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Synopsis of Proceedings

Energy Research & Development Administration

Third Public Meeting on A National Plan For Energy Research, Development And Demonstration

ERDA 76-1

Creating Energy Choices for the Future

Denver, Colorado

May 17, 18, 1976

NOTICE

This synopsis of the public meeting held in Denver, Colorado, May 17 and 18, 1976, is being provided to all persons who have indicated an interest in obtaining a copy. The interested reader is encouraged to refer to the full transcript of the public meeting, the locations of which are listed at the end of this publication under the heading: ERDA Public Document Rooms.

The views summarized herein are those of the participants at the Denver public meeting and do not necessarily reflect those of meeting steering committee and workshop moderators.

Synopses of other public meetings on the ERDA Plan are available by writing to ERDA, Office of Public Affairs, 20 Massachusetts Avenue, Washington, DC 20545.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

PUBLIC MEETING

"CREATING ENERGY CHOICES FOR THE WESTERN REGION"

May 17-18, 1976
Denver Hilton Hotel
Denver, Colorado

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In an effort to assure the public's awareness of the National Energy Plan, the Energy Research and Development Administration (ERDA) and the Western Governor's Regional Energy Policy Office (WGREPO) will co-sponsor a Denver Public Meeting on May 17-18, 1976, at the Denver Hilton Hotel.

The purpose of this meeting will be to permit the ERDA Administrators to explain their energy programs to the public and to provide the public with an opportunity to register their opinions about the National Energy Plan, ERDA 76-1.

Program Outline

May 17, 1976

8:00 am	Registration		
8:30 am	Opening Comments	-	Gov. William L. Guy, WGREPO (Moderator)
8:40 am	Welcome	-	Gov. Richard Lamm (Colorado)
8:55 am	Introductory Remarks	-	Dr. Robert C. Seamans, Jr. ERDA Administrator
9:15 am	The National Plan	-	Roger LeGassie, Asst. Administrator for Planning and Analysis, ERDA

10:05 am *Federal/State/Regional Cooperation and Coordination

Emphasizing federal-regional-state-local partnership in national energy RD&D planning, analysis, and policy-making discussion between ERDA and the western states region on matters of importance to state and local government.

Speakers will provide a cross section of views on the energy programs of ERDA as they relate to this region.

1:30 pm *Conservation Opportunities

Focuses on the savings of energy and the technical and political opportunities available to assist in achieving the National Energy Goals.

> Presentations will include: the ERDA program in conservation, marketing of near-term technology, increased energy conversion efficiency, improved efficiency in energy use, changes in use patterns and other related topics.

3:30 pm *Synthetics and Fossil Fuels

Focusing on the technological developments and commercialization aspects of this program as related to gasification and liquefaction, oil shale, water resources, agricultural trade-offs, marketing, and siting of facilities.

7:00 pm *Environmental and Socioeconomic Impact

Encompasses the environmental and socioeconomic impact and concerns as related to all phases of the energy plan including a description of the environmental and safety program efforts of ERDA.

> The socioeconomic impact associated with synfuel programs, the impact of energy resource development as other resources, i.e., water/agricultural/recreational and the impact of rapid resource development on state and local government, and other related topics.

May 18, 1976

8:00 am *Solar and Geothermal Energy

Explanation of the solar and geothermal programs of ERDA within the western states, the status of (the solar energy research institute), regional geothermal resources, solar heating and cooling programs, the solar energy budget, and related topics.

10:00 am Intensive Electrification

Covering all ERDA technology programs that lead to electrical power generation.

> Including individual technologies for power generation, the required mix of technologies to meet future electrical energy demands, cost comparison of electrical technology alternatives, the environmental impacts of these alternatives, the pros and cons of nuclear power.

1:00 pm *Government and Business Interaction

Describes ERDA's efforts to integrate the RD&D programs with private industry, independent business activities, state and local governments and institutional research and development programs, commercialization of new technologies and capitalization requirements.

2:30 pm Meeting Summary

A closing session to summarize the major topics, issues, and conclusions of the individual topic sessions. Summaries will be presented by selected persons from the group of moderators, ERDA regional representatives, from the WGREPO and ERDA.

> *To provide a true cross-section of views on the energy programs as they relate to this region, a variety of speakers will be scheduled to talk on the different programs. Additional discussion sessions on each major topic area will follow to allow adequate time to hear all who wish to comment on the plan.

INTRODUCTION

Shortly after the publication of ERDA-48, A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future, the Energy Research and Development Administration (ERDA) held a series of regional meetings to provide the public with an opportunity to exchange information and opinions about federal energy planning.

To obtain similar evaluation of and comments on ERDA-76-1, ERDA is holding a second series of regional meetings. The need for these meetings is based on the belief that the ultimate decisions about the level of energy to be consumed in the country and the technologies to be employed will be made by the nation as a whole. This iterative approach allows the public, industry, universities, and state and local governments to voice their opinions about the nation's energy policy.

In May 1976, ERDA, in conjunction with the Western Governors' Regional Energy Policy Office, sponsored hearings in Denver, Colorado.* The states involved were Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Utah, Arizona, New Mexico, and Nevada.

The agenda, which was drawn up to reflect the major concerns of this region, focused on energy conservation, synthetic and fossil fuels technology development and commercialization, environmental and socioeconomic impacts of energy resource development, solar and geothermal energy, and intensive electrification. A number of issues were defined and discussed in each of these areas, and a range of important, and often conflicting, opinions were expressed on energy planning, funding priorities, and environmental impacts. These opinions and viewpoints are summarized in the remainder of this document.

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* Earlier hearings were held in Atlanta and Seattle; future meetings will be held in Chicago, San Francisco, and Boston.

ENERGY CONSERVATION

The discussion of ERDA's research and development (R&D) efforts in energy conservation focused on the effectiveness of different approaches to conservation.

ERDA hopes to attain energy efficiency through developing new technologies or improving existing technologies, not through requiring excessive cutbacks in energy use or "doing without." For example, by developing "locked-in" energy savings in a technology, ERDA can ensure that energy efficiency will be realized regardless of end-use. Currently, ERDA plans to assume a problem-solving role in energy conservation and to bring energy-savings technologies to full-scale commercialization.

ERDA's energy conservation projects are organized into five main areas: buildings, industry, transportation, electric energy systems, and energy conversion and storage systems.

ERDA expects that conservation efforts in the buildings sector, an area currently responsible for 29 percent of total U.S. energy consumption, will result in early paybacks. Its efforts to reduce the consumption level in this sector include the development of energy-conserving construction materials, more efficient designs for new buildings, technologies for retrofitting existing buildings, and performance standards for new buildings. Although ERDA does not have the jurisdiction to implement performance standards for new buildings, it can introduce relevant legislation and provide technical information for the development of such standards. Its current R&D efforts also include the demonstration of new heating and cooling technologies.

Recently, ERDA has developed a space-conditioning system (Annual Cycle Energy System) that uses an insulated water tank for energy storage. Heat stored in the summer is used by a heat pump to warm the house in the winter and provide hot water. The chilled water resulting from the withdrawal of heat from the water is used for air conditioning in the summer. ERDA estimates that widespread implementation of this system, which is currently being demonstrated on the University of Tennessee campus, could reduce space heating and cooling requirements by 50 percent across the country.

The industrial sector, which currently accounts for 40 percent of total U.S. energy consumption, provides many conservation opportunities. ERDA will consider investing R&D monies in energy conservation opportunities if private industry will not undertake the necessary research to develop a high-risk technology and if public interest is strong.

ERDA's R&D efforts are directed towards technology improvements in specific energy-intensive industries, as well as unit process improvements that are applicable to more than one industry. For example, ERDA is working to develop a more efficient evaporator system to reduce energy consumption in the pulp and paper industry. In addition, it is developing a high temperature recuperator system to recover and recycle waste heat from industrial processes in the glass, cement, aluminum, and steel industries.

