Chapter II

Fossil Energy Issues

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1. Fossil Energy Objectives

ISSUE

Almost all of ERDA's programs in fossil energy contain unrealistically optimistic projections of the energy supplies that can be realized from new technologies in the near term.

SUMMARY

ERDA's objectives for 1985 call for 13 to 15 Quads* of fossil energy derived from new technologies. Institutional, environmental, and other nontechnical constraints aside, these objectives cannot possibly be met for the single reason that the time necessary to develop and demonstrate new technologies and to construct a commercial industry based on those technologies exceeds the 10 years between now and 1985. The lack of consistency between ERDA's overall plan in volume I and the specific program projections in volume II raises questions concerning the process by which the objectives were defined and the use served by the objectives in establishing priorities.

COMPARATIVE SUMMARY

Although ERDA has reduced its objectives, the OTA task force believes that even these goals for energy from fossil fuels cannot be realized without some clearly established bridge between R, D&D and commercialization. The ERDA Program does not address this deficiency.

If ERDA is to be effective in meeting short-term needs it will be in one or both of two circumstances. One involves efforts to push technologies which are presently available for testing on a commercial scale (e.g., high-Btu gasification). The other involves introducing existing technologies into new regions (e.g., OCS oil and gas development off the Atlantic coast).

The ERDA program does not address these two commercialization problems in any concrete way. In the cases of both, the issues are not primarily technological. They revolve around questions of social and environmental impacts, Federal-State coordination, capital needs, and regulation. Federal stimulation is required.

*A Quad is defined as 1 Quadrillion Btu's,

How should the Federal Government provide incentives for commercial demonstration? Incentive options may range from tax breaks, to guaranteed loans, to guaranteed prices for fuel output, to Federal funding of capital costs. These various incentive approaches have major implications for the ways in which other issues are resolved.

Local interests want an approach to commercialization which allows them to escape paying the front-end costs for such things as schools, sewers, roads, etc. They also want assurance that serious unexpected costs will be rapidly mitigated or that those who suffer the costs will be assured of adequate compensation. In extreme cases, they want assurance that a decision to test a commercial process will not be an irreversible commitment to development regardless of impacts.

The set of questions tied to commercialization and central to achieving fossil fuel supply objectives are not addressed in the ERDA Program and Budget. Until this is done, the ERDA effort will be seriously flawed.

z. Primary Oil and Gas Recovery

ISSUE

No Federal agency is engaged in a comprehensive research program for primary oil and gas recovery from new sources; the absence of such a program could lead to delays in the development of these resources.

SUMMARY

Exploration and development of oil and gas from new sources, particularly the Outer Continental Shelf, continues to be severely delayed by the lack of planning on the part of the Federal Government. An aggressive ERDA research program would complement industrial efforts. In particular, research is needed on the effects of offshore drilling and on ways of mitigating those which are harmful t o the environment. Congress mandated in Public Law 93-577 Sec. 6(b)(3)(Q) that ERDA engage in a program to explore methods for the prevention and cleanup of marine oil spills, but the scope of ERDA's proposed activities is not clear,

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Gas and Oil Extraction	41.4	70.3	70.3	35.1

COMPARATIVE SUMMARY

The budget is not responsive to the needs of primary oil and gas recovery. There is no indication of any work aimed specifically at improved oil spill clean-up techniques for Outer Continental Shelf operations. OTA specifically identified the need for comprehensive studies aimed at resolving institutional and environmental issues. Neither the ERDA budget nor the Program reflects a sensitivity to this need.

The Program recognizes a strategy that requires advance exploration and extractive techniques both onshore and offshore. It intends to implement the strategy through a program which in part includes research into drilling, exploration, and offshore operations. The budget does not provide for these

activities. A focus on the OCS is new to the FY 77 budget and is responsive to the issue raised in the OTA analysis of last year's plan and program. The response, however, is so limited both in funding and focus that it appears unlikely to make a near-term contribution to overcoming the delays forecast by OTA.

