

**DOCUMENT RESUME**

00168 - [ A0751104 ]

**National Energy Policy: An Agenda for Analysis. EMD-77-16; B-178205. January 27, 1977. 56 pp.**

**Report to the Congress; by Elmer B. Staats, Comptroller General.**

**Issue Area: Energy: Executive Branch Organization and Processes for Dealing with Energy Problems (1611).**

**Contact: Energy and Minerals Div.**

**Budget Function: Natural Resources, Environment, and Energy: Energy (305); Natural Resources, Environment, and Energy: Conservation and Land Management (302); Natural Resources, Environment, and Energy: Other Natural Resources (306).**

**Organization Concerned: Energy Research and Development Administration; Nuclear Regulatory Commission; Federal Power Commission; Federal Energy Administration; Department of the Interior.**

**Congressional Relevance: Congress.**

**Authority: Federal Energy Administration Act. Energy Supply and Environmental Coordination Act. Geothermal Energy Research, Development, and Demonstration Act. Solar Heating and Cooling Act. Solar Energy Research, Development, and Demonstration Act. Energy Reorganization Act. Nonnuclear Energy Research and Development Act of 1974.**

An assessment of national energy problems dealt with the urgency for new policies to avoid the heavy reliance on energy imports. The critical issues identified were the need for energy conservation, problems of nuclear fission, future reliance on fossil fuels, especially coal, and possibilities of alternate sources. Questions were posed about the role of the Federal Government in wise management of energy resources, including those on public lands. These issues were analyzed from the points of view of past and current performance and plans for future emphasis. Findings/Conclusions: There is need for conservation during the next 10 years, consolidation of Federal agencies dealing with energy, and wise management of energy resources on public lands balanced by environmental considerations. Energy efforts will require coordination of all branches of the Government, industry, and citizens. (HTW)

# REPORT TO THE CONGRESS



BY THE COMPTROLLER GENERAL  
OF THE UNITED STATES

---

## National Energy Policy: An Agenda For Analysis

Today the United States relies far more heavily on imported energy than it did at the time of the embargo. Yet, the Nation still lacks a focal point for dealing with energy problems and a coherent set of energy policies.

In its "Agenda for Analysis," GAO identifies eight critical national energy issues it believes require the attention of the Congress and the public in the years ahead. For each issue, questions requiring analysis are summarized and GAO's ongoing and planned work discussed.

GAO is convinced that a concerted national effort is needed to evolve an energy policy that will stand the severe tests facing the United States in the remainder of this century, and hopes its report will contribute to an increased understanding of this Nation's energy problems.





COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-178205

To the President of the Senate and the  
Speaker of the House of Representatives


The oil embargo of 1973-1974 brought home to us the vulnerability of the United States because of our reliance on foreign resources to meet our energy needs. Our memories are short, however, because we rely far more heavily on imported energy today, in 1977, than we did at the time of the embargo.

In reports to the Congress and in testimony, we in GAO have expressed our concern that we lack both a focal point for dealing with energy problems, and a coherent set of energy policies. To work toward these objectives, we have urged the establishment of a Department of Energy and Natural Resources, or, as an interim step to a DENR, the establishment of a National Energy Administration. Without such a focal point, it will be difficult at best to achieve policies which will stand the tests of the future. And, even with a focal point for decisions, critical long-range issues will remain needing analysis and resolution.

As part of our continuing reassessment of critical national issues, and as an aid to the focusing of our own objectives, we have tried to identify those energy issues that are most in need of attention. These key issues, of course, require not simply the attention of GAO but of the public as well and most particularly of the Congress, which will have to make important judgments in the next few years. Hopefully, these judgments will be made with the help of sound executive branch proposals, backed by the analysis required to lend confidence and credibility to its recommendations. The GAO and other legislative branch agencies must be prepared to assist in the decisionmaking process by providing timely and useful evaluations and analyses of available options.

This report discusses what we believe to be the key energy issues facing the Nation in the immediate future. It also briefly discusses some of our recent and ongoing work, and outlines our planned work to help answer some of these questions. It is our intention to concentrate our audit and analytical efforts on these issues.

In its initial form, this report was prepared as a guide for our own efforts in the energy area, but it is our hope that it will prove helpful to others considering these issues, thereby contributing to an increased understanding of our energy problems. We are convinced that only through a concerted national effort to come to grips with the problems outlined here will we, as a Nation, be able to evolve a cohesive national energy policy; a policy which can stand the severe tests facing us all in the remainder of this century.



Comptroller General  
of the United States

# C O N T E N T S

CHAPTER		<u>Page</u>
1	ENERGY ISSUES	1
2	HOW CAN THE FEDERAL GOVERNMENT ENCOURAGE ENERGY CONSERVATION?	5
3	CAN THE PROBLEMS OF NUCLEAR FISSION BE RESOLVED SO IT CAN BECOME A MAJOR ENERGY SOURCE?	10
4	TO WHAT EXTENT CAN FOSSIL FUELS (ESPECIALLY COAL) BE RELIED UPON TO FULFILL FUTURE ENERGY DEMAND?	15
5	HOW DO FEDERAL SUBSIDIES, TAXES, AND REGULATIONS AFFECT ENERGY SUPPLY AND DEMAND ACTIONS?	20
6	HOW CAN THE EXECUTIVE BRANCH ENERGY ORGANIZATION AND DECISION- MAKING PROCESSES BE IMPROVED?	25
7	WHAT ARE THE PROSPECTS FOR TRANSITION TO ESSENTIALLY RENEWABLE ENERGY RESOURCES (GEOTHERMAL, SOLAR, FUSION)?	29
8	ARE THE ENERGY RESOURCES ON PUBLIC LANDS BEING WISELY MANAGED BY THE FEDERAL GOVERNMENT?	33
9	ARE OUR DOMESTIC AND INTERNATIONAL ENERGY POLICIES COMPATIBLE AND DO THEY REFLECT INTERNATIONAL ECONOMIC AND POLITICAL REALITIES?	38
APPENDIX		
I	ENERGY LEGISLATION	42

ABBREVIATIONS

DENR	Department of Energy and Natural Resources
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
FPC	Federal Power Commission
GAO	General Accounting Office
LMFBR	Liquid Metal Fast Breeder Reactor
NRC	Nuclear Regulatory Commission
OCS	Outer Continental Shelf
OPEC	Organization of Petroleum Exporting Countries
R&D	Research and Development

## CHAPTER 1

### ENERGY ISSUES

#### INTRODUCTION

Energy is a critical national problem for today and the foreseeable future. It has proved to be a particularly difficult problem to analyze because it is so complex and because too much of our energy data is unreliable. In addition, truly solving the energy problem requires political consensus about sensitive issues such as balancing economic and environmental goals and objectives. In such areas consensus is very hard to achieve.

Where will the United States get its energy supplies in the future? How much will that energy cost in terms of inflation, the environment, and foreign policy independence? How much can energy demand be cut by using more efficient automobiles, factories, and machinery? These questions describe the general boundaries of the energy problem.

#### OVERVIEW

Over the past 3 to 4 years, we have seen growth in the strength of the Organization of Petroleum Exporting Countries; we have undergone an oil embargo by those countries; and we have seen international oil prices increase by over 400 percent. In that time the Federal Government has responded to the energy problem in many and varied ways. New regulations have been formulated, new programs initiated, new legislation passed, and many voluminous reports written.

Unfortunately the short term effects of Federal actions have not been what we might have hoped. The Nation is more dependent upon foreign energy sources today than it was 3 years ago. A longer term assessment of these effects is even more difficult. Certainly the Federal response has not been disciplined by a clearly enunciated and cohesive national energy policy.

That the Federal Government is more active in energy matters, there can be no doubt. Federal expenditures for energy programs are at an all-time high. For FY 1977, outlays totaled \$11.2 billion, a 41 percent increase over 1976. Some proposed Federal programs would cost many more billions of dollars: as much as \$100 billion for the Energy Independence Authority to subsidize capital costs in the energy industry; \$8 billion for a uranium enrichment program; \$2 to \$6 billion for synthetic fuels development; and more than \$1

billion to cushion the impact of energy development upon local communities. The new Strategic Oil Reserve Program alone will have a price tag of somewhere between \$10 and \$20 billion.

Furthermore, Congress has created new Federal agencies and programs, including the Federal Energy Administration (FEA), the Energy Research and Development Administration (ERDA), and the Nuclear Regulatory Commission (NRC). And even more extensive reorganization of the government's energy departments and agencies is under consideration and appears likely to take place in the near future.

On many occasions, the GAO has expressed its concerns of the lack of a focal point for developing a cohesive national energy policy. GAO has called for establishing a Department of Energy and Natural Resources, or, as an interim step to a DENR, establishing a National Energy Administration. Without such a focal point, it will be difficult at best to achieve a policy which will stand the tests of the future. And, even with a focal point for decisions, critical issues will remain needing analysis and resolution.

During the last 3 years, many Federal actions have been taken in the name of "energy independence", a most ambiguous concept. Just how self-sufficient we should be, or can be, has yet to be determined. The United States will be using imported oil for as long into the remainder of this century as any of us can foresee. But we could, given a national commitment, significantly mitigate our dependency on foreign sources: by making our energy-use systems as efficient as possible, by developing environmentally-sound conventional and emerging domestic energy sources, and by developing oil stockpiles.

It has become increasingly clear that, for the next 25 to 50 years, the U.S. will be shifting from primary dependence on oil and natural gas to other forms of energy. The effectiveness of conservation efforts and the success of efforts to make safe and efficient use of coal, nuclear, and renewable energy sources will determine the length of the transition and the extent of economic commitment it will entail.

Consensus does seem to have been reached on several basic aspects of America's energy future:

- The U.S. can no longer maintain historic energy growth patterns.
- Increased production from conventional domestic sources will take years to develop.



- New domestic sources will take even longer.
- Dependence on insecure sources of foreign oil should be reduced.
- Energy conservation is essential.

Energy planning must reflect the dynamic, changing nature of the energy situation. It must be flexible enough to handle changing circumstances to insure that our attention stays on the questions which bear most heavily on the Nation's energy problems.

Based partly on our past work on energy problems and partly on our continuing reassessment of critical national issues, we at GAO have tried to identify those key energy issues that are most in need of attention.

We believe that these are the critical issues with which we must come to grips soon if we are to develop a sound, cohesive national energy policy:

- How can the Federal Government encourage energy conservation?
- Can the problems of nuclear fission be resolved so it can become a major energy source?
- To what extent can fossil fuels (especially coal) be relied upon to fulfill future energy demand?
- How do Federal subsidies, taxes, and regulations affect energy supply and demand actions?
- How can the Executive Branch energy organization and decisionmaking processes be improved?
- What are the prospects for transition to essentially renewable energy resources (geothermal, solar, fusion)?
- Are the energy resources on public lands being wisely managed by the Federal Government?
- Are our domestic and international energy policies compatible and do they reflect international economic and political realities?