ERDA expects that energy savings will be realized in the short-term in the transportation sector, which currently is responsible for 31 percent of total U.S. energy consumption. To develop energy-efficient vehicles, ERDA is testing alternative, more efficient engines, including gas turbines, lightweight diesels, and stirling engines, which can operate on a variety of fuels.

Aerodynamic drag devices for trucks would lower fuel requirements by 10 to 15 percent. Those devices have been tested and are available on the market. ERDA is also investigating the use of a combination of 10 percent methanol and 90 percent gasoline as an automotive fuel. However, because methanol tends to absorb water and the mix then separates, further research is required. In conjunction with this analysis, ERDA is conducting a project to combine refuse, sewage, and sludge to produce methane.

ERDA is also concerned with increasing the efficiency and reliability of electric utility systems. In particular, it is investigating the possibility of a direct current transmission system and super-conducting transmission lines which offer little or no resistance to the energy flow. Part of this research involves studying the ecological and biological effects of high voltage fields.

The need for more efficient energy conversion and storage systems arises from the development of alternative energy sources, such as solar. ERDA is assessing improvements in heat exchangers, compressors, pumps, motors, generators, and fuel cells. It is also conducting research on batteries, solar storage, and compressed air in thermal storage. Currently, ERDA and Department of Housing and Urban Development (HUD) are jointly evaluating capital costs, benefits, and the need for more efficient storage technology in a solar heating and cooling program.

ERDA recognizes that federal agency functions will necessarily overlap, and that extensive communication is needed to ensure effective policy actions. Planning must be coordinated, particularly between ERDA and FEA; otherwise, projections of future energy use become meaningless, and programs to affect that use, ineffective.

The majority of comments on ERDA's energy conservation program were concentrated in five areas:

- Allocation of funds
- Increases in end-use efficiency
- Reliability and adequacy of statistics
- Delineation of agency responsibilities
- Public involvement and technology transfer.

ALLOCATION OF FUNDS

Many participants were concerned that ERDA was not allocating sufficient funds to energy conservation R&D. In addition, several stated that ERDA did not emphasize those technologies with the most potential for energy conservation. One participant from Colorado felt that the low budget (i.e., only 2 1/2 - 3 percent of the energy budget) contradicted ERDA's emphasis on the potential for savings through conservation.

ERDA stated that it plans to allocate more funds to conservation after it is assured that the current technologies are marketable. Since the conservation R&D program is relatively new, it cannot be compared to the other programs in the plan. However, the current budget does represent a 64 percent increase over the previous year.

An industry representative noted that, while conservation has an immediate payback, alternative energy sources (e.g., fusion) will not be cost effective for at least 25 years. The federal policy was seen as assisting a narrow-based industry to develop a narrow and limited segment of technology. This discrimination was believed to occur because the larger industries have access to greater capital.

It was also felt that if the government invests heavily in energy technologies such as nuclear energy, the government's future regulatory and tax decisions will be based on protecting that initial investment. Another participant asked if ERDA used the second law of thermodynamics efficiencies in analyzing energy alternatives, when 50 percent of its budget is directed toward developing nuclear energy, an inefficient energy source from a thermodynamic viewpoint.

One participant stated that ERDA's plan tended to overlook the simpler and smaller technologies and provided funds for extravagant technologies that had no clear energy benefits. One commentator noted that the new technologies proposed by ERDA do not substantially affect the inefficiency of our current energy delivery systems. For example, if ERDA invests in coal gasification and if the home furnace that will eventually burn that fuel is inefficient, why not address technology developments for home furnaces on the same priority level as gasification?

INCREASES IN END-USE EFFICIENCY

Several participants questioned ERDA's emphasis on short-term energy conservation measures. Some believed that the need for energy conservation would extend beyond the short-term, while others felt that ERDA's emphasis on developing alternative energy sources (e.g., nuclear) was necessary to achieve energy independence and commended the government's approach.

The ERDA plan was criticized for its lack of vision. The need to develop an energy delivery system that allows for end-use efficiency and the need to make the transition from conventional fuels to renewable fuels were stressed.

One state representative was concerned about the growing number of power plants in his state and the resulting air pollution. He felt that federal and state policymakers should stress the need for efficient end-use of energy, instead of supporting the construction of more and more utilities and thus serving the growing energy demand in the United States. ERDA suggested that the state governments work with the utilities to ensure that conservation priorities are kept in mind.

Another speaker mentioned that it was not clear that conservation will necessarily reduce pollution. In fact, in several specific technologies, conservation increases pollution. For instance, the use of automotive pollution control devices (in their present state of technology) may result in lower gas mileage.

One participant pointed out that mass transit was missing from the list of transportation technologies in the plan. In the short-term, the government should expand its assistance to mass and rapid transit; in the long-term, it should develop energy transportation strategies and alternatives to automobiles, e.g., buses, vanpools.

Another participant felt that ERDA should develop technologies for energy recovery in the solid waste stream, as well as emphasize the need for source reduction. When obvious, less costly, and more reliable energy conservation options are available,

the public is reluctant to accept or to support new solutions. For example, the container legislation, introduced in all 50 states, offers a ready means of source reduction.

RELIABILITY AND ADEQUACY OF STATISTICS

Several participants questioned the reliability and the comprehensiveness of ERDA's statistics on potential energy savings. One speaker pointed out that the potential energy efficiency of certain technologies was not adequately documented.

Another attendee criticized ERDA for not providing the public with adequate means of gauging national priorities and energy R&D progress. He felt the ERDA plan should contain an estimate of completion costs for individual programs, an analysis of industry investment, and an indication of total federal contributions to any energy program.

If ERDA hopes to achieve commercialization, it should provide all pertinent statistical information to the potential consumer. In this way, a consumer's purchase decisions can be based on life cycle costs or reliability.

ERDA admitted that its statistics are conservative and explained that additional first-cost expenses are not taken into account in calculating potential savings from a particular technology. Savings estimates are based on marketability potential, not on actual savings brought about by the implementation of technology.

For example, to determine market penetration of the Annual Cycle Energy Systems, ERDA calculated potential savings without considering first-cost, on the assumption that the buyer would base his purchase decision on the life cycle savings. It felt that in a few years the savings from operating the technology would override the initial cost. Once the technology is seen as reliable and cost effective, market penetration will increase and capital costs will decrease.

One participant believed that ERDA's plan did not account for any analysis of the social impact of federal conservation efforts. Certain short-term energy conservation measures could have a severe impact on low-income families. It was suggested that controlled studies of demonstration projects be conducted to quantify the energy savings as well as the social and economic impacts of energy conservation resources.

DELINEATION OF AGENCY RESPONSIBILITIES

Concern was also expressed that some of ERDA's work may overlap existing state and local programs. For example, one participant noted that ERDA's energy outreach program (currently being considered by Congress) duplicates an existing program in Nebraska. However, ERDA stressed that its programs complement, rather than compete with, state and local programs.

One speaker defined ERDA's role in energy conservation as that of mapping out energy solutions and ensuring their implementation. An ERDA representative defined its role as focusing on technology and leaving the enforcement to other federal agencies.

To avoid unnecessary duplication and to communicate pertinent information, ERDA and the Federal Energy Administration (FEA) have established a task force to discuss each other's plans. In addition to the FEA, many other federal agencies had an input into the ERDA plan.

PUBLIC INVOLVEMENT AND TECHNOLOGY TRANSFER

An important issue raised during the meeting was the need for public involvement in the decision-making process. As the end-user of energy, the public is a necessary factor in a successful energy conservation program.

Several participants felt that ERDA was neglecting its responsibility to the public to implement a "conservation ethic." National energy policy should aim at lowering per capita and per household consumption; in turn, the government should be aware of public concerns (particularly of low income families). On the other hand, another participant was concerned that the enforcement of energy conservation measures would infringe on personal liberties.

