United States
Environmental Protection
Agency

Office of
Research and Development
Washington D.C. 20460

EPA 600/9-79-020
June 1979

Energy, Minerals and Industry

EPA

The Federal Nonnuclear Research and Development Act (Public Law 93-577)

Section 11, Environmental Evaluation

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GLOSSARY

ASEV	Assistant Secretary for Environment
CEQ	Council on Environmental Quality
CS	Office of Conservation and Solar Applications
DOE	Department of Energy
EA	Environmental Assessment
ECC	Environmental Coordinating Committee
EDP	Environmental Development Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERD	Environmental Readiness Document
ESAAB	Energy Systems Acquisition Advisory Board
ESAPP	Energy System Acquisition Project Plan
ET	Office of Energy Technology
EV	Office of Environment
GRIPS	Geothermal Resource Impacts Projection Study
IVEP	Imperial Valley Environmental Project
KGRA	Known Geothermal Resource Area
NEPA	National Environmental Policy Act
PPMS	Program and Project Management System
RA	Office of Resource Applications

EXECUTIVE SUMMARY

The Federal Nonnuclear Energy Research and Development Act (PL 93-577) was passed in December 1974 as part of the national response to the effects of the 1973 Arab Oil Embargo. The purpose of the legislation was to establish and carry out a comprehensive national program promoting research, development and demonstration (RD&D) of nonnuclear energy technologies. Section 11 of PL 93-577 directed the Council on Environmental Quality (CEQ) to hold annual public hearings and prepare appropriate reports on " . . . the adequacy of attention to energy conservation methods and environmental protection . . . and the environmental consequences of the application of energy technologies."

In addition to ensuring that an environmental evaluation was built into the national program on nonnuclear RD&D, Section 11 also provides an opportunity for public participation in this evaluation.

In late 1977, President Carter's Executive Reorganization Plan (77-1), transferred the Section 11 responsibility from CEQ to the Environmental Protection Agency (EPA). The Office of Energy, Minerals and Industry within EPA's Office of Research and Development was assigned the task of conducting the Section 11 activities.

This report is the first of a series associated with the 1979 Section 11 Program. In order to evaluate the adequacy of attention given to environmental concerns, the 1979 Section 11 program will examine the Department of Energy's Program and Project Management System (PPMS) for determining research, development, demonstration, and commercialization investments. This examination focuses on the role played by the Environmental Research Planning and Assessment Process for determining the environmental and health consequences of energy technology RD&D. To provide a technology-specific analysis of the process, six technologies—including: geothermal, cogeneration, urban waste utilization, oil shale, coal gasification and coal liquefaction—were chosen for detailed study.

The report then raises pertinent issues relating to this process, including preliminary findings on strengths, weaknesses and areas for improvements. It includes a case study of the integration of geothermal energy development within the Process. DOE regards geothermal energy development as an example of the effective use of public involvement on a local level.

The DOE's research and development programs are organized around general energy technologies (such as nuclear, fossil, solar and geothermal) and are designed to move the development of these technologies through sequential phases from basic research through commercialization. Development activities are divided into two stages — each consisting of several phases. The first, the technology based stage, comprises both a basic and an applied research phase, followed by an exploratory development phase. The second stage, energy systems acquisition, covers four phases: technology development, engineering development, demonstration, and commercialization. For nonnuclear energy technologies such as the fossil energy program, the Office of Energy Research has responsibility for guiding technologies from the basic research phase to the exploratory development phase. The Office of Energy Technology then assumes the responsibility for the technology from the technology development phase through demonstration. Finally, the Office of Resource Application moves the project through commercialization. The process differs when applied to solar projects in that one office, the Office of Solar and Conservation Applications, guides the project from development to final commercialization.

In early 1978 DOE formulated an internal Program and Project Management System (PPMS) to guide the commitment of expenditures (Outlay Programs) for technologies through the various development phases. The Outlay Program Plans consist of two components—Technology Program Plans (TPP) and Environmental Development Plans (EDP). The objective of the TPP is to define a development strategy for a project or group of projects of the same technology moving through the development phases. The EDP will then identify and integrate required environmental, safety and health research within the appropriate phases of the technology project or projects. As site-specific technology projects are delineated, separate Project Environmental Plans (PEP) detailing necessary environmental research for each project are jointly prepared by the DOE Office of Environment and the appropriate program office.