These are the issues stated in their broadest form. They are addressed in much greater detail in the following chapters. Critical subsidiary questions are inherent in

each; those are explicitly detailed as well. These issues must be addressed by everyone concerned with energy--most particularly the Congress of the United States, but also the Executive Branch, the academic community, scientists, industry, and concerned citizens. The GAO intends to concentrate its energy audit and analysis resources on these issues, understanding that their resolution will require the efforts of many organizations and people, and will take time.

## CHAPTER 2

### HOW CAN THE FEDERAL GOVERNMENT ENCOURAGE ENERGY CONSERVATION?

Some experts still believe the Nation's energy dilemma can be resolved almost exclusively by developing new sources of domestic energy. For the next 10 years, and probably beyond, however, conservation actions appear to us to be the best and most cost-effective way to "produce" new energy. It is also increasingly clear that beyond 1985, conservation must continue to be made a cornerstone of U.S. energy policy to insure that the Nation fully considers energy efficiency.

Conservation has one basic advantage which has not received much emphasis. In many cases conservation actions result in permanent or at least long-term energy savings. Further, the savings are multiplied beyond the actual energy saved at the point of end use. All of the energy needed to get it to the end uses is also saved. If conservation actions are not taken, then more energy must be produced each year to meet the inefficient energy uses.

There are basically three kinds of conservation actions:

- Eliminating energy waste through belt-tightening or leakplugging actions. Simple actions include turning down the thermostat and observing the highway speed limits. Complex actions include demand-management approaches, whereby electric utilities can discourage consumers from wasting energy.
- Developing more efficient energy-use systems. These include developing more efficient automobile engines and more efficient industrial systems.
- Changing lifestyles and living patterns to reduce energy use, but still achieve the same social and personal objectives. These include living closer to work and using forms of communication which eliminate the need for travel.

To date, most energy savings are coming from belt-tightening actions. Much less has been done on the more complex actions, which promise the biggest payoff in long-term energy savings.

With the oil embargo, the Federal Government started showing genuine interest in energy conservation, particularly as it realized that energy from most new domestic sources would take at least a decade to develop.

Current Federal energy conservation activities have a dual focus

- creating an economic, social, and political atmosphere that encourages conservation actions and
- developing new technologies to increase the efficiency of energy-use systems.

The first activity includes (1) setting energy performance standards (e.g., for new automobiles and buildings), (2) requiring specific reductions in government energy use as an example to the Nation, and (3) providing tax credits and other financial incentives for various conservation actions. Most of these programs were included in recent legislation, particularly the Energy Policy and Conservation Act and the Energy Conservation and Production Act.

The Energy Conservation and Production Act of 1976 includes a number of ambitious conservation programs, such as

- developing energy performance standards for new buildings;
- weatherizing housing for low-income families (a \$200 million program);
- demonstrating energy conservation measures and renewable energy resource measures in existing housing (also \$200 million); and
- improving electric utility rate designs (an FEA program).

Despite these new Federal programs, there is sharp disagreement about what the Federal Government ought to be doing in energy conservation. Should the government rely mainly on voluntary conservation actions, or should it institute mandatory conservation measures?

GAO's basic task will be to evaluate these Federal energy conservation programs, and, in doing so, consider the proper balance between voluntary and mandatory conservation actions.

## PAST AND CURRENT EFFORTS

To date, GAO has looked at Federal Government actions to reduce Federal inhouse energy consumption and to influence defense contractors to reduce theirs.

We are now evaluating energy conservation actions in private industries and at State and local levels. So far, our findings indicate that much more needs to be done, and can be done, to increase energy savings. Our findings are also identifying other areas in need of study.

## FUTURE EMPHASIS

We believe the following questions are most in need of answers:

1. How effective are the energy conservation programs enacted by the Congress in maximizing energy conservation? The programs under this legislation deal very specifically with energy conservation in the residential and commercial sectors and efforts of public utilities to better manage energy demand.

2. Will essentially voluntary programs be enough to get industry to conserve energy? Industry uses about 40 percent of the energy in the United States. Existing Federal programs will establish targets for energy conservation and require key industries to report on their successes in meeting the targets. The toughness of the targets and the industries success in meeting them will help determine the need, if any, for mandatory standards.

3. Will existing energy performance standards for new automobiles adequately encourage energy conservation in the transportation sector? Transportation accounts for about 25 percent of total energy use and is the other major area where opportunities exist for significant energy savings. Achieving these savings requires changing the automobile's basic engine and body design, using alternative transport methods (buses, special lanes, etc.), and using the most energy efficient transport methods for particular purposes. This could mean, for example, that short airline routes might be discouraged in favor of train or bus service.

4. Are institutional barriers likely to inhibit our ability to conserve energy? A major unresolved question is whether reducing our energy growth rate will also result in reducing our economic growth rate. Many studies indicate that in the recent past, energy growth and economic growth have gone hand-in-hand. Other studies argue that energy

growth and economic growth can be successfully decoupled. The question has not been satisfactorily resolved, and it must be if we are to lower energy growth rates substantially.

In addition, there is a whole range of questions regarding the degree to which changes in building codes, utility rate structures, and other areas will be accepted.

5. Is the government doing all it can to encourage inhouse energy conservation? If the government does not set the pace, can it expect the private sector to follow? Past GAO work has shown that much more can be done to conserve energy at government installations. Such work should be continued. The Department of Defense has a 6 year, \$1.35 billion energy conservation investment program which we are examining. Opportunities also exist for government leadership in developing total energy systems and in designing new buildings to maximize conservation savings.

Other questions deserve consideration and will gain importance in the future, including:

1. How adequate is current information on potential savings from various energy conservation actions and on the incremental cost of taking such actions? The government has yet to undertake broad studies assessing the whole range of energy conservation opportunities. Assessments of this type are needed, together with information on the incremental cost of each action, so that analysis can be made of the trade-offs between taking such actions and increasing energy supply.

2. To what extent is energy efficiency being considered in choosing among various energy supply options? Energetics (energy accounting) is not yet an exact science, but it offers the potential for helping us choose the most efficient way to use available energy supplies. Indications are that energetics does not receive much consideration in the government's decision-making process.

3. Has the Federal Government developed adequate energy conservation contingency plans? The Federal Energy Administration is required to develop a variety of energy conservation contingency plans, including gasoline rationing, which can be placed quickly into use if there are future embargoes.

4. Can the Federal Government help upgrade the efficiency of electric power stations by reducing the substantial (17 percent) heat losses to the atmosphere? What are the potential energy savings from using energy parks, including generating power from more than one fuel (such as a combination of coal and solid waste conversion)? Burning fossil fuels

is often an extremely inefficient way to produce energy for many end uses. The opportunities for improvement in this area appear substantial, but there are questions regarding the adequacy of Federal efforts to bring about such improvements.

5. Is it possible to reduce the energy growth rate below 2 percent, or perhaps even to zero? Leading government officials, including the Administrator of FEA, are beginning to talk about setting a national goal of 2 percent annual energy growth. Others, in energy think-tanks and elsewhere, are assessing the potential for achieving zero energy growth by the turn of the century. Some, in fact, argue that we will achieve it whether we want to or not. They see this issue as whether we will plan for such a future or wait for it to appear as a crisis.

## CHAPTER 3

### CAN THE PROBLEMS OF NUCLEAR FISSION BE RESOLVED SO IT CAN BECOME A MAJOR ENERGY SOURCE?

Nuclear powerplants currently provide about 8 percent of the country's total electricity; in some local areas this figure is as high as 42 percent.

However, nuclear fission power continues to be one of the most controversial energy issues in this country. Consequently, its future contribution is not yet decided, and could range from an outright moratorium to, some optimists believe, providing up to 45 percent of our total electricity by the year 2000. Decisions made in the next 5 years may well be pivotal in deciding the future of nuclear fission.

At the heart of the controversy is the potential hazard these nuclear powerplants and support activities pose to public health and safety and to the environment. While the safety record of commercial nuclear powerplants to date has been quite remarkable, numerous studies have shown that the "worst possible" accident could kill and maim thousands and cause billions of dollars in property damage.

The Nuclear Regulatory Commission is responsible for regulating the commercial nuclear industry to protect public health and safety. NRC carries out this responsibility by developing standards, issuing licenses, and inspecting and enforcing licensee compliance with regulations.

Opponents of nuclear energy question the safety of the powerplants, the adequacy of NRC's regulatory efforts, and the safety of the "fuel cycle" activities required to keep the powerplants operating. The fuel cycle involves (1) mining the uranium, (2) processing it through several steps into fuel for the powerplants, (3) reprocessing the used fuel, and (4) ultimately disposing of highly radioactive wastes. Most of these steps involve transporting hazardous materials on public highways and railroads.

Proponents of nuclear power have claimed that it is cheaper to generate electricity with uranium than with coal, oil, or natural gas, and that this fuel cost advantage more than offsets the higher capital costs of nuclear powerplants. However, recent studies claim that coal is actually a cheaper fuel than uranium. Opponents question the overall economics of nuclear powerplants. They say that the cost advantage is based on a high reliability rate for nuclear powerplants, and



that recent figures show that the plants are far less reliable than coal burning powerplants.

The arguments against nuclear energy have been taken to the courts and to the voters. Two recent Court of Appeals decisions challenged NRC's licensing process by requiring that applicants give full consideration to (1) the environmental problems of operating reprocessing plants and disposing of wastes, and (2) the alternative of energy conservation. Antinuclear groups have garnered enough support to get nuclear "moratorium" and/or control initiatives on ballots in a number of States. While all these initiatives were defeated, a large minority continues to have concerns about nuclear power. It is unlikely, therefore, that this issue is resolved.

The Energy Research and Development Administration is responsible for developing new nuclear fission concepts. ERDA also conducts reactor safety research projects for NRC.

Another potential problem for nuclear power is perceived fuel shortages in the fairly near future. Accordingly, ERDA's present top priority project is the liquid metal fast breeder reactor (LMFBR), a nuclear fission reactor that will "create" more fuel than it uses. There are no reliable estimates of U.S. uranium reserves, and foreign sources are uncertain. The LMFBR, with its fuel "breeding" capability, could be the solution to any problem with uranium supplies. However, there are large problems involved with commercializing the LMFBR. GAO has done extensive work in this area, as described in the next section.

As of December 1976, there were 62 commercial nuclear powerplants licensed to operate in this country, and another 72 under construction. In addition, public utilities had applied for construction permits for 67 powerplants and had placed orders with manufacturers for 16 more.

Of these 217 nuclear powerplants, all except two involve "light water" reactors. The exceptions are one high temperature gas reactor which is licensed to operate, and one LMFBR which is currently under review for a construction permit. The primary manufacturer of high temperature gas reactors is getting out of the business and it is doubtful that any more of these will be built. The LMFBR is many years and billions of dollars away from commercial use. The energy output of nuclear fission, at least over the next 20 years, will continue to be almost exclusively from light water reactors.

