.

Four exhortation to population control alone could be self-defeating, by raising per capita food supply and living standards and thus raising population.

Five, a society with a high level of industrialization may be nonsustainable.

Professor Forrester's simulation models give emhasis to the question, Should or must we redefine our goals?

Shall we reject our wealth? In order to maintain present standards, we need all the wealth we have to cope with expected growth in world and national population. To reject future wealth is to force a drastic decline in population, a return to a lower level of technology, and to a lower quality of life, if by wealth we mean what men value.

Shall we limit population? Well, of course, but it is not enough. Limiting world population, given present culture, may only lead to increasing it later. Limiting U.S. population may not, given present, culture, reduce appreciably our drain on resources.

What, then, are the significant questions about goals and energy? Are the questions not far more profound than we have expected? Do they not go to the nature of our present culture, its values, its perception of wealth, of productivity, costs, and income, of progress and welfare?

In principle, the issue is that of full recognition that our modern scientific revolution centers around the two major concepts of thermodynamics: energy and entropy. The first law of thermodynamics asserts that in any closed energy system, energy is conserved. The second law of thermodynamics asserts that, in any closed energy system, entropy—roughly a measure of disorder—increases until equilibrium is reached. In other words, all systems tend to run down.

Ecological processes offset the disorder arising from entropy by built-in evolutionary tendencies, based on natural selection. Evolution, however, has often and implacably operated via catastrophe to a species unable to adapt to new conditions of life. In nature, evolutionary movement is from the simple to the complex, from the simple life form to the diverse. Driving these movements is the inclination of living systems to reduce entropy and to foster order by making useful energy available.

In general, our task is to fully recognize the significance of the laws of thermodynamics in our social systems on the globe of Earth. The scientific revolution offers us an escape from the entropy trap depicted by students of world development. One source of escape is to deliver more useful energy to our systems, to substitute energy for matter, and to use energy more efficiently. We need more energy, and the outlook is that our need for energy will continue to grow in the future.

Prof. Alvin Weinburg is optimistic about future energy supplies, anticipating significant technical and economic advances in breeder reactors, either in the uranium breeder or in the thorium breeder. Dr. Weinberg points out that the development of successful breeders could mean the availability of cheap, ubiquitous power, for which there might indeed be an elastic demand.

But even a seemingly inexhaustible supply of energy would leave us with the problem of the dissipation of energy. Less than perfect utilization of energy leaves byproducts that can affect our environment, creating potentially serious imbalances in the ecosystem. Thus, nuclear reactors pose problems of so-called heat pollution. The regassification of liquefied natural gas produces a refrigeration effect. Perhaps in all such instances we should devote more attention to capturing and utilizing those now unwanted or underutilized effects.

Indeed, there appears to be some confusion in the notion of a seemingly inexhaustible supply of energy and its relationship to the problem of maintaining the quality of the environment on earth. It would seem that concepts of inexhaustible energy supplies might land in the same wastebasket with discarded notions of inexhaustible land, free air, or inexhaustible supplies of oil and coal of an earlier era.

Without denying the need for an energy policy which fully utilizes existing or contemplated sources of energy, it would appear prudent to remain skeptical about the use of terms such as "inexhaustible." The issue of improving energy-conversion ratios, not only in fundamental mass-energy conversions where modern physics has achieved triumphs, but also in end-use convertors such as ordinary machines, might be an appropriate subject of inquiry for a study of energy policy.

The issue posed by environmentalists which appears to have validity for a fundamentally based energy policy is that of maintaining the world ecosystem in what may be called a steady state. It is not clear that the approach of the expanding use of energy in existing forms of technology, or even of substituting greater amounts of energy in existing forms of technology, or even of substituting greater amounts of energy for the use of materials, is more sophisticated than the brute-force strategy of 19th century heavy industry. The issue is not settled of the impact on the environmental balance of the summed effects of ever increasing use of energy, with little regard to improving the quality of use.

There is an increasing concern for maintaining the world ecosystem in a "steady state." Already, science empowers us to monitor the world weather and environment by satellite.

To establish environmental balance as one concern of economic policy has powerful implications. It is not clear, for example, that our conventional concern for full employment is wholly consistent with environmental balance, if the nature of available jobs remains unchanged. The object is not work for its own sake or as a means to redistribute income, but to redefine work and productivity to achieve environmental balance, and to internalize and privatize costs as means to the goal of environmental balance.

The idea implies an increasing interest in redefining wealth. The issue is not to stop the growth of wealth, but to redefine wealth. Our problem is not in the generalized concept of wealth, but in the specific forms of wealth.

In general, we overvalue forms of wealth which are entropy-creating and undervalue future forms of wealth which are entropy-offsetting. Thus, there seems little question that, with present patterns of production and consumption, as in the United States, spread over the world, there would result an environmental catastrophe before world population reached 5 billion people.

The present experiment in India of a TV network via satellite for educating Indians about limiting population and improving the quality of life is an immensely valuable form of wealth for mankind, a form of wealth which we are tragically neglecting elsewhere in our preoccupation with past forms of wealth.

The concept that all systems tend to run down implies that in the production process, all inputs eventuate in waste—except for what has been called "the collective mind of man." The idea is not clear but it is suggestive. Perhaps the best popular explanation is in an essay by Issaac Asimov. It refers to the evolutionary tendency for wealth to flow from ideas, from the mind of man.

As Dr. Weinberg has suggested, we in the world's most technologically advanced country find ourselves increasingly concerned with issues that transcend the currently conventional parameters of science and knowledge. The newly awakened interest in ecology has led increasingly, and especially so among young people to questions about the quality of life, about the ultimate nature of man, and, teleologically, about the purpose of man and life. These new interests thus are moving to reunite the fundamental branches of knowledge, of natural philosophy and of moral philosophy. Ecologists cannot ignore metaphysics.

In the short terms, emphasis must be given to transitional arrangements that facilitate the move to a more completely unified ecosystem that reflects and incorporates economic considerations. The president, in his message of June 4, 1971, affirmed the administration's support of research to insure an adequate supply of clean energy in the future.

The administration and Members of Congress are considering national fuels and energy policies, and even the possibility of establishing a national energy agency. Decisions about these issues could have far-ranging consequences, and should reflect the careful, deliberate evaluation of projections of the future as well as of the experiences of the past. Too often there is the possibility that the contributions of an administrative agency, in the long run, will net out negatively, because such agencies lack the mandate or means to achieve action on the basis of comprehensive understanding or increased knowledge.

Underpricing of energy is related to imposing private costs on society at large as social costs—environmental costs and those involving the health and safety of workers. Further, energy is overused, and inefficient proportions of the various fuels are used.

The price system provides guides to needed adjustments. For example, deregulation of natural gas producers would be expected to result in higher prices, signalling that natural gas is valued more highly than it has been, that it ought to be employed in the more valuable uses, that it should be economized in all uses, and that producers would be justified in intensifying research, exploration, and development activities.

Deregulation, and reliance on the market mechanism, suggests an answer to the question of how best to organize fuel and energy activities. Competitive pricing and the internalization and a privatization of costs through new and broader rules of the game offer the opportunity to move forward simultaneously along desired lines. Incentives to research and technological innovation would be provided along with flexibility in the choice and application of means.

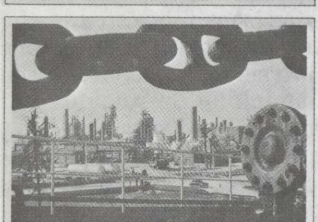
Better pricing of the earth's resources would favor conservation, or the balancing of preferences for future against present consumption. Ecological requirements could be advanced through privatization, thereby avoiding the tragedy of the commons, of which Prof. Garrett Hardin has written so effectively. User costs could be better related to user benefits, providing greater equity as well as greater incentives to economize the use of scarce resources.

Internalizing and privatizing costs will help all of us—as consumers, as producers, as environmentalists, or as just citizens interested in the quality of life—to make our own individual cost-benefit comparisons and act accordingly. In other words, the analysis of tradeoffs, in the current jargon, would be clarified and decisionmaking presumably improved through greater knowledge. The substitution of services—that is, improvements in the quality of life, or environmental improvements—for products likewise would be facilitated under conditions that would maximize individual participation in cost-benefit comparisons and decisions about environmental, ecological, and economic choices.

As stated earlier, we live in a period of culture crisis. Gains in human welfare may depend upon our ability to pose fundamental questions about national goals. Certainly such questions deserve fundamental answers. What the basic questions are appears to be the first issue to which this committee might address itself.

Thank you.

(Mr. Madden's prepared statement follows:)



Statement of the

CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA

on: National Goals and Energy Policy

to: Senate Interior and Insular Affairs Committee

by: Dr. Carl H. Madden

date: October 15, 1971

CHAMBER OF COMMERCE OF THE UNITED STATES

The Nation's largest business federation representing local and state chambers of commerce, trade and professional associations, and business firms.

STATEMENT
on
NATIONAL GOALS AND ENERGY POLICY
for submission to the
SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE
for the
CHAMBER OF COMMERCE OF THE UNITED STATES
by
DR. CARL H. MADDEN*
October 15, 1971

Perhaps the most important thing to say about national goals at the outset is that in a free society goals ought to be determined by the people and not for the people.

And perhaps the most important thing to say about energy policy at the outset is that, as a tool for attaining human welfare, energy policy is too important to our civilization and the quality of life for the energy industries to be stultified by ill-conceived or excessive administration regulations.

If the growing forces of change -- social, environmental, technological -- pose fundamental questions about national goals, these questions deserve fundamental answers. Otherwise, the cultural crisis through which we are living may end in frustration rather than in achievement of gains in human welfare.

National Goals

The United States of America is a nation-state which has been a creature of western civilization, but which now exists in a "world-neighborhood" of nations drawn together by collapsing space and time. The people of the United States of America, occupying six per cent of the world's land area, who have lived through periods of isolation from the world into an era of world leadership, now live on a planet perceived as "Spaceship Earth" as a result of their own explorations and discoveries.

As a creature of western civilization, the United States has been impelled in its pursuits of goals by a continuing search to enlarge human possibilities through the light of knowledge in a climate of freedom.

The increase in knowledge, since the days of Jefferson and Hamilton, has frustrated the specific goals of each but enlarged both the realm of choice and the means of making choices. Even so, the willingness of our country, in the

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*Chief Economist, Chamber of Commerce of the United States main, to obey the Jeffersonian dictate: "For here, we may tolerate error, so long as Reason is left free to combat it," has left broadly intact the framework goals of human freedom in the pursuit of knowledge throughout a post-Renaissance epoch marked by war, violence, and dictatorship. This is an accomplishment not to be dismissed lightly.

In such a society any discussion of goals is tentative and not definite. National goals are more than a set of abstract expressions of desires and aspirations. They provide more than a framework of analysis. They are not only future-oriented, they are oriented to the past and the present. Although they may be competitive and contradictory, and may change with time, there is something about a nation's goals, in a nation founded as this one was, that should be permanent and adaptable to the shifting sands of taste as well as to the new perspectives created by deepened understanding of the physical universe.

In other words, the goals of a people reflect their beliefs and aspirations as well as their resource limitations and their preference of activity. Perhaps the goal of highest priority is that of liberty of individuals to revise goals in recognition of new knowledge freely sought and tested by rational methods. Such goals are mutually interacting throughout the range of human consciousness, even impelling subconscious choice eventuating in aesthetic judgments. Energy policies are means to goals, but then, so are economic policies; both are means to human welfare.

Indeed, it is the profundity of the subject of national goals which frustrates efforts to agree on their substances, to price their attainment, or to achieve their authoritative statement. The adequacy of the nation's goals for the future can at best be stated only in terms of assumptions and the state of the art of prediction, a wobbly art with few masters. The nation needs, not one but many, institutions for the study of the future. Since infinite possibilities inhere in the future, no one institution should have the only pipeline to it.

National Goals and Energy Policy

The question of a national energy policy goes directly to the heart of national goals issues. Liberty continues to be a valued end in itself in western civilization, notwithstanding the challenges portrayed in 1984, and those most recently issued by Harvard Professor B. F. Skinner. Economic freedom, since the decline of feudalism and the rise of commercialism and the industrial revolution, has been viewed as vital to liberty, to the efficient use of scarce resources, and to economizing the use of coercion to accomplish given purposes. Economic efficiency is looming larger and being redefined because of the growing understanding of an emphasis on environment and quality of life. We are beginning to perceive, though admittedly rather dimly thus far, the costs as well as benefits of widely urged environmental improvements. These pressures challenge the myth of the affluent society, which implicitly devalues the reality of genuine scarcity and the importance of the derivative need for economizing in the use of resources.

The market economy -- with price flexibility and resource mobility, with opportunities for great profits and the risks of great losses and bankruptcy -- is the organizing mechanism of a free society. Through the market the essential task of economic calculation is performed, including the feedback of the cost-benefit relationships of relative valuations. Economic calculation, the Achilles heel of a command economy, is essential to rational economic decisions. A continuing goal should be the improvement of the market mechanism and its functioning. Other economic goals have included economic growth, and a reasonable degree of economic stability and economic security. The market mechanism provides the setting in which many contradictory goals can be reconciled.

The Employment Act of 1946 emphasized maximum employment, production, and purchasing power. The Employment Act thus is far from being oriented towards long-range goals, and indeed perhaps more decisions meant to implement it have been short-term and ameliorative in intent rather than being long-range and directed to basic measures to establish conditions conducive to achieving the purposes of the Act. One can but ask if much attention and thought have been devoted to long-range goals, and the strategies that permit the voluntary coordination and cooperation of free people to those ends. Is the Employment Act of 1946 simplistic? -- or has it been applied simplistically?

Shall we have to rethink relatively limited goals, and incorporate them in more complex national and world models that subsume both ecological and economic principles? Can we internalize and privatize social costs so that competitive markets can be relied upon to effect voluntary cooperation in the pursuit of broader goals? The needed kinds of institutional arrangements should be investigated.

The World Predicament

Many, if not most, advances in knowledge are rooted in methodology. The methodology of determining the effects of the interdependence of mutual goals appears to be open for significant improvement through the use of the computer. Social policies are now based on mental models of social systems. But social systems are complex. To deal with this complexity we have, up to now, relied on the collective intelligence built into the structure of society and its institutions. However, such a reliance depends in the end on the melding of intuitive judgments. But in dealing with complex systems, intuitive judgment is more likely than not to worsen matters. The computer allows us to simulate the interacting effects of our assumptions through many time periods.

Recent simulations at MIT of world developments, prepared by Professors Jay W. Forrester and Dennis Meadows, show the need to ask questions of more significance to mankind's survival than the questions that preoccupy many of us. The project attempts through a set of computer simulation models to identify long term global prospects and evaluate alternative policies for their effects over the next 50 to 200 years. The major model asks the question, What are the interrelations between global population growth, pollution, food production, natural resources depletion, and economic development?

The implications of these models suggest not that we are approaching a Golden Age, but that we are living in it, and that it will end soon. Preliminary conclusions are:

1. There is no possibility of sufficient technological and cultural progress occurring in the next 100 years to sustain as many as fourteen billion people on our globe. Since the doubling time of population is currently 32 years and decreasing, this means that sometime within the next 60 years population growth will undergo a profound deceleration, perhaps accompanied by or caused by vast disasters.
2. There is no possibility of bringing the vast majority of those living in the developing countries up to the material

standard of living enjoyed by the developed nations.

3. There is a strong probability that the western nations will witness a marked decline in their own material standard of living within the next three or four decades.

4. There is no unique, optimal long-term population level. Rather, there is an entire set of trade-offs between personal freedom, material and social standards of living, and the population level. Given the finite and diminishing stock of resources on this globe, we are inevitably compelled to recognize that more people implies a lower standard of living.

5. There is, in theory, no fundamental human value which could not be better achieved through a substantial lowering of the global population base.

6. There is a very strong probability that the transition to global equilibrium will involve a traumatic decline in population.

Several things can be said about these conclusions. For one thing, they are in general accord with other attempts to trace out global developments. For another, all such attempts have assumed that technological progress takes the form of increased productivity as conventionally defined, including conventional definitions of the nature of output, and conventional definitions of costs -- and therefore of income and wealth. And in the third place, the conclusions flow from the "existing state of the art" in computer simulation.

In evaluating such conclusions, it is worth keeping in mind that, as Meadows says, "The first version of the main model is very simple and has not been empirically validated." The science fiction writer, Arthur C. Clarke, has often cautioned against categorical negative predictions by scientists, and his caution has enough empirical evidence to support it to be worth mentioning.

Forrester's conclusions, even so, are suggestive of new, significant questions. Among the implications for policy that emerge are:

1. Industrialization may be a more fundamentally disturbing force in world ecology than is population. (Medicine and health are included here as a part of industrialization.)

2. Within the next century man may face a four-pronged dilemma -- suppression of modern industrial society by a natural resource shortage; decline of world population as a result of changes caused by pollution; population decline from food shortage; or population decline from disease, social stresses, or war.

3. We may now be living in a "golden age" better than what has come before or is to come in the next century or so.

4. Exhortation to population control alone could be self-defeating, by raising per capita food supply and living standards and thus raising population.

5. A society with a high level of industrialization may be nonsustainable.

Professor Forrester's simulation models give emphasis to the question, Should or must we redefine our goals?

Shall we reject our wealth? In order to maintain present standards, we need all the wealth we have to cope with expected growth in world and national population. To reject future wealth is to force a drastic decline in population, a return to a lower level of technology, and to a lower quality of life, if by wealth we mean what men value.

Shall we limit population? Well, of course, but it is not enough. Limiting world population, given present culture, may only lead to increasing it later. Limiting United States population may not, given present culture, reduce appreciably our drain on resources.

What, then, are the significant questions about goals and energy? Are the questions not far more profound than we have expected? Do they not go to the nature of our present culture, its values, its perception of wealth, of productivity, costs, and income, of progress and welfare?

The Scientific Revolution and Energy Policy

In principle, the issue is that of full recognition that our modern scientific revolution centers around the two major concepts of thermodynamics: energy and entropy. The first law of thermodynamics asserts that in any closed energy system, energy is conserved. The second law of thermodynamics asserts that, in any closed energy system, entropy (roughly a measure of disorder) increases until equilibrium is reached. In other words, all systems tend to run down.

Ecological processes offset the disorder arising from entropy by built-in evolutionary tendencies, based on natural selection. Evolution, however, has often and implacably operated via catastrophe to a species unable to adapt to new conditions of life. In nature, evolutionary movement is from the simple to the complex, from the simple life form to the diverse. Driving these movements is the inclination of living systems to reduce entropy and to foster order by making useful energy available.

In general, our task is to fully recognize the significance of the laws of thermodynamics in our social systems on the globe of Earth. The scientific revolution offers us an escape from the entropy trap depicted by students of world development. One source of escape is to deliver more useful energy to our systems, to substitute energy for matter, and to use energy more efficiently. We need more energy, and the outlook is that our need for energy will continue to grow in the future.

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But even a seemingly inexhaustible supply of energy would leave us with the problem of the dissipation of energy. Less than perfect utilization of energy leaves by-products that can affect our environment, creating potentially serious imbalances in the ecosystem. Thus, nuclear reactors pose problems of so-called heat pollution. The regassification of liquefied natural gas produces a refrigeration effect. Perhaps in all such instances we should devote more attention to capturing and utilizing those now unwanted or underutilized effects.

Indeed, there appears to be some confusion in the notion of a "seemingly inexhaustible supply of energy" and its relationship to the problem of maintaining the quality of the environment on earth. It would seem that concepts of "inexhaustible" energy supplies might land in the same wastebasket with discarded notions of "inexhaustible land," "free air," or "inexhaustible supplies of oil and coal" of an earlier era.

Without denying the need for an energy policy which fully utilizes existing or contemplated sources of energy, it would appear prudent to remain skeptical about the use of terms such as "inexhaustible." The issue of improving energy-conversion ratios, not only in fundamental mass-energy conversions where modern physics has achieved triumphs, but also in end-use convertors such as ordinary machines, might be an appropriate subject of inquiry for a study of energy policy.

The issue posed by environmentalists which appears to have validity for a fundamentally-based energy policy is that of maintaining the world eco-system in what may be called a steady state. It is not clear that the approach of expanding the use of energy in existing forms of technology, or even of substituting greater amounts of energy for the use of materials, is any more sophisticated than the brute-force strategy of nineteenth century heavy industry. The issue is not settled of the impact on the environmental balance of the summed effects of ever-increasing use of energy, with little regard to improving the quality of use.

There is an increasing concern for maintaining the world ecosystem in a "steady state." Already, science empowers us to monitor the world weather and environment by satellite.

To establish environmental balance as one concern of economic policy has powerful implications. It is not clear, for example, that our conventional concern for full employment is wholly consistent with environmental balance, if the nature of available jobs remains unchanged. The object is not work for its own sake or as a means to redistribute income, but to redefine work and productivity to achieve environmental balance, and to internalize and privatize costs as means to the goal of environmental balance.

The idea implies an increasing interest in redefining wealth. The issue is not to stop the growth of wealth, but to redefine wealth. Our problem is not in the generalized concept of wealth, but in the specific forms of wealth.

In general, we overvalue forms of wealth which are entropy-creating and undervalue future forms of wealth which are entropy-offsetting. Thus, there seems little question that, with present patterns of production and consumption, as in the United States, spread over the world, there would result an environmental catastrophe before world population reached five billion people.

The present experiment in India of a TV network via satellite for educating Indians about limiting population and improving the quality of life is an immensely valuable form of wealth for mankind, a form of wealth which we are tragically neglecting elsewhere in our preoccupation with past forms of wealth.

The concept that all systems tend to run down implies that in the production process, all inputs eventuate in waste -- except for what has been called "the collective mind of man." The idea is not clear but it is suggestive. Perhaps the best popular explanation is in an essay by Isaac Asimov. It refers to the evolutionary tendency for wealth to flow from ideas, from "the mind of man."

And as Dr. Weinberg has suggested, we in the world's most technologically advanced country find ourselves increasingly concerned with issues that transcend the currently conventional parameters of science and knowledge. The newly awakened interest in ecology has led increasingly, and especially so among young people, to questions about the quality of life, about the ultimate nature of man, and, teleologically, about the purpose of man and life. These new interests thus are moving to reunite the fundamental branches of knowledge, of natural philosophy and of moral philosophy. Ecologists cannot ignore metaphysics.