Public support is necessary for the implementation of any new program; therefore, the government should provide the public with basic information. It was also noted that people in Colorado are skeptical about supporting new solutions when there are obvious, less costly, and more reliable solutions at hand.

Many felt that ERDA should provide financial incentives to the consumers to stimulate their interest in energy savings technologies. Examples of the lack of consumer interest in energy-efficient technologies and equipment include the resurgence of large automobiles and the market failure of air foils for trucks.

One commentator stated that R&D funds are not being invested in heat pumps, while coal conversion technologies, which have only a 30 percent efficiency, are being subsidized. He suggested that the purchaser of heat pumps receive a rebate. ERDA indicated that it hoped that these technologies would be economically competitive without providing incentives, but, if necessary, such incentives would be provided during the early commercialization stages. However, it was pointed out that ERDA's recently established Office of Commercialization seemed more concerned with developments in energy production, rather than in marketing energy conservation technologies.

ERDA mentioned its outreach program as a means of providing technology transfer. This program, to be established in each state, will help to educate small industry personnel, and local businessmen and decision-makers in energy conservation potential. ERDA feels that large industries have the capability to provide this kind of service on their own. Once again, ERDA stressed that the outreach program will complement, not compete with, any existing state programs.

SYNTHETIC and FOSSIL FUELS TECHNOLOGY DEVELOPMENT and COMMERCIALIZATION

The discussion of synthetic and fossil fuels development centered around the associated regulatory constraints and the need for program expansion. Representatives of ERDA described the synthetic and fossil fuels program, which is broken down into the areas of oil shale, coal, oil and gas, and tar sand. The program objectives are to make these technologies available for commercialization through demonstration, and to ensure that extraction and conversion processes occur in an environmentally acceptable manner.

Currently, ERDA is developing technologies for the conversion of oil shale to synthetic fuels, with the hope that such technologies will be competing commercially by the 1900s. Its efforts in this area include combining conventional mining techniques with surface retorting and investigating in situ (underground) retorting. In situ retorting has fewer pollution problems and land and water requirements than surface retorting.

ERDA demonstration work in underground processes is currently being done under the supervision of the Laramie Energy Research Center and the Lawrence Livermore Laboratory. As a first step toward commercialization of oil shale conversion technologies, ERDA's Office of Commercialization, Synfuels Program has developed small modular plants.

ERDA's activities in the area of coal conversion and utilization are diversified and extensive. Its program is directed towards conversion of coal to synthetic fuels and demonstration of improved technologies as a means to achieving early commercialization. ERDA representatives described several of these demonstration projects. For example, in its Carbon Dioxide Acceptor Pilot Plant in Rapid City, South Dakota, ERDA is developing a process to produce synthetic natural gas (SNG) from coal. ERDA's gasification processes provide SNG or pipeline gas for home use and low Btu gas for industrial heating, process use, and electric power generation.

ERDA is also investigating in situ gasification, a process which offers potential economic and environmental advantages. In its facilities in Hanna, Wyoming, ERDA is testing a technology in which groups of vertical wells are linked together and air and steam are injected into each group.

It is also demonstrating coal liquefaction processes in four pilot plants. These liquefaction processes are geared to supplying low ash, low sulfur boiler fuel for electric power generation and higher grade fuels for transportation and home heating.

The most advanced technology for coal use currently under investigation is magnetohydrodynamics (MHD). MHD may provide a 60 percent efficiency in power generation from coal, and ERDA is in the process of building the nation's first MHD test facility in Butte, Montana.

ERDA is also investigating technologies for direct coal combustion. The fluidized bed process is more energy efficient than the conventional direct combustion process, which requires energy for pollution control.

At the Bartlesville Energy Research Center in Oklahoma, ERDA is testing new methods to recover oil and gas left in the ground by current extraction processes.

An ERDA representative reported on the legislative status of the Synthetic Fuels Commercial Demonstration Program, which was developed in response to the President's directive (voiced in the 1975 State of the Union Message), to produce 1 million barrels of synthetic fuels by 1985. He described the need to have large-scale facilities in place and operating by the 1990s, when synthetic fuels are needed to replace oil and gas imports, and presented the program components in detail.

The discussion of ERDA's research, development, and demonstration (RD&D) efforts in the area of fossil and synthetic fuels involved the following issues:

- Regulatory, economic, and legal constraints
- Environmental and socioeconomic impacts
- Funding priorities
- Other RD&D needs.

REGULATORY, ECONOMIC, AND LEGAL CONSTRAINTS

Because of decreasing supplies of conventional energy sources and the resulting need for development of alternative sources (e.g., synthetic fuels), industry representatives agreed that the existing regulatory, economic, and legal barriers to commercialization of new energy technologies should be removed through federal action.

It was felt that ERDA must communicate more effectively with the coal industry to fully understand the problems associated with coal conversion and the need for more funding. One participant listed the institutional constraints that inhibit the industry from investing in private R&D:

- Permit requirements to construct and operate a coal mine are excessive (e.g., 15 to 20 different federal, state, and regional agencies have jurisdiction)
- Lead time is excessive and continues to grow (e.g., 5 to 8 years elapse from conception to production of a mine)
- Major investment of funds and personnel is necessary long before paybacks are even in sight.

It was suggested that the regulatory process be streamlined to reduce lead times, without lowering environmental standards. ERDA was warned that, if the regulatory problems are not dealt with at this time, coal will not be available for its ongoing programs. In addition, to ensure the success of its programs, ERDA must coordinate its policies with other regulatory agencies.

The economics of transportation were also mentioned. For example, the low Btu gas produced during in situ gasification is costly to transport over long distances. It was suggested that ERDA concentrate on improving transportation methods for coal (e.g., unit train operations and slurry pipelines).

Since the United States will be dependent on fossil fuels and uranium until 1985, a regional representative stated that federal policy should aim at removing barriers to their development. To assist in further development of these conventional fuels, the federal government should:

- Make the outer continental shelves, federal lands, naval reserves, and Alaska and the Arctic available for greater production

- Provide competitively determined stable pricing, tax incentives, and low-cost financing to attract private investment

- Reduce drilling and equipment costs.

One participant suggested that, to help mitigate the natural gas shortage and develop new sources of natural gas, the federal government should decontrol wellhead prices for new gas, increase LNG imports, produce and deliver natural gas reserves in Alaska, and encourage capital formation to finance new gas supplies.

It was felt that federal R&D programs must overcome the constraints to oil shale production, coal conversion, oil and gas production from tar sands, and tertiary recovery of oil from conventional reservoirs. The oil shale industry is unable to commit large amounts of capital to technology development, because of such barriers as price controls, jurisdictional disputes, and court delays.

To meet the long-term demand, new energy sources (e.g., geothermal, solar, magnetic, atmospheric) must be developed.

ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS

Since many of ERDA's projects in fossil and synthetic fuels are located in the western region of the United States, environmental and socioeconomic concerns were an important focal point of the discussion. Some attendees expressed concern over the impacts of fossil and synthetic fuels development; others emphasized the benefits of such development.

An ERDA representative mentioned that, because production often occurs in remote areas, choices in industrial location are limited. On the other hand, as one commentator pointed out, the regional effects of industrial location can be adverse. For example, in the Powder River Basin, which is currently in the midst of a coal boom, the number of power plants and strip mines continues to increase, placing a great strain on the available public facilities. Although the unemployment rate is now low, the commentator complained that housing is in short supply, schools and jails are overcrowded, and taxes are increasing.