Regardless of what happens in this country, other countries are developing energy policies heavily dependent on nuclear fission power. This is particularly true for many

European countries which have limited energy resources. Chapter 9 discusses the implications of foreign nuclear policies for U.S. domestic and nuclear export policies.

#### PAST AND CURRENT EFFORTS

Recent work at NRC has been directed at regulatory efforts to assure the safety and security of nuclear powerplants and fuel cycle activities, and related areas such as radiation emergency preparedness and reactor safety research projects (conducted at ERDA laboratories).

ERDA's priority R&D effort, and its most expensive, is the LMFBR program. Over the past two years, GAO has issued nine reports addressing various aspects of this program. Three of the reports provided broad analyses of the LMFBR program's problems, potential, and prospects for commercialization. Other reports addressed key components of the program, such as the Fast Flux Test Facility and the Clinch River Breeder Reactor.

Another recent GAO report that received wide publicity addressed shortcomings in ERDA's system to account for and protect highly dangerous nuclear materials. GAO is presently looking at NRC's system to ensure that its licensees adequately account for and protect these hazardous materials.

#### FUTURE EMPHASIS

We plan to address the following questions in future studies:

1. Is NRC adequately adjusting its regulatory approach in view of the very basic questions raised about the future of nuclear fission? Recent court decisions underline the fact that NRC can no longer consider license applications solely on a case-by-case basis, and only in terms of reactor health and safety. NRC is being pressured more and more to consider broad programmatic questions, including

- safety and security problems;
- adequate disposal of radioactive wastes;
- the need for new nuclear plants in light of overall trends in the development of alternative energy sources; and
- socioeconomic and environmental impacts.

2. Are NRC and ERDA reactor safety research programs addressing the right questions? In view of the increasing controversy over nuclear power, it would seem logical that safety research projects be geared toward either confirming or improving the safety of nuclear powerplants and nuclear fuel cycle activities.

3. How close are NRC and ERDA to solving the fuel reprocessing and waste disposal problems necessary to closing the nuclear fuel cycle? A great deal of the public controversy over nuclear energy comes from the fact that there is no consensus on how to dispose of high-level radioactive wastes. Further, the absence of commercial fuel reprocessing and the critical shortage of commercial spent fuel storage space have already forced many nuclear powerplants to expand their onsite storage capability for wastes of all types.

4. How reliable are ERDA estimates of domestic uranium supplies and how reliable are foreign sources? The answers to these questions are crucial in determining if and when we will need a commercial LMFBR.

Other questions also needing attention include:

1. Are ERDA and NRC safeguards adequate to protect their special nuclear material? Special nuclear material is generally described as material that could be used to make a nuclear bomb; however, it could also be deadly if dispersed in a heavily populated area. The increasing incidence of domestic and international terrorism highlights the need for a much higher level of safeguards on these materials than has previously been considered necessary.

2. Why are reactor safety research projects meeting with cost, schedule, and performance problems? GAO has frequently reported on schedule slippages and increased costs, and will continue to review this area.

3. Can environmental and safeguards risks be reduced by collocating commercial nuclear fuel cycle facilities and is it economically feasible? Collocating facilities into nuclear parks could eliminate much of the required nuclear materials transportation and consequent safeguards risks. On the other hand, it would pose a new set of problems, including vulnerability to overt attack, siting problems, and transmission problems to get the generated electricity to users. Careful analysis of the tradeoffs in this area is badly needed.

4. Can NRC's licensing process be streamlined? It currently takes 8-10 years to license and build a nuclear

powerplant. While much of this time is not taken up by the licensing process, improved NRC licensing procedures and using standardized nuclear powerplant designs might help shorten the time required.

## CHAPTER 4

### TO WHAT EXTENT CAN FOSSIL FUELS (ESPECIALLY COAL) BE RELIED UPON TO FULFILL FUTURE ENERGY DEMAND?

Domestic fossil fuels (oil, natural gas, and coal) have traditionally been the mainstays of U.S. energy supply. These three fuels accounted for 86 percent of total energy consumption in 1970 and 75 percent in 1975.

Many informed observers are convinced that the recent decline of domestic oil and gas production signals the end of an era. They believe that the U.S. is entering a 25 to 50 year transition period during which our reliance on fossil fuels--especially oil and gas--will substantially decrease and our use of essentially renewable energy sources--solar, wind, geothermal, etc.--and nuclear energy will increase. Nevertheless, our remaining fossil fuel reserves are substantial and can help meet our energy needs for many years to come.

Since reaching its peak in 1970, U.S. oil production has steadily declined from 9.6 to a current 8.2 million barrels per day. At the same time, U.S. oil consumption has continued to increase, forcing sharp increases in oil imports--now accounting for 40 percent of U.S. oil consumption. Natural gas production peaked in 1973, and by 1975 had declined from 22.6 to 20.1 trillion cubic feet a year. Production for 1976 is roughly estimated at 18.9 trillion cubic feet. The only expected major increases in domestic oil and gas production in the near future are from Alaska and the Outer Continental Shelf (OCS). However, these increases are expected only to slow down or stop temporarily the decline in domestic production.

Major concerns about domestic oil and natural gas supplies relate to

- the accuracy and adequacy of information on our reserves and resources;
- completing the Alaskan oil pipeline, and eventually a gas pipeline, without undue harm to the State's fragile ecology; and
- recovering the estimated 40 billion barrels of oil and 250 trillion cubic feet of natural gas, which present commercial recovery techniques cannot extract.

Coal is the country's most abundant energy resource. U.S. coal resources are estimated to be about 4 trillion

tons, with currently recoverable reserves about 217 billion tons. The tonnage of coal used has grown slowly over the past two decades. In relative terms, however, over the last 75 years the use of coal has declined from supplying over 90 percent of the Nation's energy needs to less than 20 percent.

The low regulated price of natural gas (until this year), cheap oil import prices before the embargo, and continued development of nuclear power have all contributed to the decline. The coal industry has argued, with some validity, that growth in coal use has also been limited by state and Federal laws. Those laws govern mining health and safety, strip mining and land reclamation, and air quality. As in other areas, balancing sometimes conflicting goals requires a clear understanding of the tradeoffs involved in expanding future use of our abundant domestic coal resources.

The oil embargo and the dramatic oil price increase have stimulated interest in using coal as a primary energy source. Most studies conclude that coal consumption must rise substantially if the Nation is to rely less on imported oil. A current Administration goal is to increase coal production from 600 to 1000 million tons by 1985.

However, if this goal is to be met, a number of problems will have to be overcome. New miners need to be trained, additional mining equipment has to be produced, and new transportation sources must be found before new mines can be opened. Means must also be developed to reclaim strip-mined land and to reduce air pollution from burning coal. Increased production of western coal depends on alleviating adverse socioeconomic impacts on small rural towns and cities.

For the long term, we must also decide how coal can best be used. Although technically feasible, it is very expensive to make synthetic oil and pipeline-quality gas from coal. And while gasification and liquefaction would reduce some of the environmental problems in burning coal, others would be created. Problems of costs, infrastructure, and environmental and socioeconomic impacts will all have to be addressed in making future decisions on whether to burn coal directly or convert it to oil and gas.

The adverse health and environmental effects of continued fossil fuel use are a major concern. Some steps have been taken in the past few years to reduce these effects. Some --cooling towers and scrubbers--have raised the price of energy. In other instances--for example, the production of Alaskan and OCS oil and gas--environmental controls have

increased both the cost and the time required to develop new sources. Serious environmental problems will strongly affect development decisions on many major potential sources of domestic fossil fuels, such as OCS oil and gas, oil shale, and synthetic fuels from coal.

There is growing concern over the long-term effects of burning fossil fuels, even if all pollutants could be removed. Fossil fuels are mainly carbon and, when burned, release carbon dioxide into the atmosphere. Since carbon dioxide acts as a one-way filter, its increased concentration in the atmosphere poses a potential problem by permitting the sun's rays to reach the earth but not allowing heat to escape. Atmospheric heat buildup may well turn out to be the major problem and argument against increased use of fossil fuels. Analysis of the potential impacts of such a heat buildup is only in its infancy. Much must be learned about this phenomena, and quickly, if a major program to increase the use of fossil fuels is to achieve social acceptance.

#### PAST AND CURRENT EFFORTS

So far GAO has issued only a few reports in this area. The most notable of these was a comprehensive examination of the status and problems in Federal coal research. Another report examined the problems with coal liquefaction and gasification.

We have already issued one report on the status of construction of the Trans-Alaskan oil pipeline and have major continuing efforts in this area.

Current GAO work also includes reviewing efforts to improve oil and gas extraction methods, assessing the socio-economic impacts of developing Rocky Mountain area energy resources, and reviewing alternative systems for bringing Alaskan natural gas to the lower 48 states.

A major study now underway will provide a broad overview of the issues influencing the future of coal in the U.S. Specifically, the review is focusing on analyzing coal supply and demand markets, the status of coal development efforts, and factors which may constrain coal development. We expect this review to provide a broad overview of the future of coal use in this country and to identify a number of more specific issues which will be addressed in separate future reviews.

In addition, GAO is actively monitoring FEA's plans and progress in developing a Strategic Petroleum Reserve system designed to offset the effect of any future embargo. Once approved by Congress, this proposed program will be ongoing

for the next decade and could cost some \$10 to \$20 billion. There are many questions about this program, regarding such things as (1) selecting and acquiring storage sites, (2) acquiring oil for storage, and (3) the relationship between this program and existing Naval petroleum reserves. Because of this, GAO can expect to be involved in this program for some time.

### FUTURE EMPHASIS

The following four questions define our most immediate concerns with fossil fuels:

1. How can the socioeconomic and environmental problems associated with coal production be minimized? Improved technology is needed to reduce the air pollution associated with coal, either by removing pollutants before the coal is burned, or by removing them before smoke is released to the atmosphere. While strip-mining is a very efficient method of extracting coal, reclaiming strip-mined land remains a problem.

2. How can the U.S. make better use of its coal resources? The coal industry has been financially depressed until just recently, and little effort has gone into technology for improved extraction, transportation, and combustion of coal. A number of promising new techniques to extract a higher percentage of coal from the ground are being used by other countries, but the U.S. has not adopted them to any great extent. Locating electric generating plants near the coal mine instead of near the population being served might keep electricity costs down in some cases, but this technique is in very limited use in the U.S. Coal-slurry pipelines could transport coal efficiently, but a number of technical, environmental, and legal problems must be resolved before it can become a major, feasible way of delivering coal to users.

3. How much reliance can the Nation expect to put on domestic oil and gas resources for its future energy needs? Domestic oil and gas reserves have been declining in recent years, and the costs of finding new reserves have increased dramatically. The accuracy of U.S. oil and gas reserve estimates, and the kinds of Federal actions needed to develop better estimates, have become acutely important questions.