Economics and Energy Policy

In the short term, emphasis must be given to transitional arrangements that facilitate the move to a more completely unified ecosystem that reflects and incorporates economic considerations. The President, in his message of June 4, 1971, affirmed the Administration's support of research to insure an adequate supply of clean energy in the future. The Administration and members of Congress are considering national fuels and energy policies, and even the possibility of establishing a national energy agency. Decisions about these issues could have far-ranging consequences, and should reflect the careful, deliberate evaluation of projections of the future as well as of the experiences of the past. Too often there is the possibility that the contributions of an administrative agency, in the long run, will net out negatively, because such agencies lack the mandate or means to achieve action on the basis of comprehensive understanding of increased knowledge.

Underpricing of energy is related to imposing private costs on society at large as social costs -- environmental costs and those involving the health and safety of workers. Further, energy is overused, and inefficient proportions of the various fuels are used.

The price system provides guides to needed adjustments. For example, deregulation of natural gas producers would be expected to result in higher prices, signalling that natural gas is valued more highly than it has been, that it ought to be employed in the more valuable uses, that it should be economized in all uses, and that producers would be justified in intensifying research, exploration and development activities.

Deregulation, and reliance on the market mechanism, suggests an answer to the question of how best to organize fuel and energy activities. Competitive pricing and the internalization and privatization of costs through new and broader rules of the game offer the opportunity to move forward simultaneously along desired lines. Incentives to research and technological innovation would be provided along with flexibility in the choice and application of means.

Better pricing of the earth's resources would favor conservation, or the balancing of preferences for future against present consumption. Ecological requirements could be advanced through privatization, thereby avoiding "the tragedy of the commons," of which Professor Garrett Hardin has written so effectively. User costs could be better related to user benefits, providing greater equity as well as greater incentives to economize the use of scarce resources.

Internalizing and privatizing costs will help all of us -- as consumers, as producers, as environmentalists, or as just citizens interested in the quality of life -- to make our own individual cost-benefit comparisons and act accordingly. In other words, the analysis of trade-offs, in the current jargon, would be clarified and decision-making presumably improved through greater knowledge. The substitution of services (that is, improvements in the quality of life, or environmental improvements) for products likewise would be facilitated under conditions that would maximize individual participation in cost-benefit comparisons and decisions about environmental, ecological, and economic choices.

Conclusion

As stated earlier, we live in a period of culture crisis. Gains in human welfare may depend upon our ability to pose fundamental questions about national goals. Certainly such questions deserve fundamental answers. What the basic questions are appears to be the first issue to which this Committee might address itself.

Senator BELLMON. Probably you heard the signal just sounded for us to come and vote, and I believe Senator Allott and I should both do so before we miss our opportunity, so we would like to recess the hearing for approximately 10 minutes while we go cast our votes, then we will return.

[Recess.]

Senator ALLOTT (presiding). The committee will come to order. The committee will resume hearing.

The next witness is Mr. Robert Mead, president, Independent Petroleum Association of America.

STATEMENT OF ROBERT MEAD, PRESIDENT, INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

Mr. MEAD. It is a great pleasure to be here and I would like to state that we feel this particular committee is probably better staffed to make this kind of study than any other committee in the Senate. So, we are very proud to be able to present our testimony.

Our organization feels that to get increasing productivity, greater employment, expanding national income and higher standards of living in the United States, we have to become directly dependent on the use of more and more energy primarily in the form of oil and gas.

U.S. energy policies, therefore, should serve the basic national goals of assuring access to adequate oil and gas supplies at reasonable prices, with reserve domestic capabilities to meet requirements of national security.

I quite agree with Mr. McLean that national security should be our number one objective. In order to have these things, we have to have the maintenance of a healthy and expanding domestic petroleum industry. It is imperative that energy policies recognize unique characteristics of this industry, such as: first, the high risk inherent in petroleum exploration and the long time lag before production is established; second, the fact that no other major industry is confronted with the needs to reinvest capital on a comparable scale to replace depleting assets and; third, the essential role of independent producers and the multiplicity of effort required to discover mineral and domestic oil and gas supplies.

If these characteristics are recognized, reserves can be expanded in keeping with growing national requirements. If not, the United States could run out of oil and gas as a matter of choice, not as a matter of necessity. Now, if you ask the head of the Russian department responsible for production of oil and gas what their policy was, he would look you right in the eye and say, our policy is to be self-sufficient. If other strong nations have a policy of self-sufficiency, I think that is the least our country can try to achieve.

For more than a decade U.S. oil and gas exploration, drilling, and the ratio of crude reserves to consumption have been declining. Annual expenditures by independent producers have dropped by more than $1 billion or about 50 percent. These unhealthy trends have resulted from progressively worsening economic incentives, including a steady decline in real prices for oil and gas, including a proliferation of exemptions and special treatments which have greatly reduced the effectiveness of the oil import program, including unrealistic regulation of natural gas prices by the Federal Power Commission, changes in the Federal income tax provisions that syphon off an additional $700 million per year from domestic petroleum exploration and development, and a leasing system that emphasizes bonuses rather than development for petroleum operations on the public domain.

If present trends are permitted to continue, our Nation faces critical shortages of natural gas and an intolerable increase in the dependency on foreign oil, particularly from unstable sources in the eastern hemisphere.

National security would be imperiled and the effect on our international balance of payments would be disastrous.

This payments imbalance seems to be an item of great concern to the present administration, and the payment for imported crude oil constitutes a sizeable amount of that problem.

The Independent Petroleum Association, therefore, urges the committee and the Congress to give priority consideration to the following:

First, the establishment by legislation of a peril point for dependence on petroleum imports. In this connection I have an analysis of such a peril point study which we prepared and request it be included in the report.

Second, legislative relief for producers of natural gas as to the wellhead price by the Federal Power Commission so as to permit interfuel competition to function freely in the marketplace in order to bring forth adequate natural gas supplies.

I have just come from a meeting in Boston and listened to the distributors of natural gas plan about the fact that they can't supply their customers or their future customers.

Third, the enactment of special tax incentives for increased exploration and development. Such as an investment tax credit for expenditures for domestic oil and gas exploration and development of new oil and gas supplies. Expenditures for secondary and tertiary recovery operations.

In simple terms, this means water flooding, fire flooding, and other techniques that we use to get oil out of the ground when it won't come out of its own accord with a pump.

Fourth, the encouragement of maximum participation of the independent segment of the petroleum industry in the exploration and development of the public domain.

Thank you very much.

(The full statement follows:)

Before the

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
U. S. SENATE

Symposium on

ENERGY POLICY AND NATIONAL GOALS

Submitted by

INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

Robert E. Mead, President

L. Dan Jones, General Counsel

1101 Sixteenth Street, N. W.
Washington, D. C. 20036

October 20, 1971

ENERGY POLICY AND NATIONAL GOALS

Throughout the history of the advancing nations there has been a pattern of increasing use of inanimate energy. The use of inanimate energy powered machinery has contributed directly to increased productivity across all aspects of the economy, resulting in a rising living standard. In the United States as well as other advanced nations, there has been a very close relationship between per capita use of energy and economic development.

This experience reveals a firm relationship between economic growth and the use of energy. It would follow, therefore, that if our national goals continue to call for economic growth, then the U. S. will need increasing supplies of energy. The question is raised - will our national goals call for continued economic growth? In this regard, it is submitted that it is reasonable and realistic to assume that basic national goals will not be substantially altered for many years and particularly during the short-term first time frame of the Committee Study, namely, the period 1971-1980. Although national goals can be expected to be changed from time to time, it would require many years to shift the course of the Nation in its customs and habits in the use of energy. There is no indication that the U. S. consuming public is ready to curtail energy use; to the contrary there is every indication that our economy will be more energy intensive - not less.

The present energy and fuel supply crisis, with threatened shortages now the cause of widespread concern, calls for prompt review of energy policies. Already clearly defined problems should receive priority attention so that corrective actions may be taken at the earliest possible time.

It would be unfortunate, therefore, if the study should, in its initial stages, become burdened with a fixation to reexamine national goals - such as the concept of zero economic growth - that under any circumstances cannot be altered to any material degree during the first time frame of the study and perhaps well beyond; or that long-range considerations should cause delay in reaching decisions on problems that are now seriously threatening our energy posture.

This analysis, hereinafter, is confined to petroleum's (both oil and natural gas) place in the years immediately ahead, in a growth economy that requires increasing supplies of these energy sources.

Oil and natural gas are the primary sources of fuel and power in the United States, supplying 75 percent of our total energy requirements. For the next decade and well beyond the preponderance of evidence establishes a firm expectation that oil and natural gas will continue to be the primary source of energy for both growing peacetime consumer needs and national security requirements.

Government policies should be responsive to this outlook as to the place of oil and natural gas in our total energy needs if the Nation's historic position of an abundance of energy is to be maintained to insure the attainment of our broad national goals. Alternate or substitute sources should be examined and encouraged for the long term but if short term energy problems are to be averted it would appear to be essential that the declining trends in the exploration and development of oil and natural gas must be reversed.

Basic Objectives

In serving the public interest, national petroleum policies should have as basic goals:

1. Assurance to the consuming public of adequate oil and gas supplies at reasonable prices.

2. Assurance to the consuming public of the adequacy of readily available supplies of oil and gas free from interruption or threat thereof.

3. Assurance to the Nation of capabilities and capacities, over and above peacetime requirements, for security and defense needs in time of emergency.

These objectives can be realized only with the maintenance of a healthy and expanding domestic petroleum industry with adequate production, transportation, refining and distribution facilities to meet our growing petroleum requirements. The attainment of these objectives must, of course, be accomplished in a manner consonant with other national goals such as an improved environment.

Basic Considerations

National petroleum policies, if they are to be effective in eliciting adequate petroleum supplies, must recognize at the outset a number of considerations fundamental to the discovery, development and production of oil and natural gas.

First, government policies as to petroleum are, in effect, the controlling determinant of oil and gas supply. Adequate supplies can be made available from domestic resources, known and potential, as long as national policy so wills.

Second, there is the unique characteristic of unusual risk and uncertainty inherent in petroleum exploration and development. As the search for oil and gas extends to more remote areas and greater depths, these risks and uncertainties increase.

Third, crude oil and natural gas are the joint products resulting from the exploration, development and production activities of a single industry - the petroleum producing industry.

Fourth, the industry has demonstrated its efficiency through technological advances and cost reductions that have enabled it to supply increasing demands at no appreciable increase in real prices during the past century.

Fifth, no other major industry faces reinvestment of capital on a comparable scale to replace depleting assets.

Sixth, if increased petroleum requirements are to be met the drastic decline of recent years in total wells drilled must be reversed which means increased expenditures. The needed level of expenditures is very substantial and is estimated to range from $7 billion to $10 billion annually as compared with the average of recent years of some $5 billion.

Seventh, the petroleum industry to a greater extent than other major industries, has relied upon internally generated funds for exploration and development investments.

Eighth, consideration should be given to availability of alternative sources, but it must be recognized that alternative sources such as shale oil, gas and oil from coal, tar sands, or imported liquefied natural gas (LNG),

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cannot make any substantial contribution in filling the gap for many years and the cost projections are higher than conventional sources.

Ninth, historically the independent producer has been predominant in exploration and development of oil and natural gas reserves; if the tremendous requirements of the future are to be met the independent segment of the petroleum industry must be revitalized and reactivated.

U. S. Resource Base

There are vast provinces within the United States favorable to future discovery and development of oil and gas to meet our growing needs. Studies published by the U. S. Geological Survey, the Department of the Interior, the National Petroleum Council and the Potential Gas Committee sponsored by the Colorado School of Mines confirm that there is plenty of oil and natural gas waiting to be found in the United States.

All of these authoritative studies provide convincing evidence that the oil and natural gas resources within the United States are ample to provide our needs for decades to come.

Government policies as to oil and natural gas, therefore, will determine whether or not, and to what extent, available domestic resources will be developed. Under sound policies, the petroleum industry has demonstrated its ability to cope with the economic and technical problems involved in finding, developing and producing the Nation's petroleum resources.

The basic problems were succinctly brought into clear focus by the Honorable Hollis M. Dole, Assistant Secretary, Mineral Resources, Department of the Interior, before the National Energy Forum, Washington, D. C., September 24, 1971 when he stated as follows:

"My theme is that we have, within the boundaries of the United States, all the energy resources we need to give us any degree of self-sufficiency we choose to maintain, for as long as we choose to maintain it, but at a cost. And because there is a cost attached, the choice of maintaining this self sufficiency is overwhelmingly a political decision. Absent such a declared political objective, and a set of policies aimed at attaining it, we can predict with almost actuarial certainty the acceleration of the trends that are now evident: the forfeiture to oil of markets formerly held by coal and gas concurrent with the decline in domestic petroleum supply, which must in turn be made good by rising imports of oil, increasingly from the Eastern Hemisphere.

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This is the prospect, and as you may already have surmised, my thesis depends upon acceptance of the premise that it is worth the extra present cost we must pay to develop and use our domestic energy resources. Otherwise, I have no case, and we ought to be content to let our energy needs be served by the world market under the prevailing terms of trade. My presentation must therefore be rationalized in terms of certain objectives deemed essential to the national interest. Reliability of supply is one of them. Balance of payments might well be another."

Deteriorating conditions in the domestic producing industry in recent years have so imperilled the Nation's strength as to oil and gas supplies that it would seem clearly evident that we should now squarely face the hard decision posed by Secretary Dole.

Should the United States run out of oil and natural gas it would do so as a matter of choice - not as a matter of necessity.

The Role of the Independent Producer

The smaller industry units - the thousands of independent producers whose business is exploration and production alone - historically have played an important role in the discovery of oil and gas in the United States. The multiplicity of effort from thousands of independents searching for new deposits has resulted in substantial additions of new reserves in the various producing areas in more than 30 states of the Nation. The independent producer develops the prospects for exploratory and development ventures and initiates the drilling of the bulk of the wells. Unfortunately the declining incentive for investments in U. S. exploration and development since the mid-1950's has been accompanied by a sharp decline in drilling and as a result a large number of mergers and sell-outs of properties have seriously diminished the ranks of the independents.

The degree of decline of independent producers is evidenced by the fact that this group in the aggregate has decreased exploration and development expenditures very substantially during this period. In 1956, for example, exploration and development expenditures by independents totalled $2.5 billion or 48 percent of the total industry expenditures. In 1969, expenditures by independents seeking new domestic oil and gas supplies amounted to $1.3 billion or 25 percent of the industry total.

Changes in activities during this period can be attributed to changes in the outlook for profitability on new investments to find and develop domestic oil and gas as related to alternate investments. Improved technology has continued to help industry find, develop, and produce additional resources efficiently and economically. However, other factors have worked in the opposite direction. These include increasing volumes of imports, federal regulation of wellhead gas prices, increased costs of materials and services and depressed prices for oil and gas in relation to the inflationary economy.

It would seem to be self-evident that exploration and drilling must be expanded if we are to find new reserves adequate to restore our strength as to petroleum fuels, and that a revitalized role of independent producers will be necessary to meet this challenge.

<u>Research Effort</u>

The vast quantities of petroleum that can be made available by secondary and tertiary methods of recovery are a basic consideration in national oil and gas policies. This large source, certainly for the short term, deserves priority attention over many other alternatives such as synthetics from coal and oil shale, geothermal sources, and imported LNG.

At the present time only 30 percent of the oil in place in underground reservoirs is recoverable with existing technology. This recovery factor applies to oil already found from moneys already expended. New exploration dollars are not needed to locate these supplies - yet 70 percent of the oil in place, almost 3 barrels out of 4, remains unrecovered. If we could increase our rate of recovery from 30 to 31 percent, a single percent of the total oil in place, some 4 billion barrels would be added to our proved reserves and each additional percent would do the same. Continued progress in technical research and the maintenance of a favorable economic climate are essential to the expanded use of improved recovery techniques.

In this regard, the role of the independent is also particularly important. Historically the independents have taken the lead in developing such important secondary producing areas as Pennsylvania, the Illinois Basin, Kansas and the older fields of Oklahoma and Texas.

Consideration should be given to availability of alternate sources of synthetic fuel from domestic sources such as liquid fuels and gas from coal, oil shale, tar sands and other sources, but research as to the feasibility of these sources is still in the laboratory or pilot plant stage and costs are still very uncertain.

For the short term, therefore, wisdom would seem to dictate that priority be given to conventional sources of oil and natural gas. If this course is followed, private capital in a competitive economy will provide assurance of adequate energy at the lowest possible costs to the consumer.

National Oil and Gas Policies

Under present oil and natural gas policies the development of domestic reserves of these vital fuels is declining markedly in relation to demand. The Nation is drifting, unnecessarily, into greater dependence on foreign supplies, particularly from the Eastern Hemisphere. There is no need to continue to drift in this direction but to correct the trend will require alterations in basic policies.

The National Petroleum Council on July 15, 1971, in its report "U. S. Energy Outlook, An Initial Appraisal 1971-1985" stated:

> "1. Continuation of present government policies and economic conditions would lead to significantly increased U. S. dependence on foreign energy resources, mostly in the form of oil from Eastern Hemisphere countries, and to an acute shortage of gas.
>
> 2. Potential energy resources of the United States would support higher growth rates for domestic supplies given adequate economic incentives and careful coordination of effort between government and industry.
>
> 3. Capital requirements to meet U. S. energy needs through 1985 are extremely large and will be difficult to obtain unless the general economic climate in the energy resource industries is improved."

Future domestic oil and gas supplies, in essence, depend on increased expenditures for exploration, development and production.

However, certain existing government policies have tended to discourage such expenditures, including the following:

1. Oil Import Policy - existing controls instituted in 1959 have been systematically loosened and rendered ineffective. Exemptions, exceptions and special treatments have proliferated since 1965. The oil import program has, therefore, become "open ended," subject to pressures for ever-rising imports and ever-growing dependency on insecure foreign oil with no established guideline as to the stopping point. For example, in 1966 imports of heavy industrial fuel oil were decontrolled with the result that the important East Coast industrial area is now dependent on imports for 95 percent of its heavy fuel oil requirements. The Administration is now being vigorously urged to remove or loosen import restrictions from home heating oil. Such action would largely make the Mandatory Oil Import Program meaningless.

During the past five years, total oil imports have increased from 20 percent of U. S. oil consumption to 25 percent in 1971. Unless present government oil policies are changed and economic conditions improved, the United States by 1985 will be dependent on foreign oil for some 60 percent of its supplies.

This degree of dependency for oil supplies from uncertain foreign sources would appear on its face to be totally unacceptable.

This outlook strongly suggests the need for Government to establish a peril point for dependency on petroleum imports. It would provide a goal toward which other national policies affecting energy development could be directed.

2. Natural Gas Wellhead Price Regulation - the unrealistic wellhead prices fixed by the Federal Power Commission for natural gas moving into the interstate market have resulted in soaring gas demand while at the same time discouraging the producers of gas from investing in the search for new reserves. The inevitable result - the present natural gas shortage.

The very critical problem of natural gas supplies facing the nation, with a real threat of serious shortages, has been caused by seventeen years of impractical and very frustrating federal price regulation of a commodity that is competitively produced and sold. This long unfortunate experience under federal price regulation very strongly suggests that a complete new method and approach is required. Mere modification of old methods will not suffice. The gravity of today's gas supply situation requires and fully justifies prompt corrective action by Congress.

The realistic and only effective course that would bring relief soon enough, would be complete decontrol of wellhead gas prices and full reliance on the market place. The proper standard for determining the price of gas at the wellhead is the "market value" as determined by natural gas purchase contracts negotiated at arm's length in a competitive market.

In the face of unworkable regulations, declining natural gas supplies, and rising natural gas demands, the Commission in 1971 has initiated alterations in its regulatory pattern but their good intentioned actions are too little and too late. A natural gas shortage exists and it will very likely reach crisis proportions in the very near future unless Congress takes affirmative action at an early date.

3. Taxes - the reduction in the depletion allowance, the change in the tax treatment of production payments, the minimum tax provisions, the

loss of the investment credit and the increases in the capital gains tax rates in the 1969 Tax Reform Act placed an additional tax on the domestic oil and gas industry of some $700 million; also state and local taxes have increased, thereby diverting additional funds from the exploratory effort in a period when such expenditures should be increasing.

The present energy supply situation persuasively argues for increased tax incentives, particularly incentives tied directly to exploration and development. The investment credit for machinery and equipment, now pending in Congress will not be of material assistance because it does not cover a large portion of expenditures for petroleum exploration and development.

There is urgent need for Congress to examine the need for and propriety of a special tax incentive such as an investment credit for exploration and development expenditures for new reserves and expenditures for secondary and tertiary oil recovery operations.

4. Public Lands - the Nation must look to the public domain as an important source of oil and natural gas if we are to meet growing demands for oil and natural gas. Over 17 percent of our oil supplies are produced from lands held in trust by the United States Government.

The national interest is best served by encouraging the broadest possible participation for the exploration of oil and gas on the public domain Thus, this Nation's policy, with respect to the development of the public domain, should be one that would encourage a multiplicity of effort by as many individuals and entities as possible if we are to meet the ever-growing demand for energy.

Inherent in the proper and orderly development of the public domain is a recognition and advocacy of the "multiple-use doctrine." It should be noted that experience over a long period of years has shown that oil and gas operations are fully compatible with other uses being made of the public domain.

Under existing laws and regulations, the United States Government receives substantial revenues from oil and gas operations on the public domain through royalties, rentals and bonuses. The public domain has become an important source of revenue but this income should be considered secondary to the vital need to encourage full and orderly development of the oil and gas resources on the public lands. Increased production of oil and natural gas from the public domain and the contribution such production would make to our peacetime needs and national security should be given first priority.

The emphasis should be on development rather than on initial bonus revenue. In the long run, if the public lands are developed the Government will receive more revenue than if the short term view is pursued.

Balance of Payments

The present trend, under existing governmental policies, of drifting into greater dependence on foreign sources for our oil and natural gas needs, raises the question as to the long term effect of this trend on the balance of payments.

Also, the thesis that we should hoard our domestic reserves and use foreign sources, which always seems to come forth whenever the problem of oil imports is discussed, requires analysis as to the impact on the balance of payments.

