INTRODUCTION
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Our concern of the energy future in the United States and the world has changed dramatically in the last few years. It used to be that our energy policy was based on unrealistic trends of continued growth. It was based on infinite growth requiring increased domestic oil and gas, nuclear reactors, domestic coal and rising imports to meet the demand. The possibility of curtailing demand was not one of the options considered. The Arab oil embargo of 1973 brought home the vulnerability of our energy dependence. It became obvious that we could not afford to depend on this source to satisfy our demand. Domestic oil and gas production had peaked in the early 70’s and now seemed likely to decline steadily. A transition from oil and gas to alternative sources of energy was seen as the solution. But, in a nation where the public is increasingly aware of the environmental deterioration, every solution offered seemed to have environmental and sociological drawbacks. Increased stripmining of coal posed a threat to land; mining and using of high sulfur coal created the problem of acid rains which destroyed the crops and the streams; increase usage of nuclear power challenged us with questions of radioactive damage and terrorism; solar-energy is available in unlimited quantity, but its diffused distribution is not amenable to the centralized power generation and distribution we are accustomed to. Under these circumstances, our energy policy options need to be weighed carefully. Not only technological, environmental and economic problems need to be raised about the options. We, as a nation, need to determine the trade-offs implicit in each one of these technological complexities. We are at energy crossroads, and certain hard-hitting decisions have to be made now. To complicate the matter, we are burdened with the decision to make the transitional paths smooth, which will seriously demand changes in the lifestyles we are accustomed to. All these questions are addressed by the following speakers. Their presentations address themselves to issues such as “Can the National Energy Plan achieve its objectives by 1985?”, “What should be the short- and long-term goals and how to reach them?” and “What are the social and environmental implications of the energy options we choose?” The energy and environmental crisis is here now, and the decisions we choose to make or not to make will decide the kind of world of tomorrow.

ENVIRONMENTAL ISSUES IN DOMESTIC ENERGY DEVELOPMENT
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In 1969 Stuart Udall wrote that the 1970’s were going to be the age of ecology. This age lasted about 3-5 years, but it has since been merged into what I will call the Age of Multiple “E’s”. The energy-environment issue has a number of interface issues. Not only do we have energy and environment, but we have ecology, economics, ethics, equity and engineering. All of these social and scientific issues interact in our attempts to deal with the environmental problems. Now, as scientists, most of us are used to thinking in terms of resolving problems on the basis of technical data; but all of us are also citizens and we have to think of things in terms of costs, benefits and risks which gets us into the area of economics. We have problems of what is right and what is wrong which gets us into moral problems, and this gets us into several legal problems. These are mentioned here to merely indicate that the issues discussed are complex and there are no easy linear, objective scientific answers in all cases.

The primary discussion here will be on fossil energy. Relatively little will be said about nuclear energy. The reason for this is because the environmental issues and technical issues of nuclear energy have been sufficiently well recognized. Regulations are so tight that we are at the point that if we set standards much tighter, we will be taking effluents and processing them to achieve levels of radiation less than natural background. Regarding fossil fuels, during the exploration phase of mining, there are a whole matrix of environmental problems. Another set of environmental problems are associated with both underground mining and surface mining. We have the problems of impact on soil, vegetation, underground and surface water, wildlife and fish. These problems can affect areas that are reasonably large, produce not only direct environmental problems, but also can result in social impacts.

Recently, the Congress has passed a surface mine and
The changing energy epoch

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Today, the world is in the midst of a momentous transitional storm between two great energy epochs—the fossil-fuel epoch and an age of nuclear and synthetic fuels. The impact of this dramatic episode is being felt across the globe. Historically, the transition from one fuel epoch to the next has always been accompanied by a marked improvement in human living conditions. This time may well be no exception. But it will certainly be the same, when, eventually, the present transition is completed. In the meantime, one essential difference between this transition and all those that have preceded it must be dealt with. Today, the fossil-fuel epoch and the next age are not interlocking. There is some overlap, but there is also a large supply gap, and, we call this gap a "transitional storm"—you've heard it called an "age of anxiety." While the fossil-fuel epoch is coming to an end, the quest for less oil and gas will naturally be always available with increased cost, they will be too expensive to be burned as fuels. Promises of solar energy, fusion, geothermal and wind power sources just won't provide us with enough power in the future to satisfy our energy needs. All of these forms of energy, even optimistically, likely could supply only 7 percent of our total energy needs by the year 2000.

To summarize: We must conserve every form of energy or face a future of diminishing returns. Have we learned our lesson? By investing more money to spend doesn't mean there is more energy to use. We must stop energy waste; consider other energy sources; and carefully plan for their use. If we don't, the well will run dry in our lifetime and not in some distant future.