3. Enhanced Oil and Gas Recovery

ISSUE

The proper role for ERDA in enhanced oil and gas recovery is not well defined.

SUMMARY

Enhanced recovery of oil and gas from known reserves holds promise of significantly increasing the supply of these fuels. The need for research and development in the area of enhanced recovery clearly exists, but opinions differ as to the proper role of Government in this endeavor, The present pace of industry R&D could be accelerated by formulation of a detailed workable incentive plan, The present ERDA tertiary recovery program for oil, which involves special joint Government/industry field-pilot testing and demonstration, and the similar research on the recovery of gas from tight formations, will not yield a significant increase in production by 1985. ERDA's projection of an additional annual increase of approximately 6 Quads resulting from enhanced recovery is therefore unrealistic.

BUDGET SUMMARY

The budget information for this issue is contained in Issue 2.

COMPARATIVE SUMMARY

The budget is not responsive to the needs expressed in the issue. It is inadequate to meet the revised goal of 2 Quads of oil and gas by 1985 and 8 Quads by 2000 from enhanced recovery. OTA had earlier identified a need for 80-150 field tests and demonstrations. ERDA's existing and planned tests through this year may total 33. Its initial budget request was more consistent with the effort suggested in the OTA Analysis. The reduction of ERDA's request before submission to Congress places the budget 6 percent below the inadequate funding level of 1976. The ERDA budget justification substantiates that the present budget level will stretch out the demonstration program. This appears difficult to justify for one of the few program areas with a potential for major payoff in the short term. To the level that the oil and gas program is funded, it is devoted to a well-thought-out set of activities in enhanced recovery.

4. Oil Shale Processing

ISSUE

ERDA's priorities for oil shale R, D&D lack a sense of urgency in meeting the Nation's energy supply needs in the near- and mid-terms.

SUMMARY

ERDA's programs for oil shale development are concerned exclusively with in-situ processes, but these processes will make no contribution to liquid fuel supplies in the near-term and have uncertain prospects for the mid-term. The ERDA conclusion that the above ground processing of oil and shale is not economically feasible (or has no need for Federal R, D&D support) has no basis in operating experience. An oil shale demonstration program based on available technologies is needed.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Oil shale	13.7	25.7	25.7	21.1

COMPARATIVE SUMMARY

The ERDA program has been responsive in part to the issue. Two failings were originally identified in the ERDA oil shale development program. First, excessive concentration was placed on the Bureau of Mines horizontal in-situ process. Second, the mining and above ground' retorting processes were excluded from the ERDA program on the basis that the technology was ready for" commercialization by private industry.

The new Program and budget documents were responsive to the in-situ R&D issue. The program appears to have been expanded in scope to include in-situ processes other than the Bureau of Mines approach, although the various processes are not clearly defined nor is the emphasis on each identified.

The budget has not been responsive to the "mining and above ground retorting" issue, perhaps due to the failure of the commercialization program. The

Program discussion did identify the problems of mining and management of spent shale, but the budget indicates that the obstacles to commercial development are not visualized as requiring ERDA assistance.

Local political and public interest groups as well as national environmental interest groups have indicated that until substantive information is available on the problems associated with mining and aboveground retorting of oil shale, they will oppose any proposed commercial facility, wherever located. The OTA Analysis of ERDA-48 identified an ERDA-initiated demonstration facility under Federal control as an appropriate (and indeed perhaps the only) means of obtaining the necessary information without making an irreversible commitment to large-scale development before the consequences are known. That conclusion has not changed, nor has the ERDA response to the problem. There is some discussion of studies on spent shale in the Environment and Safety section of the ERDA program, but this is apparently to be done by other agencies (DOI, EPA) as no budget is indicated within ERDA (E&S) for such efforts.

QUESTIONS

1, Why does ERDA's oil shale program fail to include support for demonstrations of surface retorting technologies?