On February 15, 1971, an agreement between 22 international oil companies and the governments of Iran, Iraq, Saudi Arabia, Kuwait, Abu Dhabi Qatar provided for a substantial initial increase in posted prices and in addition, the agreement guarantees regular increases in posted prices up to 1975. It is clear that importing countries will have to pay more for oil imports if the flow of oil is to be maintained and expanded in line with the growth in requirements. These increases will be reflected in higher prices paid for imported oil.

Assuming that host Government annual demands beyond 1975 will be only one-half those agreed to by the operating companies through 1975, the laid down cost in the United States in 1980 for 3.9 billion barrels annually of imported oil (National Petroleum Council estimate of imports if present government policies continue) would generate a deficit item in our balance of payments of some $13 billion.

The (N.P.C.) estimated importation of 3.75 trillion cubic feet of natural gas imports in 1980 primarily in the form of liquefied natural gas would add $3.75 billion additional as a deficit item or a total in excess of $16 billion for oil and gas imports alone by 1980.

This outlook, it is submitted, clearly reveals that our present policies which permit a drifting into greater dependency on foreign sources, will very soon lead us into an intolerable balance of payments problem.

RECOMMENDATIONS

The Independent Petroleum Association of America recommends and urges this Committee and the Congress, without awaiting the conclusion of the Committee Study, to give priority consideration to the following:

I. The establishment by legislation of the peril point for dependence on petroleum imports.

II. The need for legislative relief of producers of natural gas from unrealistic regulation of the wellhead price by the Federal Power Commission, so as to permit inter-fuel competition to function freely in the market place in order to bring forth adequate natural gas supplies.

III. The enactment of a special incentive for increased exploration and development such as an investment tax credit for expenditures for domestic oil and gas exploration and development of new oil and gas supplies, and expenditures for secondary and tertiary recovery operations.

IV. The encouragement of maximum participation of the independent segment of the petroleum industry in the exploration and development of the public domain.

PERIL POINT FOR U. S. DEPENDENCE ON OIL IMPORTS

AN ANALYSIS

BY THE

INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

September, 1971

The Independent Petroleum Association of America on July 6, 1971 urged President Nixon to establish a "peril point" for U. S. dependence on foreign oil.

The peril point is the limit beyond which, in the interests of national security and U. S. consumers, the United States should not go on relying on foreign oil. It is the maximum volume of imported oil which, if disrupted for more than a short period, could be replaced from secure sources. It is an import level that would deny foreign producing countries, individually or in consort, the ability to compromise U. S. interests by withholding oil supplies.

The extent to which national security and the interests of U. S. consumers can be affected by interruptions in oil import volumes which could not be replaced from secure sources, i.e. "the peril point", varies with the duration of the interruption in oil imports. During a brief, or short term (1-3 months) interruption in oil import volumes above the peril point, the domestic industry's ability to replace such imports from available inventories and spare producing capacity is substantial. For longer periods, however, the domestic industry's ability to replace interrupted volumes diminishes due primarily to the necessity of keeping certain available inventories in storage to meet seasonal demands for fuels when required. Oil stored in advance of the winter season, for example, cannot be withdrawn for emergency use since in that event the winter requirements for heating oil could not be met. The analysis, therefore, deals with various situations involving interruptions for a 12 month period in oil import volumes.

Establishment of a peril point does not necessarily require an immediate cutback in oil imports to the peril point level. The peril point is the goal toward which other Government policies, as well as import restrictions, should be directed. Achievement of that goal, over a period of time, would involve holding imports within the limits of the peril point.

Conclusions

This analysis leads to the conclusion that the peril point for U. S. dependency on oil imports is reached when:

(1) Total imports exceed 20 percent of total U. S. oil consumption, and

(2) Imports from Eastern Hemisphere sources exceed 5 to 10 percent of total U. S. oil consumption.

If these limits are exceeded, any substantial loss of imports in the future would require rationing which probably would not be tolerated for an extended period except under wartime conditions.

Analysis

The attached Table I presents a detailed analysis of the industry's ability to satisfy U. S. oil demands under a range of possible conditions as to dependency on imported oil and losses in access to foreign supplies. The finding for 1975 may be summarized as follows:

ANALYSIS OF OIL IMPORT PERIL POINT
IN 1975

Percent Imports to U. S. Oil Demand	Case I	Case II	Case III	Case IV	Case V
From Eastern Hemisphere	4.5%	7.5%	10%	15%	40%
From Western Hemisphere	15.5	17.5	20	20	20
Total	20.0%	25.0%	30%	35%	60%

Assumed Loss of Imports: East Hem.	West Hem.	Ability to Offset Loss of Imports: Case I	Case II	Case III	Case IV	Case V
25%	0	O.K.	O.K.	O.K.	O.K.	Rationing
50%	0	O.K.	O.K.	O.K.	O.K.	Intolerable
50%	25%	O.K.	O.K.	Rationing	Rationing	Intolerable
100%	0%	O.K.	O.K.	Rationing	Rationing	Intolerable
100%	25%	O.K.	Rationing	Rationing	Intolerable	Intolerable
100%	50%	Rationing	Rationing	Intolerable	Intolerable	Intolerable
100%	75%	Rationing	Intolerable	Intolerable	Intolerable	Intolerable

The industry's ability to offset losses in imports, before rationing becomes necessary, is based on estimates of shut-in, or reserve, producing capacity and withdrawals from inventories. As shown above, if total imports do not exceed 20 percent of U. S. oil demand and if imports from the Eastern Hemisphere are held within 5 percent of total demand (Case I), the industry could cope with losses in imports up to 100 percent of Eastern Hemisphere imports plus a 25 percent loss in imports from the Western Hemisphere, without rationing of civilian uses. Larger losses in imports could be offset by rationing under this case. For Case II with total imports equal to 25 percent of demand and imports from the Eastern Hemisphere at 7.5 percent of demand, losses of imports could be offset without rationing up to a loss of 100 percent of Eastern Hemisphere imports. In Cases III and IV, rationing would be necessary after relatively small losses in access to foreign supplies, and heavy losses would result in an intolerable condition that could not be overcome even with rationing. Any loss of imports in Case V would bring about rationing at an early date, and even rationing could not offset any substantial loss in imports.

It may be concluded, therefore, that the national security and consumers' interests are protected to a reasonable degree in Case I but questionable in Case II. Further increases in the percentage of total imports and Eastern Hemisphere imports to U. S. oil demands, as assumed in Case III, Case IV and Case V, rapidly imperil the supply position of the United States to cope with any significant denial of access to foreign sources.

The estimates for 1985, also shown in the attached Table I, indicate that the peril point for U. S. dependency on oil imports is approximately the same as in 1975.

Prudence dictates that the peril point is reached when total imports exceed 20 percent of total U. S. oil demand, and Eastern Hemisphere imports exceed 5 to 10 percent of total demand.

The footnotes on Table I explain the method of analysis, but further comment may be helpful.

The supplies available from shut-in producing capacity are estimated at 5% of U. S. production. The current shut-in producing capacity approximates 10% and in recent years has been a much higher percentage. It is believed, however, that during the next 10 to 15 years shut-in capacity will average in the order of 5% of production. It is reasonable to assume the producing industry will operate at less than 100% of capacity throughout the 32 producing states, but under present economic conditions will not maintain as large a percentage of shut-in capacity as in the past.

The estimates of supplies available from inventory withdrawals are based on data from the 1970 report of the Natural Petroleum Council on "Petroleum Storage Capacity". That report shows the volume of "available" inventories. Over a year's span, about 30% of the "available" inventories must be retained, even in an emergency, if the domestic seasonal requirements are to be supplied. Since some 40% of the crude oil, clean products and residual fuel oil inventories are completely unavailable for consumption since they comprise pipeline fill, tank bottoms etc., there remains only 30% of "available" inventories for withdrawal for emergency use over a 12 month period.

Supplies available from rationing are estimated at 10% of U. S. oil demand which is the estimate use in the 1970 report of the Cabinet Task Force on Oil Import Control. It is important to note that this percentage could not be obtained across the board for all products but would vary by product and use. For example, tolerable rationing of automobile gasoline could exceed the 10% overall estimate. The substitution of other fuels i.e., coal for oil in electric utility plants is believed to be relatively small and is included within the rationing estimate.

As shown in Table I, a peril point limit of 20 percent dependency on oil imports results in a requirement to increase domestic oil supplies to keep pace with increasing U. S. oil demand. Required U. S. production in 1975, for example, would be 14,700,000 barrels daily, an increase of 30 percent over actual 1970 production.

Government policy as to petroleum imports since the closure of the Suez Canal in June 1967 has been almost "open ended" to maximize supplies from any and all available sources. Such short-term policy, if continued, would result in declining domestic exploratory and development activity and the elimination of the relatively inadequate shut-in or reserve producing petroleum capacity that exists presently.

Oil imports as a percent of domestic demand and domestic production have been increasing steadily during recent years. In the year 1970 imports were 23.2% of domestic demand and 30.2% of domestic production. In 1971, imports are at an even higher level revealing a continuing escalation of dependency on imported oil.

If total imports were limited to approximately 20 percent of total U. S. requirements, and if other Government policies are also directed toward improved economic conditions and greater incentives for domestic producers, the domestic industry will expand and the expansion can be expected to create spare capacities. Under these conditions, the Nation would continue to be essentially self-sufficient and the domestic industry could cope with a substantial loss in imports.

TABLE I

Analysis of "Peril Point" for U.S. Dependency on Oil Imports
1975 and 1985
(all figures in thousand barrels daily except percentages as indicated)

	Actual 1970	1975 Case I	1975 Case II	1975 Case III	1975 Case IV	1975 Case V	1985 Case I	1985 Case II	1985 Case III	1985 Case IV	1985 Case V
(1) Assumed Percent of Imports to U.S. Oil Demand for Cases I-V											
From Eastern Hemisphere	4%	4.5%	7.5%	10%	15%	40%	5%	10%	10%	15%	40%
From Western Hemisphere	19	15.5	17.5	20	20	20	15	15	20	20	20
Total	23%	20 %	25 %	30%	35%	60%	20%	25%	30%	35%	60%
(2) Estimated U.S. Oil Demand	14790	18400	18400	18400	18400	18400	26000	26000	26000	26000	26000
(3) Imports based on Above Assumptions											
From Eastern Hemisphere	540	800	1400	1850	2750	7350	1300	2600	2600	3900	10400
From Western Hemisphere	2825	2900	3200	3700	3700	3700	3900	3900	5200	5200	5200
Total	3415	3700	4600	5550	6450	11050	5200	6500	7800	9100	15600
(4) Required U.S. Production	11320	14700	13800	12850	11950	7350	20800	19500	18200	16900	10400
(5) U.S. Supplies Available to Offset Loss of Imports											
(a) Without Rationing											
From Shut-in Producing Capacity	1000	750	700	650	600	400	1050	1000	900	850	500
From Inventory Withdrawals	850	950	950	950	950	950	1150	1150	1150	1150	1150
Total	1850	1700	1650	1600	1550	1350	2200	2150	2050	2000	1650
(b) From Rationing	1500	1850	1850	1850	1850	1850	2600	2600	2600	2600	2600
(c) Total Available U.S. Supplies	3350	3550	3500	3450	3400	3200	4800	4750	4650	4600	4250

(6) Assumed Loss of Imports

Loss of imports in thousand barrels daily and as a percent (%) of total imports

From East. Hem. (percent lost)	From West. Hem.		Actual 1970	1975 Case I	1975 Case II	1975 Case III	1975 Case IV	1975 Case V		1985 Case I	1985 Case II	1985 Case III	1985 Case IV	1985 Case V
(a) 25%	0		150(4)	200(6)	350(8)	450(8)	700(11)	1850(17)		300(6)	650(10)	650(8)	1000(11)	2600(17)
(b) 50%	0		270(8)	400(10)	700(15)	900(16)	1400(22)	3700(34)		650(13)	1300(20)	1300(17)	1950(21)	5200(33)
(c) 50%	25%		970(28)	1100(30)	1500(33)	1800(32)	2300(36)	4600(42)		1650(32)	2300(35)	2600(33)	3250(36)	6500(42)
(d) 100%	0		540(16)	800(22)	1400(30)	1850(33)	2750(42)	7350(67)	A	1300(25)	2600(40)	2600(33)	3900(43)	10400(67)
(e) 100%	25%	A	1260(37)	1500(40)	2200(50)	2750(50)	3650(57)	8250(75)		2300(44)	3600(55)	3900(50)	5200(57)	11700(75)
(f) 100%	50%		1980(58)	2250(60)	3000(65)	3700(67)	4600(71)	9200(83)		3250(63)	4550(70)	5200(67)	6500(71)	13000(83)
(g) 100%	75%	B	2700(79)	3000(80)	3800(85)	4650(84)	5550(86)	10150(92)	B	4200(81)	5550(85)	6500(83)	7800(86)	14300(92)

A - Peril Point without rationing
B - Peril Point with rationing

Footnotes for Above

(1) Imports assumed to increase as a percent of U.S. oil demand with most of increase from Eastern Hemisphere because of limited potential supplies from Western Hemisphere sources outside the United States. Case V approximates percentages that would result from no changes in economic condition or Government policies, per "U.S. Energy Outlook - An Initial Appraisal", Natural Petroleum Council, July 1971.
(2) U.S. oil demand for 1975 and 1985 from July 1971 NPC report.
(3) Estimated U.S. oil demand (2) times assumed percent of imports (1)
(4) Estimated U.S. oil demand (2) minus imports (3)
(5a) Shut-in producing capacity estimated at 5% of required U.S. oil production (line 4). Inventory withdrawals calculated on assumptions that total inventories will increase in historical relationship to U.S. oil consumption and that approximately 30 percent of total inventories will be available (see NPC report "Petroleum Storage Capacity", July 1970) for one year period.
(5b) Supplies available from rationing estimated at 10 percent of U.S. oil demand, per report of Cabinet Task Force on Oil Import Control, February 1970
(5c) Sum of (5a) and (5b)
(6) Range of possible losses in imports. Losses above Line A could be offset by supplies available without rationing (5a). Losses between Line A and Line B could be offset with rationing (5c). Losses below Line B would be intolerable and could not be offset even with rationing.

Independent Petroleum Association of America
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Senator ALLOTT. The next speaker is Prof. Walter Mead, Department of Economics, University of California.

STATEMENT OF PROF. WALTER MEAD, DEPARTMENT OF ECONOMICS, UNIVERSITY OF CALIFORNIA, SANTA BARBARA, CALIF.

Dr. MEAD. Thank you, Mr. Chairman.

I would like to concentrate my efforts in two goals only and they are economic efficiency and national security.

When we talk about economic efficiency, we are talking about allocating resources among competing needs and uses. If we allocate them wisely, we will have a high standard of living and we will also have a strong defense posture, if that is the way we want to use our output.

Also, when I speak of economic efficiency, I have a broad definition of it, to include allocation of resources after consideration for what economists all externalities, external costs.

I believe that a price system where it internalizes externalities, external costs, is the ideal mechanism for getting at the environmental problems that concern many of us. I believe all of the panel members of both this morning and afternoon, if we correctly assign social costs to the organization, the units that create them, I believe it follows that we will get the best possible resource allocation.

Carl Madden spoke of this at considerable length. I would like to associate myself with his comments. I read his paper last night and I agree with what he said. In order to avoid duplication, I would like to so associate myself.

The problem of economic efficiency is also clearly related to the problems of national security, the second goal. If we misallocate our resources, we hurt our national security position, because we could have greater output and thereby, if we wished, divert more of our output to national security purposes.

As soon as one gets into the national security goal, one runs into a problem of subversion of that goal. It is a broad umbrella and once Congress has said and people in society have said the national security is one of prime importance and give it public blessing, it becomes something you can crawl under in order to pursue the other objectives that you may have.

I would take the oil import quota system as a case in point. The oil import quota system restricts the supply of a competitive source, the supply from abroad. The principal result of this is that it causes the domestic price to be higher than it would otherwise be. If you are in the oil industry and if you own oil resources, it is good to have a higher price. If you are a farmer, you may want to restrict output of your product through the help of government in order to get a higher price.

I am not condemning anyone for this, it is simply an economic fact of life. We are all self-motivated and universities are not excluded. But that umbrella of national security is a broad one, it has public approval and you rush to get under it.

National security becomes the objective of oil import quotas. I would suggest to you that we cannot really understand the oil import quota proposition unless we first understand that the motive is higher prices.

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Now, I am not saying that oil supply security is not important. I believe it is, along with security of other resources as well. Granting the need for oil supply security, we should ask the next appropriate question, what is least cost, what is the most efficient means of providing national security?

That question, unfortunately, has not been asked. It was not asked in 1959 when we went to mandatory oil import quotas. Is there a better policy to serve the national security than import quotas? Well, let's take a look at import quotas and see how they can work. They increase prices and thereby subsidize current production. It makes it profitable and that stimulates exploration, and we get current production.

However, oil is a nonrenewable resource. Once it is taken out of the ground, it can never be used again.

The way the economy works is to encourage people to develop the best resources first. This is what we always do and oil is no exception. We have developed the best, the least cost first. That leaves the least best for the future.

The oil import quota provides short-run security at the expense of long-run security. It provides short-run security by emphasizing the current production, but once that oil is taken out of the ground it can never be used again.

What about the future? We are sacrificing the long-run security. We don't often make a distinction between oil and hula hoops or safety pins. The latter we can probably go on producing at present rates for hundreds of thousands of years. But the same is not true with a nonrenewable resource.

Dependence on foreign resources—as a number of panelists said, dependence is here. It is a fact of life. That is where the crude is now. Dependence is greater today, partly because of import quotas in the past and the present. I believe it is also true that dependence in the future will be greater the longer we continue import quotas.

Shandard Oil of New Jersey has estimated or projected that by the year 1980 we must get 50 percent of our crude oil from abroad. That is up from 25 percent today, up from 19 percent in 1959. Dependence is a fact of life.

Look at our ratios of reserves of crude oil to domestic demand. In 1945 reserves were 11.2 times domestic demand for crude oil. By 1961 they declined to 8.7 times domestic demand. By 1970 they were down to 5.5—excuse me—5.3 times domestic demand.

In that year, the new discovery of Prudeau Bay was added to our reserves. It still brought the ratio up to only 7.3 times domestic demands.

Is there a better way? Is there a better way than import quotas? I think there is. This particular proposal that I wish to make I don't think has ever been considered by Congress or at least I never found evidence that it has, and it has not been discussed in the literature either.

A colleague and I very recently finished an article developing the idea of national defense petroleum reserves. It is published in the current issue—that is the August 1971 issue—of a journal called "Land Economics." I have copies with me for all panelists and everyone who wishes them to a limited degree.

The national defense petroleum reserve, what is it? Well, it is a fully developed oil reservoir, a fully developed field, but shut in, fully developed so that on a 60-day notice basis it can be set into production at a fairly high level. We have one such national defense petroleum reserve which is particularly, not fully, developed. That is Elk Hills Naval Petroleum Reserve No. 1 in Bakersfield, Calif. It is only partially developed. If fully developed, Elk Hills will have enough emergency productive capacity on a 60-day notice basis to offset completely non-Canadian imports into district 5. That is the States west of the Rocky Mountains.

In other words, if Elk Hills is fully developed, the west coast has security. That is against interruption or threat or what have you of foreign suppliers.

The study I have referred to that recently has been published attempted to estimate the cost of this kind of a reserve. There are a number of estimates, as you probably know, of the cost of the import quotas systems. Using the Department of Interior estimate of the social cost of import quotas, this is the lowest estimate I can find. Interior has two estimates. This is the lower of their two.

Their estimate shows that the social cost of oil import quotas is $1.04 per barrel of additional domestic production per year; $1.04; the cost of establishing a system of national defense petroleum reserves we have estimated to be not $1.04, but 81½ cents per barrel of reserves.

Unlike import quotas which sacrifice future security, this you may have for as long as you wish it.

Another way of looking at the cost of a system of national defense petroleum reserves is not to ask what is the cost per barrel of reserve—that is 8½ cents—but rather what is the cost per barrel of emergency production which you would maintain year after year? The answer to that is 32 cents per barrel of emergency production. This is production that you could get in the initial year of any such emergency, 32 cents, not $1.04.

There are other alternatives to the oil import quota system. They are a little higher cost. For example, the task force on oil import control estimated that salt dome storage would cost 39 cents per barrel; steel tank storage, 98 cents. Both have costs more favorable than the oil import quota system of $1.04. That is on the subject of what is the cost.

Another question that needs to be raised is what about the effectiveness? We are concerned about national defense and security. I pointed out that import quotas provide temporary security and they create future dependency. On the other hand, a system of in situ, shut-in reserves, can be permanent if you don't use them. Also, a system of in situ reserve shut-in can provide any level of security that Congress wishes to provide. We simply acquire, through the market mechanism, more such reserve fields, buy them at a price at which the seller would be willing to sell. No takeover here excepting within the market system and establish such reserves on a fully developed but shut-in basis.

I would also point out that the import quota system provides a very haphazard system of security. We don't know what our reserve situation is right now. A recent statement, again I believe by the president of Humble, stated that the market demand factors coming out of, say, Texas vastly overestimate that reserve and the Department of the Interior, in a recent publication, states that by 1973 or before our reserve capacity will become zero.

The import quota system emphasizes domestic production, not a reserve and it produces something that isn't replaceable. It is a nonrenewable resource. In the in situ shut-in system reserves can be acquired whenever you like, wherever you want them, providing you can find reserves in existence in such places.

It would seem to me wise to establish a system of national defense petroleum reserves in areas which are fully set up with pipelines. Obviously, Texas, Oklahoma, Louisiana, the Rocky Mountain area, the Gulf of Mexico, perhaps, fields exist there. There are a few brandnew ones that can be acquired in toto.

The pipeline system is in existence, it feeds into the rest of the country already.

Summarizing, I am making two points. We ought to pay a great deal of attention to our goal system to efficiency. It should be elevated to a higher level because we need the check of getting under an umbrella of publicly accepted goals such as national defense. When we impair efficiency, we impair national security.

I am suggesting that a system of shut-in ready reserves is considerably cheaper and far more effective and if one is seriously concerned about national security, this kind of a proposal deserves careful attention.

Thank you.

(The prepared statement of Mr. Walter Mead follows; other material submitted by Mr. Walter Mead will be found in appendix B.)