4. What role will Alaskan energy resources play in the future? Alaska has large known oil and natural gas resources, and potentially large coal reserves. But its vast areas of undeveloped land and its extremely fragile ecology are greatly threatened by large-scale resource development. Furthermore, since the high cost of constructing transportation systems



has made it uneconomical for private interests to build competing systems, the Federal Government will continue to be involved in deciding how to transport Alaskan energy resources to the lower 48 states.

The Federal Government may also have to assist in determining the ultimate destination in the lower 48 states for Alaskan oil when production starts in 1977. Current industry plans call for the oil to be delivered to the West Coast and may result in a glut of oil there. The government may have to approve a plan to ship some of the oil east or to export it.

Other questions to be addressed include:

1. How can oil and gas extraction methods be improved? Two-thirds of all the oil ever discovered in the U.S. still remains in the ground waiting for improved methods of extraction to be invented or to become economical. Also, vast natural gas deposits in the Rocky Mountains and in the East cannot be extracted with present methods. Commercial production of natural gas from these sources awaits technological and economic breakthroughs.

2. How much carbon dioxide from fossil fuel combustion can the atmosphere absorb? If continuing studies indicate that increasing carbon dioxide levels are causing serious atmospheric problems, plans for massive coal development will have to be reevaluated.

3. What is the future role of synthetic fuels from coal and oil shale? The U.S. has huge resources of oil shale that can be converted into synthetic crude oil, and coal that can be processed into both synthetic crude oil and natural gas. Although technologies for these processes are generally proven, development costs are enormous and the ultimate cost of synthetic fuels is uncertain. Consequently, the size of contribution synthetic fuels can be expected to make over the next 25 years or so is still uncertain. Further, if the U.S. is, as some claim, already in a transition period to renewable resources, does it make sense for the government to spend billions of dollars to develop a synthetic fuels industry that might soon be outdated? Should the government instead focus its research, development, and demonstration efforts on techniques for enhancing oil and gas recovery, or try to accelerate renewable resources development?

## CHAPTER 5

### HOW DO FEDERAL SUBSIDIES, TAXES, AND REGULATIONS AFFECT ENERGY SUPPLY AND DEMAND ACTIONS?

#### GOVERNMENT ROLE IN ENERGY FINANCING

The proper government role in energy financing is far from determined and is likely to be argued for years to come. Developing new energy technologies on a commercial scale will require major technical breakthroughs and capital outlays.

Although the Federal Government has become increasingly responsible for the research, development, and demonstration of new technologies, its role in bringing these technologies into commercial use is still argued. Whether commercialization should be through direct government involvement or through incentives for private development is still an unresolved issue. The Federal Government is involved also in offsetting the environmental and socioeconomic impacts of large-scale energy development, particularly in remote unpopulated areas.

Reviewing recent and proposed legislation shows the wide range of financing options being considered. They include government loan guarantees, price subsidies, grants, direct payments, and tax incentives.

Provisions of passed legislation include:

- Grants to individuals and States for energy conservation programs, along with price control exemptions for certain oil wells (Energy Conservation and Production Act-- see appendix I).
- A \$750 million loan guarantee program to stimulate underground coal mine development (contained in the Energy Policy and Conservation Act and expanded in the Energy Conservation and Production Act).
- Providing Federal financial assistance to coastal states to help mitigate the environmental and socioeconomic impacts of developing OCS oil and gas.

Provisions of legislation considered by the 94th Congress, and which may reappear in the 95th Congress, include:

- Establishing an Energy Independence Authority with up to \$100 billion to assist energy development projects through grants, direct loans, loan guarantees, and price supports. Ford Administration spokesmen have indicated that the Energy Independence Authority would primarily assist nuclear energy and synthetic fuel development, and major construction projects such as the proposed Alaska gas pipeline.
- Authorizing between \$2 and \$6 billion to ERDA for government assistance in constructing commercial or near-commercial size synthetic fuel plants, and demonstration plants for biomass conversion and other technologies.
- Increasing the Nation's uranium enrichment capacity either by expanding existing government facilities or providing financial incentives to encourage a private uranium enrichment business, or both.
- Direct loan or loan guarantee authority of \$1 billion to the Department of the Interior to assist states in meeting the socioeconomic costs of energy development.

#### ECONOMIC REGULATION

The Federal Power Commission (FPC) regulates natural gas and electricity in interstate markets. About half the natural gas consumed in the U.S. moves in interstate markets, compared with only 10 percent of all electricity used. The purpose of FPC regulation is to assure consumers a reasonable price for gas and electricity, and assure utilities a reasonable rate of return on investment.

With the recent decline in natural gas production, producers have been calling for price deregulation. In response, FPC recently announced a substantial price increase for new natural gas--from \$.52 to \$1.42 per thousand cubic feet. FPC also announced that the price of natural gas discovered since 1972 would rise to \$1.10 per thousand cubic feet. Consumers have challenged these increases, claiming they were based on estimated future production costs, rather than actual production costs.

The 94th Congress spent a lot of time on the subject of deregulating natural gas, and the 95th Congress can be expected to do the same. GAO's new authority to verify cost data submitted to FPC by natural gas producers may play an important part in identifying problems and developing information to help resolve these issues.

Since the price of most electricity is regulated by state and local public utility commissions, there is some question about how effective the Federal Government can be, without additional legislation, in setting policy involving the utility industry. One particular concern relates to modifying utility price structures as a means of reducing energy demand.

Since the oil embargo, domestic oil prices have been regulated by FEA. The Energy Policy and Conservation Act provided for a 40-month phaseout of oil price controls. During this period, the price of domestic oil is expected to slowly rise until it reaches a level closer to the world market price. The more recent Energy Conservation and Production Act provided FEA additional authority to increase the price of domestic oil. At the end of the 40-month period, Congress must decide whether oil price controls should be completely discontinued.

State and local governments are also responsible for regulating energy development, and are using taxes as one means. New Mexico, Montana, Wyoming, and Alaska have increased tax on coal, oil, and gas, both to control resource development and to get what they consider "their fair share" of development revenues. Just how state actions interface with Federal actions and their likely influence on energy resources development will be important questions in the years to come.

#### PAST AND CURRENT EFFORTS

Much of GAO's energy-related work over the last year has looked at government financing and economic regulation. The results have been several widely-used reports:

- Our reports on the Administration's proposal for turning uranium enrichment over to private industry were used in the Congressional debate on the proposal.
- Our findings on the resource, economic, social, and environmental implications of deregulating natural gas were also widely quoted in a House debate.
- Our analyses of Federal financing alternatives to commercialize synthetic fuel technologies prompted considerable Congressional interest.

In response to Congressional interest, we prepared early in 1975 a package of energy proposals which included a number of suggestions on taxes and other financial incentives and disincentives. We also provided the Senate Committee on

Finance with an analysis of H.R. 6860, as passed by the House of Representatives. This bill included financial incentives to reduce energy consumption, and would have imposed quotas on imported petroleum products.

Current work includes (1) a recently released report on analyzing considerations for commercializing the LMFBR, (2) studying FPC's allowing of advance payments by pipeline companies to natural gas producers to spur natural gas exploration, and (3) studying the impact of FPC's regulatory processes on the utility industry.

### FUTURE EMPHASIS

GAO will increase its reporting in this area. Some of the more important questions to be considered include:

1. If natural gas and oil are not deregulated, how does the Nation establish a stable regulatory policy? The continued disagreement on whether or not to deregulate has made both the oil and gas industries unsure of their actions.

We are planning a three-phase study looking into (1) FPC's basis for its recommended increases in natural gas prices, (2) the adequacy of Federal information on natural gas reserves, and (3) natural gas companies' production costs and profits.

We also plan to evaluate FEA's oil price regulation activities, including an evaluation of a complete phase-out of oil price regulations.

2. What is the appropriate government role in commercializing new energy technologies? Our work on uranium enrichment and synthetic fuels established our entry in this area. The latter work, "An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies," provided a framework for selecting energy technologies and for financing them. The issues which led to this work are still critical, and GAO expects continued Congressional interest in these areas.

3. To what extent are Federal energy production and conservation programs and incentives complementary or counterproductive? With Federal energy programs developing in a piecemeal fashion, GAO will need to examine the overall pattern carefully.

4. How do State tax and energy policies relate to Federal objectives? Several states have adopted aggressive tax policies which could affect future national energy policy.

including the price of energy and the ultimate mix of supply sources. The interface between state and Federal energy policies will need close examination.

5. What are the effects of taxes and other forms of regulation on the production and price of energy supplies? Recent Federal actions, such as the repeal of depletion allowances, coal mine health and safety regulations, and air and water quality regulations, affect national energy supplies and prices. The economic effects of these and proposed regulations should be studied in order to better understand the trade-offs involved.

Other questions include:

1. Are price control activities coordinated with Federal research and development (R&D) efforts to ensure that energy prices are reasonable? In a sense, both price control and R&D activities are aimed at reducing or holding down the costs of new and existing supply sources. As price control policies change, R&D policies should reflect those changes. For example, if oil price controls are removed, should ERDA place greater emphasis on improved oil recovery technologies which may help hold down oil costs?

2. What should be the primary emphasis of government economic regulation as we move into an era of relative energy scarcity and dependence on foreign sources, coupled with a greater need for energy conservation? In recent years, emphasis has been on holding down prices. Will this continue to be the appropriate goal of pricing and taxing policy? What goals could be set as a substitute? Most other industrialized countries already control all facets of the energy industry much more than the U.S. does. Current discussions over oil industry competition and profit levels, government purchase of foreign oil, and government exploration and even production on public lands all indicate Congressional interest in government control of the energy industry and of energy development generally. Whether increased or decreased government involvement is warranted will lie at the heart of the energy policy debate in the next few years.

## CHAPTER 6

### HOW CAN THE EXECUTIVE BRANCH ENERGY ORGANIZATION AND DECISION- MAKING PROCESSES BE IMPROVED?

The energy future of the Nation will depend in large part on making the right decisions today. This requires that available alternatives be fully explored, and that consideration be given to energy's relationship to the environment, the economy, housing, transportation, and other national priorities.

The inability to solve many energy problems stems at least in part from the diffusion of major energy programs among several Federal agencies. For example, ERDA is responsible for research, development, and demonstration of energy technologies, while FEA formulates short-term energy policy, and the Department of the Interior makes decisions regarding the development of energy resources on Federal lands. There are also two national energy planning systems: ERDA's--which produced A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future (ERDA-48), and the 1976 revision of the plan; and FEA's--which produced the original 1974 Project Independence Report and the 1976 National Energy Outlook.

As a result of such fragmentation, policymaking and management of Federal energy activities have not proceeded as effectively as they might have, and at times work at cross purposes. For example:

- Developing Federal resources can significantly affect our ability to meet future energy demand. However, there is presently no reliable mechanism for relating current resource development actions to projections of future demand. Consolidating the key Federal energy programs would provide the means to mesh both supply and demand considerations into a single effort and to pinpoint leadership and responsibility for making energy decisions.
- Price regulation affects the entire energy system, not just the regulated components. At present, low regulated prices may contribute to making it uneconomical to develop new energy sources; likewise, they discourage conservation actions.