In the immediate future—1977 to 1985: Oil and natural gas will satisfy the bulk of our energy needs. As we continue to plan with the oil and gas we need and we prepare for the next month, we should make it through this period. By construction, lead time for production and development of new nuclear power as well as the conversion of coal into synthetic gas and oil.

The immediate future—1985 to 2000: Coal and nuclear power will supply most of our energy needs, but only if we chip away at the lead-time bottleneck.

The future beyond 2000: With coal resources properly developed, coal and nuclear power could last several centuries and provide the core of our energy system. But without new major energy supplies, the future looks bleak.

Our biggest challenge is ahead of us. As we think about how to position ourselves in the new energy world, we must take a look at the role of coal and nuclear power in the future.

Energy versus society: profiteering from scarcity

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From an environmental perspective, the key ingredients to an energy plan for the future is to ensure that we realize that conservation is not just a means to save on energy resources, but that it can also substantially help to reduce the economic and social costs which society uses up in producing this energy. Efficiency and conservation also go the farthest in protecting the environment. The dichotomy of coal versus fusion is a false one. Neither of them is desirable environmentally or in terms of efficiency, and furthermore they are only being considered transitional energy sources. If a commitment to safe and renewable sources is made today as seriously as the commitment to fusion of the last century, the requirements for a better future might turn out to be more optimistic.

The production of electricity is a prime example of a wasteful process. Not only is the process of generating electricity very inefficient since for instance two-thirds of the fossil fuel energy is consumed as waste heat in the conversion, but also it is ecologically harmful in terms of the heat pollution as well as chemical or radioactive pollution. Therefore, it is extremely important to minimize the need and the use of electricity should become a primary goal.

This can be accomplished through a rational conservation program and by implementing the more efficient end-use devices available today such as solar collectors for heating as well as the numerous other technical fixes such as cogeneration in the industrial sector. To this end, an oriented program need not be expensive and could certainly pay for itself as a cause of less jobs. One of the interesting facts is the number of studies including one by McCracken for the National Science Foundation, which showed how a conservation program would only not only basically save jobs but be treated in labor intensive areas, but would also save billions of dollars in investments.

What I want to analyze now is the economic and
political environment surrounding the energy problem enables us to find the underlying motivations for the important decisions being made today which will affect our future. Probably some of the most important trends and large profits generated in the energy sector of the economy. Oil companies attempt to justify their profits by a growing sense of massive development and exploration. But it is hard to see how Mobil Oil’s purchase of the Montgomery Ward retailing chain is going to help produce more gasoline for transportation! It is clear that the oil conglomerates are, in effect, increasing their control over the economy by acquiring, to their own advantage. Oil firms have also been acquiring a large controlling share of the other energy sources as well. The 500 percent increase in the price of uranium yellowcake over the last four years is a very good indication of this monopolization where an international cartel including a number of companies has been charged by Westinghouse of price fixing.

The sun as an energy source cannot be owned and therefore cannot in general be profitably sold, especially when it is used through solar collectors or wind mills on a decentralized neighborhood basis. Unfortunately, this thinking may be too naïve. A recent ERTA report issued last spring recommended that public utilities be given exclusive monopolies to provide solar heating and cooling systems for individual consumers. This would then be a captive market for a telephone from the local phone company. In this way the energy industry can continue to be guaranteed control over the national energy supply.

Negativistic redistribution of wealth would probably take place under President Carter’s plan for higher regulated oil and gas prices. U.S. oil will now be subject to a tax relief scheme. A ruling by the U.S. Oil Equalization tax price scheme and a gas price ceiling of $1.75 per thousand cubic feet would cost consumers $14 billion per year. As part based on technical information an increasingly egalitarian society, we will be heading towards greater inequalities aggravated by the approach taken to deal with the scarcity of new energy sources. It is a welcome sign that public concern over energy options is increasing. An example is the astonishing growth of the anti-nuclear movement across the country. The Carthage Alliance itself has now over a thousand active members of widely different political persuasions and diverse backgrounds including scientists, lawyers, workers and students. We should also note that this citizens’ movement is quite international. Large organizations exist in most European countries as well as in the United States. These and similar organizations have the major responsibility of educating the public. But we are faced with a sizeable handicap as was clearly shown by the statewide initiatives and referenda last year. The Alliance, and other similar environmental and consumer organizations will be pursuing a broad spectrum of strategies to challenge the energy industries and the utility companies. Exposing the dangers of a nuclear waste dump step by step in educating the public. Petitions and endorsements are being used to influence elected officials at the local, state and federal levels. Legal initiatives during the licensing process will be pursued at every possible step even though the heavy financial burden this requires has generally yielded minimal results. In this way, the energy debate will become increasingly important and will involve a larger and larger segment of the population.