2. How serious are the problems of water consumption, waste disposal, revegetation, and water contamination for surface retorting processes?

3. How adequate are waste management procedures for the disposal of spent shale?

5. Synthetic Liquid Fuels From Coal

ISSUE

New and existing projects in coal liquefaction must be carried through the pilot and demonstration stages in order to determine what technical problems remain and to establish the oil price levels at which commercial production will occur.

SUMMARY

Justification of the coal liquefaction program rests primarily on the decline in U.S. oil production and on the need for supplies for those uses of liquid fuels for which there is no ready substitute. A successful commercialization program in the 1980's depends on the results of pilot projects. The existing and proposed development programs of ERDA are judged to be of the proper magnitude and in the correct direction. However, the constraints to commercialization, such as the capital investment, construction time, and development of associated mine facilities, imply that the projection by ERDA of 5 Quads per year cannot be overcome by 1985. Thus, ERDA's projection that coal liquefaction will significantly affect fuel supplies by 1985 is unrealistic.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Liquefaction	89.9	99.8	94,8	73,9
Clean Boiler Fuel Demonstration Plant (Construction Project)	20.0	(Not Available]		30.0

COMPARATIVE SUMMARY

The program and the budget is not fully responsive to the projected needs for synthetic fuels by 1985 even though ERDA has revised its projection of 5 Quads per year by then to 3.8 Quads. The Nation's utility and industrial coal-fired boilers remain under sulfur-emission limitations. The supply of flue gas desulfurization equipment and naturally occurring low sulfur coal is inadequate to bring all boilers into compliance. Demonstration and commercial support for a broader scope of processes that produce complying coal-based fuels will be required.

The liquefaction budget reflects a decrease due to lower requirements for the H-coal pilot plant, projects at the Cresaps test center, and support projects.

QUESTIONS

1. How did ERDA arrive at the projection of 3.8 Quads by the year 2000 in light of the budget reduction?
2. What improvement in process efficiency is indicated by second-generation technology and what is the magnitude of improvement needed over first-generation liquefaction processes to make them commercially viable?

6. High-Btu Gasification of Coal

ISSUE

The construction and operation of a first-generation, commercial-sized, high-Btu coal gasification plant is a prerequisite to any decision on a coal-based synthetic natural gas industry.

SUMMARY

A pioneer commercial plant, producing 250 million cubic feet per day of high-Btu gas from coal, can be constructed immediately using current technology. Through its construction and operation, the economic, technical, and operating data necessary to assess the desirability of a coal-based synthetic natural gas industry can be determined. The objective of this construction is to determine whether or not high-Btu synthetic natural gas from coal is economically justifiable as a means of using the Nation's coal reserves to replace the declining supplies of natural gas and oil.

While several companies have shown a strong desire to build a commercial plant, they have not done so because of difficulties in financing such a plant, which will cost at least $1 billion, Incentives of some form, such as loan guarantees or regulatory changes, may have to be provided by the Government if the natural gas industry is to build one of these plants.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
High-Btu Gasification	53.4	55.8	53.3	45.0

COMPARATIVE SUMMARY

ERDA 76-1 and the ERDA Budget request for FY 77 fail to make progress with the crucial issue of high-Btu gasification. ERDA chose to address the problem through the Commercialization Program which failed to receive authorization. No contingency plan is apparent to allow the immediate construction of a first-generation, commercial-sized plant and thus create an impact on the near-term gas supplies. Consequently, ERDA's available strategy is, "The investigation and advancement of technology in the development of improved second-generation processes", This sole strategy cannot achieve the stated objective of promoting "an energy production of 0.5 to 1.0 Quads per year" by 1985 by high-Btu gasification. Such an objective requires the construction of from 6 to 12 plants each with a capacity of 250 million cubic feet per day and each requiring a capitalization of at least $1 billion and taking many years to complete.