In the summer of 1978, as part of the DOE Commercialization Task Force Study, program offices screened candidate technologies for near term commercialization. A component in the screening process was the Environmental Readiness Document (ERD), an independent assessment prepared by the DOE Office of Environment to determine the "readiness" of the technology for commercialization. Now integrated within the PPMS, the ERD supports the Office of Environment's position determining the environmental acceptability of a DOE technology program or project at each development phase.

The combination of the three Environmental Research Planning and Assessment Documents (EDP/PEP/ERD) coupled with a formal management structure for their preparation and implementation, comprise the DOE Environmental Planning and Assessment Process for technology RD&D. Although this process is designed to insure that environmental concerns are integrated into DOE decision-making at each phase of the development of energy technologies, none of the documents specifically address alternative actions or projects. While the outputs from this process are not intended to be part of the formal National Environmental Policy Act requirements, they are perceived as building blocks leading to the preparation of Environmental Impact Statements (EISs).

Three factors limit the conclusions that can be drawn regarding the effectiveness of the DOE Environmental Research Planning and Assessment Process: (1) A Departmental Order has not yet been developed for PPMS. (It is still operated by an Interim Guidance and Policy Statement issued in May, 1978. A separate DOE order for Environmental Development Plans was issued before PPMS was fully implemented and does not mention the EDP as a specific part of the PPMS review process.) (2) Neither the Program Planning and Management System nor the environmental process were fully operational until late 1978. (3) Only a single nonnuclear technology project (the 50 megawatt geothermal pilot plant in Baca, New Mexico) has been through a formal PPMS review.

In examining the Environmental Planning and Assessment Process, several relative strengths and weaknesses can be identified:

- Key elements of an effective management system are present in this process.
- Process documentation for a significant number of energy technologies is available.
- Environmental planning and review requirements are conceptually integrated into the technology planning process.

On the other hand, there are several shortcomings in the process:

- A lack of a formal, regular and systematic exchange of research results between researchers and technology development planners.
- An inability to identify research results associated with environmental planning.
- Unresolved issues with respect to the content and frequency of updates for EDPs and ERDs.

Public Participation In This Process

It is critical that the public be involved in the planning and decision-making processes associated with emerging energy technologies. The following issues are raised:

- What is the most effective way to keep the public informed?
- How can DOE's internal management process for environmental research planning and assessment be modified to include opportunities for the public to participate effectively in the process?

Case Study: Geothermal And The Process

Findings related to how the Environmental Planning and Assessment Process functioned in the case of geothermal energy are presented.

I. OVERVIEW AND FOCUS OF SECTION 11 ACTIVITIES

Section 11 of the Nonnuclear Energy Research and Development Act of 1974 calls for an ongoing review of the Federal Nonnuclear Energy Research and Development Program to evaluate the adequacy of attention given to energy conservation and environmental protection measures.

Since 1975 when the CEQ first conducted Section 11 Public Hearings, there has been an expression of public concern over a lack of understanding of the way in which environmental considerations are brought into the energy technology decision-making process.

During the 1978 Section 11 public hearings, this concern was focused on the Department of Energy. Witnesses expressed:

- a lack of understanding of the DOE's decision-making process and the manner in which environmental considerations were brought into the process.
- a sense of frustration at their inability to become effectively involved in the process; and
- a lack of credibility resulting from their being unable to review decisions concerning emerging energy technologies.

In response to last year's testimony, the 1979 Section 11 review will focus on the DOE Environmental Planning and Assessment Process for determining the environmental and health consequences of energy technology RD&D. Particular emphasis will be given to the current and potential effectiveness of the process, and the opportunities that could be provided for ongoing and interactive public involvement.

This year a Report to Congress will be submitted based upon an analysis of the management process for six emerging technologies and also upon the discussion concerning this process at a series of regional workshops and a national public hearing. **Figure 1** provides an overview of the various Section 11 activities scheduled for 1979.

