

C. INTRODUCTION

Plans and Programs

Ideally, energy R&D programs should be derived from R&D plans which, in turn, should be derived from a national energy policy. National energy policy, for its part, should flow logically from a set of broad national goals agreed upon by both the Administration and the Congress. In practice the formulation of energy programs does not operate in such a tidy, rational way. It is reasonable, however, to expect that energy R&D programs be consistent, or at least compatible, with R&D planning and with energy policy in general. Thus, potential effectiveness, rather than perfection, has served as the standard for this review of the ERDA Plan. Using this standard, the OTA analysis produced the following consensus about the ERDA Plan and Program:

- Volume I of the ERDA Plan represents a serious and praiseworthy initial effort to formulate a procedure whereby energy R&D can contribute to the realization of the five goals postulated as guidelines for national energy policy.
- Volume II of the ERDA Plan and Program is markedly inferior to volume I and does not always present a convincing programmatic approach to realizing the objectives set forth in volume I.

The lack of coordination between the plan of volume I and the program of volume II was cited repeatedly by ERDA administrators during the oral presentations at the OTA review. The Plan was prepared in the spring of 1975, in the context of ERDA's still-evolving definition of its role and mission. Because of the short time available to ERDA personnel for the preparation of the Plan, the program plans of volume II appear to have been compiled from those of several organizations folded into ERDA. Therefore, they do not properly reflect the policy goals set forth in volume I. The effectiveness with which ERDA will relate its programs to its plans, and its plans to national goals should improve with the plans

and programs that will evolve in the coming years.

A major objection to the Plan is its reliance on a very limited range of scenarios. There is no investigation of the effects of price on the demand for energy services. If the international oil price or policy affecting low cost supplies change drastically, clearly the demand for expensive new low cost supplies change drastically, clearly the demand for expensive new energy technologies will also change. A high priority for ERDA in future versions of the Plan should be to link energy demand to economics,

Goals

The ERDA Plan addresses 5 national policy goals. Realization of these goals requires that inherently difficult choices be made between international cooperation and domestic self-sufficiency as well as between environmental versus energy emphasis. These conflicts appear to have led ERDA to a very narrow, technological interpretation of the 5 goals. For example, the first goal is apparently the most important as the major thrust of the Plan is to minimize reliance on imported oil. This is to be done by vastly increasing domestic supplies. An alternative approach would be to store sufficient supplies of petroleum to make an embargo ineffective and striving to reduce our growing dependence on energy. In addition, the ERDA Plan places little emphasis on programs addressing regional issues; it also neglects to identify programs which might facilitate the implementation of technologies, such as commercialization strategies, end-use conservation technologies, macrosystem modeling, and international institutional development. Each of these subjects falls within the purview of the 5 goals and the ERDA enabling legislation. Whether or not ERDA assumes responsibility for these broader *R, D&D* issues, there can be no question as to their importance to the evolution of a national energy posture. Solutions to our national energy concerns require that those energy-related programs reemphasized by ERDA be vigorously pursued

somewhere in the Government. Most are not, at present, receiving priority attention anywhere.

"Is ERDA's role to develop technologies or to solve problems?" was a basic question asked by the OTA task groups. In general, it was agreed that the ERDA programs are too narrowly defined and that ERDA appears primarily concerned with developing technological options rather than exploring solutions to energy problems. This hardware orientation has the following consequences:

- International cooperation receives minor emphasis as compared to domestic self-sufficiency.
- Environmental concerns receive minor emphasis as compared to energy development,
- Elaborate technology is favored over simpler technology,
- Supply technology is favored over end-use technology.
- Technical R, D&D is favored over non-technical R, D&D.
- Demonstration projects in partnership with energy suppliers are favored over projects with energy consumers.
- Mid- and long-term results are favored over short-term results, except for certain energy conservation programs.
- Electrification options are favored over other options.