A suggestion was made that development and testing facilities are better suited to the eastern and midwestern regions of the country because unemployment rates are high in these regions, towns and necessary public facilities already exist, markets are more accessible, and water is more abundant. However, an energy industry representative indicated that, in one affected locality, those individuals who had studied the prototype leasing program supported its goals and felt that the environmental safeguards were adequate and the related economic development, desirable. It was noted that projections of a commercial oil shale industry indicate that development can proceed in an environmentally acceptable manner, because the industry has already developed sophisticated methods to mitigate adverse impacts. However, he pointed out, since the oil shale industry does not formally exist at this time, any claims about its adverse effects are unjustifiable.

One commentator pointed out that, if the nation were to depend on coal to meet energy demands, the land requirements for strip mining would be almost 300 square miles of land per year. It was felt that reclamation technology is still too unsophisticated to handle massive areas of disturbed land.

Direct transportation of gaseous and liquid fuels to the consumer, rather than conversion to electricity, was suggested by one participant as a means of reducing the land requirements of energy transportation. Not only would valuable land near metropolitan areas be made available for other uses, but the costs of energy delivery would be significantly reduced.

It was also pointed out that if coal were desulfurized, de-ashed, and dewatered at the main site, transportation costs are reduced by 20-40 percent, the calorific content of the product is improved, and pollution control costs and waste disposal problems are reduced.

ERDA was asked to consider the effect of fossil fuel combustion on the global and regional climate. In the short-term, the atmospheric cooling effects of particulates and aerosols counterbalance the heating effects of carbon dioxide. It was also suggested that major energy conversion facilities be located in remote areas.

Another felt that federal agencies should compare indirect environmental damage costs to direct energy costs to determine their priorities.

One participant, who viewed energy conservation as a necessary federal priority, warned that conservation efforts must not interfere with the nation's industrial and economic strength and goals.

FUNDING PRIORITIES

Many participants supported ERDA's projects in the synthetic and fossil fuels program, but called for greater funding to help industry achieve commercialization.

In spite of ERDA's identification of oil shale as a significant energy source, private industry has had to invest heavily in the development and demonstration of oil shale technology. One industry indicated that if it received government assistance it would build a commercial-sized retort to produce boiler fuel. Several participants called upon ERDA to renew and strengthen its commitment to oil shale development.

One industry representative noted that federal support is needed to produce oil shale in the Green River Formation (a 16,500 square mile area in Colorado, Utah, and Wyoming) since 80 percent of the land is federally owned.

Another participant maintained that since natural gas and synthetic gas will continue to be competitive, natural gas was also deserving of R&D funding. It was suggested that government and industry combine forces in an aggressive RD&D program for gaseous fuel alternatives.

Although many participants requested increased funding, a regional representative warned ERDA against setting a precedent for federal interference in the private sector. For example, in Wyoming, applications have been made to ERDA for federal assistance to the Y-Coal-Gas Proposal. The participant questioned the necessity of replacing private capital with government funds.

To demonstrate to ERDA the full potential of commercialization of coal conversion technologies, one participant described the commercial by-products of in situ gasification. For example, carbon monoxide can be used as a fuel gas, and hydrogen sulfide can be readily stripped from hot exit gases and converted to elemental sulfur. Depending on the feed stream mix, hydrogen and carbon monoxide can be combined to produce a blue water gas, methanol, and methane. In addition, a high octane gasoline can be produced.

Another participant suggested that steam produced during in situ coal gasification can replace natural geothermal steam, which is a costly resource to explore and develop. This alternative source of steam is tapped by drilling many wells into a known coal deposit, otherwise unsuitable for conventional mining, and installing heat exchangers in the wall bores. During gasification, water is circulated through the heat exchangers, and the hot gases from the burning coal will convert the water into a pure, reliable, industrial steam.

OTHER RD&D NEEDS

Some participants felt that ERDA should commit itself to other important RD&D projects. For example, the Nebraska Gasohol Project offers a regional solution to the shortage of transportation fuels. Gasohol, a blend of 10 percent agriculturally derived ethyl alcohol and 90 percent unleaded gas, is competitive with unleaded gas. Currently, its suitability to year-round highway and city driving conditions is being tested. However, assistance is needed to make the fuel available on a state-wide basis.

Another participant explained the benefits of the liquid metal fast-breeder reactor (now being demonstrated in Tennessee) and regretted that the United States is currently in last place in world demonstration of the reactor. Because this reactor produces more fuel than it consumes, it would not be necessary to mine uranium in the next century if enough breeders are developed and installed. The commentator also estimated that, by the year 2000, the stockpile of depleted uranium from enrichment plants will be large enough to power U.S. electrical needs for 300 years.

Other suggestions for federal projects included the use of satellites to improve fuel extraction methods, the testing of first generation processes (i.e., Luigi, Koppers, Totzek) for high Btu gas production, and the development of economic recovery methods (i.e., new fracturing techniques) for gas locked in tight formations.

It was also suggested that federal RD&D be directed towards energy delivery and storage systems. It was thought that the development of a sophisticated storage system would lower consumer vulnerability to short-term supply interruptions. Federal policy must be directed towards developing a flexible energy system that can respond to economic fluctuations and serve diverging consumer requirements.

ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS OF ENERGY RESOURCE DEVELOPMENT

The public's rising opposition to the exploitation of natural resources and its concern about the social and economic consequences of energy development were evident in this extensive meeting. Many issues, including the impact of energy development on weather and the need for programmatic environmental assessment of the western states, were discussed.

ERDA is concerned about the environmental effects of effluents from all phases of energy development, from exploration and extraction to the ultimate disposal of waste, and is seeking means for characterizing, measuring, and monitoring effluents. It is also concerned with the transportation of pollutants in all media.

To ensure that all energy technologies take into account the impact of energy development on the communities, the state, and the region, ERDA has established an environmental development plan to identify all major questions that must be answered before the technology is implemented commercially. Such issues as environmental, health, socioeconomic, and institutional impacts have not received adequate attention in the past. In addition, ERDA compiles all relevant information about the technologies, the regions in which they may occur, and the research and development that may be carried out.

In an effort to work with people in the region and to make available all existing data to the local decision-makers, ERDA has established a Regional Systems Analysis Program in each of its major national laboratories. Based on such factors as census, business and economics, topography, and regulations, these data allow decision-makers to play the "what if" game, i.e., what if we locate a plant here--what are the impacts on the economics, health, and environment of the local community and the state? This plan is aimed at bringing the involved parties together to evaluate the various technology options and their associated factors (e.g., health, environmental, socioeconomic, business). Thus, the environmental and health impacts of energy development will be reduced to the lowest possible level and the nation's demand for energy will be satisfied.

Communities need educational assistance to aid them in coping with the impacts of growth, waste disposal, and transportation. In addition, ERDA feels that the development of leadership and citizen responsibility is required.

Until the necessary legislation is promulgated, however, ERDA has to deal with environmental, safety, and health questions in a circuitous manner. The best that ERDA can hope to accomplish with the existing legislation is to help identify the problem and push the government to take some action. Once the requisite legislation is passed, ERDA will publish guidelines concerning the implementation of environmental and socioeconomic policies with the specific energy programs. These guidelines will then be open for public comment.

Many issues were brought to the forefront in this meeting. The main areas of concern were:

- Funding priorities
- Socioeconomic impacts
- Environmental impacts

- o Interstate impacts
- o Additional research needs
- o External relationships.

FUNDING PRIORITIES

The least cost-effective energy sources were perceived as receiving the most taxpayer dollars. Several participants mentioned their concern that ERDA has chosen to spend most of its funds on nuclear fission and fossil fuel development. It was felt that more emphasis should be placed on renewable and alternate energy sources to reduce the nation's dependence on fossil fuels.

ERDA was criticized for allocating funds to the most expensive and environmentally damaging technologies (e.g., nuclear and fossil fuels) and for supporting unpromising energy technologies such as oil shale. It was pointed out that the $6 billion spent on synthetic fuels development could retrofit approximately 1.2 million homes with solar heating equipment. Participants considered solar power to produce more energy and to be a better environmental and economical investment. There was a general consensus that the government should assess the economic attractiveness of a particular technology and calculate its costs and benefits before spending the taxpayers' money.