As background material, a general introduction to the organization and functions of DOE, its Field Organization, and the Office of Environment—**Figures 2 through 4**—are included.

Section II of this report describes the DOE Environmental Planning and Assessment Process for energy technology RD&D. The relationship of the process to the principal DOE management system for the development, approval and execution of budgetary expenditures for technology programs is also described. Much of the descriptive material is excerpted from DOE management documents.

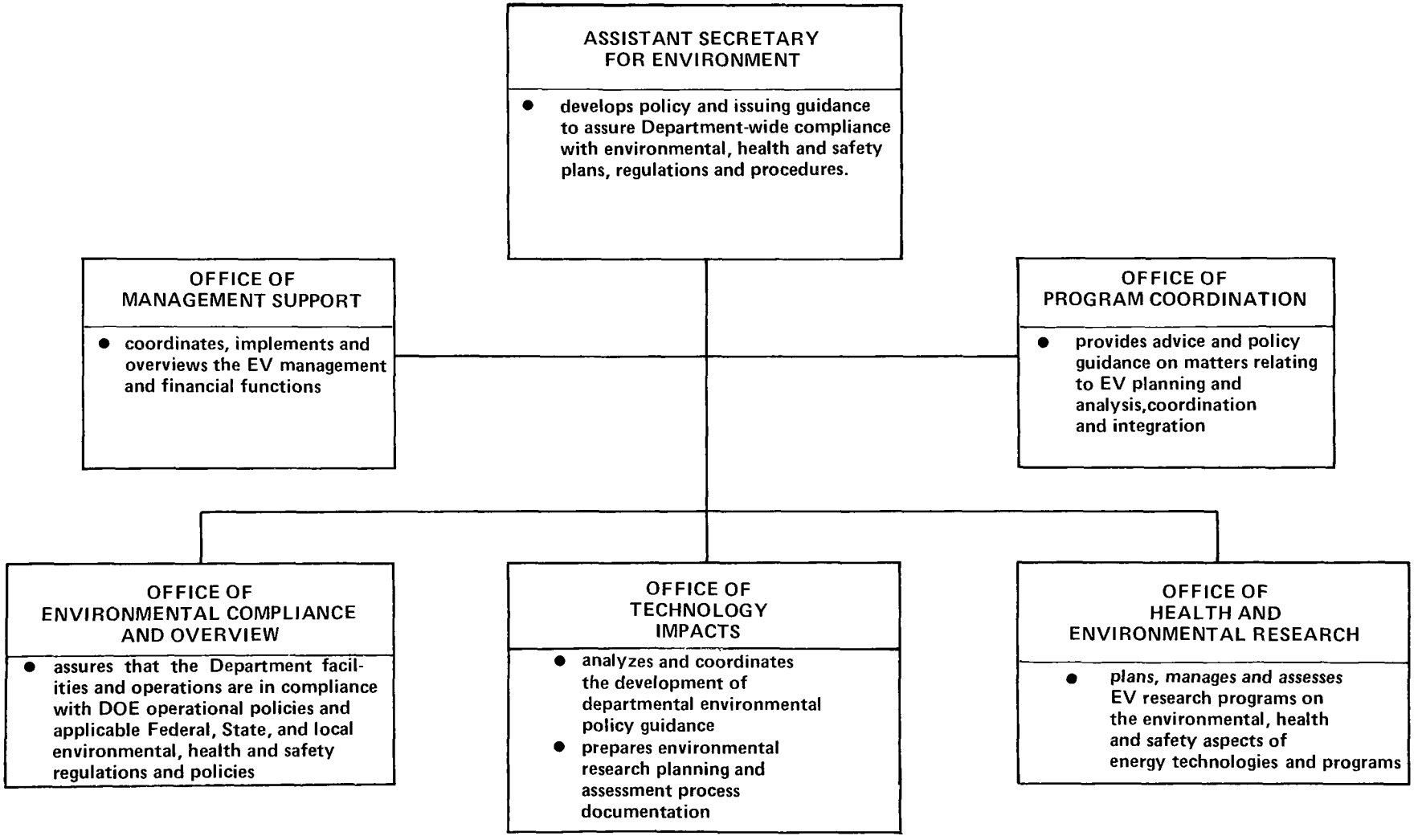
Section III presents preliminary findings regarding the effectiveness of the environmental process. Some of the relative strengths, weaknesses, and the opportunities provided for public participation are reviewed. A series of questions are raised that will serve as a focus for continuing analysis under the Section 11 legislative mandate and as potential issues for public discussion at the workshops and hearing.