What can the scientific community do to contribute meaningfully to this debate? Although policy decisions affecting the environment are generally made at management or governmental levels, the decisions are in large part based on information furnished by scientists and engineers employed in and out of government. When the technical information is freely available, the professional engineers working inside the company or laboratory are usually in the best position to offer a critical analysis of the technical basis for the policy decisions or of other related health and safety questions. It should therefore be in these situations that dissenting views be expressed without being subjected or threatened with retaliation. This conflict has indeed been borne out by a number of recent polls of engineers.

While some 60 percent of the members of the National Society of Professional engineers polled believe there are valid reasons for the public to be worried about nuclear plants, as many as 40 percent of them felt restrained from criticizing industry’s products for fear of a reaction. Although many aspects of an environmental problem may not be grasped on the technical level by the public, an average citizen can certainly readily understand the social and political aspects. It is here that the scientific community can make the greatest deal of credibility in the eyes of the public as was happening during the Vietnam war. Walter Sondheim, an economist and member of the scientific community, will be given the right to be acknowledged as an object of democratic society.

OUR ENERGY FUTURE

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Our national debate on the energy field reflect a great deal of ambivalence in the public and environmental thinking. Recent predictions by government stated goals and actual programs in congressional reactions, and in public attitudes. Before we can make coherent energy policy, we must do some basic things, to try to understand these ambivalences, and to come to grips with underlying concerns. The government that can make the energy for the future seems to assume that we are on a road moving ahead in terms of energy—that will take technology in the next 30 years. But, let us remember, the last few decades have also been a period of hypo therapy, so that we use more carefully the oil and gas we still have, expand greatly the use of coal, and carry on through government investments. Thus the energy consumed in the past 20 years. Conservation of energy fits into the plan as an important near-term goal. We must consider some real steps to help promote energy efficiency—there are energy efficient—at least until some limitless source of energy is developed. The road we have been traveling in fact has a distinct advantage, the economists tell us that cheap and plentiful energy as a base for a comfortable sophisticated society that has thrived on waste. We have more cars and still deteriorating mass transit systems. We have homes that leak heat. We have a lifestyle that is filled with all kinds of unnecessary energy-consuming gadgets. The energy situation has become so bad that during the past five years, the gross domestic production, we consume 1,513 tons of oil or oil equivalent, while in Sweden, with comparable standard of living, the consumption rate is 865 tons.

The change in value and planning is not just the government’s responsibility. How many of us have re-evaluated or altered any of our habits? How many of us drive at speeds of 55 m.p.h.? How many of us walk a couple of blocks instead of driving? How many of us have failed to do these, but we are educating our children by the examples we set. If we accept the fact that a real change is needed, then there are a number of areas in which substantial change will have to be made.

The first area we should consider involves our individual lifestyles. Even though conservation is viewed as a short-time effort, in a world of limited resources, conservation will become the permanent way of living. This will demand development of a sustainable, harmonious relationship with our environment—feeling a part of the earth and not just the user of it. An energy conservation lifestyle will mean making changes in significant ways in our daily lives. For example, if the government decontrolled oil and gas prices, many of us would not find significant changes enjoyable, and annoying to make any changes over years. For example, if the government decontrolled oil and gas prices, many of us would not find significant changes enjoyable, and annoying to make any changes over years. For example, if the government decontrolled oil and gas prices, many of us would not find significant changes enjoyable, and annoying to make any changes over years.
NATIONAL ENERGY PICTURE

ROBERT McFARREN

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Washington, D. C.

The thinking that the energy crisis is a passing phe-
nomenon on the national scene is coming to a fast
stop. Even though a consumer's immediate interest in
the price of gasoline at the pump for his automobile or
the price of oil and gas for his furnace, from the point
of view of government's planning and action, the energy
picture is extremely complex. There are many ways of
looking at the energy crisis, which include price, federal
regulation, OPEC, balance of payments, foreign de-
pendence for resources among others. Regarding the
price structure of energy, if we let the market place
rule, the distribution of energy may become unacceptable.
To make it equitable for all the people and to control
to some extent the supply and demand, government
regulations are imposed. Since a great deal of our oil is
imported, many of the energy and environment decisions
we make are dependent on the pricing policies of the
exporting nations, which invariably creates balance of
payments problem. Because of the increased interdepend-
ence of nations for the energy resources, the decisions we
make invariably influence our foreign policy deci-
sions.