As far back as 1971, the President proposed a Department of Energy and Natural Resources (DENR), but the Congress has

not approved such a reorganization. More recent proposals to create a Department of Energy are likely to receive serious consideration in the very near future. While it is not practical to centralize all energy-related programs, the major ones can and should be consolidated as a further step towards a nationalized energy decisionmaking system.

A closely related issue is Federal energy data collection and analysis. Dispersed energy responsibilities have resulted in dispersed energy data collection and analysis responsibilities. Much of the Congressional debate has centered on charges that the Federal Government lacks a coordinated and credible energy data base on which to make intelligent energy decisions.

A provision was included in the Energy Conservation and Production Act to strengthen FEA's energy data capabilities. It remains to be seen whether this will meet the government's needs, or whether other changes will be needed. Other options are unlikely to be seriously considered until FEA's performance under the recently passed legislation can be evaluated.

#### PAST AND CURRENT EFFORTS

GAO has provided the Congress with reports and testimony on Federal energy data problems. One important problem we reported on was the lack of information on energy resources on Federal lands.

We have also testified on energy organization problems and the need for a DENR or, as an interim step, a National Energy Administration (similar in concept to a Department of Energy).

We are also studying the role of ERDA's national laboratories, the way in which the Tennessee Valley Authority's power program relates to national energy goals, and the relationship between current energy policy decisions and national energy goals.

Problems identified during this latter study have further demonstrated the need for reorganizing the current Federal energy structure; the need for greater consideration of the effects of price regulation on other energy policies; and the need for greater coordination of energy goals with national goals in transportation, housing, the economy, and the environment.



## FUTURE EMPHASIS

Some of the questions we plan to address in the future are:

1. How can reorganization of Executive Branch energy responsibilities best be achieved? This includes Federal responsibilities for energy policy formulation, energy program development, energy financing, and energy regulation. With a new Administration and with FEA's enabling legislation due to expire at the end of 1977, there is likely to be renewed Congressional interest in a DENR, or a Department of Energy. If reorganization does not occur, we will explore ways of improving analysis and decisionmaking under the present structure, including expanding our current work on the relationship of energy policymaking to national energy goals. We would expect to evaluate and comment upon alternative reorganization plans as they are developed for Congressional consideration.

2. Are Federal regulatory activities causing unnecessary problems for the energy industries? Federal regulatory responsibilities are spread among several agencies, which sometimes have conflicting goals. The electric power industry, for example, is regulated to some extent by FPC, FEA, NRC, and the Environmental Protection Agency. Other chapters of this report discuss specific responsibilities of some of these agencies; however, we will also need to take a broader look at the interrelationships of these agencies and their collective impact on the energy industries.

3. Can the structure of the electric power industry meet the future needs of the Nation? Concern continues to be expressed as to whether the Nation's 3,600 municipal, cooperative, State, Federal, and private utilities can cooperate sufficiently to build the kinds of systems needed for the future, or whether further Federal planning and intervention is needed.

4. How does the Federal Government balance energy, economic, environmental, and other national priorities in its decisionmaking process? The Office of Management and Budget is the only agency with overall responsibility for balancing priorities and reconciling goals and needs. Clearly this is an essential part of operating government programs, and perhaps the present mechanism is sufficient. However, because of the importance of reconciling goals and needs, we will need to evaluate the present process and consider possible alternatives.

5. What should the future roles of the Federal power marketing agencies be? Electricity sold by these agencies generally has been cheaper than other energy sources, when compared to the national average, and has encouraged electricity consumption. The power marketing agencies' decisions on prices and constructing additional generating facilities may not be consistent with overall Federal energy policies and goals which encourage conservation and reducing energy use. The programs of those agencies will need reexamination in the light of changing national needs.

6. How effective are Federal energy data collection and analysis activities? The Energy Conservation and Production Act strengthened FEA's responsibilities with the intent of making FEA a strong, objective, and credible focal point for energy information. The Act also established a review committee to oversee FEA's data activities and to report annually to the Congress and the President on the progress of FEA's new Office of Energy Information and Analysis. GAO is required by law to designate the committee chairman, and will participate in the committee's work.

## CHAPTER 7

### WHAT ARE THE PROSPECTS FOR TRANSITION TO ESSENTIALLY RENEWABLE ENERGY RESOURCES (GEOTHERMAL, SOLAR, FUSION)?

Renewable, or essentially inexhaustible, energy resources are here divided into three broad categories:

--Solar energy is potentially the most abundant form of energy available. At present, three major types of technologies are being developed

--direct thermal technologies which use sunlight to heat a transfer medium (such as water or air) for space heating and cooling;

--solar electric technologies, such as wind energy and photovoltaic conversion (a process for converting sunlight directly into electricity); and

--technologies which convert organic matter, or biomass, into a variety of clean fuels.

--Geothermal energy can be used to generate electricity or as a direct heat source.

--Nuclear fusion, the process by which the sun and other stars generate their energy, produces energy when nuclei of light atoms are fused into larger nuclei. It could be used to generate electricity as a direct heat source, or possibly "create" hydrogen from sea water.

Other promising technologies, which may get more attention in the future, make use of various forms of ocean energy, including ocean currents, tidal power, and ocean thermal gradients.

Most of these technologies are not expected to make major contributions to the Nation's energy supplies until after the turn of the century, if then. Solar energy, for example, will probably supply only about 1 percent of national energy demand by 1985, with estimates increasing to 10 to 30 percent by the year 2000, given an all out commitment to its development. Even if successfully developed, nuclear fusion technologies are expected to supply only a small fraction of national energy by 2000.

Recent public concern about dwindling oil and gas supplies has resulted in legislation to speed up development of solar and geothermal energy. The Solar Heating and Cooling Demonstration Act of 1974, the Solar Energy Research and Development Act of 1974, the Non-nuclear Energy Research and Development Act of 1974, and the Geothermal Energy Research, Development, and Demonstration Act of 1974 gave ERDA authority to conduct a wide range of activities. Those activities are intended to promote economically competitive and environmentally acceptable solar and geothermal technologies. The Energy Conservation and Production Act of 1976 also provides for a national demonstration program to test various forms of financial assistance to encourage installing renewable resource energy measures--such as solar heating and cooling equipment--in existing buildings.

Funding for research, development, and demonstration of these technologies has also dramatically increased. Solar energy R&D funding, for example, increased from \$11.5 million in FY 1974 to \$120 million in 1976. From 1951 through FY 1974, about \$660 million was spent on nuclear fusion research; an estimated \$2.1 billion in funding has been or will be provided from 1974 through FY 1980. FY 1977 funding for geothermal R&D more than tripled over FY 1975 levels.

The commercial potential of each of these technologies varies widely. The fusion reactor concept has not even been scientifically demonstrated as yet, and a demonstration reactor is not expected to be in operation until the mid- to late 1990's.

In contrast, some solar and geothermal applications have been operating for a number of years, but only on a small-scale basis. R&D is still needed to increase the reliability and durability of system components, increase the storage capacity of solar electric technologies, and improve performance of large-scale systems. Information must also be gathered and assessed on possible environmental consequences, and on social and institutional problems.

In the last couple of years, a number of people have questioned the priority ERDA has placed on developing renewable energy technologies. They have argued that these technologies can and should be developed and commercialized more rapidly. In its present and future work, GAO will need to study this issue, focusing particularly on whether there is a reasonable balance to be drawn between the development of renewable energy resources and other options, such as nuclear fission and coal.

## PAST AND CURRENT EFFORTS

GAO's work to date has centered primarily on assessing the status of R&D programs in nuclear fusion, geothermal, and solar energy. Our emphasis has been on identifying management improvements and other actions needed to assure successful and rapid attainment of program goals. Other studies have examined the types of incentives necessary to commercialize these new technologies. In all of these reports, we stressed the important role of these new technologies in meeting national energy goals and in conserving valuable oil and gas resources.

Some study has also been devoted to the opportunities for increasing hydroelectric power from Federal power projects. While hydroelectric power can be considered a renewable energy resource, it has supplied only a small portion of total U.S. energy in the past, and is not expected to increase significantly in the future. For this reason, while we will continue to do some work on this resource, we do not plan to do a large number of hydroelectric power development studies in the future.

## FUTURE EMPHASIS

While R&D in each of these technologies faces a unique set of technical, environmental, economic, and other obstacles, several basic questions should be raised about them as a group. The important questions, in our view, include:

1. How accurate are ERDA's estimates of the future contributions of renewable energy sources? For the most part, ERDA believes that new energy sources will have little if any impact before 1985. From then until 2000, only geothermal energy and solar heating and cooling are expected to make any appreciable contributions to energy supply. The modesty of these estimates tends to reinforce ERDA's decisions about the appropriate funding level for these programs. The validity of the estimates, therefore, becomes an important item for analysis.

2. Once developed, how will these new technologies be incorporated into the existing energy supply system? Increased use of these new technologies as a partial substitute for existing energy technologies will require advance planning. Possible economic and social dislocations that result from changes in energy sources must be minimized. Since application of many of these technologies can be decentralized and used on a smaller scale than current systems, changes in investment characteristics also must be anticipated. Other considerations, such as land and water use, public acceptance, and legal and institutional barriers must be identified if rapid deployment of such technologies is to take place.

3. How are priorities among these emerging technologies determined? Given limited resources, how does ERDA select the most promising technologies and approaches? Are some technologies emphasized at the expense of other potentially more desirable approaches?

4. What environmental impacts are associated with these technologies, and what is being done to identify and overcome them? Although proponents of solar technologies argue that they have few adverse environmental effects, problems associated with those technologies as well as with nuclear fusion and geothermal energy must be studied further. Will nuclear fusion, for example, introduce as many problems as nuclear fission? What is being done to assure that necessary environmental controls are developed?

5. How effective are new demonstration programs, such as the solar heating and cooling program, in meeting program goals? One goal of the solar heating and cooling program is to bring about commercial acceptability by the early 1980's. To this end, solar heating equipment is currently being demonstrated in about 120 homes, apartments, and office buildings around the country. This program, as well as some geothermal programs, should be evaluated to determine how well they are being conducted, and if they will be able to meet program goals.

Other questions concerning specific technologies include:

1. What is the long-term potential of geothermal energy? Is a Federal loan guarantee program or other incentive needed to encourage and assist the private sector in developing geothermal resources? Although ERDA does not consider geothermal a direct substitute for oil or gas, certain non-electrical applications, such as space heating, do exist and could substantially increase the potential of geothermal energy before 1985. In addition, ERDA is currently developing plans for a Geothermal Resources Development Fund to reduce the financial risks in developing geothermal energy systems. An evaluation of these plans could show which types of incentives, if any, are likely to be most effective.