Section IV provides a case study (Geothermal Energy) to permit a review of the effectiveness of the Environmental Planning Process. A full complement of process documentation (EDP/ERD/PEP) has been completed for this energy technology, and it is considered by DOE to be a successful example of how to involve local concerned parties in its environmental management process.

FIGURE 1. OVERVIEW OF 1979 SECTION 11 ACTIVITIES

REPORTS/EVENTS	1979								1980
	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Report: Overview of DOE Environmental Planning and Assessment Process		▲ June 15							
Six Issue Papers: To Raise Process Issues and Focus Workshops • Geothermal • Coal Liquefaction • Coal Gasification • Oil Shale • Cogeneration • Urban Waste		▲ To Be Distributed June 15-30							
Regional Public Workshops: • Cogeneration and Urban Waste • Oil Shale • Geothermal • Coal Gasification and Liquefaction			▲ July 12, Atlanta ▲ July 18, Denver ▲ July 24, San Francisco ▲ July 31, Pittsburgh						
Pre-Hearing Document: Summarize Regional Workshops, Present Issues For Discussion At Public Hearings					▲ September 7				
National Public Hearings						▲ October 3-5, Washington, D.C.			
Hearing Transcript & Summary Document								▲ December 10	
Report to Congress:									▲ January 30

FIGURE 4. DOE OFFICE OF ENVIRONMENT ORGANIZATION AND FUNCTIONS



II. DOE ENVIRONMENTAL PLANNING AND ASSESSMENT PROCESS FOR TECHNOLOGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION

A. Introduction

The Department of Energy (DOE) was established on October 1, 1977 to bring together the various energy activities dispersed throughout the Federal government and to provide unified leadership to the Nation's energy policies and programs. The Department has developed both a National Energy Program and an organization to oversee its execution.

A primary mission of the Department of Energy (DOE) is to implement the objectives of the National Energy Plans by developing and commercializing energy technologies that are economically practical, technically feasible, and environmentally acceptable. In carrying out its mission, DOE has responsibility for a number of programs, including the development of oil and gas regulatory pricing, power marketing and transmission, weapons production, and nuclear and nonnuclear technology research, development, and demonstration (RD&D).

This report deals with the nonnuclear technology RD&D aspects of DOE's programs. More specifically, the focus will be on the environmental planning and review conducted within nonnuclear technology RD&D programs and projects.

Program offices such as the Office of Energy Technology or the Office of Conservation and Solar Applications are the units within DOE that determine technology research objectives. This is achieved through RD&D plans that outline technical activities and allocate budget resources for energy systems. The plans are goal-oriented descriptions of specific technical, environmental, and economic activities that are necessary to achieve energy development.

B. Program and Project Management System

The Program and Project Management System (PPMS) is the principal DOE management system that governs the development, approval, and execution of DOE's outlay (budgetary) programs. **(See Table 1.)**

TABLE 1
PROGRAM AND PROJECT MANAGEMENT SYSTEM FOR DOE OUTLAY PROGRAMS*
Interim Policy and Guidance

Objectives of the Management System

- Insure that all major programs are developed with clear operational, time-phased objectives (multi-year to relate to current budget process).
- Insure that all significant projects and activities have clear sub-objectives that relate to program objectives.
- Relate program/project and activity objectives to National Energy Act (NEA), National Energy Plan (NEP) and related plans and legislation, where possible.
- Provide for determining priorities among programs and projects, and, in turn, relate these to various levels of resource availability.
- Avoid commitment of major resources prior to adequate project definition.
- Provide key program and project managers with a clear view of related program and project objectives and plans.
- Provide visibility on all key decisions and timely feedback for all levels of management.
- Maintain accountability through all levels of the organization with a minimal amount of procedure and paperwork.