EFFICIENCY AND NATIONAL SECURITY AS GOALS FOR ENERGY POLICY

by
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A paper prepared for the U.S. Senate,
Committee on Interior and Insular Affairs,
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INTRODUCTION

The issue before the Symposium is--What is the relationship between the country's declared and generally acknowledged national goals and existing or proposed energy policies? We are asked to consider a series of goals in order that specific policies may then be tested against the standards established by the goals. We are immediately confronted with a set of problems.

1. As soon as more than one goal of energy policy is established, inconsistencies and conflicts develop between goals. The only way to avoid inter-goal conflict is to establish a single objective.

2. If all energy policy alternatives are to be tested against this single norm, then the statement of the goal must be comprehensive. But the more comprehensive the statement of the goal, the more difficult the policy test. If we make the goal specific, then it provides no normative guidance for a diverse set of policy alternatives.

3. It is politically unrealistic to assume that wide agreement can be found for a durable set of goals that express the general interest. Rather, in a democracy, government must, to use a current phrase, "be responsive to the needs of" various interest groups. As interest groups, their "needs" or goals are in conflict with the needs of other segments of society. A democracy must accommodate competing and inconsistent ends and means. It normally does so by weighing the political-economic power of competing special interests, including "disinterested" forces expressing their concept of the general interest, and by compromising in order to maximize the excess of group satisfaction over group dissatisfaction. This political process has a parallel in economic theory. It is called profit maximization.

While this economic rule is imperfect, it comes reasonably close to providing an optimum allocation of resources among competing uses.

4. As soon as a goal is established and sanctified with public approval, goal subversion begins. Various interest groups will attempt to bring their unstated private objectives under the umbrella of an approved national goal. If national security is declared to be a prime goal, then petitioners for public subsidies (tariffs, quotas, tax favors, etc.) will attempt to legitimatize their claim for favors by relating to national security in order to disguise their private motivation. The more general the goal, the more effective its subversion is likely to be.

It is difficult to name an industry or activity that is not in some way essential to the national security.

5. Finally, agreement on a single goal or a set of goals does not clearly validate a single policy and invalidate all others. The ingenuity of man will bring forth a multitude of alternative means to given ends. Each alternative policy should be evaluated in terms of its economic efficiency. This requires a cost-benefit analysis.

The issue of national goals and alternative energy policies is a large one. My efforts will be concentrated on two alternative goals, (1) economic efficiency including environmental protection, and (2) national security. Certain energy policies related to these goals will also be discussed.

I Economic Efficiency as a National Goal

Efficiency refers to the relationship between resource input and product output. Basically, an efficient, competitive economic system maximizes the value of output at a minimum input cost. A competitive economic system efficiently allocates resources among alternative uses except where private costs and revenues do not correspond with social costs and benefits. The two essential characteristics are (1) effective competition and (2) the absence of external costs and benefits.

(1) A series of economic studies concerned with the extent and trends of monopoly and competition in the United States have estimated that the economy is essentially competitive,[1] that from the Civil War to the present there are no clear trends toward either more monopoly or more competition,[2] and that while the nation would derive some benefit from antitrust action to break up dominant firms in about five oligopolistic industries like steel,[3] the annual welfare gains would be less than one percent of national income.[4]

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[1] See G. J. Stigler, Five Lectures in Political Economy, p. 50; G. W. Nutter, The Extent of Enterprise Monopoly in the United States, 1937 and 1939, p. 21; and H. A. Einhorn, "Competition in American Industry, 1939-58", Jour. Pol. Econ., Oct. 1966, pp. 506-511.

[2] In addition to Stigler, Nutter and Einhorn, see M. A. Adelman, "The Measurement of Industrial Concentration", Rev. Econ. and Stat., 1951, pp. 269-296; and W. G. Shepherd, "Trends of Concentration in American Manufacturing Industries, 1947-1958", Rev. Econ. and Stat., May 1964, pp. 200-212.

[3] G. J. Stigler, "The Case Against Big Business", Fortune, May 1952; and J. S. Bain, "Advantages of the Large Firm", Jour. of Marketing, April 1956, pp. 336-346.

[4] A. C. Harberger, "Monopoly and Resource Allocation", Amer. Econ. Rev., May 1954, pp. 77-87; and D. Schwartzman, "The Effect of Monopoly: A Correction", Jour. Pol. Econ., October 1961, p. 494.

(2) The presence of external costs and benefits probably leads to a far more serious level of resource misallocation in a free market economic system than does the absence of perfect competition. An external cost is a real cost that is borne not by the decision maker, but by an innocent third party or segment of society. Similarly, external benefits accrue to persons other than the party creating them. The classic illustration of an external cost is air pollution, by automobile exhaust, a factory smoke stack, or other cause. The air of the larger community is polluted, hence the community bears the cost, while the party responsible for pollution bears only an infinitely small part of the cost.

In a free enterprise economy, resources are allocated among alternative uses by means of a price system. A decision maker (a firm or an individual) makes investments after considering the probable private costs, private benefits, and the private rate of return. If some real costs are external to the firm, then too many resources will be allocated to the activity in question. Similarly, if external benefits are present, there will be under-investment in the activity. Thus, a free enterprise system misallocates resources whenever uncompensated net external benefits or costs are present.

The result of resource misallocation is that gross national product will be below its potential for any given level of resource use. Thus we are either using resources at a faster rate than necessary, or we are settling for a lower standard of living than necessary. Because national security is related to productivity, resource misallocation weakens national security.

There are three alternative governmental remedies for the net externality problem, (1) internalize the externality, (2) government regulation, including prohibition, and (3) government enterprise.

(1) Where net external costs are present, the externality may be internalized by levying a tax against the producer of the external cost equal to

the net value of the external cost borne by society. Thus, the cost is internalized and would be considered along with other costs and revenues by the producer. He would then have an economic incentive to reduce the social cost in the same sense that he has an incentive to reduce his private costs. Internalizing the external cost then enables a market system to allocate resources more efficiently at the producer level. A problem remains at the "consumer" level. The taxes levied against external costs, and equal to those costs, are collected by some level of government and are not necessarily distributed to those segments of society bearing the external cost. This is primarily an equity problem, but may also involve some slight resource allocation and therefore some efficiency consequences.

Where net external benefits are present, the net externality may again be internalized by a subsidy to the producer of the external benefit. Again, the subsidy should be equal to the net value of the external benefit. Thus, if a private utility considers construction of a reservoir to generate hydroelectric power which also produces side benefits in flood control, the utility should be offered a public subsidy equal to the value of the net external benefits. Thus, calculation of the net private rate of return on the investment would then correspond to the net return to society. Resource allocation at the producer level would then be optimal. Again a problem remains at the "consumer" level. Those who receive the net social benefits should pay the tax. However, in this, as in other cases, tax payments and corresponding benefits rarely have a one-to-one relationship.

(2) Government may regulate, including prohibit, activities which create external costs. In the case of the trans-Alaskan pipeline, the Interior Department is preparing an elaborate set of "stipulations" which specify certain precautions that must be taken, certain activities that are prohibited and other activities that must be performed by the permittee.

This is an effort to minimize environmental damage (an external cost), and to protect the rights of people external to the reward system of the participating firms.

The regulatory system, instead of utilizing the price system to improve resource allocation, relies on the power of government to direct resources. It assumes that government administrators know what is in the best interest of the various communities involved and that such interest will be wisely administered through the stipulations.

Each stipulation should be subjected to a separate benefit-cost analysis. A stipulation imposes a compliance cost on society through the medium of the permittee. If the benefits that follow from carrying out the requirements of the stipulation are less than the compliance costs, resource allocation is worsened, not improved.

(3) Finally, where external benefits are large relative to any private revenues, as in the case of national defense, government rather than private enterprise may be the appropriate remedy.

Three important conclusions for national goals follow from the above analysis. (1) Efficiency should rank high among the goals of national energy policy. Energy resources, as well as other resources are then allocated to their best attainable use. (2) An efficiency goal also serves the needs of environmental protection when the decision making structure internalizes external costs and benefits. Government regulation is a substitute method of eliminating or reducing external costs. (3) If an economy operates at a high level of efficiency, then it is employing energy and other resources effectively, i.e., conserving resources and producing a high level of gross national product. An efficient economy serves other possible national goals. It serves a national security goal because (1)energy resources are not squandered, and (2) a high level of gross national product permits a relatively high level of output to be devoted to a national security use. Similarly, cleaning up an already befouled environment requires a productive economy so that resources may be diverted to the clean-up task.

II NATIONAL SECURITY AS A GOAL

One cannot reasonably question that national security is an appropriate national goal and a goal of energy policy in particular. However, the goal needs careful definition. Further, agreement on the goal invites a multitude of policy choices, some of which are inconsistent with other goals, and/or counter-productive in the long-run.

A Resources For the Future (RFF) report pointed out that "in the widest sense, the security of the nation is based on the strength and flexibility of its general economy"[1]. This is quite different from a piecemeal approach based on individual claims that national security requires a tariff on vitrified china, a quota on textiles and wool, a subsidy to farmers, etc., because each is essential to national security.

The national security goal requires a careful analysis of the kinds of security risks that the nation faces so that policies may be developed relative to them specifically. The President's Cabinet Task Force on Oil Import Control identified several types of "particular interruptions" of oil supplies and several types of "war contingencies". One policy, such as oil import controls, is not a suitable policy for each contingency. A careful objective study of the security contingencies of policy alternatives and of peril points has never been undertaken. RFF pointed out that "this is a subject at present obscured in a fog of undefined ends and means... no systematic assessment of the security role of energy policies has ever been attempted."[2]

Section 7 of the Trade Agreements Extension Act of 1955 requires the Director of the Office of Defense Mobilization to advise the President

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[1] U. S. Energy Policies, an Agenda for Research, 1968, p. 42.

[2] Op.Cit. p. 144.

whenever the Director has "reason to believe that any article is being imported into the United States in such quantities as to threaten to impair the national security." The President is then authorized to make an investigation and if his studies confirm a threat to impair the national security, he is empowered to restrict imports. The Director advised the President in 1955, 1957 and 1959 that such a "threat" existed. On March 10, 1959 the President proclaimed mandatory oil import controls.

I have been unable to find evidence of a carefully documented study available by 1959 defining the national security goal, stating what kind of security contingency is threatened, showing how oil imports are related to that contingency, and of great importance, specifying precisely what level of imports threatens and does not threaten national security. Similarly, Professor Adelman testified in 1969 that the Committees that recommended the mandatory oil import controls never "seriously discussed or debated" the serious departures from competition. The analysis of the national security goal was "frivolous", according to Adelman.[1] What is abundantly clear is that the economic interest benefiting from higher crude oil prices due to reduced foreign imports repeatedly asserted such a threat to the national security. Given an ill-defined goal, the political system is vulnerable to pressure from economic interest groups. Poorly specified goals are easily subverted by beneficiary economic groups. Indeed, we were warned at an ODM hearing on oil import restrictions in 1956 by the President of Standard Oil Company of California in his testimony opposing mandatory quotas to "be sure that any action we take on imports, which becomes part of our foreign economic policy, is not finally

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[1] M. A. Adelman, Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U. S. Senate, 91st Congress, 1st Session, Part 1, March 11, 1969, pp. 20, 30, 31.

determined by special interests."[1]

Conflicts and inconsistencies of two general types will exist between two or more goals and policies, (1) inter-goal conflicts and (2) intra-goal conflicts.

(1) Inter-goal conflicts. As soon as more than one national goal is established, conflict between goals becomes highly probable. For example, individual liberty has been a goal of this nation since it was first established and, in fact, is written into the Preamble of the Constitution. Similarly, the Constitution provides for "the common defense." The oil import quota system has been rationalized almost solely on the basis of the national security goal. However, the import quota system denies to citizens the right to purchase crude oil at the lowest possible cost in whatever market they please. Their liberty is thereby infringed.

As another example of conflict, market demand prorationing authorized by Congress through the Interstate Oil Compact Commission Act, has frequently been justified on the basis of national security. Market demand prorationing infringes upon the individual's right to determine his own optimum output level.

Efficiency as a national goal has also been advanced. For example, President Johnson, in his State of the Union Address in 1965, included on his "national agenda" item number nine calling for "an all-out campaign against waste and inefficiency."[2] However, efficiency is inconsistent with both oil import quotas and market demand prorationing. The effect of import quotas is to raise the domestic price above its real value, as in-

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[1] Testimony by T. S. Peterson. Hearings, Office of Defense Mobilization, In the Matter of Petroleum, Oil Import Restrictions, October 24, 1956, p. 550.

[2] Quoted in Franklin P. Huddle, "The Evolution and Dynamics of National Goals in the United States," Library of Congress, Washington, 1971, p. 46.

dicated by the competitive world price. In the twelve years since mandatory oil import quotas were established, the U. S. price of crude oil has been artificially held about $1.25 per barrel above the world price. As a result, excessive resources have been directed to oil exploration and development. Further, inefficient stripper wells have been maintained in production. The net efficiency result is the same in both instances. At the artificially high price we are consuming more resources in oil exploration and production than are being produced in subsequent oil recovery from such wells. For example, a stripper well requiring a delivered price on the east coast of $3.89 per barrel, displaces oil that would under free enterprise be imported from the world market at $2.14 per barrel, delivered in the same east coast market.[1] This involves an economic waste amounting to $1.75 per barrel. We are using $3.89 worth of resources to produce a product worth only $2.14. In this instance we can pursue an efficiency goal, or we can utilize oil import quotas as a means of serving short-term national security, but we cannot do both. Import quotas are inconsistent with efficiency.

The amount of economic waste due to oil import quotas and market demand prorationing (which could not exist with import restrictions) has been estimated for the years 1960 and 1968 in the Charles River Report, and similarly for the years 1975 and 1980 by the U. S. Department of the Interior.[2] The Charles River Report estimated that in 1960 the social cost of oil import quotas, together with the cost of market demand prorationing which quotas permit, was $2.6 billion.[3] By 1968 this social cost had increased to $3.9

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[1] The prices shown here are drawn from the Cabinet Task Force on Oil Import Control, <u>The Oil Import Question</u>, February, 1970, p. 19.

[2] U.S. Department of the Interior, Bureau of Mines, "The Cost of the Oil Import Quota Program," September, 1969.

[3] J. C. Burrows and T. A. Domencich, <u>An Analysis of the United States Oil Import Quota</u>, 1970, p. 159.

billion for the year.[1] If we assume that the social cost for the twelve years from 1959 to 1971 averaged $3.25 billion per year (the arithmetic average of estimates for 1960 and 1968) we find that the total social cost for twelve years was $39 billion. This is the price the nation has paid in terms of output of goods and services for oil import quotas. If the committees that were charged with advising the President prior to 1959 regarding the use of import restrictions as a means of promoting national security had analyzed the social cost of quotas and had determined that such costs would average $3.25 billion per year, it seems unlikely that they would have recommended such a policy.

The Chairman of the Council of Economic Advisors stated that the goal of energy policy is as follows: "Simply stated, the goal is to provide reasonable assurance of supply needed to meet future demands for clean energy at reasonable prices."[2] This statement involves three essential parts -- (1) supply insurance for future demands, (2) clean energy, and (3) reasonable prices. The third goal is inconsistent with import quotas since the purpose of the latter is to limit supply and thereby increase prices. Again using the President's Cabinet Task Force on Oil Import Control price data, the east coast delivered price of crude oil was increased 82 percent above the world price ($3.89 + $2.14 = 1.82) as a result of import quotas. Whether or not this increase is "reasonable" is a matter of individual judgement.

Like the <u>social</u> cost of oil import quotas, the <u>consumer</u> cost has also been estimated. The Charles River Report estimated that in 1960 the cost to consumers was $2.8 billion, increasing to $6.2 billion by 1968.[3]

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[1] J. C. Burrows and T. A. Domencich, <u>An Analysis of the United States Oil Import Quota</u>, 1970, p. 159.

[2] P. W. McCracken, Hearings before the Committee on Interior and Insular Affairs, U. S. Senate, 92 nd. Congress, 1st. Session, June 15, 1971, p. 4.

[3] Burrows and Domencich, <u>Ibid</u>. p. 158-159.

If we again take the arithmetic mean of these two estimates as the average cost to consumers, we find a consumer cost of $4.5 billion per year. For the twelve year period 1959-1971, the total cost to consumers would be $54 billion. Again whether onejudges this consumer cost to be "reasonable" is a matter of personal point of view.

(2) Intra-goal conflicts. Even within the national security goal and within a single policy intended to satisfy that goal, there may be conflicts. For example, a policy that satisfies this goal in the short-run may be counter-productive in the long-run. Oil is a non-renewable resource. It is not like hoola-hoops and safety pins that can probably be produced indefinitely without increasing costs. Oil that is recovered at one point in time cannot be recovered at a later point in time. Oil import quotas reduce the supply of foreign oil below a competitive level and as a result force the nation to consume its own non-renewable oil resources at an accelerated rate.

How, then, can oil import quotas serve a national security interest? The answer is, by limiting competition from abroad and thereby raising the domestic price, domestic oil exploration and production is encouraged. Assuming that supply elasticity is greater than zero, accelerated production will occur for a limited number of years. This is a short-run answer. However, a basic principle of economics tells us that the best resources will be utilized first, leaving only inferior resources for a later date. Motivated by a relatively high price for crude oil, the oil industry has sought out the best oil exploration prospects within the domestic sphere. The U. S. Geological Survey pointed out what every oil wildcatter knows, that in the United States "new oil is getting harder to find in paying quantities."[1] As early as 1956 the President of the Standard Oil Company of California stated that "there is mounting evidence that, despite the strides made in geological and petroleum engineering technology, the discovery and development of additional reserves in the United States is becoming more difficult and certainly more costly."[2] He continued with the opinion that "there is a serious question in my mind that the economic well-being and strength of this country--the bases of our national security--would be promoted by measures of control set up to promote a greater dependence on increasingly costly domestic reserves. To the contrary, consideration seems to be warranted for a gradual increase in the proportion of imports to domestic requirements."[3]

In 1971, having developed the best oil prospects in the lower forty-eight, and having exploited outer continental shelf oil prospects since about 1954, we are now moving into the North Slope of Alaska to again develop the best prospects first.

Recent studies by the Standard Oil Company of New Jersey of the U. S. liquid petroleum supply and demand through 1985 clearly establish the consequences of accelerated use of domestic oil resources. Figure 1 shows that in 1959, when mandatory quotas were established, imports amounted to about 19 percent of total demand. Ten years later, in 1969, oil imports amounting to 22 percent of domestic demand were permitted. The Standard Oil Company estimates show that by 1985 we must obtain 49.6 percent of our liquid petroleum needs from imports.

Supporting evidence for the point that domestic crude reserves are becoming less dependable is shown in Table 1. We see that in 1945, the

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[1] An Appraisal of the Petroleum Industry of the United States, January 1965, p. 16.
[2] Hearings, Office of Defense Mobilization, op. cit. p. 546-547.
[3] Ibid.

ratio of proved reserves to domestic demand was 11.2. From 1945 through 1961, crude reserves increased 59 percent. However, domestic demand in the same period increased 105 percent. Therefore, the ratio of reserves to domestic demand declined to 8.7. From 1961 through 1970, proved reserves, excluding Alaska, declined while domestic demand continued to grow. Thus, the reserve-to-domestic demand ratio declined again to 5.3. In 1970 reserves were expanded nearly 10 billion barrels due to the addition of the Prudhoe Bay discoveries on the North Slope of Alaska. This increased provedreserves, but the reserve-to-demand ratio still declined from the 1961 level. Alaskan reserves, particularly North Slope reserves, will probably increase substantially in the next decade. However, Alaskan oil must also obey the economic rules for a non-renewable resource and Alaskan oil too, will in time, become a less dependable source.

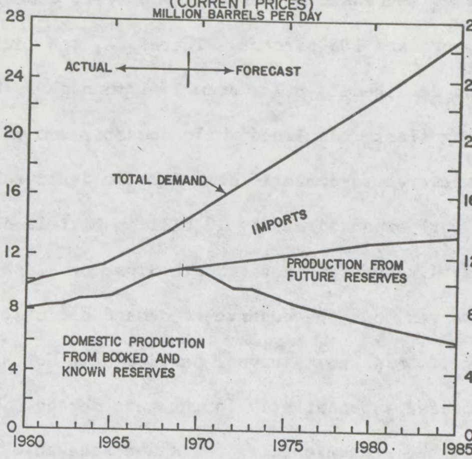
Given the fact that oil is a non-renewable resource, we come increasingly to the point where dependence on foreign crude oil supplies is a fact of life, and this dependence will be greater and more critical because of present and past policies such as oil import quotas and depletion allowances. Import quotas in particular have sacrificed future national security in favor of present security. In addition to being a costly policy, import quotas are also counter-productive in the long-run. The quota is an internally inconsistent method of promoting national security.

The relevant question which should have been raised prior to the adoption of mandatory quotas in 1959 is -- What is the cost of alternative means of providing a satisfactory degree of oil supply security for the nation? This question has two parts, (1) the <u>cost</u> of alternative policies, and (2) the <u>degree of security</u> provided by such alternatives.

(1) <u>The cost of alternative oil security policies</u>. The most promising

Figure 1

U.S. LIQUID PETROLEUM SUPPLY AND DEMAND WITH CONTINUED IMPORT CONTROLS (CURRENT PRICES)



Source: Standard Oil Company of New Jersey

Table 1

Ratio of proven reserves of crude oil, to domestic demand for oil products (million barrels)

Year	Domestic demand	Proved reserves	Ratio
1970		28,853[A]	5.3
	5371	39,001[B]	7.3
1961	3641	31,758[B]	8.7
1945	1773	19,942[B]	11.2

[A]Excluding Alaskan reserves
[B]Including Alaskan reserves

Sources: Reserves--American Petroleum Institute, Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada and United States Production Capacity as of December 31, 1970, Vol. 25, May 1971, p. 25.

Domestic Demand--American Petroleum Institute, Annual Statistical Review, U.S. Petroleum Industry Statistics, 1956-1970, April 1971, p. 1-2; and U.S. Department of Commerce, Survey of Current Business, Business Statistics Supplement.

alternative to oil import quotas as a means of meeting the national security goal seems to be a series of fully-developed but shut-in domestic oil fields organized into a system of national defense petroleum reserves. This alternative has been analyzed in a recent publication.[1] A copy is attached. The nation currently has one partially developed in-situ petroleum reserve -- Naval Petroleum Reserve No. 1, also known as Elk Hills Petroleum Reserve. This Reserve, located near Bakersfield, California, contains approximately 1.4 billion barrels of recoverable oil. Its currently rated efficient productive capacity available on a 60-day notice basis, is 160,000 barrels per day, or 58.4 million barrels in one year of emergency production. On a fully developed basis, initial year production could be increased to an estimated 453 million barrels.