The second- and third-generation gasification processes upon which ERDA is concentrating its efforts can improve gasification efficiency. This is important in long-term conservation of resources and in reducing the cost of gas, but it has little to do with contributing to the solution of the Nation's immediate gas supply problem.

proven technology exists that permits the construction of commercial-sized plants, Since less than 25 percent of the cost of gas from such a plant is dependent on the gasification process, technical improvements in this phase of the high-Btu gas process will not fundamentally affect decisions. Anticipating the possibility that its Commercialization program may not materialize, ERDA needs contingency plans to assure that a large commercial gasification plant is built immediately to obtain data on the economic, technical, and operating characteristics. Information from the operation of first-generation plants remain essential for arriving at a judgment as to whether or not this country should proceed with a high-Btu synthetic gas industry to replace our declining reserves of natural gas.

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7. Low-Btu Coal Gasification for Industrial Use

ISSUE

The ERDA program on low-Btu coal gasification does not give attention to the fuel needs of industrial furnaces, kilns, and ovens.

SUMMARY

Many users of natural gas and oil in the industrial sector (ferrous and nonferrous metallurgy, glass, lime, cement, refractories, stills, etc.) could shift to low-Btu gas from coal if suitable gas producers were available, This shift would make an important contribution to the conversion from the use of oil and gas to the use of coal, and it would help to ensure against production cutbacks due to curtailments. There is much room for R, D&D supported by ERDA with a focus on assessment of the potential demand for low-Btu gas by the industrial sector, means for increasing this potential through modification of equipment or operations, and the development of gas producers having performance characteristics suitable for modern industrial use,

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Low-Btu Gasification	24.5	64.0	64.0	33.1

COMPARATIVE SUMMARY

The new program and budget is responsive to this issue and it appears that ERDA has developed an effective program.

8. Mining Technology

ISSUE

Research on underground mining technology is required if coal production is to double in the next 10 years as projected.

SUMMARY

Government and industry are expecting coal production to double to 1.2 billion tons annually by 1985. To help assure that these projections can be met, coal mining R, D&D will require priority support. The productivity per miner in underground mines has decreased in recent years, principally because of improvements in health and safety standards; technological progress has been unable to offset the decline. Improvements in mining technology have the potential for making significant contributions sooner than most R, D&D projects in fossil energy. Although Federal responsibility for coal mining rests with the Bureau of Mines in the Department of the Interior, ERDA has a responsibility to ensure that the research necessary to improve the technology of underground mining of fossil fuel resources is carried out.

BUDGET SUMMARY

No budget indicated.

COMPARATIVE SUMMARY

The ERDA program document recognized extractive technologies and stated that work is underway. No intensive or introspective analysis is indicated or budgeted to assure that the mining, coal preparation, and associated environmental R, D&D activities, regardless of performing agency, are in concert with national or ERDA energy goals. ERDA should schedule and budget for an examination of the Bureau of Mines and Environmental Protection Agency programs and ensure that a balanced program exists.

QUESTIONS

1. What contact has ERDA made with the Bureau of Mines and EPA regarding their coal mining, preparation, and associated environmental programs?
2. What has ERDA's analysis revealed regarding the adequacy, priority, and timeliness of the other agencies programs in meeting the needs of the goals of ERDA's R, D&D programs?

9. Direct Coal Utilization

ISSUE

ERDA's near-term program for direct coal utilization by utilities and industry is narrowly oriented toward fluidized-bed combustion.

SUMMARY

The use of fluidized-bed combustors with sulfur-absorbing beds to provide gas cleanup is unlikely to make a significant contribution in the near-term (to 1985), as predicted by ERDA, due to technological barriers to implementation. Two major coal combustion problems whose resolution would have major near-term impacts are:

1) the technical difficulties of substituting coal for gas and oil in presently existing utility and industry applications (retrofit), and
2) the direct use of coal in a way which will meet environmental requirements.