*From Under Secretary Myers Memorandum May 31, 1978, "Program and Project Management System for DOE Outlay Programs."

PPMS was formulated in early 1978 under the direction of the Under Secretary, Dale Myers, and was first used in Fiscal Year 1980 DOE budget development. The basic purpose of PPMS is to fully define and review projects before any commitment of major resources occurs and to ensure that all major programs are developed with clear, operational, multiyear objectives that are in phase with budget processes. PPMS was designed to incorporate a systematic review of every major energy system acquisition (program and project) at specifically defined transition points in their development (**Figure 5**).

"Major system acquisition" is a budgetary definition formulated by the Office of Management and Budget (Circular A-109, April, 1976) for the procurement of major systems by the Federal Government. In DOE, a major system acquisition entails a sequence of acquisition activities for high-priority programs and projects starting with basic research and proceeding through commercialization.

DOE uses many factors to determine if a project will be designated as a major system acquisition. These include: development costs, technical complexity, and the projected market penetration of the technology in terms of time of entry, energy requirements, and relationship to energy supplies displaced or substituted. For example, development cost criteria stipulate that a project is considered major if there is an estimated $50 million annual or $200 million lifetime cost. Of approximately 100 nuclear and nonnuclear DOE technology RD&D projects now under way, only 20 to 30 are major systems, with these accounting for nearly 50 percent of the total Departmental budget for energy RD&D. Nuclear and nonnuclear RD&D projects which are currently designated as major systems are listed in **Table 2** (DOE Order 4240.1, Designation of Department of Energy Major Systems).

Those projects which are not designated as major system acquisitions, do not come under formal PPMS review and are under the management responsibility and direction of the appropriate program office. For example, in the Coal Gasification program, the Gasifiers-in-Industry Project is now in the technology development phase under the direction of the Office of Energy Technology. If the project is ultimately moved to commercialization, the Office of Resource Applications will have responsibility for the final development phase. As these projects are outside of formal PPMS review and controlled by a less formal project development reivew there is not an opportunity for as comprehensive an environmental review as that provided in PPMS. The Assistant Secretary with the prime responsibility for project implementation performs the role fulfilled by the PPMS Review Board for major systems.