One speaker felt that by subsidizing nuclear and fossil fuel energy development and thus making it artificially competitive, ERDA was further retarding sound energy development. Another commentator stated that if ERDA were going to subsidize the costly alternatives proposed in ERDA 76-1, it should leave the energy business entirely. If existing subsidies were removed, the cost-effective and environmentally sound energy alternatives, such as energy conservation, would come on line in a meaningful manner.

Others felt that ERDA's support for some technologies resulted from industry's reluctance to make the required investments in energy development and that the inequitable and hidden subsidies and penalties in the production, sale, and use of energy encourage wasteful consumption.

To counteract this situation, one speaker suggested that ERDA assume a more enlightened view on spending taxpayer money and make public interest one of the prime criteria for the determination of energy priorities. Public interest would include environmental concerns, wise use of tax monies, emphasis on maximum energy conservation and renewal, and energy resource development.

It was recommended that a workable mechanism for feeding state input to federal budget and research priorities be instituted. Several speakers requested more detailed data on ERDA's budget and research information and questioned the selection of the environmental factors emphasized in the budget. For example, was ERDA concerned with just the primary environmental effects or was it also concerned with higher impacts, such as the effect of environmental pollution on human health?

Although the plan presented new budget figures associated with environmental issues, actual research application could not be determined. It was felt that environmental control technology must be directly and explicitly linked to energy research. One participant stated that ERDA's actual activity and/or commitment can be questioned

when it is noted that ERDA spent only 23 percent of its authorized budget for environmental control technology and only 45 percent for environmental research in the previous year. Another mentioned that the ERDA budget did not indicate the amount of R&D in environmental control technology that is being undertaken in the actual development of the technologies.

SOCIOECONOMIC IMPACTS

Many meeting participants felt that the ERDA 76-1 did not address social impacts or the large economic costs associated with energy extraction. People in the small western communities most affected by energy development feel impacts upon their personal lives; new roles are added to the community and old roles are redefined or eliminated. As energy development grows in size and complexity, the beliefs and values held by the average person change. In essence, this compressed urbanization experience is forced upon the individual.

One speaker stated that the spiraling concentration of available growth capital in energy production and transmission is creating disturbances in the traditional economic structure of the region. As another observed, it is disconcerting when a regional power utility has to wait in the lobby next to a major oil company to get to the money brokers.

One speaker observed that capital, which would normally be utilized to finance the expansion of our economy, is being diverted to finance the production of energy. Housing developers are unable to compete with energy developers for mortgage money, resulting in massive layoffs in the construction industry. Industries that utilize minerals mined and processed in the region are faced with reduced markets caused by shrinkage in personal and disposable incomes; this reduction can be traced to rising energy costs and the competition for growth capital. Consequently, mines have closed and the work force at smelters and processing plants has been sharply reduced. On the other hand, competition for the available labor supply is increasing in many of the localities that have been affected by major industry development.

Although the agricultural sector is not drastically affected at this time, the prospect of rapid energy development, with probable air and water degradation, will undoubtedly result in dislocation or elimination of jobs and changes in lifestyles. One speaker commented that the nation is already losing 27,000 farmers a year.

One participant felt that the shifts in investment patterns caused by the energy crisis have placed formerly productive members of the regional economy in economic situations that are indistinguishable from those experienced by the disadvantaged inhabitants. The ripple effect of inflationary cost increases caused by automatic escalator or pass-through privileges granted to energy producers and suppliers is most apparent in the cost of necessary goods: food, shelter, heat, light, and transportation. This situation conflicts with the ongoing effort to maintain and extend the progress towards social justice begun in the last 10 years.

The speaker also felt that current and projected levels of energy consumption require a choice between accepting an increase in the incidence of poverty in the general population or subsidizing the lifestyles of the general population and the historically disadvantaged. The only viable alternative to this situation is increasing the efficiency of energy use and developing methods for facilitating changes in social values and lifestyle in order to realize lower and perhaps zero growth rate in energy consumption.

An infant energy conservation program, funded through community services administrators, has been operating in several western states since August 1975. Grants of between $100 and $150 per low income household are earmarked for temporary conservation measures. However, the poor of this region will still subsidize energy development with increased rents and property taxes and strained human service delivery systems.

An ERDA participant stated that the agency's primary mission is not to solve the social problem, which must be worked out at different government levels among many agencies. It is difficult for the agency to propose social income redistribution programs as part of its energy R&D responsibilities. ERDA's role in mitigating socioeconomic impacts was questioned. Participants felt that ERDA should analyze and assess means of developing alternative economic foundations in affected communities, and emphasize less socially and environmentally disruptive technologies. For example, detailed and comprehensive studies relating to the role of the rights of Native Americans in the development of western resources must be undertaken.

ERDA should develop guidelines for project initiation, i.e., the way the new industry comes into the community and relates to the established systems. One participant stated that the industries' typical approach to the small community ranges from benign neglect to outright lying.

Communities find that they need to make large expenditures early in the life cycle of an energy development project, yet the additional public revenues do not start flowing until some time later, e.g., the property tax is collected only after the tax base from the new plant and new houses has begun to grow. Because of this time lag in assessment and collection of taxes during the first several years of a project, the communities face a fiscal deficit. One spokesman pointed out that the short-term nature of energy extraction requires that the impacts be handled in advance of industry development. The entire economic scenario (i.e, development, production, and decline) should be presented in advance as accurately as possible so the affected communities can plan accordingly. In addition, it was recommended that methods for mitigating social and financial impacts of boom towns be studied.

Several participants believed that ERDA should require that the private sector and industry provide money and information at the front end of development; in this way, proper planning could occur. For example, most small communities do not have medical and hospital services, and funds should be provided for implementing this type of service.

Although some communities do obtain the front-end money from the specific industry, they run the risk of establishing a company town. One participant recommended that an industry coming into the area should establish an escrow fund with a public entity to guarantee that it would cover the impacts incurred by development. Another participant suggested instituting a reasonable severance tax that would cover all anticipated costs.

ENVIRONMENTAL IMPACTS

It was felt that ERDA must address environmental impacts at the federal, state, and local levels. The development of natural resources and the associated secondary development should emphasize environmental protection, reclamation, and agricultural preservation. Some of the areas of concern were:

- o Deterioration of air quality
- o Competition for water use between energy development and agriculture and recreation
- o Social impact, including lifestyle changes, lack of vital community services, and infringement on Native American rights
- o Land impact, including destruction of aquifer recharge areas and effects on significant agriculture or grazing lands
- o Protection of valuable ecosystems, geological formations, significant wildlife habitats, and unique scenic or historic areas.

One participant felt that the cumulative impact of massive energy development on climate and air quality has not been clearly delineated.

It was felt that a reasonable regional energy development policy should be determined by the ability of a region to absorb the environmental and socioeconomic impacts of energy industry development. This policy should be based on a programmatic assessment of the impact of all proposed energy development tradeoffs on agriculture, recreation, and other industry for the western states. As a result, future choices in the development of western energy resources could be true choices and result in a balanced use of our water, air, agriculture, and human resources. More specifically, the discussion of environmental impacts focused on water supply, weather, and land reclamation.

One speaker stated that the main environmental impact of ERDA's plan would be on the quantity and quality of water. Since all the main energy development priorities (other than oil and gas) require large quantities of water, it appeared that the government was subsidizing massive exploitation of water, one of the most valuable resources in the West. Another commented that the plan tacitly assumes that sufficient water will be available for industrial consumption, coal or oil shale development, or for the associated communities.

The lack of water in the semiarid West and the removal of water from an agricultural region were viewed as two important constraints to the development of energy sources. Not only does energy development directly compete for the existing water sources, it also poses threats to the future supply. One speaker briefly mentioned the history of water pollution by energy companies.