Other technologies which hold promise of providing solutions to these problems are pulverized fuel firing, and precombustion cleanup; both of these need research and development support in order to enhance their contribution to direct coal utilization by utilities and industry. There is also a need for more basic research in coal chemistry. The present division among three Federal agencies of responsibili- t y for coal cleanup causes variations in the criteria adopted by the agencies as well as in the size and effectiveness of their programs, By assigning the funds and responsibility for managing these programs to one agency, the development of a balanced coal cleanup program could be facilitated, In all areas, the energy program could be set back by a failure on the part of ERDA to recognize the needs of the industrial sector such as the ferrous and nonferrous metal fabrication industries, the glass and ceramics industries, and manufacturers of cement and lime.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division request	FY 77 ERDA Request	FY 77 Request to Congress
Direct Combustion	38.1	85.3	77.3	52.4

COMPARATIVE SUMMARY

Although the budget related to this issue has increased, ERDA's program remains unresponsive. Most of the increase is in the area of fluidized-bed combustion. Expanded research in the fluid bed technology is appropriate because of its midterm potential for economical and environmentally acceptable utilization of coal in industrial and utility systems. However, no near-term direct combustion development work is indicated. Moreover, within the direct combustion program, funds for supporting studies and engineering evaluations have been cut. This area contains the coal-based combustion research, coal-oil slurries work, and other activities which would have broadened the direct coal utilization effort and been more responsive to the issue. ERDA's program appears to be less than responsive to the issue and to near-term energy needs.

QUESTIONS

1. Why aren't the problems of pulverized fuel firing, precombustion cleanup, and basic research in coal combustion chemistry being examined with increased emphasis?
2. Why isn't R, D&D directed to improving the energy generation and environmental problems of existing direct coal utilization equipment ?

10. Low-Btu Gasification, Combined Cycle Powerplants

ISSUE

The present ERDA program to develop integrated low-Btu gasifier, combined cycle powerplants has underestimated their potential.

SUMMARY

In terms of both efficiency and economics, the integrated low-Btu gasifier, gas-turbine/steam-turbine, combined cycle electrical-generating system promises to become one of the best methods of using coal in an environmentally acceptable manner that is likely to be developed. Commercialization of such a system, which would have an overall efficiency of 37 to 38 percent (coal pile to bus bar), should be achievable in the mid to late 1980's if a balanced research and development program is conducted. The ERDA documents give no indication that planning for such a program is taking place.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Low Btu Gasification	24,5	64,0	64.0	33.1
Advanced Power Systems	10.0	35.2	28.2	22,5
Low Btu Demonstration Plant (Construction Project)	8.0	(not available)		12.0

COMPARATIVE SUMMARY

ERDA has responded to the issue by developing a coordinated and integrated program of activities. The original Division and ERDA budget requests as well as the reduced final request to Congress appear consistent with the early potential of this efficient process which provides energy by burning coal in an environmentally acceptable manner. The original budget requests, however, seem to more suitably represent a recognition of priority.

11. Advanced Fossil Fuel Combustion Programs

ISSUE

Frequent evaluation of progress in magnetohydrodynamic (MHD) and other high-efficiency energy R, D&D programs will be necessay to ensure maximum energy yield over the long term.

SUMMARY

The ERDA Direct Coal Utilization program contains both the Direct Combustion (i.e., fluidized bed) and Advanced Power Systems (i.e., gas turbine) programs. MHD research is a separate program, even though MHD is a direct combustion process. Fuel cell R&D is not included in the Fossil Fuel Division of ERDA, though it has more in common with the fossil programs than with the non-

combustion Advanced Division in which it is housed. Relative funding of these programs indicates heavy ERDA emphasis on fluidized bed and MHD, much less emphasis on advanced gas turbine research and an almost total disregard of fuel-cell technology.

A portion of the present ERDA emphasis is well placed, given that fluidized-bed combustors and MHD systems can burn coal directly, while the advanced gas turbine and fuel-cell technologies require liquid or gaseous fuels which over the long term will have to come from coal conversion. Thus, while the advanced gas turbine and fuel-cell technologies can probably be brought to commercial application much sooner than MHD or pressurized fluidized beds, their fuel deployment will depend on progress in the commercialization of synthetic fuels.