Based on Elk Hills cost and recovery conditions, we have estimated that the total social cost of this form of National Defense Petroleum Reserve would be 8.5¢ per barrel of reserves per year, or 32¢ per barrel of additional emergency oil supplies in the initial year of emergency production.

This is significantly lower than the social cost of the present system of import quotas. The Interior Department has estimated the high-low range of 1975 and 1980 social costs of continued oil import quotas. The low cost estimate for 1975 shows a social cost of $1.04 per barrel of additional domestic production. This is more than three times the 32¢ per barrel cost of initial year production under an in-situ shut-in reserve system. Further, the minimum cost of continuing the quota system at $1.04 per barrel of annual production compares unfavorably with the 8.5¢ per barrel of carrying in-situ reserve production capacity indefinitely.

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[1] W. J. Mead and P. E. Sorensen, "A National Defense Petroleum Reserve Alternative to Oil Import Quotas," Land Economics, August 1971, pp. 212-224.

A fully developed Elk Hills petroleum reserve is capable of replacing, on an emergency basis, all current non-Canadian imports into District V (the Pacific Coast states west of the Rocky Mountains). For the rest of the nation, emergency oil needs for national security purposes can be provided by establishing in-situ fully-developed and stand-by reserves in strategic locations. Naval Petroleum Reserve No. 3, also known as "Teapot Dome", is located in Wyoming. Consideration may be given to purchasing privately owned oil resources adjacent to the Teapot Dome Reserve, then developing this reserve into a ready-reserve capability. In addition, known large oil fields can be acquired in Texas, Louisiana, Oklahoma, and the Rocky Mountain area. For example, the recently discovered "Main Pass Block No. 112" offshore from Louisiana, reported to be one of the largest U. S. oil fields, might be purchased in its entirety and placed in ready-reserve shut-in status. Since the areas listed are located in historic oil producing areas, pipeline delivery facilities to other parts of the country are already available.

Acquisition of a system of National Defense Petroleum Reserves would require no interference with the free market mechanism. Existing reserves would be purchased from their present owners at prevailing market prices. With national security needs provided by reliable stand-by reserves, import restrictions could be removed. The supply of oil and its price could then be determined by the free market.

Studies provided by the Interior Department indicate that oil could be stored in salt domes at a cost of 39¢ per barrel of additional reserves (compared to 8.5¢ for in-situ reserves). Steel tank storage costs are estimated by the Interior Department at 98¢ per barrel of additional reserves. Thus, an in-situ reserve system of providing secure oil supplies is much cheaper than the existing system of oil import quotas, and compares very favorably with the next best alternatives, salt dome and steel tank storage.

(2) The degree of security provided by alternative policies. The oil import quota system is a current production system of providing security, i.e., through import restrictions, domestic prices are increased to stimulate accelerated domestic oil production. In contrast, the in-situ reserve system, as well as salt dome and steel tank storage, are reserve systems. Because oil is a non-renewable resource, the current production system is not an effective long-run oil security policy. Rather, it promotes short-run security at the expense of future security. Having utilized mandatory oil import quotas since 1959, and oil depletion allowances since 1926 as policies for stimulating domestic oil production, the nation is now entering upon a period when imports of oil must be increased and dependence upon foreign supplies has become a fact of life.

By establishing a system of in-situ National Defense Petroleum Reserves, perhaps augmented by salt dome and steel tank storage, the nation can enter the coming period of higher level oil imports and still have secure emergency supplies.

The present system of oil import quotas provides a haphazard degree of oil supply security for two reasons: (1) There is no precise relationship between an increase in domestic crude prices and a resulting increase in short-run oil production (or long-run exhaustion), and (2) there is no known relationship between higher domestic prices and idle emergency production capacity. In contrast, a shut-in ready-reserve system can provide any desired volume of reserves on a known emergency production basis.

Under the import quota system, the <u>location</u> of any reserve production capacity is also haphazard. In contrast, in-situ reserves may be established in any desired location where complete reservoirs may be purchased.

As a policy for achieving the national security goal, the evidence indicates that a system of in-situ shut-in reserves, perhaps supplemented by salt dome and steel tank storage, is both lower cost and provides a higher degree of oil supply security than the present import quota system.

III RECOMMENDATION

1. Efficiency, as a goal of national energy policy, should be given a higher level of priority relative to the past and present. This is necessary in order to prevent various interest groups from subverting other national goals. The efficiency concept should be broadly interpreted to include external costs and benefits. This will occasionally require that special taxes be levied equal to net external costs, and subsidies granted equal to demonstrated net external benefits. Externalities should be evaluated by benefit-cost analysis.

2. National security is obviously a legitimate goal of the federal government and security of oil supplies is similarly a necessity. However, the present method of attaining oil supply security (oil import quotas), by subsidizing current production rather than creating a reserve production capacity, is counter-productive. It supplies a haphazard degree of present security, at the expense of long run security. In addition, oil import quotas are extremely expensive both in terms of consumer costs and social costs. Import quotas, as a policy for achieving national security, should be abandoned and replaced by a lower cost, more effective system of in-situ shut-in petroleum reserves.

Senator ALLOTT. Thank you.

The next panelist is Mr. Young, vice president of the Edison Electric Institute. Mr. Kearney, also.

STATEMENT OF H. J. YOUNG, VICE PRESIDENT, EDISON ELECTRIC INSTITUTE; ACCOMPANIED BY JOHN J. KEARNEY

Mr. YOUNG. Thank you.

My name is Jack Young, and I will try to sumarize our statement briefly and Mr. Kearney will join with me in the discussion as that develops.

In the discussions before this committee today the electric utility industry is perhaps in a somewhat unique position. Most of those who appear are either producers or consumers of energy. The electric utility industry is a convertor of energy. It is both a consumer of primary energy, purchasing major portions of the coal, gas, and oil used in the country, and is a supplier of energy to customers in farms, homes, and factories across the country.

Energy policies at all levels of Government affect the ability of electric utility companies to fulfill their obligations to these customers. The Edison Electric Institute has not attempted to define broad national economic and social objectives. This isn't our role.

We think our industry's responsibility is to assist in the attainment of such goals once they have been established by the people through their Government.

As was pointed out in the background papers provided to us, the Constitution describes broad goals for the country and they remain valid today, though sometimes we must translate them into contemporary language. For example, the concept of the tranquility in today's terms can be defined to include the need for a strong national economy, which we have talked about this morning and this afternoon which is an essential element in maintaining defense against foreign aggression and providing for internal order.

Tranquility can include also the need to maintain a high standard of living for the people of the Nation and the extension of that standard to increasing numbers of people.

Further, it can include achievements of these objectives in qualitative as well as quantitative terms. That is the concept of living standard probably should include economic, environmental, and cultural values.

It seems to me the general question of energy policy relates primarily to these issues.

Now, we are a country which moves on energy. By developing our energy resources and harnessing them in machines we have achieved a standard of living that is far beyond the dreams of most of mankind through most of history. More and more we are turning to electric energy to meet our energy needs because modern interconnected power systems are able to provide clean, reliable, and economically attractive energy, though there is a long way to go in this process.

Now, we need the energy to get work done and to improve the productivity of our society.

Simply stated, increased use of energy means we can make more things more cheaply, that more people can afford these goods, and that the demand for goods and services in turn leads to the development of entirely new industries and job opportunities.

We agree with those on the panel this morning and this afternoon who have been saying that if we are to maintain our standard of living and raise it for those in our society who live below the general standard, that we must continue to expand our use of energy of all kinds.

On the domestic problems facing our society, such as food and water supply, transportation, conditions of urban living and the recycling of waste, cannot be solved without an abundance of electric power. Presently, the ability of the electric power industry to fulfill its role in helping meet our national goals is being hindered, not as a result of a lack of Government policy but because of a proliferation of Government policies which are often uncoordinated and even contradictory. For example, restrictions are placed on the use of a certain type fuel for environmental reasons without encouragement for development of alternating energy sources.

Permits to import low-sulfur fuel are granted on short-term basis, making it impossible to secure long-range commitments for reliable fuel supplies.

In addition to policies applying directly to the availability of fuel, the electric utility industry is faced with the necessity of obtaining permits, licenses, approvals, authorizations, and certifications from a myriad of public agencies at the Federal, State, and local levels to build facilities needed to meet public demands for service. The deliberative process involving these proceedings has become excessively drawn out and the opportunity for comment and participation by intervenors is too often seized upon by persons whose motive is to delay or prevent construction without regard to the merits of the case or the effects on adequacy of power supply and the economy.

In some instances, it appears that the public interest in an adequate energy supply has not been given equal consideration with the Nation's justifiable concern for the environment. A recent example of how this can affect our industry is the new licensing procedure prescribed by the Atomic Energy Commission in complying with a U.S. Court of Appeals decision on implementation of the National Environmental Policy Act. The new commission procedures can seriously hinder the ability of electric power systems to complete their current nuclear expansion plans on schedule.

We understand this committee is planning hearing on this subject so we won't discuss it further here.

Coordination of sound energy policies must take sometimes conflicting objectives and their consequences into consideration. There is clearly a need for Government to coordinate its existing research and development and environmental policies. Any new governmental policies should be so framed that the public need for energy is given equal consideration with the Nation's environmental concerns.

Finally, although certain forms of energy are and should be regulated, competition can still play an important role in assuring reasonably priced energy is available to the American public.

Any energy policy should permit and encourage this competition, at the same time insuring that the rules are the same for all.

Thank you.

(The prepared statement of W. Crawford follows:)

STATEMENT ON NATIONAL GOALS AND ENERGY POLICY

Submitted to the
Senate Interior and Insular Affairs Committee
By
W Donham Crawford, President
Edison Electric Institute

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In the discussions before this Committee the electric utility industry is, perhaps, in a unique position. Most of those who appear here will be either producers or consumers of energy. The electric utility industry is a converter of energy. It is both a consumer of primary energy, purchasing major portions of the coal, gas and oil used in this country, and a supplier of energy to millions of customers in farms, homes and factories throughout the land. Energy policies, at all levels of government, affect the ability of electric utility companies to fulfill their obligations to these customers.

Chairman Jackson's letter of September 20 stressed the Committee's interest in receiving testimony on major national goals, their adequacy for the future, and their relationship to energy policies. While there may be conflicting views on various facets of these important subjects, we believe that a statement of objectives is the logical starting point for a study of National Fuels and Energy Policy. Recently, in a speech before the National Energy Forum, Mr Shearon Harris, Chairman of the Board of the Edison Electric Institute, endorsed such an approach when he said, "I therefore suggest that we first determine our national objectives in terms of economic and social well being, and then our energy policy can be stated and administered in terms that will achieve those economic and social goals."

The Edison Electric Institute has not attempted to define broad national economic and social objectives. That is not our role. We believe our industry's responsibility is to assist in the attainment of such goals once they have been established by the people through their government. The following comments concerning national goals are my own, although I am confident that many electric utility industry leaders would be in agreement with them.

National goals can be defined in a variety of ways. At one level, they can be stated very broadly. The preamble to the Constitution, as Dr F P Huddle has pointed out in his background paper for the Committee, defines the nation's goals as being "tranquility" and "individual liberty." Certainly these objectives remain valid today.

The concept of "tranquility," in today's terms, can be defined to include the need for a strong national economy, an essential element in maintaining defense against foreign aggression and in providing internal order. It can include the need to maintain a high standard of living for the people of the nation and the extension of that standard to increasing numbers of people. Further, it can include achievement of these objectives in qualitative as well as quantitative terms. That is, the concept of "living standard" can include economic, environmental and cultural values.

It seems to me that the general question of energy policy relates primarily to such issues, though questions of justice and individual liberty should not be outside the scope of consideration.

We are a country which lives on energy. By developing our energy resources and harnessing them in machines, we have achieved a standard of living that is far beyond the dreams of most of mankind through most of history. More and more we are turning to electric energy to meet our energy needs because modern interconnected power systems are able to provide clean, reliable and economically attractive energy. We need the energy to get work done and to improve the productivity of our society. Simply stated, increased use of energy means we can make more things more cheaply, that more people can afford these goods, and that the demand for goods and services, in turn, leads to the development of entirely new industries and job opportunities. It seems self-evident that if we are to maintain our standard of living, and raise it for those in our society who live below the general standard, then we must continue to expand our use of energy of all kinds, and of electric energy in particular.

Other domestic problems facing our society, such as food and water supply, conditions of urban living, and the recycling of waste, cannot be solved without an abundance of electric power. For example, the process of mechanization of the farms of the United States has increased agricultural productivity. Our growing population will require an expanding electric power supply if future generations are to have food supplies comparable to ours.

Tremendous amounts of electric energy will be required as we rebuild our cities. Electrified mass transportation and electric vehicles will have a net beneficial effect on the quality of urban life. Dr Glenn Seaborg, past chairman of the Atomic Energy Commission, has pointed out that at current rates of use, known reserves of most stable elements will be exhausted within 175 years. Electric power provides the basic energy means to reclaim needed supplies of gold, silver, iron, aluminum, magnesium, wood pulp and other products.

The solution to the problem of providing an adequate fresh-water supply to a growing world population is energy. This is true not only because power is needed to pump water from low levels where it is generally available to ground level where it can be used by man, but because energy is needed to make desalination of ocean waters practical. Moreover, it recently has been estimated that $30 billion of sewage waste facilities will be required in the next five years. Electricity will be required to run these plants.

In the final analysis, use of electric power is part of the solution rather than part of the problem as it relates to the quality of our nation's progress in the coming decades. Thus the energy policy of our nation, if it is to further our national goals, must assure that we have an ample supply of electric energy.

Presently, the ability of the electric power industry to fulfill its role in helping to meet the national goals is being hindered, not as a result of a lack of government policy but because of a proliferation of government policies which are often uncoordinated and even contradictory. For example, restrictions are placed on the use of a certain type of fuel for environmental reasons without encouraging the development of alternate energy sources.

Permits to import low-sulfur fuel are granted on a short-term basis, making it impossible to secure long-range commitments for reliable fuel supplies.

In addition to policies applying directly to the availability of fuel, the electric utility industry is faced with the necessity of obtaining many permits, licenses, approvals, authorizations and certifications from a myriad of public agencies at the federal, state and local levels to build facilities needed to meet public demands for service. The deliberative process involved in these regulatory proceedings has become excessively drawn out, and the opportunity for comment and the participation by intervenors is too often seized upon by persons whose motive is to delay or prevent construction without regard to the merits of the case or the effects on adequacy of power supply and the economy. In some instances it appears that the public interest in an adequate energy supply has not been given equal consideration with the nation's justifiable concern for the environment. A recent example of how this can effect our industry is the new licensing procedure prescribed by the Atomic Energy Commission in complying with a United States Court of Appeals decision on implementation of the National Environmental Policy Act of 1969. The new Commission procedures can seriously hinder the ability of electric power systems to complete their current nuclear expansion plants on schedule. This could result in serious inconvenience and expense to consumers and possible disruption of the economy. Utilities may be forced to operate older plants, many of which are not equipped with modern air pollution facilities, while new, pollution-free nuclear power plants stand idly by.

Furthermore, the Justice Department is playing a stronger role in electric utility regulatory matters, and its responsibilities must be considered in relation to the duties of the State and Federal regulatory agencies.

A sound energy policy must take sometimes conflicting objectives, and their consequences, into consideration if the nation is to have an adequate and reliable electric power supply to meet economic, social and environmental needs. There is clearly a need for government to coordinate its existing energy, research and development, and environmental policies. Any new government policies should be so framed that the public need for energy is given equal consideration with the nation's environmental concerns.

Although certain forms of energy are, and should be, regulated, competition can still play an important role in assuring that reasonably priced energy is available to the American public. Any energy policy should permit and encourage this competition, at the same time ensuring that the rules are the same for all.

Attainment of our national goals requires that we have an abundant source of reliable, adequate and reasonably priced electric power. Our nation's energy policy can and should foster this necessary objective.

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Senator ALLOTT. Thank you, Mr. Young.

According to the list I have, we have one more witness, Dr. Iraj Zandi. Did I pronounce that correctly?

Dr. ZANDI. Yes, sir.

Senator ALLOTT. He is professor and chairman of the Graduate Group Committee of Energy, Management and Power, University of Pennsylvania.

STATEMENT OF DR. IRAJ ZANDI, PROFESSOR AND CHAIRMAN, GRADUATE GROUP COMMITTEE OF ENERGY, MANAGEMENT AND POWER, UNIVERSITY OF PENNSYLVANIA

Dr. ZANDI. Thank you, Mr. Chairman.

For the record, I am an environmentalist. These days we are repeatedly reminded that the United States with only 6 percent of the world's population consumes the major portion of the world's resources, including 30 percent of the total energy consumed.

Now, there are many fair-minded observers who would ponder the equity of this affair. They ask how can man live happy amongst dying neighbors. Also, there are practical but thoughtful individuals who argue with justification that this state of affairs cannot last for long. They ask how much longer a hungry world would allow this to continue? There are others though who with the zeal of fanatics either demand on one extreme that this generation of Americans should repent the great sin of being successful and advise total immersion in remorse, or on the other extreme demand more, without concern for others and for the future.

The relative gain of extreme attitudes coupled with both the real and the imaginary deterioration of physical and moral environment have contributed to the creation of a millieu of deep anxiety, within which alarm and fear have become significant inputs to the decision-making systems. Therefore, it is heartening to note that this august body is studying with deliberate care the Nation's energy problems.

From the point of view of a person who was born and lived half of his life outside this country and has seen firsthand the misery of man's inability to control natural phenomena, I cannot but marvel the success, both material and otherwise, of the United States. I believe this Nation should be proud to have been able, through the genius of its people and fortunate circumstances of a relatively free government to mobilize the forces which has helped to open the doors to the eventual freedom of man from some of his ancient wants.

For the first time in man's history we can gaze into the future and see with our mind's eye that at least, if he acts wisely man can be free from poverty, most diseases and cruelty and harshness of nature to pursue his happiness on a much higher plateau than so far has been possible.

Therefore, the fundamental question of national policy should be how can this Nation, as a part of the world community, open as many options as possible for this living generation and those who will come to pursue their happiness with dignity and in harmony. No matter what else will be needed for the implementation of this general policy, we shall need much more reasonably inexpensive clean energy to sustain the thrust into the future. The problem is that the magnitude of energy we are going to need is such that staggers the imagination, taxes all our geniuses and resources, and if unwisely developed, endangers our habitat. Within the components of this problem: Magnitude of the demand, quality of supply, and economy of availability; lies our dilemma.

Much has been written in recent years about these components of the energy system and their interrelationships. Based on past trends many have attempted to foresee the future and have suggested various plans to prevent a forecasted catastrophe. The scenario, usually proceeds something like this: between 1880 and 1910 the consumption of energy had grown with an annual rate of 3.10 percent; between 1910 and 1960 with a rate of 1.77 percent; and since 1960 it has increased with a rate of 4.4 percent.

If the present trend continues, between now and the turn of the century the United States will consume more energy than it has in the past 200 years of its history.

Chauncey Starr in a recent issue of Scientific American predicts that by 2000 the annual U.S. demand for energy is expected to double. The U.S. Bureau of Mines goes even further and estimates upward to tripling.

Within the energy system, the demand for electricity is expected to grow at an even faster rate. Secretary Morton expects that it will triple over the next 15 years and again double over the succeeding 15-year period.

Satisfying the demand of such a magnitude would not only require the availability of fuels in an incomprehensive quantity but also other resources, including manpower, and facilities for extraction, transportation, conversion and utilization on a scale which is hard to believe. This is only half of the story. The other half is that all these should be accomplished inexpensively and without environmental impact.

The question is: Can we do it? President Nixon in his recent clean energy message articulates a position which seems to answer the above question positively. He sets his hope on the commercial development of the liquid metal breeder reactor. Others who agree in general with his goals may have different ideas how the goals can best be achieved. The differences are not in the ends but in the means. They wish to plan one way or another to satisfy the demand.

On the other hand, there are others who see salvation only in conservation. In the course of these hearings before your committee, I am sure both of these points of view plus technical aspects of energy development will be discussed and various courses will be eloquently championed. I shall not travel that road.

No matter what the policy, if the planning is to be successful, the contribution of both highly qualified personnel and a highly cooperative public is vitally needed. The purpose of this presentation is to bring to your attention the necessity of integrating into the fabric of a national energy policy, from the beginning, an education component consistent with whatever course of action is chosen. Here, I have in mind both the education of the public and the experts. And this is the area that I believe the President's message has sadly neglected.

It is obvious that no matter what policy this Nation adopts in regard to its energy problems: increasing the supply, decreasing the demand, or some of both; the public needs to be an active participant in carrying out the policy to its fruition Therefore, it is vital that from the outset, the public becomes cognizant of both the strengths and the weaknesses of the policy that you adopt.

Present danger is that the public, learning through mass media and constantly encouraged by special interests, may misinterpret the data base of your decisions and react by either negating your carefully adopted position or force you to abandon it to the benefit of those special interests.

There are at least three basic areas which I believe need special attention and require intensive public education, environmental considerations, future planning, and planned failure concept.

Environment consideration—since environmental considerations have in recent years significantly contributed to the creation of a so-called power crisis, it is altogether necessary that this interaction should be intensively studied and the public be appraised of its real implications. The public should be told the whole story. It is my feeling that the state of our environment is not as bad as some would have us believe.

If one reads newspapers and books, listens to the radio, or watches television, he cannot help but become convinced that man's environment is deteriorating at a rapid rate. He knows that things are changing and he suspects that the change is for the worse. This suspicion is confirmed when he hears specialists listing all kinds of ills, and promise him even worse in the future to come. He hears the same figures and data, the same dire predictions, and the same information over and over again so that very soon he believes in them, repeats them, quotes them and more often than not adds to them his own interpretation.

In the present era of electronic communication, the unfounded facts, the half facts, the simplified facts, circulate so rapidly and extensively that within a short span of time they form a strong substructure in people's attitudes. In preradio and television time people had a limited and delayed exposure to the various kinds of violence and perplexing problems of life. They would only feel seriously involved in local situations. Therefore, there was some natural balance between the good and evil that they would experience in their daily lives.