It was felt that before energy extraction activity was increased, its potential adverse impacts on the quality and quantity of water should be analyzed. One speaker stated that primary research needs are an assessment of the consequences of removing irrigation water and an analysis of the value of different management procedures for maintaining acceptable food production levels while reducing the quantity of irrigation water.

One speaker addressed the inadvertent effects of energy development on weather and suggested that the effects of particulate and gaseous pollution on weather processes be examined. He stated that the effluents from coal-fired generators and coal gasification facilities will produce enough particulates, as well as gaseous contaminants, to seriously affect weather processes. Several participants voiced their concern about the interstate impacts of power generating plants on the weather.

One speaker described a numerical modeling study, conducted on the effect of submicron particles from stationary fossil fuel combustion sources on weather downstream. The results of the study demonstrate a decrease in rainfall. Although at this state the effect is local, a loss of 1 or 2 inches of rainfall could occur in an area where only 17 to 25 inches fall annually.

Several participants addressed the reclamation issue with specific reference to Appalachia. One speaker stated that the very energy companies who wish to develop the West are the same companies who have lobbied against reclamation laws. Since the good intentions of energy companies alone are not adequate to protect the land or the inhabitants of the region, it was felt that stringent reclamation and strip-mining laws should be supported and that the federal government should become instrumental in promulgating such legislation.

Another speaker suggested that before any mining activity is undertaken, evidence should be presented that guarantees that the land can be reclaimed. Since reclamation can be considered an internal cost to development, any land which is disturbed by mining activity should be returned to its original use. Areas presently undergoing reclamation do not even meet this criterion. In addition, the low rainfall in the western region makes reclamation particularly difficult.

INTERSTATE IMPACTS

Several participants were concerned about the large-scale development of energy resources and its associated production and transportation impacts, which produce positive and negative effects that do not respect political boundaries and extend far beyond the original location of energy resources. As these effects are transmitted through environmental, social, and economic systems, the welfare of the citizens of one state becomes dependent on decisions made in another. By virtue of its own energy demands, geography, and desire to maintain its quality of life, a state can find itself enmeshed in energy issues that begin and end beyond its own borders. In particular, South Dakota is concerned with the potential for trace element air pollution, inadvertent weather modification, and other consequences of pollutants.

One commentator stated that although we have adequate knowledge concerning the impacts of a particular development site on a particular community, we have little information about the diffuse effects and the cumulative impact of energy development. Essentially, the site-specific focus of environmental assessments limits our knowledge. In addition, planning grants are only intended for the specific state in which a particular project is proposed. For example, the coal fields and power plant development region in Wyoming could create land development pressures in the Black Hills of South Dakota, approximately 70 miles from the energy development activities.

One participant suggested the development of a unified set of procedures to identify, study, and monitor interstate energy development problems. A regional planning process would monitor changing conditions over time in a comprehensive manner; promote coordination of energy development activities; and have a unified institutional framework. To account for interstate impacts, research should focus on multistate and regional problems of energy development.

One commentator pointed out that the Western Governors' Regional Energy Policy Office already provides a forum for the states and the federal government to work together to identify possible energy development impacts, prepare an inventory of development impact information, determine additional information needs, and encourage research to provide missing information.

Other participants recommended that the states form a task force with interdisciplinary resources that can give support to the local government. This system would provide technical assistance from the states to the community and create an awareness of some of the steps that the community must take. Past experience, however, has shown that until the decision-makers in the community see the need, they fail to ask for support, which they may ultimately resist.

ADDITIONAL RESEARCH NEEDS

The existing studies of the social and economic consequences of energy development were criticized for relying on secondary data and failing to develop integrated interdisciplinary data. In addition, they have been poorly timed in relation to the developments; consequently, they have not established adequate predevelopment baselines or monitored changes in social baselines as the developments proceed.

One participant recommended that additional research work include:

- Measurement of changes in business activity and employment resulting from energy development at regional, state, and local levels and analysis of vocational patterns of energy-induced employment
- Comparison of the actual occurrences with the projections, which consider the lag between the new developments and the full adjustment of the local economy
- Analyses of interindustry effects of energy development, e.g., resource and labor competition
- Assessment of the effects of development on existing retail and agribusiness firms
- Consideration of the economic and demographic threshold levels needed to induce the establishment of specific types of new businesses
- Delineation of the extent of induced in-migration of new residents and the extent of reduced out-migration of present residents because of increased employment opportunities, and analyses of the probable demographic and socioeconomic characteristics of the new energy-related workers, households, and families
- Assessment of residents' attitudes towards energy development, including their perception of quality of life before and after development and differences in attitudes and perceptions between long-term residents and newcomers
- Assessment of increased demands for public services, their type, and location; determination and evaluation of alternative federal, state, and local plans for financing public services, and analyses of transportation alternatives
- Analyses of changes in local leadership and decision-making patterns
- Assessment of the effects of development upon special groups (e.g., elderly, farmers and ranchers, Native Americans) and methods of protecting these groups

- o Examination of cumulative effects resulting from multiple developments and evaluation of long-range economic potential of various development and settlement patterns

- o Development of growth management strategies to prevent or lessen potentially adverse effects of development and criteria for designating strategy and evaluating performance

- o Development of organizational mechanisms to encourage effective interdisciplinary or multidisciplinary research.

EXTERNAL RELATIONSHIPS

Several participants voiced a need for ERDA to recognize the western states as a partner in the approaching development activities. One speaker hoped that the absence of a liaison and coordination with the environmental improvement agency in his state was the exception rather than the rule.

Although ERDA currently works through the governors and the Western Governors' Regional Energy Policy Office and has established regional offices, it was felt by some that local governments had no means at the state and federal level for addressing their concerns. Another commentator recommended that ERDA's regional centers should not simply be local public relations outfits; they should have the authority to act.

It was also felt that honest, accurate, and credible information from ERDA was essential and that a system of grass roots dissemination of information and technology must be devised. It was suggested that if the information were filtered through universities and state agencies, it would have more credibility than if it originated in Washington.

On the other hand, another speaker stated that ERDA was ignoring the existing structure in the region, i.e., the active federal regional council, the active regional FEA offices and the EPA offices that have conducted innovative work. ERDA should coordinate with the federal agencies that already exist in the region and are sensitive to the area.

SOLAR AND GEOTHERMAL SYSTEMS

The discussions on solar and geothermal energy systems had two main themes: the question of priorities for resource utilization and the need for financial incentives. Many participants felt ERDA should reallocate its budget priorities and concentrate on research and development in the solar and geothermal fields, and on providing subsidies in the form of tax write-offs and legislative incentives.

ERDA's solar energy program is currently divided into three principal areas:

1. Direct solar conversion which includes solar heating and cooling of buildings, agricultural and process heat applications, and fuels from biomass

2. Solar electric application, which includes photovoltaic or solar cell conversion, solar thermal or high temperature conversion, and wind energy and ocean thermal conversion

3. Technology utilization and dissemination of information concerning the commercialization of these energy technologies.

The goal of ERDA's magnetic fusion program is the development and demonstration of safe, economical, and reliable production of energy using nuclear fusion processes. The schedule of this particular program is: production of near reactor level hydrogen plasma in late 1970s; production of substantial quantities of thermal energy in first fusion test reactor in 1981; production of electrical energy in the mid to late 1980s; and, the operation of a near commercial-size demonstration reactor in the middle to late 1990s.

The program has several ongoing, major high-temperature experiments at national laboratories to demonstrate methods of heating. If the program is successful, commercial quantities of electricity could be generated by fusion reactor plants after 2000.

ERDA is attempting to encourage the development of the industrial base and user infrastructure that must be present before substantial use of these energy sources occurs.