In many applications, these technologies are mutually exclusive. Funding and program decisions about each will be affected by progress in the other programs. The MHD program in particular has several major technology hurdles to overcome prior to commercial application using coal. While the MHD program appears to be adequately funded and structured, continuous assessment of progress in MHD development relative to the other technologies will be necessary to ensure that research expenditures yield the maximum benefit. By comparison, fuel-cell technology development deserves more support than it is currently receiving in ERDA. Both recent industrial progress in developing commercially feasible fuel-cell technology and the congressional mandate in Public Law 93-577, Section 6(b)(3)(N), "to commercially demonstrate the use of fuel cells for central station electric power generation" indicate a need for more ERDA attention to fuel-cell technology.

BUDGET SUMMARY

SUMMARY TABLE

(Dollars in millions)

Budget Category	FY 76 Appropriation	FY 77 Division Request	FY 77 ERDA Request	FY 77 Request to Congress
Advanced Power Systems	10.0	35.2	28.2	22.5
Direct Combustion	38,1	85.3	77.3	52.4
Fuel Cells	(Included in Conservation Division)			

COMPARATIVE SUMMARY

The budget was not responsive to needs for fuel-cell work. The original issue indicated that a change in relative emphasis between the MHD, advanced gas turbine, fluidized-bed combustion and fuel cells could yield a significant reduction in the time required to reduce dependence on petroleum and natural gas. Increased emphasis on fuel-cell research and on advanced gas turbines for electric generation from coal was identified as important.

The discussion in ERDA 76 and the budget requests for FY 77 indicate that ERDA has significantly upgraded the gas turbine program. The fuel-cell program, on the other hand, is recognized only rhetorically. That program is improperly housed in the Conservation Division and maybe suffering for that reason. The fuel cell research has more in common within the Fossil Energy Division and, if moved, might receive more attention as a technology for electric generation. As matters now stand, it is not possible even to identify a separate budget allocation for fuel-cell research.

QUESTIONS

1. What will be achieved in fuel cell R, D&D within the FY 76 budget?
2. Why has not more emphasis been placed on fuel-cell work?

12. Interagency Coordination: Coal Cleanup

ISSUE

Coordination between ERDA and other agencies appears to be inadequate in activities relating to research and development of fossil energy. This is particularly evident in coal **cleanup.**

SUMMARY

The responsibility for many programs important to the successful development of increased fossil fuel supplies lies outside ERDA, While this division of responsibility acknowledges the scope and expertise of other agencies, ERDA, in its capacity as lead agency in formulating Federal R, D&D strategy, has a responsibility y to participate in the design, development, and coordination of these outside activities and to evaluate their progress. This is necessary to ensure that no serious omissions or delays occur because of problems in non-ERDA programs on which ERDA programs are dependent either in their development or their implemental ion. Further, when policy decisions are made concerning alternative technologies, it is important that the criteria used in assessing the options do not vary among the decisionmaking agencies, In some cases, a redefinition of responsibilities may be desirable. A case in point is the problem of coal cleaning, Precombustion cleanup research is performed by the Bureau of Mines, during combustion cleanup by ERDA, and postcombustion cleanup by EPA.

BUDGET SUMMARY

Not applicable.

COMPARATIVE SUMMARY

The ERDA program document identifies R, D&D being conducted on coal mining, coal preparation, and associated environmental consequences. However, it is impossible to determine if they have addressed the issue and are achieving an appropriate coordinated interagency program. There is no way to determine the degree of ERDA participation in the design, development, and coordination of outside activities or of ERDA evaluation of other agencies' progress consistent with ERDA's interdependent program requirements.