As we move to diversify energy supplies and increase efficiency, a number of elaborate technologies will be developed; these will result in large-scale projects such as breeder reactors and central station solar electric facilities. However, many of our most promising opportunities are smaller in scale. Examples are solar water heaters, electricity peak shaving, and modified transportation systems. Large and sophisticated technologies have inherent appeal, especially to scientists and engineers, while "low technology" opportunities may seem mundane. ERDA should therefore maintain a program focus which continually measures relative economic and energy benefits, not merely technological accomplishment, as its objective. Success in developing technological capabilities alone is not likely to solve energy problems.

In order to avoid the bottlenecks that will delay or prevent solutions to energy problems, especially in the short-term, a variety of actions could be considered:

- The scope of ERDA's mission could be expanded and clarified, particularly in the areas of demonstration and commercialization. Central to this is a clarification of ERDA's responsibilities vis-a-vis the Federal Energy Administration, the Environmental Protection Agency, the Nuclear Regulatory Commission, and the Department of the Interior,
- Widespread utilization of newly developed technologies depends on a complex process involving the removal of constraints on commercialization, industrial incentives, and technology transfer. This process requires further delineation than exists in the present ERDA Plan.
- Programs associated with the identification and evaluation of environmental, institutional, and societal constraints associated with alternative energy technologies should receive immediate and substantial attention,
- Programs directed toward increasing the efficiency of energy use should be accorded the highest priority.
- New efforts to assess global issues associated with energy, such as climate modification, international energy supply and demand estimates, the role of multinational energy corporations, and the link with ocean resources, should be instituted.
- The ERDA management approach, including the management of National and Federal laboratories and the role of contract R, D&D should be reevaluated.
- Closer working relationships with State and local governments, including their participation in ERDA program planning, should be established.
- The potential national benefit from higher ERDA budget levels should be examined. The present ERDA budget derives from pre-bargo assumptions which are highly questionable at the present time.

Institutional Issues

The OTA review of ERDA's Plan and Program identified the problem of divided or uncertain jurisdiction as a major concern. For example, responsibility for developing technologies to remove sulfur from coal is divided among Interior, EPA, and ERDA. Similarly, coal mining technologies are the responsibility of the Department of the Interior, while burning and processing technologies are ERDA's responsibility. This situation of split responsibilities inhibits development of a comprehensive and balanced R, D&D program for coal.

Uncertainty concerning the roles of ERDA and FEA in providing incentives for commercialization of new technologies poses problems. Incentives may range from provision of capital for commercial demonstration plants to loan guarantees to insuring floor prices for fuels produced from pioneer commercial plants. If the various types of incentives are divided between ERDA and FEA, orchestration of the most appropriate incentive package for commercialization of a given technology will be difficult. This issue might warrant specific attention as the Congress considers extension of the FEA enabling legislation. Moreover, institutional issues permeate the whole question of the separation of energy R, D&D from the broader responsibility for energy policy which is presently divided among numerous agencies. Although the Congress has designated ERDA as the lead energy R, D&D agency, the ERDA Plan indicates a timidity as to accepting this role. It is not clear that the ERDA Plan and Program provide for effective coordination with other Federal agencies. ERDA could be more assertive in assuming the lead role, in order to assure that the R, D&D needed to achieve the Nation's energy goals and objectives is undertaken.

Marketing and Commercialization

Because of the long lead times and high capital costs involved, special attention should be given to commercialization of new technologies. The energy market is complex, ranging from the individual consumer to large industrial facilities. The market for energy R, D&D is different from that supported by DOD and NASA, both of which provided the markets for their own R, D&D.

Similarly, the R, D&D of the AEC was aimed at a specific market consisting of the large-scale electric power industry.

The broad responsibilities inherent in ERDA's programs call for an approach that involves both producers and consumers from the initiation of program planning. R, D&D should reflect ultimate consumer preference and conditions of use (e.g., convenience, acceptable environmental impacts). The phasing from R, D&D to commercialization (usually by private enterprise) must take such issues as proprietary rights, patent rights, and licensing into careful consideration.