Now, in contrast, television brings the whole world into the living room. No matter where one is, he will become involved in almost all of the problems of the world, whether it is war, pollution, injustice, or riots. The results of this extension of what Marshall McLuhan calls the "Central nervous system in a global embrace" is a lopsided view of life. One feels surrounded by all the ills of the world without actually experiencing them. Life before the era of electronic communication was local and slow, but it is now global and rapid.

Although we have improved our total living environment beyond our grandfather's wildest dream, we feel widespread environmental deterioration. The psychological millieu in this country makes it very difficult not to feel guilty if you are not in despair in the face of those predictions that we are running out of oxygen to breathe, water to drink, places to live, trees to see, birds to watch, food to eat, and love to cherish.

The result is that a nation which is in general well fed, well clad, and well provided for gives the impression that it is disenchanted and in despair.

This general and vague feeling of disenchantment is slowly creeping into most of our policy decision and if we are not careful, may produce harmful effects beyond our control.

Today, being a conservationist is fashionable and chic, like growing sideburns and wearing midiskirts. Like any other serious matter which becomes vogue one should be careful to distinguish between the legitimate forces which belong to it and those which are there for the ride.

I believe that this new vogue as it is shaping up at the present time in the overexposed glare of TV and the other news media, creating overnight experts may contribute to our failure to meet our future needs. In jumping impulsively onto the propaganda bandwagon, we may irrevocably slam the door on some vital options which may be available to us for a quality of life in the future.

I wish to imply that in searching for solutions to our many complex problems through a colored lens, which filters out of our sight some options for action, that color being an excessive passion for wilderness or avariciousness is a dangerous self defeating game. It is becoming a distinct possibility that belated public awareness and demand for a decent environment may be goaded into action by the large, well-financed lobbyist conservation groups in the form of stopping all types of developments, some of which like powerplants are vital to the Nation's well-being.

I believe that the large organized conservation groups are promoting the formation of an environmental and resources policy, which have considerable impact on the energy system, that for the following reasons they are wrong:

By blocking indiscriminately the development of any significant new water project, industrial complex and powerplant they will, if successful, reduce the future capacity of this Nation to face the increasing demand.

By excluding industry and agriculture from open spaces which are at the present time lightly populated, they in essence apply forces which ~~make~~ it inevitable that the future growth will occur in already over-populated sections of the country. The policy will not only intensify the problems of city living, but indeed is biased against the poor and black who will not only have to share the same space in center cities with more people, but of course are unable to take advantage of the wide open undistributed spaces which would be so preserved.

By overestimating what can actually be done to recapture the pristine clarity of American streams, by assuming that we have all the technology we need to do so, they are forcing the Federal, State, and city governments to spend way over their means in pollution-control projects that would not really accomplish the stated goals anyway.

And finally, by condemning science and technology as the mother of all ills, and by arrogantly accusing all scientists of insensitivity to the human cause, they may discourage the young from selecting career opportunities as scientists and engineers and deprive humanity of talent required to help it to solve its problems. There are indications that this is already happening.

It seems to me because of the inevitable population growth in the next 15 to 20 years, because of an increased demand for the basic requirements of life, because of our obligation to a hungry world, because of the limited capacity of the environment to assimilate various wastes, because of the astronomical sums needed to just maintain the status quo in the quality of environment, because of all the problems which too many people create when they live in too small an area, we do not have any other choice but to, among other things, use our land and other resources including fuels more efficiently, accept a policy which encourages dispersion of the population, and use all the miracles that a wisely managed science and technology can foster. I said a "wisely managed technology" because no doubt an unbounded technology can impinge in the words of Rene DuBos "* * * with increasing effectiveness and violence on all aspects of human life."

I believe it is high time to ask ourselves very frankly and objectively whether we are really justified in criticizing ourselves and our way of life so harshly. Is it all as bad as some try to make us believe? Are we not, in the words of Max Ways, "indulging in an orgy of self-flagellation?" The answer to these questions are vital because they affect the way we will chart our actions for the future. The public should become an active partner in this discussion if we expect to solve environmental crises, energy crises, transportation crises, or hundreds of other affairs which we may wish to call crises.

Future planning—it is easy to say how much energy we use, but it is a much more difficult task to estimate with reasonable confidence how much energy we will need in the future. It is customary for planning to extrapolate the past trend into the future. In doing so, however, we get ourselves into trouble if we are not extremely careful.

First, any decreasing or increasing function, given sufficient time, will either disappear or will take over the universe; second, a simple extrapolation which assumes that the rate of change will remain constant ignores the feedback mechanisms of the techno-societal systems; and finally, the simplicity of the procedure masks the complexity of the problem under study and produces instant wisdom susceptible to panicky responses. Examination of the energy system and the environmental implication of its development and utilization reveals the occurrence of such a happening.

The straight line projection of both demand and pollution upward and resources downward will no doubt predict a breakdown point. Those who make the predictions, of course, always qualify them. The problem is that after being quoted several times the information loses its qualification and assumes the significance of undisputed fact.

I believe your committee should insist on bringing to the attention of the public the vulnerability of any prediction beyond a few short years. The public should fully appreciate the characteristics of contingeny plans. If we learned anything from the Ellsberg papers, it is that we should strive to educate the public to differentiate between predictions that were made to design contingency plans and what may happen in that distant future.

As we enter the era of a rapidly changing world, we need more and more planning for our future. Alvin Toffler in his brilliant work, "Future Shock," recommends the creation of contemplative bodies which would look exclusively into the future and try to predict the consequences of each present action. I fully believe that he is right Such a forecasting machinery must be created.

But also, I feel strongly that the public should be educated to fully recognize the limitations of such forecasts, especially in what Toffler calls the super industrial society.

Since a straight-line projection into the distant future will always predict a breakdown of the system, it may produce false impressions and burden the public with unnecessary anxiety, alarm, and fear. There are indications that this is already happening in the energy field. This situation should not be allowed to develop.

Planned failure concept—according to a survey by the Edison Electric Institute, during the last 12 years electric power customers have had, on the average, service more than 99.98 percent of the time. If we wish to admit it or not, this is a tremendous record of accomplishment for the industry. It is so profound that we forget the electric utility industry is only about 80 years old. It is such a record of reliability that we have forgotten the days not long ago when electricity was not available whenever and wherever desired. We have become so accustomed to the performance of electric utility industry that the mere thought of brownout and blackout disturbs us beyond reason.

Last year I was visiting a modern capital of one of the Middle Eastern countries, and during my first night there the electricity was cut off three times. I was the one person amongst 20—all natives—that was disturbed. The rest took it in good stride and every time the electricity was turned off they brought a kerosene lamp and proceeded as though nothing had happened.

I am certainly not advocating to allow the deterioration of our electrical utility systems, but I think there is a lesson to be learned from such an experience.

As a result of the tremendous success of technology and the application of the tools of management, the United States is developing into a Nation with what I may call "zero-risk mentality." What I mean here is that it would be inconceivable for the average person to accept any failure in the country's response to the urban, environmental, energy, or transportation problems on the face of the Herculean success of going to the moon and other significant achievements. Any small event, beyond what one expects, becomes a crisis of national significance. The mood of the present generation of Americans is best epitomized by the recent Volkswagon advertisement on TV which the narrator says: "* * * you people just expect too much."

Careful examination of the future, with the due consideration of the ever-increasing complexity of the process of living in a man-made environment, and observing the interdependence of almost everything which occurs around us points to the inevitable increased occurrence of failure. We should recognize that it is inevitable that failure could occur somewhere, someplace along the line. It is inevitable that some brownouts and blackouts will occur. It is inevitable that once in a while air over a certain community becomes polluted beyond the adopted thresholds. It is inevitable that oil spills occur someplace, sometime. And finally, it is inevitable that for a few days in some community, someplace in the country we have to turn off the air conditioners during a severe heat wave.

While it is significant that we should do our best and plan ahead to prevent such happenings, it is also significant that we should allow in our expectation some degree of failure. Wasn't it the Scottish Poet Robert Burns who said that "The best laid schemes o' mice and men gang aft a-gley."

The national policy in regard to any significant aspect of our lives, including the energy system, should not only enunciate grand goals and shining hopes, but also it should strive to educate the populace toward adaptability to nuisance for the sake of preserving our nervous system against the constant jolting of trivial alarms. We should strive to determin the limits of failure that this Nation can withstand without unduly affecting its general life system. We need to ascertain the limits of nuisance as compared to limits of survival. Everything humanly possible should be done to prevent reaching the survival limits.

In brief, I believe that a national energy policy should embody the concept of planned brownout and blackout, a few days reduction in heating or cooling if they are necessary to solve temporary problems. We should not make the price of, out of proportion to the consequences of failure itself, so that huge resources are spent to protect the decisionmakers against unreasonable demands of the public for marginal benefits. This committee could serve this Nation well if it participates in establishing a national dialogue to change the zero-risk mentality.

Education of experts—energy flow of the proper magnitude and mix within an industrial society is essential to the function and survival of that society. Almost everything man does depends for its motivation on energy of some sort. Therefore, it is essential that the reasonable flow of energy of some sort within the society be maintained.

Energy systems includes essentially three types of activities: One, technological, which includes extraction of fuels, refining of the fuels, transportation, conversion and utilization of energy, including the handling of the waste products; two, societal, which includes economics, the social impact of energy development and utilization, the political and governmental aspects of fuel and energy management; and three, public policy, which includes the decision as to the trade off between various aspects of energy system with one another and with the components of other societal system.

The traditional response of the universities to this multicomponent problem has been to educate persons in traditional disciplines. This narrow education has in the past occasionally caused the wrong problems to be identified and solved, which in turn has caused socially undesirable consequences.

Recently, a feeling is developing in the educational community that it is highly desirable to adopt a holistic approach to the interdisciplinary problems such as energy or environment. Almost everyone agrees that a broader education is needed to enable one to participate with experts of other fields, to articulate the problems which lie in overlapping areas of various disciplines. However, no one as yet really knows how to do this. There is not as yet a body of knowledge and a set of techniques available which can be applied uniquely to the analysis of these larger techno-societal problems.

Despite considerable recent advances in the direction of the development of analytical techniques, the main body of the desired discipline remains to be developed. A national energy policy should provide encouragement for the development of such a body of knowledge as applied to the energy field, and provide opportunity for the education of these broader specialists.

Thank you.

(Mr. Zandi's prepared statement follows:)

A Few Comments

On

Energy & Education

by

Iraj Zandi

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Committee of Energy Management & Power

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For Presentation to the:
Committee on Interior & Insular Affairs
United States Senate

Session on:
National Goals & Their Relationship
To Existing & Proposed Energy Policies

October, 1971

A Few Comments On Energy & Education

by

Professor & Chairman of Graduate
Committee of Energy Management & Power

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Philadelphia, Pennsylvania

ABSTRACT

In this paper it is argued that a national energy policy should embody amongst other things, an educational component which strives not only to educate experts but also the public. It is advocated that at least three areas of public education need special attention: 1) environmental implication of energy development, 2) future planning, and 3) planned failure concept.

It is argued: that the environmental conditions in this country are not as bad as some would have us to believe; that there is a distinct possibility that belated public awareness and desire for a decent environment may be goaded by large, well financed conservation groups into stopping all types of development, some of which are vital to the nation's well being; and that in jumping impulsively onto the propaganda bandwagon, we may irrevocably slam the door on some vital options for a quality life in the future.

It is warned: that unless extensive public education accompanies the plans for future contingencies, it is possible that any future prediction may be interpreted by the public as absolute fact; that extrapolation of past into the future is a hazardous task; that any decreasing or increasing function, given sufficient time, will either disappear or will take over the universe; that the straight line projection of demand upward and resources downward will no doubt predict a breakdown point; that in reality we may never reach the breakdown point because of feed-back mechanisms that exist in any techno-societal system; and that the projection to doomsday without weighing the myriad underlying assumptions produces unnecessary enxiety.

It is also argued: that as a result of considerable success in solving past problems this generation of Americans are developing what maybe called a zero-risk mentality- a low tolerance level for adverse situations; that we should differentiate between global and permanent versus local and temporary adverses; and that we should include in our planning the possibility of tolerable failures if we do not wish to waste huge quantities of resources to satisfy unreasonable demands for marginal benefits.

The necessity of educating experts with broad backgrounds to participate in articulating socially significant energy problems and to contribute to their solutions is also discussed.

It is concluded that the President's energy message neglects the educational aspects of energy systems.

A Few Comments

On

National Goals & Their Relationship
To Existing & Proposed Energy Policies

by

Iraj Zandi

I. Introduction- These days we are repeatedly reminded that the United States with only 6 per cent of the world's population consumes the major portion of the world's resources, including 30 percent of the total energy consumed. Now, there are many fair minded observers who would ponder the equity of this affair. They ask how can man live happy amongst dying neighbors? Also there are practical but thoughtful individuals who argue with justification that this state of affairs can not last for long. They ask how much longer a hungry world would allow this to continue? There are others though, who with the zeal of fanatics either demand on one extreme that this generation of Americans should repent the great sin of being successful and advise total immersion in remorse, or on the other extreme demand more, without concern for others and for the future.

The relative gain of extreme attitudes coupled with both the real and the imaginary deterioration of physical and moral environment have contributed to the creation of a milieu of deep anxiety, within which alarm and fear have become significant inputs to the decision making systems. Therefore, it is heartening to note that this august body is studying with deliberate care the nation's energy problems.

From the point of view of a person who was born and lived half of his life outside this country and has seen first hand the misery of man's inability to control natural phenomena, I cannot but marvel the success, both material and otherwise, of the United States. I believe this nation should be proud to have been able, through the genius of its people and fortunate circumstances of a relatively free government to mobilize the forces which has helped to open the doors to the eventual freedom of man from some of his ancient wants.

For the first time in man's history we can gaze into the future and see with our mind's eye that at last, if he acts wisely man can be free from poverty, most diseases and cruelty and harshness of nature to pursue his happiness on a much higher plateau than so far has been possible. Therefore, the fundamental question of national policy should be how can this nation, as a part of the world community, open as many options as possible for this living generation and those who will come to pursue their happiness with dignity and in harmony. No matter what else will be needed for the implementation of this general policy we shall need much more reasonably inexpensive clean energy to sustain the thrust into the future. The problem is that the magnitude of energy we are going to need is such that staggers the imagination, taxes all our geniuses and resources, and if unwisely developed endanger our habitat. Within the components of this problem: magnitude of the demand, quality of supply, and economy of availability, lies our dilemma.

Much has been written in recent years about these components of the energy system and their inter-relationships. Based on past trends many have attempted to foresee the future and have suggested various plans to prevent a forecasted catastrophe. The senario, usually proceeds something like this: between 1880 and 1910 (1) the consumption of energy had grown with an annual rate of 3.10 per cent, between 1910 and 1960 with a rate of 1.77 per cent, and since 1960 (2) it has increased with a rate of 4.4 per cent.* If the present trend continues, between now and the turn of the century the United States will consume more energy than it has in the past two hundred years of its history. Chauncey Starr (3) in a recent issue of Scientific American predicts that by 2000 the annual U.S. demand for energy is expected to double.** The U.S. Bureau of Mines (4) goes even further and estimates upward to tripling.*** Within the energy system the demand for electricity is expected to grow at an even faster rate. Secretary Morton (5) expects that it will triple over the next fifteen years and again double over the succeeding 15 year period.****

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* Annual U.S. consumption of total energy varied from 2×10^{11} kwh in 1880 to 8×10^{12} in 1910, to 1×10^{13} in 1960, and to 3×10^{13} in 1968.

** In 1970 approximately 70×10^{15} B.T.U. was consumed per year and will increase to 160×10^{15} B.T.U. per year by 2000 (arithmetic extrapolation).

*** Assuming an average annual increase in real GNP of 4 per cent, population increase of 1.6 per cent, and Industrial production of 4.4 per cent, the U.S. Bureau of Mines estimates for year 2000 the demand will range from 165×10^{15} B.T.U. to as high as 239×10^{15} B.T.U.

****Consumption of electricity is expected to rise from 1500×10^{9} kwh in 1970 to 4500×10^{9} in 1975 and to 9000×10^{9} kwh in the year 2000.

Satisfying the demand of such a magnitude would not only require the availability of fuels in an incomprehensive quantity but also other resources (including manpower) and facilities for extraction, transportation, conversion and utilization on a scale which is hard to believe. This is only half of the story, the other half is that all these should be accomplished inexpensively and without environmental impact.

The question is: Can we do it? President Nixon in his recent Clean Energy Message[6] articulates a position which seems to answer the above question positively. He sets his hope on the commercial development of the liquid metal breeder reactor. Others who agree in general with his goals may have different ideas how the goals can best be achieved. The differences are not in the ends but in the means. They wish to plan one way or another to satisfy the demand. On the other hand there are others who see salvation only in conservation. In the course of these hearings before your committee, I am sure both of these points of view plus technical aspects of energy development will be discussed and various courses will be eloquently championed. I shall not travel that road.

No matter what the policy, if the planning is to be successful, the contribution of both highly qualified personnel and a highly cooperative public are vitally needed. The purpose of this presentation is to bring to your attention the necessity of integrating into the fabric of a national energy policy, from the beginning, an education component consistent with whatever course of action is chosen. Here, I have in mind both the education of the public and the experts. And this is the area that I believe the President's message has sadly neglected.

II. Public Education - It is obvious that no matter what policy this nation adopts in regard to its energy problems: increasing the supply, decreasing the demand, or some of both; the public needs to be an active participant in carrying out the policy to its fruitation. Therefore, it is vital that from the outset, the public becomes cognizant of both the strengths and the weaknesses of the policy that you adopt. Present dnager is that the public, learning through mass media and constantly encouraged by special interests, may misinterpret the data base of your decisions and react by either negating your carefully adopted position or force you to abandon it to the benefit of those special interests.

There are at least three basic areas which I believe need special attention and require intensive public education: a) Environmental Considerations; b) Future Planning; and c) Planned Failure Concept.

A) Environment Consideration - Since environmental considerations have in recent years significantly contributed to the creation of a so called power crisis,* it is altogether necessary that this interaction should be intensively studied and the public be appraised of its real implications. The public should be told the whole story. It is my feeling that the state of our environment is not as bad as some would have us believe.

* For instance it is estimated that as a result of new regulations on mine safety, restoration of stip mines, and sulfur removal the cost of coal will increase over one-third by 1985; in 1970 dollars (1970 price of coal is $7.30/ton or $.31/10^6 B.T.U., it is estimated it will increase $11.00/ton or $.40/10^6 B.T.U. by 1985).

If one reads newspapers and books, listens to the radio, or watches television he cannot help but become convinced that man's environment is deteriorating at a rapid rate. He knows that things are changing and he suspects that the change is for the worse. This suspicion is confirmed when he hears specialists listing all kinds of ills, and promise him even worse in the future to come. He hears the same figures and data, the same dire predictions, and the same information over and over again so that very soon he believes in them, repeats them, quotes them and more often than not adds to them his own interpretation.

In the present era of electronic communication the unfounded facts, the half facts, the simplified facts, circulate so rapidly and extensively that within a short span of time they form a strong substructure in people's attitudes. In pre radio and television time people had a limited and delayed exposure to the various kinds of violence and perplexing problems of life. They would only feel seriously involved in local situations. Therefore, there was some natural balance between the good and evil that they would experience in their daily lives. Now in contrast, television brings the whole world into the living room. No matter where one is, he will become involved in almost all the problems of the world whether it is war, pollution, injustice or riots. The results of this extension of what Marshall McLuhan calls the "Central nervous system in a global embrace" is a lopsided view of life. One feels surrounded by all the

the ills of the world without actually experiencing them. Life before the era of electronic communication was local and slow but it is now global and rapid. Although we have improved our total living environment beyond our grandfather's wildest dream we feel widespread environmental deterioration. The psychological milieu in this country makes it very difficult not to feel guilty if you are not in despair in the face of those predictions that we are running out of oxygen to breathe, water to drink, places to live, trees to see, birds to watch, food to eat and love to cherish.* The result is that a nation which is in general well fed, well

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*Actually available data does not verify these clandestine claims. While it is true that in some areas, environment is deteriorating it is also a fact that in many other areas it is gradually improving. Let us examine some of these improving or stationary situations:

A) Air: [8] (all data is mg/m^3) Annaul average for selected cities:

	SO2						
	62	63	64	65	66	67	68
Cincinnati	92	68	100	79	81	55	44
Denver	NA	NA	NA	55	29	13	34
Philadelphia	231	181	215	223	278	257	212
St. Louis	NA	NA	155	123	113	76	73

	NO2						
	62	63	64	65	66	67	68
Cincinnati	56	56	60	66	68	53	60
Denver	NA	NA	NA	68	64	70	68
Philadelphia	73	71	71	68	73	81	73
St. Louis	NA	NA	62	64	61	45	43

	CO						
	62	63	64	65	66	67	68
Cincinnati	NA	8050	7015	4600	5635	6440	6440
Denver	NA	NA	NA	8280	9085	8740	6210
Philadelphia	NA	NA	8165	9315	7820	7240	9890
St. Louis	NA	NA	7245	7475	6670	6440	5270

In addition, the notion that we may deplete oxygen in atmosphere by burning fuels is just absurd. If we burn all fossil fuel reserve in the world only about 3 per cent of oxygen will be consumed.

B) Forest:

Year	1630	1920	1930	1938	1945	1953	1963 [6]
Total Forest area in the conterminious U. S. [9] in million acres	950	614	615	630	624	648	758*
Growing Stock** (in 10^9 ft.^{3})						596 [10]	628
Sawtimber** (in 10^9 ft.^{3})						2,561 [10]	2,537

*This also includes Alaska
**In the decade of 1953 to 1963 there has been a net increase of 8 X 10^9 ft.^{3} in all species on commerical forest land. The change has been in the direction of younger and consequently ecologically more active woods.

C) Water - because of the wide variation in the condition of water in the river systems it is impossible to portray the state of water pollution in tabular form with a few parameters. However, anyone acquainted with water pollution in the U.S. cannot disagree that many large river systems such as Delaware River, Ohio River, and smaller rivers such as Schuylkill river [11] have improved measurally doing past decade. The 1971 Environmental Quality Report states that: "EPA estimates that the BOD of waste actually discharged into receiving states in 1968 was only slightly larger than the BOD of waste discharged in 1957. The total BOD produced - but not necessarily discharged - during this period doubled...". Since between 1957 to 1968 a considerable more mileage of streams in the country were used for waste removal, the constancy of BOD discharged implies that the condition was improved in those stretches of streams which were in use prior to 1957.