QUESTIONS

1. What coordinating activities has ERDA undertaken with other agencies' programs with interdependent ramifications?
2. What analysis of the total system from mine face, preparation, transportation, combustion and conversion, to end use has ERDA undertaken?
3. What prescription of work has ERDA developed to guide outside agencies in performing work consistent with the needs of ERDA's interdependent R, D&D?

13. Environmental, Social, and Political Impacts of Mining

ISSUE

Even if mining technology is adequate to support an expanded use of coal and oil shale in the United States, there are potential obstacles associated with environmental, social, and political impacts of a massive increase in mining.

SUMMARY

A major increase in electricity generation from the direct combustion of coal or the conversion of coal to synthetic gas and liquid fuels at a commercial scale will require a significant expansion of coal extraction. For example, a 250 million cubic feet per day plant for producing pipeline gas from coal will require a coal mine as large as any presently operating in the United States. The plant will consume more coal than is now mined in Utah. An activity of this scope will almost certainly encounter resistance from groups in society that are especially concerned about environmental quality; these groups may have considerable influence at State and local levels. If these concerns are not to become a serious constraint to the use of improved fossil fuel technologies, ERDA must be sure that necessary programs are established to reduce uncertainties about environmental and social impacts and to mitigate serious negative impacts.

COMPARATIVE ANALYSIS

ERDA and private industry are conducting or contemplating a significant range of demonstration or commercial level programs in coal conversion, oil shale, and other fossil fuel activities. Significant concern regarding environmental, social, or institutional matters associated with each activity can be expected among local and national interest groups. These concerns should be anticipated and addressed early by the appropriate agency. To be most effective, the magnitude of the environmental, social, and institutional costs and benefits must be clearly and convincingly expressed at a high level of authority and preferably on site or near the place of the anticipated activity. Theoretical regional and national studies conducted by the laboratories, while necessary, are not fully responsive to the immediate promotional mandate of ERDA. Trained social and environmental scientists working in teams coordinated and supervised at a high level of authority are required. There is no evidence in the new ERDA Program that this approach is being taken, or indeed that the Fossil Division of ERDA has access to the necessary personnel. While the appropriate words appear briefly from place to place in ERDA-76, references to the required funds, staff, and programs do not appear.

QUESTIONS

1. Are the research activities of Federal agencies, other than ERDA, sufficient to avoid future environmental and social constraints on the application of improved fossil fuel technologies?
2. What are the options—and the pros and cons—for accommodating the concerns of States about potential negative environmental and social impacts of an expansion of coal and oil-shale mining?
3. How large a community must be established to build and operate a commercial-sized synthetic fuel plant and its associated mining activities?
4. How many trained personnel in the social and environmental sciences will be required to accomplish the work defined in the ERDA Program? What is ERDA's present staff size in these disciplines?

14. Manpower

ISSUE

ERDA's program for massive expansion of the use of coal will require far more trained personnel at various levels than can naturally be expected to enter those sectors of the labor market.

SUMMARY

ERDA estimates of increased coal production will require a significant increase in the number of underground coal miners, including first-line supervisory personnel and coal mining engineers. The fluctuating production levels of the coal mining industry over the last 25 years has resulted in a current work force composed principally of miners over 50 or under 30 years of age. Simultaneously, advanced mining techniques and machinery impose a requirement for more education and special training. Coal research and mining engineering programs at the university level are few and thinly staffed. Significantly more faculty are needed to expand and multiply these programs. The development of gasification and liquefaction plants will also increase demand for both university-trained professionals and for subprofessionals with special skills. Failure to support the development of the necessary manpower pool in these and other areas requiring critical skills could result in failure to achieve the goals which ERDA has set, even if the technology and other required inputs are available.

BUDGET SUMMARY

The budget request treating this issue is contained within the Advanced Research and Support Technology subprogram. No explicit amount can be identified.

COMPARATIVE SUMMARY

ERDA has acknowledged the need for professional manpower training and declares satisfaction of this need as a principal objective of its university-based research activities. There are no efforts described, however, to deal with the need for personnel in mining and equipment operation areas or those skills needed in construction and operation of synthetic fuel plants. Although treating part of the problem, ERDA has not effectively responded to this issue.