2. Is ERDA underemphasizing the importance of solar heating and cooling in relation to solar electric applications? The Office of Technology Assessment has criticized ERDA's solar energy program for emphasizing solar electric applications over solar heating and cooling.

3. Has ERDA underestimated the possibility of obtaining synthetic fuels from solar energy? The program to produce fuels from biomass has one of the lowest funding levels among all solar options.

## CHAPTER 8

### ARE THE ENERGY RESOURCES ON PUBLIC LANDS BEING WISELY MANAGED BY THE FEDERAL GOVERNMENT?

Managing energy resources on public lands is one of the most important Federal energy responsibilities. Tremendous pressures are being exerted to exploit these resources much faster. Wise long-term management, however, requires properly balancing our energy needs with environmental considerations, land use, and social and economic goals.

Public lands cover 760 million acres, and contain about half of our remaining energy resources. The most important of these are OCS oil and gas, the Naval Petroleum Reserves, and western coal and oil shale.

#### Outer Continental Shelf

From 1954 until just recently, OCS leasing was confined to the Gulf of Mexico and Southern California. Recent and planned leasing off the Atlantic and Alaskan coasts has increased public concern over the program's management, the fair value return to the Treasury, and the environmental consequences of oil spills.

The OCS contains an estimated 16 to 49 billion barrels of recoverable oil, and 146 to 181 trillion cubic feet of gas. These figures themselves cause concern, because they are considerably lower than previous estimates, and there is not much confidence in their accuracy.

#### Naval Petroleum Reserves

Until recently, the general policy of private development of energy resources on public lands did not apply to the Naval Petroleum Reserves. Past production from these reserves was limited. The reserves were viewed as potential stockpiles for national emergencies. The actual limited capacity of the reserves, however, led to a rethinking of their utility. That, coupled with the desire to use them to mitigate foreign imports led to a change in the law.

Under the Naval Petroleum Reserves Production Act of 1976, oil from Reserves 1, 2, and 3 will be produced and sold on the open market. Reserve 4, located in Alaska, has been retained for future use, but responsibility for its management will be transferred to the Interior Department in 1977. (The Naval oil shale reserves will not be transferred to the Interior Department.)

The Reserves are estimated at 11 to 34 billion barrels of recoverable oil, but the estimates are questionable because the Reserves are largely unexplored.

### Coal

From 1945 through 1970, the acreage of coal under lease increased tremendously, while production decreased. This was one of several factors which caused the Interior Department to largely stop leasing until a new policy and system could be established. Following recent coal-leasing legislation, the Department announced a new program and plans to resume leasing in 1977.

### Oil Shale

About 80 percent of the high-grade oil shale is located on public land. Domestic resources of high-grade shale contain an estimated 400 billion barrels of oil, and the Federal Government will directly control most of its development.

In 1974 a prototype leasing program was started to find out if developing oil shale was economical and environmentally safe, and whether a commercial oil shale industry was feasible. The Interior Department offered six leasing tracts, but received bids on only four. The program is now at a standstill because of environmental, technical, and economic problems.

The Secretary of the Interior recently suspended development of two tracts for a year and application has been made to suspend the other two. Unless conditions change, the leaseholders may actually give up their leases when the current suspension period ends.

### Geothermal Resources

The only electricity currently produced from geothermal energy in the U.S. is 500 million watts from plants located at the Geysers in California.

There are about 1.9 million acres described as known geothermal resource areas, and about 56 percent are on public lands. There are another 95.7 million acres described as known potential geothermal resource areas, of which about 60 percent are on public lands.

### The Importance of These Resources

Properly managing these public land resources can greatly influence our ability to meet future energy needs.



To a great extent, decisions on leasing public lands will be a major determinant of both the amount and type of energy the country uses.

Leasing decisions will also affect our ability to handle another oil embargo. Regional development will be affected too, because many states with large sections of public land are sparsely settled.

The Interior Department's leasing policy sets three basic objectives

- assuring orderly and timely resource development;
- protecting the environment; and
- ensuring the public a fair value return on the use of public land.

These objectives often conflict, however, and lead to difficult policy problems.

In order to properly manage energy resources on public lands, the government must establish certain policies and procedures

- leasing decisions should be based on national energy needs, and not on private industry initiative;
- a reliable inventory of energy resources on public lands should be prepared before leasing decisions are made;
- economic and environmental implications must be carefully considered before leasing decisions are made;
- leasing programs should encourage competition and provide a fair return to the public; and
- leasing programs should ensure that leaseholders actively attempt to develop the resources.

#### PAST AND CURRENT EFFORTS

In two recent reports on OCS leasing, GAO concluded that:

- Acreage leasing goals were unrealistic and did not consider national energy goals and plans.

--Shortages of materials, equipment, manpower and capital can limit the timing of OCS production.

--A government-financed and directed exploring program is essential, because information on reserves is inadequate and hinders proper tract selection and valuation.

One review now in progress addresses conflicts among various groups--Federal, State, local, and industry--on OCS development. Another ongoing review addresses the rationale for a recent lease off the California coast.

GAO recently reported that the Interior Department had not determined when and how much land should be leased to meet national coal production goals. In any case, the new coal leasing program will be seriously hindered because information on coal resources is inadequate. In two related studies, GAO is looking at the adequacy of coal resource data for existing leases, and at the socioeconomic impacts of leasing.

GAO studies of the Naval Petroleum Reserves also identified a need for reliable resource estimates and for clear statements of how the Petroleum Reserves will be used.

GAO examined Federal geothermal resources and concluded that through 1985, these resources will not be a major energy source; and through 2000, projections are uncertain. GAO also concluded that more reliable information was needed before designating Federal lands as known geothermal resource areas, and that leasing regulations should be changed to promote early exploration and development of leased lands.

#### FUTURE EMPHASIS

The following questions about Federal leasing policy will continue to be of primary importance in the near future.

1. Are socioeconomic and environmental values adequately considered and protected in the leasing programs? Future OCS development along the highly populated Atlantic coast and the environmentally sensitive Alaskan coast will cause increased concern in this area. These issues have not received adequate consideration in the past. One area of immediate concern will be the effects of OCS pipelines on frontier areas.

The Interior Department contends that its new environmental requirements on coal leasing will eliminate past problems. We plan to evaluate the effectiveness of the

new requirements after the program has been operating for a sufficient time.

2. What action has the Interior Department taken to establish (1) OCS leasing goals related to national energy needs and (2) an adequate data base? The Interior Department has not responded favorably to our past OCS recommendations, and we plan to review future OCS sales to determine the need for additional steps which might spur the Department to action. Management of the Alaskan Naval Petroleum Reserve will be transferred to the Interior Department on June 1, 1977. We will review the Department's management plans, including those for estimating the amount of oil in the Reserve.

3. Will the Department's new coal development requirements prevent speculation and assure production? After the new requirements have been in force a reasonable time, we plan to evaluate their adequacy and enforcement.

Questions about oil shale and geothermal leasing may gain importance in the future:

1. Why has there been no progress on the prototype oil shale program? What, if any, Federal actions are warranted?

2. What action has the Interior Department taken in its geothermal program to (1) establish an adequate data base and (2) encourage leasing and development? How successful are ERDA R&D efforts to expand the use of geothermal resources, including (1) improving our ability to identify and quantify geothermal resources, (2) developing advanced engineering techniques, and (3) building pilot plants. How is ERDA planning to use its loan guarantee authority to help industry develop geothermal energy?

## CHAPTER 9

### ARE OUR DOMESTIC AND INTERNATIONAL ENERGY POLICIES COMPATIBLE AND DO THEY REFLECT INTER- NATIONAL ECONOMIC AND POLITICAL REALITIES?

By 1985, as much as 60 percent of our oil and 10 percent of our natural gas may be imported. This dependence makes the Nation vulnerable to international, political, and economic pressure--such as that exerted by the oil embargo--and reduces our freedom in foreign and domestic policymaking.

The embargo served as a catalyst for the present search for a national energy policy which could minimize the country's reliance on energy imports. FEA estimated that the embargo caused a \$10 to \$20 billion drop in Gross National Product and a rise in unemployment of 500,000. The embargo and accompanying four-fold increase in imported oil prices are principal causes of the worst U.S. recession since World War II. World-wide impacts have been similarly severe.

Most other countries, including nearly all Western industrialized nations, are even more dependent on imported energy. This further impairs foreign and domestic policymaking. Further, since domestic production continues to drop, the United States increasingly finds itself competing in the world market for oil and gas supplies. At the same time, the dramatically increasing wealth of the oil-producing countries causes important changes in international, economic, military, and power relationships.

The dependence of industrialized nations on imported oil and gas, and the recognition that the world's fossil fuel resources are limited, have led to increased efforts to develop new energy technologies. Developing new technologies is very expensive and requires long leadtimes--these are strong incentives for the U.S. to coordinate its research, development, and demonstration programs with other nations.

The growing use of nuclear energy and developing new nuclear technologies pose critical worldwide security problems. Present international safeguards cannot prevent diversion of nuclear materials intended for use in nuclear reactors. The growth of nuclear energy poses the threat of further proliferation of nuclear weapons among nations, and of theft of nuclear materials by terrorists.

Finally, the interrelationships between U.S. domestic energy policy and actions and our international posture are not well understood. The areas where actions taken in

one sphere directly reverberate throughout the other are numerous. In far too many instances, little thought has been given to coordinating policy decisions. The Nation cannot afford that kind of myopia much longer.

#### PAST AND CURRENT EFFORTS

Past GAO reviews have concentrated on U.S. policy regarding foreign nuclear energy programs, with particular attention to nuclear safeguards. We have also examined the role of imported liquefied natural gas in alleviating the Nation's natural gas shortage, and looked at the economics and politics of oil imports.

Present reviews concentrate on the relationship between the multinational oil companies and OPEC governments; the effectiveness of the International Energy Program; U.S. coal export policy; foreign nuclear energy programs, particularly safeguards; and the pros and cons of placing quota restrictions on future imports of liquefied natural gas.

#### FUTURE EMPHASIS

Questions relating to the U.S. and international energy situations are extremely complex and far-reaching. The following problems especially need attention:

1. Will the Nation be able to import enough reasonably priced oil and gas to meet future demand requirements? Oil supply and demand projections for mid-term U.S. needs vary considerably, but they all assume adequate international supplies. Those supplies may not be adequate. Certain key supplier nations might not be able to develop their reserves fast enough to meet world demand.

Other important problems are related. As a member of the International Energy Agency, the U.S. is somewhat protected from oil shortages by a system which would allocate available oil among member nations. In the event the International Energy Agency breaks down, would U.S. contingency plans get the Nation through another oil embargo? What are the implications of growing economic interdependence between the major oil importing and producing nations?

2. What more should the Federal Government be doing to advance international cooperation in conserving energy and in researching and developing new energy technologies? Considerable lip service has been paid to international cooperation, but much remains to be done to achieve a significant impact.