ERDA's geothermal program contains three main subprograms:

1. Research and advanced technology, including drilling techniques, conversion cycles, resource and reservoir assessment

2. Resource utilization, including utilization problems and environment studies

3. Policy/planning, where federal, state, and local regulations and incentives that may deter or accelerate the development of this resource are being examined.

ERDA is encouraging the fledgling geothermal industry to use existing technologies to identify hydrothermal resources, and to develop these technologies so that they can be used to exploit larger geopressured and hot dry rock resources. In addition, ERDA is concerned with the environmental and land use problems associated with this energy source.

To address the institutional problems (e.g., tax write-offs, investment constraints), ERDA is currently promulgating the regulations for a Geothermal Loan Guarantee Program.

The discussion of these programs fell into the following areas:

- o Budget priorities
- o Financial incentives
- o Demonstration programs
- o Alternative energy systems
- o State/federal coordination
- o National energy planning.

BUDGET PRIORITIES

Many participants urged a rethinking of ERDA's priorities. One participant stated that ERDA should reconsider its mandate in light of the passage of the Federal Non-Nuclear Research and Development Act of 1975, which emphasized the development of non-nuclear energy sources. He found that the activities of ERDA continue to be concentrated in nuclear energy research and in non-research functions, involving the production of nuclear materials and nuclear weapons development.

Although ERDA has made commendable efforts to increase solar and energy conservation priorities, one attendee did not feel that the budget increases in solar and energy conservation were sufficient. Several participants felt that the increased budget for solar energy in ERDA 76-1 was only a minimal step forward, and that ERDA was not committed firmly to a meaningful and successful program in the solar field.

One speaker commented that while ERDA is a mover and shaper of nuclear technology, non-nuclear projects are treated differently. Twenty years for commercialization in a nuclear project seem to inspire an outpouring of programs, options, and decision points, but 20 years for commercialization in a non-nuclear project seem to paralyze the imagination and the project is consigned to a low priority.

Another speaker pointed out that while solar energy can play an important part of our future, it is not the entire answer. He then outlined the different areas of energy consumption and indicated where solar energy was suitable. For example, solar energy has no potential in the transportation sector, which consumes 25 percent of our total energy. On the other hand, 41 percent of the nation's energy is used by the industrial sector and two-thirds of that is in heating and process steam; consequently, solar energy has potential in the industrial sector. He believed that the most important areas for solar energy are the residential sector and commercial sector, which together consume 34 percent of the nation's energy.

Others voiced the opinion that the current program to improve and reduce the cost of solar heating equipment should have the highest priority in the ERDA solar mission. However, the level of funding to solar thermal electric power generation was considered to be out of proportion to its chance of economic success and potential for commercial application. One participant felt that although solar power might partially meet our requirements for electricity generation, the high costs of photovoltaic

cells made them noncompetitive. It was felt that research in this area should be vigorously supported only as long as there is a possibility that the costs of these energy sources will be reduced.

FINANCIAL INCENTIVES

The need for financial incentives in the solar heating and geothermal fields was emphasized during the meeting. Participants generally believed that solar conversion has a tremendous potential for near-term fuel supply to the residential sector and that, in many parts of the nation, it is less expensive to heat buildings with solar energy than with electricity. In addition, solar equipment could bolster our present oil and gas systems, thereby conserving scarce fossil fuels.

According to one of the speakers, nearly half of the energy consumed in the United States is used for space heating, water heating, and electricity generation, with space heating accounting for about 20 percent. In the past year, equipment has become available for solar heating and hot water supply. Construction of a small amount of additional storage capacity to accumulate off-peak power in the building and to supplement the energy source for heating under a prolonged cloud cover is currently being developed.

It was generally felt that more private sector activity in solar energy would occur if there were a climate of competition. At this point, solar energy is competing against highly subsidized energy sources. Unless the subsidies are extended in the form of tax write-offs, solar energy will not become economically viable.

Another speaker recommended that the government should allow a tax credit to the consumer for some percentage of the installed costs or the mortgage payments; or that the government should provide assurances similar to the FHA or VA guaranteed loans. One speaker stated that the decision to install solar heating and/or cooling can then be made on a life-cycle cost approach.

Another speaker felt that for solar energy to succeed, Congress must make a substantial effort, and the Administration must be dedicated to its applications. However, it was also mentioned that in some respects the private sector has been derelict in supporting solar research. An ERDA spokesman stated that presently the total dollars for non-nuclear technologies exceed the dollars fo nuclear technologies. Another speaker observed that the size of the solar budget is related to our ability to spend money wisely. One speaker also mentioned that it was difficult to compare the atomic research budget to the solar research budget, when the scope of the nationwide activities in the solar field is considered.

The common perception of the geothermal energy program was that industry was provided with little financial security, given the long lead time involved. Revenues are not realized until 5-10 years after the drilling of a geothermal wildcat well. One industry spokesman stated that the type of research that was needed was to drill holes, which give the necessary information to run reservoir models and parameters. These high-risk holes can be drilled over and over again before the necessary data are obtained. However, he felt that ERDA would not receive the necessary information until industry obtained sufficient incentives to undertake this high-risk investment. Another participant observed that the industry could concentrate on technologies other than boring for geothermal investigation.

Highly complex approval and licensing procedures for the investigation, exploration, and development of geothermal resources and existing tax structures also discourage industry investment. One participant mentioned the difficulties of the licensing and approval procedures, which are largely controlled by state and local regulatory agencies. It was felt that the states could simplify the approval and licensing procedures for the investigation, exploration, and development of geothermal resources.

DEMONSTRATION PROGRAMS

One speaker suggested that after methods and systems have been fully tested in the R&D program, they should be demonstrated in many buildings throughout the country. If solar heating were available for public observation and information in towns and cities throughout the country, the public interest would be substantially increased. In addition, the demonstration program would provide the sales assurance that a manufacturer requires for an investment decision.

One participant stated that the current slow pace of the solar heating demonstration program, a few hundred systems per year, was not more than a token effort. It was recommended that the current demonstration program of fully developed and dependable solar heating systems should be substantially expanded and divorced from activities in the field. One participant recommended that to prevent prohibitive program costs, massive investment in large systems should be avoided. In addition to judicious limits on the support of individual demonstration projects, only those systems that are fully proven should be selected for demonstration. Unproven systems and those requiring further development should be funded under the R&D program and separated from the demonstration program.

ALTERNATIVE ENERGY SYSTEMS

One speaker felt that the use of sludge from the nation's wastewater treatment facilities would provide at least a partial solution to the nation's energy shortage problem from the standpoints of new energy source development and energy conservation. Although further research is needed to establish its reliability, environmental impacts, and economics, several pilot studies have been conducted to demonstrate the utilization of sludge for fertilizer, soil conditioners, animal and poultry feed, and fuel. In fact, many wastewater treatment facilities use the methane gas produced by anaerobic digestion of sewage sludge for heating, generating electricity, and for fueling direct gas-powered engines.

This speaker also stated that the use of sludge as a fertilizer and soil conditioner reduces the amount of commercial fertilizer required for agriculture use, thus reducing the fuel required to produce commercial fertilizer.

Although ERDA is still at an early stage of thinking concerning bioconversion, one company, Biogas, Colorado, has recently isolated several appropriate sites in Colorado, Utah, Arizona, and New Mexico for bioconversion facilities and is seeking monies for the demonstration model that would produce commercial quantities of gas. Their figures indicate that Colorado can produce almost 3 percent of its daily natural gas needs from readily collectable agricultural wastes.

In regard to wind energy, several participants seemed to believe that this area has developmental possibilities for limited capacity systems in the future.

STATE/FEDERAL COORDINATION

Throughout the meeting, ERDA was urged to emphasize public understanding of energy sources and uses through effective educational programs. Several participants recommended the establishment of these programs on a decentralized regional and community level. Specifically, ERDA and the states could jointly develop and review ERDA's long-range plans; develop and review state long-range plans, plan, select, evaluate, and fund demonstration projects; and develop and fund public information and educational programs. For example, the Solar Energy Exhibit Program, a citizen-initiated educational and communication project sponsored by the University of Colorado was designed to stimulate widespread public interest and acceptance of solar energy conservation technology.