In addition, the claim of water shortage in this country is just a myth. The problem is not shortage at all but distribution & timing out of an average of 9 inches net rain which reaches annually the surface and ground shortages in this country, we only consume 1 inch.

clad and well provided for gives the impression that is is disenchanted and in despair.

This general and vague feeling of disenchantment is slowly creeping into most of our policy decision and if we are not careful, may produce harmful effects beyond our control.

Today, being a conservationist is fashionable and chic, like growing sideburns and wearing midi skirts. Like any other serious matter which becomes vogue one should be careful to distinquish between the legitimate forces which belong to it and those which are there for the ride. I believe that this new vogue as it is shaping up at the present time in the over exposed glare of TV and the other news media, creating overnight experts may contribute to our failure to meet our future needs. In jumping impulsively onto the propaganda bandwagon, we may irreovably slam the door on some vital options which may be available to us for a quality life in the future. I wish to imply that in searching for solutions to our many complex problems through a colored lense, which filters out of our sight some options for action, that color being an excessive passion for wilderness or avariciousness is a dangerous self defeating game.* It is becoming a distinct possibility that belated public awareness and demand for a decent environment may be goaded into action by the large well financed lobbiest conservation groups in the form of stopping all types of developments, some of which like power plants are vital to the nation's well being.

* Phosphate controversy battle over non-returnable bottles, and volunteer recycling are clear examples of misdirected public attention. These are discussed elsewhere (See referance 12).

I believe that the large organized conservation groups are promoting the formation of an environmental and resources policy, which have considerable impact on the energy system, that for the following reasons are wrong:

● By blocking indiscriminately the development of any significant new water project, industrial complex and power plant* they will, if successful, reduce the future capcity of this nation to face the increasing demand.

● By excluding industry and agriculture from open spaces which are at the present time lightly populated, they in essence apply forces which make it inevitable that the future growth will occur in already over-populated sections of the country. The policy will not only intensify the problems of city living but indeed is biased against the poor and black who will not only have to share the same space in center cities with more people but of course are unable to take advantage of the wide open undistributed spaces which would be so preserved.

● By over-estimating what can actually be done to recapture the pristine clarity of American streams, by assuming that we have all the technology we need to do so, they are forcing the Federal, state or city governments to spend way over their means in pollution control projects that would not really

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*A few years ago they argued and were successful in stopping the Bureau of Reclamation's projects on the upper Colorado River. One of the arguments was that there is plenty of coal in the vicinity to produce power. Now they are fighting the construction of the plants which they were previously advocating.

accomplish the stated goals anyway.* And finally:

● By condemning science and technology as the mother of all ills, and by arrogantly accusing all scientists of insensitivity to the human cause, they may discourage the youngs from selecting career opportunities as Scientists and Engineers and deprive humanity of talent required to help it to solve its problems. There are indications that this is already happening.

It seems to me because of the inevitable population growth in the next 15 to 20 years, because of an increased demand for the basic requirements of life, because of our obligation to a hungry world,[13,14] because of the limited capacity of the environment to assimilate various wastes, because of the astronomical sums needed to just maintain the status quo in the quality of environment, because of all the problems which too many people create when they live in too small an area,[15] we do not have any other choice but to among other things, a) use our land and other resources including fuels more efficiently, b) accept a policy which encourages dispersion of the population and c) use all the miracles that a wisely managed science and technology can foster. I said a wisely managed technology because no doubt an unbounded technology can impinge in the words of Rene DuBos"...with increasing effectiveness and violence on all aspects of human life".

*As an example, while lack of funds is causing the City of Philadelphia to close its public schools a month early, the city is forced to spend millions of dollars in addition to planned outlay for water treatment projects of questionable merit.

I believe it is high time to ask ourselves very frankly and objectively whether we are really justified in criticizing ourselves and our way of life so harshly. Is it all as bad as some try to make us believe? Are we not, in the words of Max Ways, "indulging in an orgy of self flagellation"? The answer to these questions are vital because they effect the way we will chart our actions for the future. The public should become an active partner in this discussion if we expect to solve environmental crisis, energy crisis, transportation crisis, or hundreds of other affairs which we may wish to call crisis.

b) Future Planning - It is easy to say how much energy we use, but it is a much more difficult task to estimate with reasonable confidence how much energy we will need in the future. It is customary for planning to extrapolate the past trend into the future. In doing so however, we get ourselves into trouble if we are not extremely careful. First, any decreasing or increasing function, given sufficient time, will either disappear or will take over the universe; second, a simple extrapolation which assumes that the rate of change will remain constant ignores the feed back mechanisms of the techno-societal systems*; and finally the simplicity of the procedure masks the complexity of the problem under study and produces instant wisdom susceptible to panicy responses. Examination of the energy system and the environmental implication of its development and utilization reveals the occurrence of such a happening.

* For instance such a feed-back mechanism is already in operation in Los Angeles where the population is for the first time experiencing zero-growth.

The straight line projection of both demand and pollution upward and resources downward will no doubt predict a breakdown point. Those who make the predictions of course, always qualify them. The problem is that after being quoted several times the information loses its qualification and assumes the significance of undisputed fact.

I believe your committee should insist on bringing to the attention of the public the vulnerability of any prediction beyond a few short years.* The public should fully appreciate the characteristics of contingency plans. If we learned anything from the Ellsberg papers it is that we should strive to educate the public to differenciate between predictions that were made to design contingency plans and what may happen in that distant future.

As we enter the era of a rapidly changing world we need more and more planning for our future. Alvin Toffler [16] in his brilliant work, "Future Shock" recommends the creation of contemplative bodies which

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*In 1918 there were about 25 million horses and mules in this country. Had the planners of that era projected arithmatically to the present time the number of these animals, they would have come up with an absurd figure. Is it not possible that our planners of today would seem equally incorrect some 40 years from now?

would look exclusively into the future and try to predict the consequences of each present action. I fully believe that he is right. Such a forecasting machinery must be created. But also, I feel strongly that the public should be educated to fully recognize the limitations of such forecasts, especially in what Toffler calls the super industrial society.

Since a straight line projection into the distant future will always predict a breakdown of the system, it may produce false impressions and burden the public with unnecessary anxiety, alarm, and fear. There are indications that this is already happening in the energy field. This situation should not be allowed to develop.

c) Planned Failure Concept - According to a survey by the Edison Electric Institute, during the last 12 years electric power customers have had, on the average, service more than 99.98% of the time. If we wish to admit it or not this is a tremendous record of accomplishment for the industry. It is so profound that we forget the electric utility industry is only about eighty years old. It is such a record of reliability that we have forgotten the days not long ago, when electricity was not available whenever and wherever desired. We have become so accustomed to the performance of electric utility industry that mere thought of brown out and black out disturbs us beyond reason. Last year I was visiting a modern capital of one of the Middle Eastern Countries, and during my first night there the electricity was cut off three times. I was the one person amongst twenty (all natives) that was disturbed. The rest took it in good stride and everytime the electricity was turned off they brought a kerosine lamp and proceeded as though nothing had happened.

I am certainly not advocating to allow the deterioration of our electrical utility systems, but I think there is a lesson to be learned from such an experience. As a result of the tremendous success of technology and the application of the tools of management, the United States is developing into a nation with what I may call "zero-risk mentality". What I mean here is that it would be inconceiveable for the average person to accept any failure in the country's response to the urban, environmental, energy, or transportation problems on the face of the Herculean success of going to the moon and other significant schievements. Any small event, beyond what one expects, becomes a crisis of national significance. The mood of the present generation of Americans are best epitomized by the recent Volkswagon advertisement on TV which the narrator says: "...you people just expect too much".

Careful examination of the future, with the due consideration of the ever increasing complexity of the process of living in a man made environment, and observing the interdependence of almost everything which occurs around us points to the inevitable increased occurence of failure. We should recognize that it is inevitable that failure could occur somewhere, someplace along the line. It is inevitable that some brown outs and black outs will occur. It is inevitable that once in a while air over a certain community becomes polluted beyond the adopted thresholds.* It is inevitable that oil spills occur someplace,sometime. And finally it is inevitable that for a few days in some community, someplace in the country we have to turn off the air conditioners during a sever heat wave. While it is significant that we should do our best and plan ahead to prevent such happenings it is also significant that we should allow in our expectation some degree of failure. Wasn't it the Scottish Poet Robert Burns who said that "The best laid schemes o'mice an' men gang aft a-gley."

The national policy in regard to any significant aspect of our lives, including the energy system, should not only enunciate grand goals and shining hopes but also it should strive to educate the populace toward adaptability to nuisance for the sake of preserving our nervous system against the constant jolting of trivial alarms. We should strive to determine the limits of failure that this nation can withstand without unduly affecting its general life system. We need to ascertain the limits of nuisance as compared to limits of survival. Everything humanly possible should be done to prevent reaching the survival limits.

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* For instance of all places that one may suspect, last year an air " episode" occured in Birmingham, Alabama where the levels of particulate matter in the air reached a peak of 607 micrograms per cubic meter of air during April 19-20.(8) For comparison one should note that the average concentration of particulate matter over urban stations in the United States during 1964 and 1965 has been only about 105 micrograms per cubic meter end over non-urban stations it has been only 37 micrograms per cubic meter. Birmingham is certainly not New York!

In brief, I believe that a national energy policy should embody the concept of planned brownout and blackout, a few days reduction in heating or cooling if they are necessary to solve temporary problems. We should not make the price of failure out of proportion to the consequences of failure itself, so that huge resources are spent to protect the decision makers against unreasonable demands of the public for marginal benefits. This committee could serve this nation well if it participates in establishing a national dialogue to change the zero-risk mentality.

III - Education of Experts - Energy flow of the proper magnitude and mix withing an industrial society is essential to the function and survival of that society. Almost everything man does depends for its motivation on energy of some sort. Therefore, it is essential that the reasonable flow of energy within the society be maintained. Energy system includes essentially three types of activities: 1) technological, which includes extraction of fuels, refining of the fuels, transportation, conversion and utilization of energy including the handling of the waste products; 2) societal, which includes economics, the social impact of energy development and utilization, the political and governmental aspects of fuel and energy management; and 3) public policy, which includes the decision as to the trade off between various aspects of energy system with one another and with the components of other societal systems.

The traditional response of the Universities to this multi-component problem has been to educate persons in traditional disciplines. This narrow education has in the past occasionally caused the wrong problems to be identified and solved, which in turn has caused socially undesirable consequences. Recently, a feeling is developing in the educational community that it is highly desirable to adopt a holistic approach to the interdisciplinary problems such as energy or environment. Almost everyone agrees that a broader education is needed to enable one to participate with experts of other fields, to articulate the problems which need to be solved, and also contribute to the solution of those problems which lie in overlapping areas of various disciplines. However, no one as yet really knows how to do this. There is not as yet a body of knowledge and a set of techniques available which can be applied uniquely to the analysis of these larger techno-societal problems.

Despite considerable recent advances in the direction of the development of analytical techniques, the main body of the desired discipline remains to be developed. A national energy policy should provide encouragement for the development of such a body of knowledge as applied to the energy field, and provide opportunity for the education of these broader specialists.

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Senator ALLOTT. Mr. Bellmon?

Senator BELLMON. Thank you, Mr. Chairman.

I would like to start with Mr. Taylor. I believe on page 2 of your statement, Mr. Taylor, you say that we ought to be able to find a way to improve the standard of living for the 30 percent of our people who are now at or near the poverty level. Will this mean in your judgment finding and using more energy?

Mr. TAYLOR. I think it will inevitably mean that more energy supplies will have to be found, because at the present time this group of people in this country are consuming relatively little energy as compared to middle-class and upper-class people, industry and commerce. If programs were found which would provide full employment for all employable people who are seeking jobs, naturally the increased income that they have will enable them to increase their standard of living which will produce a greater demand on energy to a certain extent.

Senator BELLMON. If there is an energy shortage, what group in our society will likely be left out, in your judgment?

Mr. TAYLOR. I think that would be difficult to contemplate, as to what priorities of use you would have. I presume that you have to start out by saying what are the most important and vital uses of energy in a community.

Senator BELLMON. Well, if power becomes in short supply likely the price is going to come up, don't you agree?

Mr. TAYLOR. Yes.

Senator BELLMON. And which groups are likely to pay the penalty?

Mr. TAYLOR. The people who have the least money will naturally have to curtail certain things that they would ordinarily be buying in order to preserve their basic needs that include paying their bills, paying for the mortgage on the house.

So, the consumption of energy would probably be curtailed to that extent.

Senator BELLMON. I must say I liked very much the position of your statement in parts which apparently puts the AFL–CIO squarely on record favoring a national policy to secure an abundant and dependable supply of energy. This is the message you intended to get across?

Mr. TAYLOR. Yes.

I would like to add this one codicil, because of the importance of the environmental considerations we want the adequate protection of the environment to be part and parcel of those considerations.

Senator BELLMON. This is one thing in your statement that troubles me, and this is the position you have taken on page 8 in which you are very critical of the fact that companies are no longer oil companies or coal companies, or uranium companies but rather they are energy companies. You feel this means a reduction in competition?

Mr. TAYLOR. Yes; that is our position.

Senator BELLMON. We have some representatives of the energy companies here and I would like to ask them some questions along this line, but do you have any basis for reaching this conclusion?

Mr. TAYLOR. Well, yes. This gives me the opportunity to respond to Mr. McLean's position in his statement.

Senator BELLMON. He might have a chance to get one in here, also.

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Mr. TAYLOR. I am glad Mr. McLean is here because I think his company was one of the first to move into the field of coal production a number of years ago. Of the first 25 largest in terms of assets, oil companies in the country, nearly all of them have moved into other energy forms in addition to oil petroleum. They moved into natural gas, uranium, oil shale, and in some of them into tar sands. One of them, I think, is important to realize is that the goal of abundant competitive priced energy is that energy sources have to compete against each other.

If a handful of companies in this country——

Senator BELLMON. Before you go beyond that point, then, would you not favor the FPC control of gas? This keeps gas from competing because prices are fixed.

Mr. TAYLOR. I am not talking about regulated industry, I am talking about the part of the oil industry which is not regulated, which is most of it.

I am saying that oil companies, from Humble on down, are without restriction able to make decisions concerning acquisition of other companies which deal in the energy field. The only thing they come up against is a positive violation of the antitrust act. I don't know whether the proposal here, in criticism of my statement, is that one of the national goals is not the maintenance of competition in all areas of private economy including the oil producing area or not. We consider this as a very desirable national goal both from the standpoint of the general thrust of antitrust legislation and its purpose and also in terms of benefiting consumers.

We feel that if a handful of companies control the large proportion of oil, gas, uranium and in uranium the whole process from fabrication clear back to the mine, that the possibilities of healthful competition among companies and among fields are stultified to that extent, and I think it is something the Congress should take a serious look at.

Senator BELLMON. Well, I would like to ask Mr. McLean if he would just tell the committee why it was that his company got into the coal business. I have heard this argument a great many times and I would like to have the industry explain its position.

Mr. MCLEAN. I think we had a number of strategic reasons for going into coal, but basically the idea was that we wanted to diversify our activities, we had financial resources, management, technology, which we could apply in the coal field. We, in the Consolidation Coal Co., thought that together we could do a far more effective job in developing those reserves and making them available to the public than Continental Oil could alone.

The facts of the last 5 years speak very dramatically to that record. In the 3 years after we acquired the coal we spent about three times as much money in the establishment of new coal mines, the bringing of new coal production to the market than they had in the prior 3-year period.

I think it is also worth noting that if the whole coal industry in the United States had expanded as rapidly as did Consol after we acquired it, you certainly would not be looking at any coal shortages today, because we expanded far faster than the industry generally.

So, the record here speaks to increasing competition, not the restriction in production. Faster development of resources rather than slower. I think this is generally the experience of the oil companies when they have moved into new fields of endeavor. They usually have brought intense competition.

I cite the fertilizer business as a case in point. Five or 6 years ago several of the major oil companies moved into that field, the business became highly competitive, extremely price pressure and quite unprofitable for all concerned.

Now, you can say that is foolishness on your part, but nonetheless the evidence of competition is there. I think that would be true throughout the energy industry generally as these big aggressive oil companies get into these new fields of endeavor, they will compete vigorously, bring capital badly needed in to do the job, resources, technology, and knowhow, and the best way I can think of getting this job done quickly and aggressively is to foster a policy of encouraging corporate diversity of activity in the energy field.

The fact that there are five, six, or eight or 10 of them in there does not mean competition has disappeared. I think Mr. Taylor and his associates should be vigorously charged to bring forth evidence to substantiate the position they are taking.

Mr. Taylor. I would be glad to do so for the record, Senator. [The aforementioned material will be found printed in the appendix.]

Mr. McLean. I think your evidence will show to attract prices, capital inputs, productive output and many such things and I think you will be very hard pressed to find anything other than very vigorous competition.

Mr. Taylor. I don't think the oil company competes.

Senator Bellmon. You will endeavor to submit that?

Mr. Taylor. Yes.

Mr. McLean. If we don't compete, how do you explain the average rate of return on investment in the oil industry over 20 years has run lower than manufacturing generally in the United States? How do you explain the fact that prices of oil products generally have advanced less than the cost of living generally? These two facts are not evidence of a lack of competition, they are evidence of a very extreme competition.

Senator Bellmon. I would like to continue my questions a little further. Now, it is my understanding that the Federal Power Commission's control of natural gas prices gave an unusual incentive to many industries to convert from coal to natural gas and caused another source of energy, other than natural gas, to have difficulty competing. Is this generally the case?

Mr. McLean. Yes. I think the low price for natural gas encouraged its consumption in industrial use, particularly, thus displacing both coal and residual fuel oil to some extent, depending on the geographic location of the plant in question.

Senator Bellmon. What effect did this have on the economic health of the coal industry?

Mr. McLean. I would say it was to some degree negative.

Senator Bellmon. Was Consolidated Coal in need of capital when you acquired their properties?

Mr. McLean. I would not say in dire need of capital, but certainly we had more capital at our disposal than they did, and we were in a better position to undertake expansion than they were.

Senator Bellmon. Could they have expanded at a rate that occurred after your acquisition?

Mr. McLean. Left alone, I don't think they could have expanded at the rate we expanded them. As I say, we almost tripled the capital inputs. Whether they could have done that or not, it is hard to judge. It would have been a considerable financial strain for Consol to have done what we did, and I doubt that the management would have undertaken it.

Senator Bellmon. Is this pattern fairly common in the case of other combinations of oil and coal companies?

Mr. McLean. The pattern of more rapid expansion?

Senator Bellmon. Yes.

Mr. McLean. I cannot speak to that, because I do not have the facts. I can certainly speak to the fact that competitive pressures remain in the marketplace because we meet them every day.

Senator Bellmon. Mr. Chairman, I would like to pursue another line of questioning.

Dr. Kinsey, you say that, at the present time, people seem to see no need to conserve resources. Do you have any basis for that statement? How do we get people to get out of this frame of mind?

Dr. Kinsey. They really have not had any reason to. In the past, for the most part, energy has been available. There have been a few exceptions to it and there has been no particular dramatic occasion as to why they should have this brought to their attention. Probably the power failures in New York last year did more to create a sense of urgency than anything that has happened very recently.

As indicated in the particular model which I presented there, authority values, that is the things people will believe because somebody tells them, has a range way outside. It is something people believe, but it doesn't really hit them. It is not really central to them.

It only becomes crucial when it hits them, it hits them in the middle. It affects their standard of living or effects the ability of themselves or their children to get a job or education. Something that gets right down to their core of values. Then they begin to see the relevancy of it.

Quite frankly, I don't see anything that would suggest that this is going to change.

Senator Bellmon. Dr. Zandi is recommending that there be a strong educational component in any policy we have. Is this in line with your thinking?

Dr. Kinsey. It has to be in line with a peculiar kind of educational policy. Somebody remarked if we had a perfectly informed consumer, we could solve a lot of problems. There will never be a perfectly informed consumer because a consumer listened with a tin ear. They hear what they want to hear. This is true in any field.

Any educational program is going to have to operate in such a way that people deal with something on an equal level. Let's say people are concerned about ecology. This is pretty important to them. Then you are going to have to approach energy from the point of view of what effect it will have on ecology. You have to educate them in that sense. You have to force them to make choices between real issues and this is the reason why I suggested maybe a series of conferences or programs in which people were forced to deal with issues of equal magnitude.

All right, you want to eliminate poverty, you want to eliminate pollution, how are you going to reconcile these two and really have to deal with them at that level? I don't think education will do it. It is simply a matter of some authority telling people that they have to be concerned about energy.

For one thing, people telling them are people who have vested interests of some kind. They are environmentalists concerned about environment or oil producers concerned about profits. It is very easy to ignore that kind of factual information.

Senator BELLMON. I happen to agree with this line of reasoning because when I came to the Commerce and the Senate, I was very surprised to find what I considered to be almost a vast ignorance of the energy conditions in this country, and I have been interested ever since that time in trying to figure out some way of filling this void. Your suggestion and the suggestion of Mr. Zandi, I think, are right on target. I am curious, Professor Zandi, do you have a suggestion of a practical means of accomplishing this?

Dr. ZANDI. Yes, sir. As much as one can answer with certainty in this kind of question.

There are several levels of education needed to be simultaneously to be operative in the society. One that was mentioned here, I think this is one way of doing it, but the other thing is the attitude which comes as a part of the enunciation of the policy that you select, that you decide upon.

If one reads the President's energy message, for instance, no place over there brings about the sort of communication that I am talking about to the public. What he is talking about is that we need this and we are going to go and get it. There is no place here that the public is going to play a role here to understand what is happening.

My feeling is, yes, for one thing Alvin Coffler's type of community of forecasting which looks into the future would be a solution. Also, a program like——

Senator BELLMON. Forecasting in practical application, who would do the forecasting?

Dr. ZANDI. This could be done through several national centers that is lacking in this program.

Senator BELLMON. You see the problem is, the only group that has the facts in this field are the energy companies, and nobody believes them any more. Nobody believes anyone who comes from an energy State. The people who come from consumer States, particularly the politicians, are afraid to tell the truth because the voters won't like what they hear.