Energy Crisis is a multiple transition we all are going
through. In this oil was the first major commodity to
trade from a buyer's to a seller's market. We have
really come to a point of recognizing how small we are,
how insignificant we are in the big picture. This demands
a need to get along with each other on this small island
called earth. No longer can one turn to a "Go West Young Man" philosopher. Third world countries are
challenging the right of fourteen nations to divide among
them the Antarctic.

Because of the ever increasing global consumption of
energy, insignificant environmental issues have be-
come problems at levels we never thought would be of
concern to us. The problems are so suddenly upon us
that we don't know what degree of controls is necessary.
More important than anything else is the recent public
awareness of complex scientific issues such as CO2 threat
to the atmosphere. When we consider new technologies
to combat the energy crisis, the electric utilities will be
increasingly scrutinized, which will have a hard time
changing. Some of the changes will be inherent in the
technological change, but others will be forced upon
them by the public and governmental regulations.

The extent of such changes will depend on the public
participation in the resolution of conflicts. The extent
to which the public participated in energy and environ-
mental issues, a decade ago was small and insignificant.
With the increased activity by the public in environ-
mental issues, we will be seeing more of sunshine laws,
open meetings and public forums. To reach rational
decisions under such circumstances, we all have to
become knowledgeable on the problems at hand. We
will be called upon to change our lifestyle to fulfill our
obligations to govern a nation which will have to make
some difficult decisions in the energy field.

Such a changing picture will thrust upon us more and
more decentralization. Since the Roosevelt administra-
tion of the thirties, the nation has been seeing more and
more of centralization of decision making in Washington.
Even though it served well in the past, with the antici-
pated enhanced participation of the 'man in the street',
the future trend will be moving away from this. What
is going on is a forcing function on a lot of the ways we
do things, and this forcing function is the energy
shortage. Such an issue cannot be easily resolved unless
we actively seek and debate each other's views.

Sixty percent of the citizenry does not realize (or
accept) that there is an energy crisis. The number of
motorists who refuse to maintain a $5 m.p.h. speed-
limit on our illustration is an example of this. The De-
partment of Energy will assume the responsibility to
increase communication with the citizenry and help
educate them on the energy crisis. In recent years, we
have seen every state in the Union formulating its own
plan in the field of energy to satisfy its special interests.
The Carter administration is very much interested in
coordinating our national plan with the state plans. It is
surprising that many of the states are simply not aware
of their own energy needs, expected growth rate, etc.
Part of the reason for such a gap in information is that
in the past they were not required to collect, maintain
and interpret such information. The Department of
Energy will have plans to change these.

This nation has more coal than all of the oil in the
Middle East. Our biggest problem in the past has been
the safe utilization of this resource. There are strict laws
against stripping; there are laws that restrict the
burning of high sulfur coal. We have got the technology
to get the coal out of the ground, but using it in large
quantities in the safest way with least environmental
disruption is a challenge to our technology. In DOE,
one of our main interests is to find ways to put coal to
use quickly and in such an endeavor, increasing em-
phasis is being given to synthetic gas and fluidized bed
processing of coal.

The economic factors, uncertainty in regulatory pro-
cedures, and environmental concerns are having an im-
pact in power plant construction in the past decade.
If we were to maintain the rate of growth we are accus-
tonned to, then the new power plants that are going
on line at present, will not be able to meet the demand. At
present, it takes 10-12 years lead time to put a nuclear
power plant in operation. To make them operative in the
year 2000, we have to start planning now. The gen-
eral public cannot understand this unless they have tech-
nical training to do so, and the willingness to access the
risks of not understanding such issues.

President Carter is in opposition to the Clinch River
Breeder Reactor which is based on the plutonium cycle.
This is not necessarily the same as his opposition to the
breeder concept itself. It is the administration's feeling
that it is time to examine alternative fuel cycles, be-
cause the Clinch River Breeder Reactor will be obsolete
by the time it becomes operational. An alternative to
consider here is the thorium cycle, which will have fewer
drawbacks from weapons standpoint. We have an obli-
gation to prevent weapons proliferation, but reprocessing
of breeder is not the only way that can happen. The
breeder may one day become a major world power
source; in such a case, the breeders might be confined to
a few countries to produce fuels to be used by different
types of reactors in less developed countries.

Publicizing of complex issues can be good, but it can
carry with it some agonizing problems. But in a demo-
cratic set-up as we have in the U.S. unavoidable. When
public awareness of the energy issues is increased, it will
become increasingly easier for us to solve them, and we
all will have to do it together.

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