Commentators recommended that ERDA work closely with the states in planning and funding regional energy educational efforts and hold regional meetings with states. In this way, government activities could become socially responsive and responsible. It was also recommended that ERDA hold open competition for research.

NATIONAL ENERGY PLANNING

One speaker felt that national energy planning ought to be based on the possibility that nuclear power, synthetic fuel, and imported crude oil will be unavailable. He suggested a scenario for energy development to the year 2000, which included:

- Placing heavy emphasis on developing deep-mined eastern coal in a manner that underscores mining safety
- Developing the necessary infrastructure that would allow for transportation of this coal to national load centers
- Providing all reasonable funding necessary to ensure an aggressive research, development, and demonstration effort in the area of magnetohydrodynamics
- Exploiting every opportunity to utilize waste heat and recovery of energy from agricultural wastes
- Pursuing an aggressive effort to educate the public on opportunities for energy conservation and solar retrofitting
- Optimizing energy conservation wherever and whenever possible and earmarking the billions scheduled to be spent on nuclear research, development, and demonstration, in advanced solar and wind technology.

He also noted that the energy business ties up 21 percent of United States capital and that two-thirds of all energy used in U.S. manufacturing is consumed by the food processing, chemicals, paper, glass, ceramics, and metal industries. Although total U.S. employment increased 41 percent from 1950 to 1971, employment in these industries stayed the same. These figures lead to the assumption that energy is a substitute for labor. Consequently, a slowdown in energy use implies increased employment opportunities because capital could be directed from energy into labor.

The speaker suggested that it would be prudent for ERDA, because of its role in shaping political-economic decisions, to recognize the limitations of traditional economics in making energy decisions. By providing subsidies to energy programs which cannot exist on their own, federal energy policies are supporting some programs that represent environmental and economic threats. He also stated that energy policy has a definite impact on inflation, because of declining net energy.

INTENSIVE ELECTRIFICATION

The underlying principle of intensive electrification is to shift the nation's energy mix to uranium and coal, the two domestic fuels that the United States possesses in abundance. Electric generation is the only existing technology for using these fuels.

During this session, many participants voiced their concern about the long-term impacts of increased nuclear development; others believed that the development of coal resources created more severe impacts.

Nuclear power can potentially meet a significant portion of the nation's energy demands· therefore, it ranks among ERDA's highest priorities. In a decade, we should see approximately 180 nuclear plants producing 25-26 percent of this country's electricity. Currently, nuclear power is inexpensive and, to a large extent, has minimum environmental impact.

To ensure that nuclear technology is handled in a safe and reliable manner, ERDA's plan calls for increased emphasis in several areas:

- o Development of improved exploration and extraction techniques
- o Increased capacity for uranium enrichment
- o Development of a spent fuel reprocessing and recycling program
- o Improvement of waste management and discovery of stable geologic formations that can store radioactive wastes
- o Reduction of the time required to construct, license, refuel, and decontaminate nuclear plants
- o Implementation of nuclear safeguards.

The discussion of intensive electrification and the associated fuels can be divided into three general areas:

- o Environmental hazards
- o Capital costs
- o Regional participation.

ENVIRONMENTAL HAZARDS

The expected growth in nuclear generating plant capacity and other energy industry activities will provide challenges to the regions involved. The foremost challenge will be to ensure that the developments are truly beneficial to an area.

One issue raised was the plan's omission of specified responsibility for the environmental problems associated with the tailing piles after termination of a mill license. Although uranium tailings fall below the specific limit of 1 lb per ton, the residual amounts of radioactive material emit radon gas. The dispersion of this gas and thorium dust from the mine or the mill tailing creates a long-term health hazard.

It was felt that the short- and long-term environmental health costs of nuclear energy ought to be compared to the benefits of different strategies. Society should weigh the possible long-term future damages to our genetic heritage from nuclear fission processes against the present health hazards of mining, storing, and burning fossil fuels. One participant suggested that the development of nuclear fission power be delayed until its genetic effects can be predicted more accurately.

One commentator also pointed out that if a moderate rate of energy growth were assumed and the nuclear power option were withdrawn, substantial amounts of coal-fired power plants would have to be built. Although the growth of the nuclear industry would increase radioactive and other emissions, these emissions would remain with the current maximum permissible concentration levels. However, if coal became the major substitute for nuclear energy, air pollution would increase, as would occupational deaths and injuries. In addition, the development of coal would cause an increased demand for equipment and transportation facilities.

Another speaker was concerned about the interstate aspects of energy development. Although energy development may occur in one state, a neighboring state may be required to provide roads, schools, housing, and other supportive services, although it cannot exercise jurisdiction over the development. In addition, the environmental effects may be felt by the citizens of the neighboring state, even though they cannot set controls over emissions and pollutants.

One speaker observed that the federal agencies have only been interested in answering impact questions for the state in which the development is occurring; they have not been concerned with the neighboring states that may also suffer impacts.

A new wave-powered hydroelectric system was also described, which uses water as its primary power source.

CAPITAL COSTS

The discussion on costs centered on such issues as reclamation, surveillance and maintenance, and lead time.

One issue was that no party-at-interest had established the price of reclamation. Since the federal government does not claim jurisdiction over the tailing sites, the states will probably be responsible for the long-term surveillance and maintenance of the tailings pile.

One suggested solution to this problem was that industry delineate a program that will include these external costs as a normal part of corporate expenses. These costs will then be passed on to the purchaser or beneficiary of the corporate product. In other words, the uranium industry should voluntarily accept the concept that perpetual surveillance and maintenance of the tailings is a social liability that must be accounted for during the lifetime of the plant.

Another participant recommended that ERDA work with regional bodies to resolve the problems associated with equitable financing of reclamation, surveillance, and maintenance of uranium tailing sites. The resultant handling of these social costs would help to create the proper cooperative relationship among government, industry, and the public.

Several participants attributed the difference in the economics of the two energy sources (i.e., coal and nuclear) to the lead time required to put nuclear plants on line. One pointed out that if a nuclear plant could be put on line at exactly the same time as a fossil plant, initial costs would be comparable. The long lead time and the regulatory constraints were perceived to be a result of the social concern that impedes the development of nuclear power.

Several utility representatives gave two examples of plants that are taking approximately 12 years to build instead of the former 8, and where 40 percent of capital costs is for interest-bearing construction. The intensive capital costs caused by interest-bearing construction was one of the main criticisms of nuclear power. Industry representatives stated that the government should take the prime role in those technologies that involve long lead times and high risks.

One industry representative found the incentives embodied in Senate Bill 598, the lead synthetic fuel bill, to be constructive. If the government granted increased investment tax credits, industry could reduce the overall amount of the loan required.

REGIONAL PARTICIPATION

One state representative proposed that the federal government provide a means to continually monitor the effects resulting from energy development policy and to make these data known to the states, local governments, and interested citizens on an on-going basis. This mechanism would enable the states to plan for orderly development, identify emerging issues, collect new information, conduct expanded analyses, and mitigate adverse effects.

A regional planning process would allow:

- Identification of effects of coal development, which can be diffuse, unintended, delayed, and cumulative and may adversely impact communities and states at some distance from the actual coal mines and power plants
- Determination of available information on the negative effects of coal development
- Completion of data gaps
- Assembly of relevant federal, state, regional, tribal, and local officials to act in a cooperative manner to mitigate adverse effects and find solutions to problems created by coal development.

In an initial step towards developing a regional planning process, the Western Governors' Regional Energy Policy Office adopted Public Policy Resolution 76-3, which calls for the establishment of a federal/state regional planning process to assess energy development impacts.

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