Dr. ZANDI. Some of the questions are like that, but many are not. Lots of problems—right now we are talking about energy in which we have a crisis—comes from the environmental considerations. I maintain, as I described, looking at the overall, totality of our environment and in general the trend is not sure, the data is not very far that it is deteriorating. What I am saying is that someplace along the line somebody said so and somebody else said it again and again and again, and they believe it. But when you look at the data, since 1929, constantly you have increased the forest land in this country. Since 1929, constantly the volume of the wood, new wood in the forest has increased, which is ecologically efficient. Since the last decade, many of our rivers are in a better situation. The Delaware River, the Ohio River.

Since the last decade we have the data which is valuable, the data which we can rely upon. It shows in many situations it is becoming stationery or improving. But this data somehow is shuffled someplace because we have started in this direction and nobody is analyzing this thing. Everybody is scared and gives lip service to environmentalists.

I am an environmentalist myself, but I think it is time to evaluate the system, including university involvement.

Senator BELLMON. I might say your approach is an extremely healthy one for an environmentalist. I hope it doesn't hurt you back home.

Dr. KINSEY. I would like to make one more comment that related to the model I gave. The beliefs of people is second to the authority itself. If they have confidence to the authority, they will believe what he says. If they don't have confidence in the authority, they won't believe it even if it is true. If they do believe in the authority, they will accept a wide attitude of the statements, some of which are not necessarily true.

The implication of that, what the energy field needs now is some charismatic, dynamic young leader that the young people can identify with, that they will have confidence in. They have those leaders in the environmental field. Where are they in the energy field?

Senator BELLMON. I think that is a very good question and a very good suggestion.

Mr. Chairman, I have other questions, but I will yield.

Senator ALLOTT. I would like to say to the panel that you have been very gracious and very patient. We want to thank you very much. I would like, however, at least before my part of this is over, to go back to the paper by Professor Mead, which causes me many, many grave misgivings.

I do not believe, or do I get the wrong impression from your paper, that national security is a cloak or umbrella under which everybody is operating for inputs.

Dr. MEAD. No, I wouldn't have that kind of extreme position. I said I grant the import of oil supply security and grant that importance because it serves the national security goal. Then I am asking is there a better way to meet that, where you get to bogus points out of the suggestion that once we all agree that national security is a prime goal, then many interest groups, having their own interest in mind, will try to get under that umbrella.

Senator ALLOTT. National Security is not alone a matter of defense, as I look at it.

Dr. MEAD. I would not say so either.

Senator ALLOTT. It is a matter of projecting into the future the pursuit of the happiness and tranquility and the good life that we have wanted in this country since America was founded.

So, you have these two facets, but you did state that, in effect, you cannot understand the import quota unless you realize it is a motive for higher prices alone.

Now, we run our country, in most instances, on a free competitive basis. How would you procure the additional reserves if the oil companies could not operate at a profit?

Dr. MEAD. They would operate at a profit. I am suggesting that we adopt the free enterprise system. I think it is an excellent system. A lot of the panelists have spoken on the subject of gas prices, asking for decontrol. I heartedly agree. Let's let the free market system allocate gas prices.

I would also say let's let the free market system allocate oil resources. I think the free market system will provide for future supplies. My guess about the future on oil is that international oil prices will probably go up faster than domestic oil prices as they have in the past year.

Senator ALLOTT. Yes; and they are very significant.

For the sake of the record, could you provide us with some document ation of what the prices were before the new Opec agreement and what are they now?

Dr. WALTER MEAD. It is awfully hard to say what the price was because you know all that has happened is that the posed price has been increased and it is on that posed price that the oil companies must pay a percent. The price of oil, it is awful hard to say what it is.

My paper adopts figures from the President's Task Force on International Oil Prices.

Senator ALLOTT. I would like to call attention to the fact that the last price I saw personally, I think I read it in the Wall Street Journal, was the Libyan price which was $3.347, I believe, or $3.37 per barrel. This is the price that—if anybody had mentioned it 2 years ago—everyone would have thought they had a few loose bolts in their head. Yet, it is the result exactly of the situation that we are all fearful of.

I can recall, for example, in World War II, when we found ourselves without the development of florisfarb, paying $45 a ton for florisfarb. Who in the world would ever think of it. This is the reason we must develop our reserves.

I grant you, you are using up a depletable, nonrenewable resource. But, on the other hand, unless you have some protection against these imports, I don't know how you can keep private industry in business enough to go out and develop the reserves that you need in the future.

Now, with respect to your national petroleum reserves, there is one very practical aspect. How do you put a petroleum reserve on a standby basis for 60-day production and keep it that way for 20 years?

Dr. WALTER MEAD. It is being done in Elk Hills. That petroleum reserve existed since, I think, 1913 or something like that.

Senator ALLOTT. Do you think it could be put into production on 60 days notice?

Dr. WALTER MEAD. Yes; it can be. That is the way it is set up.

Senator ALLOTT. I would like to turn to some of the people in the oil business here because I think they all were listening to your testimony with a great deal of thoughts rattling around as was I.

Let's start with Mr. McLean and have him comment, and I would like to get some of the other peoples thoughts on this subject also. From my experience in the field, I don't think it would be a practical way to approach the question of oil reserves.

Mr. MCLEAN. First I would like to respond to what is happening to foreign oil prices. I can give you the market prices.

About a year and a half ago Libyan crude oil sold, third-party transactions, at $1 60 a barrel. Today it buys and sells at about $2.75 a barrel, an increase of $1.15. Of course, a very big percentage increase.

The increases in the Middle Eastern crude oils have been slightly less than that, but the order of magnitude is still very large indeed.

I should also mention in this same connection, that the value of an import ticket, a differential between domestic and foreign oil today is about $0.25 a barrel. A year or year and a half ago it was $1.25 a barrel.

So this differential between foreign and domestic oil is narrowing very rapidly and I suspect it will continue to do so in the future.

That $0.25 value is on the east coast; on the west coast it is $0.50.

May I speak to the general thesis?

Senator ALLOTT. I wish you would; yes.

Mr. McLEAN. I think Professor Mead's analysis ignores several things. The first question you might ask is what happens at the end of this 60 days and how do we know that all future emergencies are going to be of only 60 days duration?

Second, I think he ignores two things. First, long leadtime necessary to do anything in oil exploration, development, and production.

If for the moment you let a surge of foreign oil come in and diminish or discourage the domestic exploratory activity of the oil companies, diminish the funds they have available to use for the purpose, of course they will cease the activity and turn to other endeavors, many of them overseas.

That is fine for a short period of time but overseas today we have about 10 countries, and I have to emphasize this, who have about 80 percent of the free world crude oil reserves. For the next 10 years that is oil we have got to have, Western Europe has got to have, and Japan has got to have because there is no way in the world you can develop alternative out of oil shale or tar sand, gasification of coal, any of these things, nuclear power, within 10 years time to supply very much of our energy.

So in this interval we have got to have that oil. About 10 countries, largely the Arab, have got it. As soon as you diminish our position to produce our own supplies, they are going to move aggressively and very aggressively to extort a very high price indeed from us and all of the other consuming countries.

Dr. Mead at that moment would say that is too bad, I misjudged it. Now you boys get busy here in the United States and find and produce us some more domestic oil.

That is great, we will go to work again, but you have a 5- to 7-year leadtime to get the machinery going. That is what is wrong with this thesis about pulling out the import controls in a vain effort to get cheaper oil. You are going to wind up with higher priced oil and under very difficult circumstances.

Senator ALLOTT. Does anybody else wish to comment on that?

Dr. MEAD. Well, I concur with everything he said. I also think that we should bear in mind that any large increase in imports would further complicate our balance of payments problem which is very much in the public eye these days.

Senator BELLMON. I would like to ask Professor Mead if his calculations which are on page 11 of his statement include the cost of providing natural gas for the domestic market? Natural gas at the wellhead, I believe, sells for about 70 cents per thousand and yet liquefied natural gas lands in New York at limited quantities sells for from 75 cents to $1 per thousand.

You use figures that indicate we now are paying $2.6 billion a year for our oil import program; are you including the effect of having the supply of domestic natural gas which we would not have if we were importing crude?

Dr. MEAD. The figures I use on page 11 are drawn from the Charles River report and I don't know whether they used the price of gas or not.

However, my answer to this thing would be, let us decontrol gas. If we do so the price of gas will certainly go up, where it should be under supply-demand traditions. When the price goes up, it will be more profitable to explore for oil and gas, because the price of gas is worth more. So I don't know how the Charles River associates handle that.

Senator BELLMON. Can someone in the industry comment on this $2 billion figure? What you are saying is that by keeping the oil import quota effective you are penalizing the consumers; is that right?

Mr. MCLEAN. I don't think the figures are accurate.

This Charles River group is the one that did the staff work for the Reeder committee?

Senator BELLMON. I don't know.

Mr. MCLEAN. I thought that was thoroughly discredited in many hearings down here over the past 12 months.

We would be glad to take those figures apart for you, if you wish and give you some evidence on it.

Senator BELLMON. I would like to have both of you analyse it.

Dr. WALTER MEAD. One can take any estimates they like. Professor Edelman has estimates, they are available, the Department of Interior has estimates on both the private costs and social costs.

They are all in the same ball park. The extremely high cost of oil import quota system I don't think is in doubt. The exact amount is.

May I reply to a couple of the comments?

Senator BELLMON. On page 12 you told us that would be $39 billion?

Dr. WALTER MEAD. That's correct.

Let me tell you how I did that. I took the figures by the Charles River report and they show that for the years 1960 and 1968 they made estimates for each of those 2 years of the social costs of the oil import quota system, this is past, not future. and they have two different figures. One is $2.6 billion and the other is $3.9 billion for those 2 years.

What I did was to take the average of those two for the span of time, 1959 through 1971 and assume that that average was, which is $3¼ billion per year of social cost, and multiply it by 12, it is all laid out here in my paper, and when you do that you get a social cost to the Nation of $39 billion.

Now, someone may use other estimates of what the cost was in that period of time, it will still be in the billions.

Senator BELLMON. But your whole thesis is based on a report that Congress perhaps discredited.

Would you go into this on your own, give us your estimate based on your own figures. We can ask Mr. McLean to do the same.

Mr. MCLEAN. May I make one comment?

If we are not willing to recognize the changes that have taken place in the world since 1968, that is the latest figure he is using, we can make no really intelligent approach to this problem, because the picture of domestic versus foreign oil has changed so radically in the last 12 months, to say nothing of the last 4 years. It is a totally different thing.

Dr. WALTER MEAD. I agree with that. The picture in the future has changed. What I did was estimate the cost of the oil quota system.

Senator BELLMON. You are criticizing the oil import program with the purpose of asking us to abandon it or wipe it out.

Dr. WALTER MEAD. That would be my choice. I am just trying to estimate the past cost, that is all.

Senator BELLMON. We have to be concerned with the future.

Senator ALLOTT. What do you do, with the law of economics—and human beings being such animals as they are—what do you do if you take off the import control, you get a greater dependence on imports. Mr. McLean says it would take 5 years to gear up, then at the end of that 5 years you are looking down a gun barrel.

So the people, then, are paying the price, your so-called social costs, anyway.

Dr. WALTER MEAD. I agree with you 100 percent and that is why it is so important that we have a standby reserve system.

Senator ALLOTT. How would you finance that standby reserve system? We have several naval petroleum reserves, we have the Elk Hill, we have one in Alaska, one in Oklahoma, but outside of these present reserves that we have, we have the basic problem of trying to identify new sources of oil in this country.

The number of wells being drilled is going down dramatically every year, simply because the money is not there to drill them.

Are you going to advocate that we socialize this system?

Dr. WALTER MEAD. Exactly the opposite, let's go to a free enterprize system. Let's get rid of import control. This is Government interference on behalf of a particular industry. I advocate a free market system in gas supplies, which Mr. McLean agrees with me, and I think every spokesman for the oil industry agrees.

Senator ALLOTT. When Ralph Nader hears about you you will have to be running.

Dr. WALTER MEAD. I will be glad to defend myself.

Senator ALLOTT. I think you realize, don't you, the highly charged emotional nature of this issue. I know these industry people do hear from the public with respect to Federal power regulation of gas prices. Right or wrong it is one of those things that has been sold to the American people. Somebody said it, somebody else kept repeating it, and we were getting further and further into the field.

But I do not see, under your system, how you can develop the new reserves in the United States without entering into a period in which you would be totally at the mercy of foreign countries.

Dr. WALTER MEAD. Let me explain. Mr. McLean totally misinterpreted what I said.

My 60-day leadtime he interpreted as a 60-day supply. That is not what I said. I said if we have a reserve system set up it will be set so that on a 60-day-notice basis that reserve system can be fully productive for a period of time. The model I have set up here is based upon the real experience of Elk Hills and Elk Hills is set up partially now and with an added investment can be set up so that on a 60-day-notice basis it can deliver oil for a long period of years but in 1 year it can deliver an amount of oil exactly equal to the present imports from abroad into the west coast. That means that the west coast, you see, can be fully secured. I am concerned about security.

My problem with the present system is that it does not provide long-run security. It depletes our resources so that in the future we are really going to be at the mercy of the OPEC countries. We are already there and this point has been made by Mr. McLean. He has pointed out that the price of OPEC oil is going up. I agree, it is going up more and to the extent that we rapidly deplete our American oil supplies we will be at the greater mercy of the OPEC countries in the future.

Therefore, it is so important that we establish standby reserves which would say to the OPEC countries, your threats are idle, we have reserves. Right now their threats are good because our excess capacity is almost zero and it will be by 1973 according to the Department of Interior.

Senator ALLOTT. You never explained satisfactorily how you would stimulate, under your theory, exploration, unless it is financed by the Federal Government.

Dr. WALTER MEAD. First of all, I would rely on the free enterprise system to do the stimulating. I think it is capable of it. If we would do so, we would have higher gas prices.

Senator ALLOTT. Higher oil prices, too.

Dr. WALTER MEAD. I think in the future we would because the supply of oil is not going up as fast as the demand for oil. That is why they can demand higher prices and get it. We can't do much about that.

Some environmentalists would say, cut back on the demand for it, but this is an idle hope. It is the supply and demand that determines the price of oil on the free market. The price of oil, in my opinion, is going up.

Now, they make the point that this gap between the U.S. price and the foreign price is declining. He said down to 25 cents, 50 cents is the price of the import quota tickets.

I agree that is what the record says, as this gap between the U.S. price and the world price diminishes to zero, we no longer need import quotas, let's get rid of them.

Mr. HARDY. May I say something, sir?

Senator ALLOTT. Yes; would you give us your name, please.

Mr. HARDY. Edwin F. Hardy, representing American Gas Association.

I think it is important to inject here that we have more to replace than the oil that would not be replaced in the United States if we allow the amount of imported oil to go way up. I mean above 50 percent. We will now have to supply energy that has left the country in the form of gas, as well. We do not go out and look for gas and find just gas. In fact, we can't find enough gas that way to do ourselves much good under the circumstances.

Gas is frequently associated with oil. If we are to say this is just gas that we find and leave the oil, then you can't get the oil later because the gas is the pressure drive that gets the oil out of the ground for us. So we are, in fact, saying let's not use natural gas any longer, either.

So we will have to import more of something, probably oil, to take the place of the gas we can no longer get.

Senator ALLOTT. Well, I still don't have an answer to the question. You think at that point, industry would go out and suddenly find great new reserves, Professor, and our problems would then be amply settled, and we would be in a competitive position with the OPEC countries.

Dr. WALTER MEAD. I am not saying that, if we decontrol gas the price of gas would go up.

Senator ALLOTT. I am talking about oil imports.

Dr. WALTER MEAD. If we were to decontrol oil imports over a period of a year, I suspect initially the price of oil would go down a bit. What do you say, 50 cents is the difference between them?

Mr. McLEAN. I doubt it very much.

Dr. WALTER MEAD. Then what is all the argument about? If the price is the same, Americans are going to buy oil where they can buy it cheapest. As the world price goes up, they will buy it domestically and we don't need any import quotas.

Senator ALLOTT. But you don't have the domestic incentive, this is my point.

Dr. WALTER MEAD. This is the situation all over the world. Demand for oil is going up more than the supply, and that is where the Middle Eastern price is going up rapidly. My suspicion is that it will continue to go up rapidly. We need to establish reserves to take care of our security needs.

Senator ALLOTT. How do you establish reserves without drilling?

Dr. WALTER MEAD. We have a lot of needs which can be purchased in the free market.

Naval Petroleum Reserve No. 1 is Elk Hills. Right now, there is a corner of that which is being recovered, and therefore the Navy is forced to recover some in order to protect their interests. I would like to see us buy out that little residual interest in Elk Hills so it doesn't have to be pumped to protect the interest. That is enough.

Some of the new fields in the gulf can easily be purchased for what they are worth.

Senator ALLOTT. When you say easily purchased, where do you get the money to purchase them?

Dr. WALTER MEAD. One source would be savings on the import quota system. It still costs, even in 1971, a fair amount of money, and I think even in 1971 it would be far cheaper to shift over to this kind of system.

Senator ALLOTT. How do you recover costs in this business?

Dr. WALTER MEAD. One suggestion this morning is if this is a national defense need, it ought to be in the national defense budget. But the point is still the cost of this system, which is less than the cost of the present system that we are now using, which provides us with less security.

Senator ALLOTT. You know, somewhere you have to reduce this to legislation. My trouble is in seeing how you put into our national economy the money, except through the private enterprise system, to do it, I think if you do away with imports you won't get the money you need.

Dr. WALTER MEAD. The import-quota system has been quite costly and getting rid of it would be a saving to the Nation. We have No. 2, Buena Vista just south of Elk Hills. It is pretty well depleted and wouldn't be a good reserve any more.

No. 3 is in Wyoming, Teapot Dome. That too is being drained. We should stop the drainage by buying out that private interest so that the whole thing can be set up on a 60-day-emergency-production basis and become another Rocky Mountain Reserve.

Right now, that reserve is not set up in an emergency production basis at all. Elk Hills is only partial. Naval Petroleum Reserve No. 4 is on the north slope of Alaska, due west of Prudhoe Bay, right on the boundary. It contains a tremendous amount of oil but no one knows exactly how much.

I have found estimates that say from 10 billion to 150 billion barrels, if you can imagine that much.

You can find all kinds of estimates, all we know is that there is a lot of oil up there. That might be another reserve. You don't have to buy it, we already own it.

Senator ALLOTT. Well, it is a reserve right now.

Dr. WALTER MEAD. Right, but it is not set up as such. It is not on a 60-day-production basis.

Senator ALLOTT. Well, it is a reserve and I don't think you would find the Congress or the public in a position to utilize those reserves except on a continuing national emergency basis. Then you have for production of the Alaskan Naval Reserve, which is No. 4, I believe, a period of development which is 5, 6, 7 years.

We have been wrestling on this committee, for 5 years at least, with the Prudoe Bay problem. You don't have any assurance that you are going to get it here. With the Russian proliferation of submarines, you can't be sure that you can use tankers, anyway.

So you are right back against the circle. So I still can't see that the so-called reserves now owned by the Government would be sufficient to meet the extended national needs, we have to develop new reserves and I don't see how they would be developed under your theory.

Dr. WALTER MEAD. All right.

Down in the Gulf of Mexico there is an area called the Main Path Block, No. 112, I think is the number. I don't know much about this block, I simply developed that information from an Oil & Gas Journal article and the report was that this was a big new field.

Why not purchase this field and set it aside as Elk Hills, develop it fully so it is on a 60-day-standby basis, then shut it in.

Senator ALLOTT. Where do you get the money to develop this? The Federal Government?

Dr. WALTER MEAD. Yes, of course; it becomes part of the defense budget and that is why it belongs.

Mr. ROBERT MEAD. I would like to be excused, may I put Mr. Jameson in my place here, I have to catch a plane?

Senator ALLOTT. Yes, thank you.

The Senator from West Virginia has been waiting patiently, I explored this very carefully but I have great reservations. Senator Randolph, you go ahead.

Senator RANDOLPH. I think, Senator Allott, that your colloquy with the gentlemen of the panel has given me a better insight into this subject of imports and reserves than I have ever had before.

I compliment all of you who have entered into this discussion of subject matter. I think it is an excellent consideration of the problem, I hope more people can read it. It is a give and take, of course. Sometimes our differences are strengths; you know if we follow through to the *n*th degree and not so much modify our thinking to believe that there are just two sides to a question, you know, there are as many sides as there are parties concerned and the entire public should be considered.

This on a worldwide basis as well as a more provincial look. So it has been very helpful to me and I am appreciative.

I think I would help these gentlemen by letting them continue their discussion and submit them questions later which they can respond to by mail. I want to try to accommodate the people.

Senator ALLOTT. I am informed by the clerk that that would be satisfactory. When I say the clerk, I am referring to the counsel of the Interior Committee.

Senator RANDOLPH. You see, I am still understanding of the people.

I have questions for Mr. McLean and for Mr. Taylor and perhaps others and we will have them submitted for the record and you will follow through in that way.

(The questions submitted by Senator Randolph and the responses to them will be found printed in appendix B.)

Senator ALLOTT. Certainly.

Mr. JAMESON. I am Minor Jameson, executive vice president of the Independent Petroleum Association of which Mr. Robert Mead is president.

There is some recent information extremely pertinent to the comments of Professor Mead which was filed this morning by General Lincoln, the Director of the Office of Emergency Preparedness, information by the Chief Economist of the Cabinet Task Force which shows that the cost of the oil import program is very, very misleading and should not be used as Professor Mead has used it.

I would suggest this is very pertinent to the record. (The material referred to will be found in appendix B.)

Senator ALLOTT. Do you have that available?

Mr. JAMESON. Yes; I have it right here.

Senator ALLOTT. Would you supply that for the record?

Mr. JAMESON. Yes.

Senator ALLOTT. For those in the room, the record will remain open for 15 days. You are free to file additional statements or comments with respect to the other panelists during that 15 days, if you wish.

May I express to you on behalf of those of us who have been here, our deep appreciation for your long patience and contributions to what is going to be, as the discussion shows, a very, very difficult problem to solve.

Thank you. The committee stands adjourned.

(Whereupon, at 5:05 p.m., the committee meeting was adjourned.)

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