Resource Constraints

The various energy technologies addressed in the ERDA Plan frequently draw upon resources which are also in demand for nonenergy uses. It appears necessary that these multiple use factors receive greater priority than they were accorded in the Plan and Program. Although the ERDA Program emphasizes fuel resource constraints, there are actually two categories of resources whose availability could constrain ERDA program developments: physical and societal. The physical resources include water, land, raw materials, equipment, and atmosphere. Of these, water appears to pose the most urgent physical problem, particularly in the western United States. Societal factors which may constrain energy developments include manpower constraints, regional impacts, capital and financing availability, and information collection, processing and dissemination.

Supply Versus Conservation Balance

Lack of concern with end-use efficiencies developed during an era of decreasing energy prices. At current prices, it pays to shift to a system of much more efficient energy use. Although this will require years to achieve, it will have the ultimate effect of greatly stretching out energy resources. Hence, energy conservation will not only help "buy time" in the near-term (the ERDA emphasis) but also dramatically reduce the rate at which resources are consumed in the long-term future. Furthermore, improved energy efficiency has distinct and permanent environmental benefits.

Unlike supply expansion, some conservation improvements can be made quickly and with minimum investment. However, many of the achievable and cost-effective improvements will require R, D&D. Unfortunately, the ERDA Plan for conservation focuses on the near-term and thus neglects its long-term importance. It implies an emphasis on conservation (principally higher efficiency of use) only until new supplies come on line, thus ignoring the potential of a long-term efficiency improvement program. Funds committed to conservation, as opposed to supply increase, are out of balance in terms of (a) cost-effectiveness; (b) time until payoff; (c) environmental benefits versus cost; and (d) demand on resources. ERDA also pays insufficient attention to research related to implementing known energy conservation technologies.

Global Issues

One of the five national policy goals listed in ERDA's Plan is "to contribute to world stability through cooperative international efforts in the energy sphere." Clearly ERDA has to take the world community into account if its Plan and Program are to succeed in the long run. International cooperation is essential in the short- and medium-term to cope with the environmental effects of energy technologies such as global pollution of air and water; to address security issues arising from the management of nuclear materials and wastes; and to manage resources, such as the oceans, that are the common heritage of mankind. Finally, cooperative efforts in research programs can take advantage of substantial advances in certain energy technologies achieved in other countries.

Basic Research

ERDA's inherited programs in basic research need reorientation in order to conform more closely with the ERDA Plan. Such reorientation should not damage the vitality of existing programs such as particle physics. Rather, other basic energy research needs should be defined. Specific attention should be focused on the appropriate distribution between ERDA in-house (i.e., National laboratory) and contracted research; strengthening of social and behavioral research programs; and establishment of an effective role for universities.

Relations to State and Local Governments

The ERDA Plan neither describes mechanisms for incorporating state and local inputs into program development nor shows any indication that these groups were consulted during the preparation of the Plan; these omissions suggest that State participation in energy programs may be restricted primarily to the implementation phases. The ERDA Office of Industry and State and Local Government Relations is much too small to ensure effective coordination between the Administration and the various State and local governments,

ERDA and many of the State and local governments differ in their perceptions of energy problems and in approaches to solutions. The State and local governments tend to attach more importance to conservation efforts than ERDA; they are more concerned with the potential impact of energy R, D&D projects on local communities; and they have greater concern for states-rights issues, including the allocation of water rights and the regulation of land use. The smaller jurisdictions could also benefit from the broader viewpoint that ERDA can provide.

Failure of ERDA to adequately consider State and local viewpoints and to include these agencies in early program planning will result in unnecessary conflict and costly delays in the implementation phases of these programs. More importantly, such failure will limit the Administration's ability to take advantage of these groups' experiences and capabilities in the areas of land and water rights management, taxing and regulatory incentives, manpower training, mobilization of public support, and many other areas vital to program success.

ERDA Budget

Finally, the ERDA budget is largely an outgrowth of decisions made in 1973, before the OPEC embargo led the United States to emphasize self-sufficiency. This budget, about \$10-15 billion over a 5-year period, deserves re-examination in the light of the much greater urgency now accorded the energy problem. ERDA could usefully develop alternative 5-year budgets at several specific levels (e.g., \$20 billion, \$30 billion and so forth) as a device to stimulate new thinking and to assist ERDA in breaking out of established patterns of designing R&D programs,