In related efforts, the Mine Enforcement and Safety Administration (MESA) has training programs focusing on strengthening health and safety factors in mining. The training is designed primarily for mine foremen. The Government program in total does not appear responsive enough to the requirements of the national energy objectives,

QUESTIONS

1. What role should ERDA play in developing the manpower required for coal mining and related equipment operation to meet ERDA's goals for expansion of coal use?
2. What special skills are critical to the SUC- cess of the proposed fossil fuel programs, and how many trained personnel will be needed?
3. What information is available concerning the ability of existing professional and trade educational facilities to provide the neces- sary trained personnel?
4. What impact will other energy programs have on manpower available for the fossil fuel industries?

15. Transportation Systems

ISSUE

The application of fossil fuel technology research will require improved transportation systems in the United States.

SUMMARY

A shift from the use of crude oil and natural gas, imported or domestic, to the use of coal and synthetic fuel products from coal will make heavy demands on existing transportation systems. The rail network, which moves most of the Nation's coal, will be especially affected. In order to avoid major constraints on the application of improved fossil fuel technologies, ERDA needs to anticipate the commodity movements that may be required and to assure that necessary additions to or changes in present transportation systems are brought about.

BUDGET SUMMARY

No budget can be identified.

COMPARATIVE SUMMARY

There is no indication in the revised Plan that ERDA has addressed the issue nor analyzed the questions that were posed and restated below. Many users of coal have found that they are inaccessible to rapid-unit train shipment due to the poor track maintenance that seems to prevail in many important energy regions of the Nation. ERDA should assume responsibility for fuel transportation studies, recommend actions required of other agencies, and provide for budget support of its own responsibilities.

QUESTIONS

1. What are the interregional transportation requirements of ERDA's scenarios in volume 1, and how do they compare with the present capacities of transportation networks?
2. In ERDA's opinion, what are the prospects for an increased use of coal slurry pipelines?
3. To what extent are the needed changes in transportation capabilities a problem of Federal regulatory policy rather than a problem of technology development?
4. What portion of the current railroad system can handle unit trains at high speed? How do they relate to source and users of coal?

16. Water Availability

ISSUE

ERDA has not established a systems-oriented study of water availability related to its energy program.

SUMMARY

ERDA has defined programs for extensive development of U.S. coal resources, for oil shale, and for increased electrification as part of its overall strategy for supply of energy in the United States. These programs all imply a greatly increased demand for water, in terms of both withdrawal and consumption. When these programs are viewed in the context of the total ERDA program, including nuclear and geothermal energy programs, it is apparent that the availability of water to supply commercial level energy production activities is uncertain, especially in the fossil fuel area. A large percentage of the fossil fuel development programs relate to the use of low-grade coal, generation of low-Btu gas, processing of oil shale and other activities which involve fuel sources or product streams which are not economically transportable, These activities may be located primarily in the resource-rich but water-short Northern Great Plains and Colorado River Basins, There is no evidence in the ERDA Plan of any coordinated water-resource planning activity to facilitate the implementation of the technologies for fossil energy production which ERDA has defined as critical to future energy supply.

BUDGET SUMMARY

No budget can be identified.

COMPARATIVE SUMMARY

ERDA 76-1 recognizes the importance of assessing the water resources of this country particularly as they impact on the development of fossil energy reserves. Water assessment programs are outlined in discussions both of Fossil Energy and of Environmental Research. However, since most of the Government research on water resources is conducted through the U.S. Geological Survey and the Water Resources Council, this issue is not indicated in ERDA's budget. It appears that consideration is now being given to this issue in the development of coal and oil shale in the Western States. No detail as to the role ERDA plays with respect to water resources is apparent. Neither is it obvious that ERDA considers the availability and use of water in its assessments of alternative strategies for meeting energy objectives.