3. What is the Federal Government planning and doing to insure that international safeguards are upgraded to prevent nuclear proliferation and diversion of nuclear materials? How well does the U.S. have its own house in order in this regard? Two recent CLASSIFIED studies by GAO have found problems in our own systems. If cooperative international efforts fail, are alternative actions available? For example, could the U.S. produce and sell enough enriched uranium to maintain a dominant supplier position? Could, or should, the government promote international nuclear reprocessing facilities to meet the future enriched uranium needs of present non-nuclear nations?

4. Is the government doing all it can to minimize the possibility of foreign energy policies impairing vital U.S. interests? For example, do producer nations' growing monetary reserves and increasing direct investments in the United States harm U.S. economic interests? Conversely, will encouraging such investments improve the bargaining position of the U.S. and improve relations with key producing countries?

At the same time, care must be taken to see that major interests are not jeopardized by government actions to promote secure supplies of imported energy. For example, what are the security implications of exporting vast quantities of sophisticated military hardware to the Middle East? Are these exports necessary to alleviate balance of payments problems or to provide future bargaining leverage for oil suppliers? Are there other options to achieve the same results?

5. Will world energy supplies match future world energy demand? This question is closely related to the first question, but has a somewhat different focus. Experts disagree on future world energy supply. Some foresee critical shortages, while others predict ample supplies for the next 25 years or so from new petroleum discoveries--in the North Sea, the Persian Gulf, and Indonesia. If an energy glut occurs over some period in the next two decades, could major investments for new energy supplies be lost because of reduced world market prices? This raises the further question of whether the U.S. should fully develop domestic supplies now, or save them and use imports as long as they are available, "reasonably" priced, and do not jeopardize domestic security. Can a domestic stockpiling program insure sufficient security to allow the U.S. to adopt such an option?

In the future, other important questions are likely to be:

1. What policy should the government adopt with respect to the multinational oil companies? What effect would vertical or horizontal divestiture have on the Nation's ability to secure foreign oil and gas supplies? How would consumer prices be affected?

2. What lessons can the U.S. draw from the energy policies and habits of other nations? Why is it that some industrialized countries enjoy a comparable or better standard of living than the U.S., yet consume less energy per capita?

ENERGY LEGISLATION

In the past few years a number of energy laws have been enacted. The most important laws and recently proposed bills are summarized below.

RECENT ENERGY LAWSThe Federal Energy Administration Act  
(P.L. 93-275; May 7, 1974)

FEA was created as a temporary agency primarily to manage short-term fuel shortages using existing allocation and price control authorities. Several energy responsibilities previously held by the Department of the Interior and the Cost of Living Council were transferred to FEA. That Act also directed FEA to

- prepare a comprehensive energy plan (Project Independence);
- report on the Nation's oil and gas resources; and
- create a national energy information locator system.

The Energy Supply and Environmental Coordination Act  
(P.L. 93-319; June 22, 1974)

Although the Act's main effect was to delay temporarily certain emission standards established under the 1970 Clean Air Act, it also contained several major energy provisions. FEA was directed to prohibit electric utilities from burning oil or natural gas if their facilities were capable of burning coal. FEA was also given broader authority to gather and publish energy information.

The Geothermal Energy Research, Development, and Demonstration Act (P.L. 93-410; September 3, 1974)The Solar Heating and Cooling Act  
(P.L. 93-409; September 3, 1974)The Solar Energy Research, Development, and Demonstration Act  
(P.L. 93-473; October 26, 1974)

These three Acts were essentially expressions by the Congress that the U.S. needs to rely less on oil and accelerate development of alternative energy forms. The geothermal bill authorized \$50 million to guarantee loans for acquiring and developing geothermal resources. The solar heating bill authorized \$60 million over a five-year period to develop



solar heating and cooling systems for buildings, while the solar energy bill authorized \$75 million for solar energy research.

The Energy Reorganization Act  
(P.L. 93-438; October 11, 1974)

This Act abolished the Atomic Energy Commission and transferred its functions to two new agencies--ERDA and NRC. The reorganization was to separate nuclear regulatory and safety programs from nuclear development and promotional programs. The Act also moved to centralize Federal energy R&D activities by transferring to ERDA several energy R&D programs from the Interior Department, Environmental Protection Agency, and the National Science Foundation.

The Non-Nuclear Energy Research and Development Act  
(P.L. 93-577; December 31, 1974)

This Act established a 10-year, \$20 billion program to research and develop non-nuclear energy sources. It established broad policy guidelines for carrying out non-nuclear R&D to go along with the nuclear energy policy established by the Atomic Energy Act of 1954. Most energy R&D programs were assigned to ERDA.

The Energy Policy and Conservation Act  
(P.L. 94-163; December 22, 1975)

This Act established a number of new energy programs, including

- a strategic petroleum reserve;
- mandatory automobile efficiency standards;
- continuing crude oil price controls through May 1979; and
- a \$750 million loan guarantee program to develop new underground coal mines.

The Coastal Zone Management Act  
(P.L. 94-370; July 26, 1976)

This Act provides coastal states with funds to deal with the impact of offshore oil and gas exploration and production activities. It creates a 10-year, \$1.2 billion coastal energy impact program, dispensing loans and loan

guarantees to states and localities to build additional public facilities needed because of the impact of offshore development.

The Energy Conservation and Production Act  
(P.L. 94-385; August 14, 1976)

This Act extends FEA's existence through 1977, and contains a number of conservation provisions, including programs to improve energy efficiency in commercial and residential buildings, assist in insulating housing of low-income persons, and improve electric utility rate designs.

On the supply side, the Act lifts price controls for oil stripper wells (producing less than 10 barrels a day), and oil from wells using tertiary production techniques. The Act also establishes in FEA an Office of Energy Information and Analysis to coordinate all Federal energy data collection and analysis activities. This reflects a continuing Congressional concern about the credibility of available energy data.

The Federal Coal Leasing Amendments Act  
(P.L. 94-377; August 4, 1976)

The Act establishes new policies for leasing coal on Federal lands, requires the Interior Department to develop comprehensive land-use plans before leasing, and requires coal operators to submit detailed mining and reclamation plans within three years of the issuance of the lease. Other major features of the Act include

- increasing the royalty rate from 5 cents per ton to 12-1/2 percent of the coals value;
- requiring that production start within 10 years;
- permitting State governors to block surface coal mining leases for 6 months if problems arise; and
- requiring that the Interior Department conduct a comprehensive survey of coal resources on Federal lands.

PENDING LEGISLATION

A number of energy-related bills were considered but not passed by the 94th Congress. Bills likely to be reintroduced during the 95th Congress include

- amendments to the Clean Air Act;
- revised OCS leasing procedures;
- oil company divestiture;
- synthetic-fuels financing;
- eminent domain for coal-slurry pipelines;
- nuclear export controls;
- natural gas pricing revisions; and
- private industry uranium enrichment.

GAO LINES-OF-EFFORT AND  
RECENT ENERGY REPORTS

HOW CAN THE FEDERAL GOVERNMENT  
ENCOURAGE ENERGY CONSERVATION?

	<u>Date</u>
Opportunities for Federal Power Marketing Agencies to Increase the Conservation of Oil and Natural Gas Through the Sale of Surplus Hydro Energy (EMD-Code 08518)	12/15/76
Energy Conservation at Government Field Installations: Progress and Problems (LCD-76-229)	08/19/76
Opportunities for More Effective Use of Animal Manure (RED-76-101)	06/14/76
Status of Federal and Private Research and Development Efforts to Conserve Energy by Reducing Electric Power Transmission Losses (RED-76-107)	06/01/76
Review of the Department of Commerce Activity to Convey "Save Energy Citations" to American Industry (OSP-76-27)	05/27/76
Policies and Programs Being Developed to Expand Procurement of Products Containing Recycled Materials (PSAD-76-139)	05/18/76
Feasibility of Using Electric Vehicles on Federal Installations (LCD-76-206)	03/03/76
Energy Conservation Measures at Government Field Installations--To Officials at 19 Locations Inspected (LCD/Multiple Regional Offices 943421)	07/10/75 thru 01/05/76
Progress and Problems of the Government's Utility Conservation Programs (LCD-76-311)	12/30/75
Procurement of Foreign and Domestic Petroleum Products by the Department of Defense (PSAD-76-51)	12/29/75

	<u>Date</u>
Navy's Practices of Discharging Fuel at Sea (LCD-76-420)	12/12/75
National Standards Needed for Residential Energy Conservation (RED-75-377)	06/20/75
Review of Energy Conservation Measures at Government Field Installations--To Officials at 48 Locations Inspected (LCD/Multiple Regional Offices 943421)	02/24/75 thru 06/20/75
Energy Consumption Comparisons in Five Federal Office Buildings (LCD-75-341)	04/18/75
Bulk Fuels Need to be Better Managed (B-163928)	04/08/75
Using Solid Waste to Conserve Resources and to Create Energy (RED-75-326)	02/27/75
Quantitative Information on Various Energy Proposals (B-178205)	02/26/75
Department of Defense's Conservation of Petroleum (B-178205)	02/24/75
Alternative Energy Proposals Developed by GAO (B-178205)	01/31/75
Survey of Efforts Being Made in the Federal Government to Encourage and Effect Energy Conservation in the Private Sector (B-178205)	11/12/74
Update of Federal Efforts to Conserve Energy (B-178205)	11/14/74
Review of Contractors' Energy Use and Conservation Programs (B-178205)	10/29/74
How Federal Agencies Can Conserve Utilities and Reduce Their Cost (B-178205)	09/17/74

	<u>Date</u>
Energy Conservation Practices Being Encouraged by State Utility Commissions and Public Utilities (B-178205)	08/15/74
<u>CAN THE PROBLEMS OF NUCLEAR FISSION BE RESOLVED SO IT CAN BECOME A MAJOR ENERGY SOURCE?</u>	
Considerations for Commercializing the Liquid Metal Fast Breeder Reactor (EMD-77-5)	11/29/76
Evaluation of the Status of the Fast Flux Test Facility Program (EMD-76-13)	11/15/76
Evaluation of the Publication and Distribution of "Shedding Light on Facts About Nuclear Energy" (EMD-76-12)	09/30/76
Poor Management of a Nuclear Light Water Reactor Safety Project (EMD-76-4)	08/25/76
Shortcomings in the Systems Used to Control and Protect Highly Dangerous Nuclear Material (EMD-76-3)	07/23/76
Certain Actions That Can Be Taken to Help Improve This Nation's Uranium Picture (EMD-76-1)	07/02/76
Letter Report to Administrator, Energy Research and Development Administration, on Requirements for Safety Analysis Reports (B-183920)	06/04/76
This Country's Most Expensive Light Water Reactor Safety Test Facility (RED-76-68; RED-76-68A)	05/24/76
Commenting on Proposed Modifications to the Clinch River Breeder Reactor Contract (RED-76-96)	03/26/76
Stronger Federal Assistance to States Needed for Radiation Emergency Response Planning (RED-76-73)	03/18/76

	<u>Date</u>
Development of Interagency Relationships in the Regulation of Nuclear Materials and Facilities (RED-76-72)	03/10/76
Management of the Bellefonte Nuclear Powerplant, Scottsboro, Alabama (PSAD-76-86)	03/01/76
Information on ERDA's Hedge Plans for Building Uranium Enrichment Capacity (RED-76-55)	11/28/75
Review of NRC's Environmental Protection Program in the Licensing of Commercial Nuclear Powerplants (RED-Code 30359)	10/22/75
Selected Aspects of Nuclear Powerplant Reliability and Economics (RED-76-7)	08/15/75
The Liquid Metal Fast Breeder Reactor: Promises and Uncertainties (OSP-76-1)	07/31/75
Cost and Schedule Estimates for the Nation's First Liquid Metal Fast Breeder Reactor Demonstration Powerplant (RED-75-358)	05/22/75
Efforts to Develop Two Nuclear Concepts That Could Greatly Improve This Country's Future Energy Situation (RED-75-356)	05/22/75
The Liquid Metal Fast Breeder Reactor Program--Past, Present, and Future (B-164105)	04/28/75
Comments on Energy Research and Development Administration's Proposed Arrangement for the Clinch River Breeder Reactor Demonstration Plant Project (B-165105)	04/04/75
Sequoyah Nuclear Plant--Tennessee Valley Authority (PSAD-Staff Study)	March 1975
Operating Cost and Environmental Radiation Monitoring at the Shippingport Atomic Power Station (RED-75-325)	01/13/75

	<u>Date</u>
Fast Flux Test Facility Program (PSAD-Staff Study)	January 1975
Problem Areas Which Could Affect the Development Schedule for the Clinch River Breeder Reactor (RED-Staff Study)	December 1974
Survey of Security Systems at Commercial Nuclear Powerplants (B-164105)	10/16/74
Survey of the Manpower Needs of the Nuclear Power Industry and AEC's Efforts to Help Meet Those Needs (B-164105)	07/22/74
<b><u>TO WHAT EXTENT CAN FOSSIL FUELS (ESPECIALLY COAL) BE RELIED UPON TO FULFILL FUTURE ENERGY DEMAND?</u></b>	
Plans for Construction of a Magnetohydrodynamics Test Facility in Montana (EMD-76-8)	09/01/76
Status and Obstacles to Commerciali- zation of Coal Liquefaction and Gasification (RED-76-81)	05/03/76
Trans-Alaska Oil Pipeline--Progress of Construction Through November 1975 (RED-76-69)	02/17/76)
Improvements Still Needed in Coal Mine Dust-Sampling Program and Penalty Assessment and Collection (RED-76-56)	12/31/75
The Economic and Environmental Impacts of Natural Gas Curtailments (RED-76-39)	10/31/75



HOW DO FEDERAL SUBSIDIES, TAXES,  
AND REGULATIONS AFFECT ENERGY  
SUPPLY AND DEMAND ACTIONS?

	<u>Date</u>
Federal Power Commission: An Evaluation of the Federal Power Commission's Rule-making on Utilities' Construction Work in Progress (EMD-77-7)	12/02/76
Federal Power Commission: Management Improvements Needed in the Federal Power Commission's Processing of Electricity-Rate-Increase Cases (EMD-76-9)	09/07/76
An Evaluation of Proposed Federal Assistance for Financing Commercialization of Emerging Energy Technologies (EMD-76-10)	08/24/76
Information Concerning a Change Made by the Small Business Administration to Its Size Standard for Petroleum Refiners (GGD-76-85)	06/18/76
Report of Oil Company Requests to Federal Regulatory Agencies for Waivers and/or Modifications to Regulations (OSP-76-25)	06/15/76
Actions Taken by the Federal Power Commission on Prior Recommendations Concerning Regulation of the Natural Gas Industry and Management of Internal Operations (RED-76-108)	05/24/76
Comments on Selected Aspects of the Administration's Proposal for Government Assistance to Private Uranium Enrichment Groups (RED-76-110)	05/10/76
Comments on the Administration's Proposed Synthetic Fuels Commercialization Program (RED-76-82)	03/19/76
Federal Energy Administration's Problems in Promulgating Regulations for Natural Gas Liquids Produced by Gas Processing Plants (OSP-76-15)	02/22/76

	<u>Date</u>
Implications of Deregulating the Price of Natural Gas (OSP-76-11)	01/14/76
Review of Gulf Oil Corporation's Involvement in Double Dipping of Increased Crude Oil Costs (OSP-76-13)	02/09/76
Evaluation of the Administration's Proposal for Government Assistance to Private Uranium Enrichment Groups (RED-76-36)	10/31/75
Federal Energy Administration's Efforts to Audit Domestic Crude Oil Producers (OSP-76-4)	10/02/75
Comments on Proposed Legislation to Change Basis for Government Charge for Uranium Enrichment Services (RED-76-30)	09/22/75
Need for the Federal Power Commission to Evaluate the Effectiveness of the Natural Gas Curtailment Policy (RED-76-18)	09/19/75
Analysis of the Energy, Economic, and Budgetary Impacts of H.R. 6860 (OSP/OPA-76-3)	09/02/75
Possible Violation of Ceiling Prices in a Sale by Texaco Export, Inc. (PSAD-76-10)	08/12/75
Survey of the Federal Energy Administration's Efforts to Audit Fuel Oil Suppliers of Major Utility Companies (OSP-76-2)	07/15/75
Review of the Federal Energy Administration's State Set-Aside Program (OSP-75-13)	05/08/75
Problems of Independent Refiners and Gasoline Retailers (OSP-75-11)	04/04/75
Staffing of FEA's Compliance and Enforcement Program (B-178205)	03/31/75

	<u>Date</u>
Problems in the Federal Energy Administration's Compliance and Enforcement Effort (B-178205)	12/06/74
Review of Federal Energy Administration Operations Relating to the Allocation and Pricing of Fuel (OSP/San Francisco Regional Office 00107)	10/29/74
Need for Improving the Regulation of the Natural Gas Industry and Management of Internal Operations (B-180228)	09/13/74
Domestic Crude Oil Pricing Policy and Related Production (B-178205)	08/19/74
Overallocation of Motor Gasoline to Service Stations (OSP/Boston Regional Office 00107)	07/30/74
Problems in the Federal Energy Office's Implementation of Emergency Petroleum Allocation Programs at Regional and State Levels (B-178205)	07/23/74
<b><u>HOW CAN THE EXECUTIVE BRANCH ENERGY ORGANIZATION AND DECISIONMAKING PROCESSES BE IMPROVED?</u></b>	
Review of the Availability of Electric Utilities' Tax Information to the Federal Power Commission (EMD-76-7)	08/27/76
Operation and Effectiveness of the Federal Energy Administration's Advisory Committees (EMD-76-5)	08/02/76
Improvements Still Needed in Federal Energy Data Collection, Analysis, and Reporting (OSP-76-21)	06/15/76
Review of the 1975 Project Independence Evaluation System (OPA-76-20)	04/21/76

	<u>Date</u>
Reliable Contract Sales Data Needed for Projecting Amounts of Natural Gas That Could Be Deregulated (RED-76-11)	09/08/75
Possible Conflict of Interest Problems at the Federal Energy Administration (B-178205)	11/12/74
<u>WHAT ARE THE PROSPECTS FOR TRANSITION TO ESSENTIALLY RENEWABLE ENERGY RESOURCES (GEOTHERMAL, SOLAR, FUSION)?</u>	
Opportunities to Improve Planning for Solar Energy Research and Development (EMD-77-8)	11/30/76
Federal Hydroelectric Plants Can Increase Power Sales (CED-76-120)	07/08/76
Federal and State Solar Energy Research, Development, and Demonstration Activities (RED-75-376)	06/10/75
Problems in Identifying, Developing, and Using Geothermal Resources (RED-75-330)	03/06/75
How Solar Energy was Treated in the Atomic Energy Commission Chairman's Report "The Nation's Energy Future" (B-178205)	10/18/74
<u>ARE THE ENERGY RESOURCES ON PUBLIC LANDS BEING WISELY MANAGED BY THE FEDERAL GOVERNMENT?</u>	
The Coastal Zone Management Program: An Uncertain Future (GGD-76-107)	12/10/76
Department of the Interior's Approval Process for Coal Mining Plans (EMD-76-6)	07/20/76
Management of and Plans for the Naval Petroleum Reserves (LCD-76-313)	05/14/76

	<u>Date</u>
Role of Federal Coal Resources in Meeting National Energy Goals Needs to be Determined and the Leasing Process Improved (RED-76-79)	04/01/76
Indian Natural Resources--Part II: Coal, Oil, and Gas Better Management Can Improve Development and Increase Indian Income and Employment (RED-76-84)	03/31/76
Department of the Interior Study of Shut-in Oil and Gas Well Completions and Leases--GAO Observations (RED-76-90)	03/30/76
Followup on Recommendations of Report on Outer Continental Shelf Oil Operation (RED-76-48)	11/21/75
Information on Federal Coal Leases (RED-76-26A)	10/15/75
Followup Review of the Naval Petroleum Reserves (LCD-75-321)	07/29/75
Outer Continental Shelf Oil and Gas Development--Improvements Needed in Determining Where to Lease and at What Dollar Value (RED-75-359)	06/30/75
Further Action Needed on Recommendations for Improving the Administration of Federal Coal-Leasing Program (B-164124)	04/28/75
Outlook for Federal Goals to Accelerate Leasing of Oil and Gas Resources on the Outer Continental Shelf (RED-75-343)	03/19/75
Information Relating to the Department of the Interior's Leasing of Minerals on Public Lands (B-164613)	09/19/74
Information Relating to Oil and Gas Leasing on Federal Lands (B-178205)	07/12/74

ARE OUR DOMESTIC AND INTERNATIONAL ENERGY  
POLICIES COMPATIBLE AND DO THEY REFLECT  
INTERNATIONAL ECONOMIC AND POLITICAL  
REALITIES?

	<u>Date</u>
Assessment of U.S. and International Controls Over the Peaceful Uses of Nuclear Energy (ID-76-60)	09/14/76
Can the U.S. Breeder Reactor Development Program be Accelerated by Using Foreign Technology? (RED-76-93)	05/06/76
Review of U.S. Coal Exportation (OSP-76-17)	04/14/76
Natural Gas Shortage: The Role of Imported Liquefied Natural Gas (ID-76-14)	10/17/75
U.S. Financial Assistance in the Development of Foreign Nuclear Energy Programs (ID-75-63)	05/28/75
Economic Implications of Current World Oil Prices (ID-Staff Study)	March 1975
Allocation of Uranium Enrichment Services to Fuel Foreign and Domestic Nuclear Reactors (ID-75-45)	03/04/75
Review of Eximbank's Financing the Export Sales of Items in Short Supply for Domestic Energy Activities (B-178205)	10/04/74