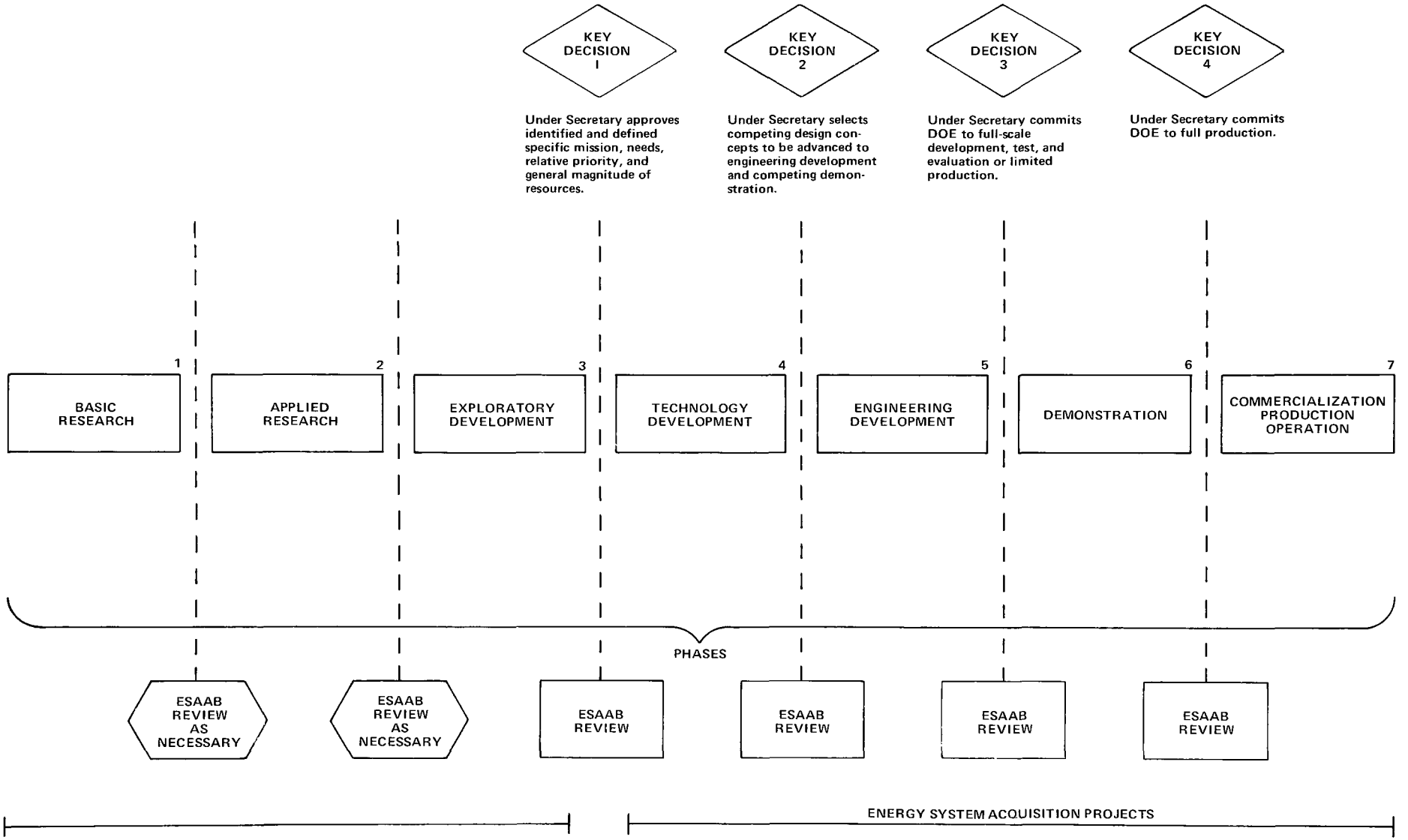
C. Environmental Planning and Review

The PPMS is not a policy planning system. It was originally designed to coordinate project evaluation and planning with the budget cycle. Although the PPMS implementation schedule was completed in October 1978, it is still undergoing revisions. A number of the major systems that PPMS covers are ongoing projects that have not completed a phase development cycle. Therefore, specific transition points are not yet evident. The total number of projects that make up a technology program may not be included in PPMS, but those projects included represent a large part of a technology budgetary program. In the DirectConversion Coal Liquefaction Program, for example, only some of the projects are now reveiwed by PPMS, but these projects (i.e., the Solvent Refined Coal and H-Coal Projects) represent a large share of the program budget.

With the creation of PPMS and the availability of a system for approving outlay (budgetary) program and project plans, an opportunity for synchronizing needed environmental research with the development phases of the technologies became apparent. This led to the integration of two separate but complementary program plans within an outlay program — a Technical Program Plan (TPP) and an Environmental Development Plan (EDP). The objective of the TPP is to define a development strategy for a project or group of projects of the same technology moving through the development phases. The EDP will identify and integrate required environment, safety, and health research within the appropriate phases of the technology project or projects.

From its inception, it was stressed that PPMS would take into consideration at all phases "...the environmental issues..." (Myers Memo May 31, 1978) relevant to significant RD&D projects. Environmental planning and review then was considered an integral part of PPMS at the program and project levels. There are two sets of environmental planning and review documents that are used in PPMS: those that are generic to an energy technology and those that are specific to each project. Environmental Development Plans, Environmental Readiness Documents, and Generic Environmental Impact Statements (EISs) are of the first type. The second type consists of Project Environmental Plans, the Site or Process Specific EISs, and the Safety Analysis System. The relationship of these documents to a discrete phase in the PPMS process is shown in **Figure 6**. This figure shows how the program office and the Office of Environment work together to identify uncertainties and develop solutions to environmental issues as the technology projects move through a development phase.

FIGURE 5. MAJOR SYSTEM ACQUISITIONS--PHASE TRANSITION DECISION POINTS



— — — = Phase Transition Decision Points

ESAAB = Energy System Acquisition Advisory Board

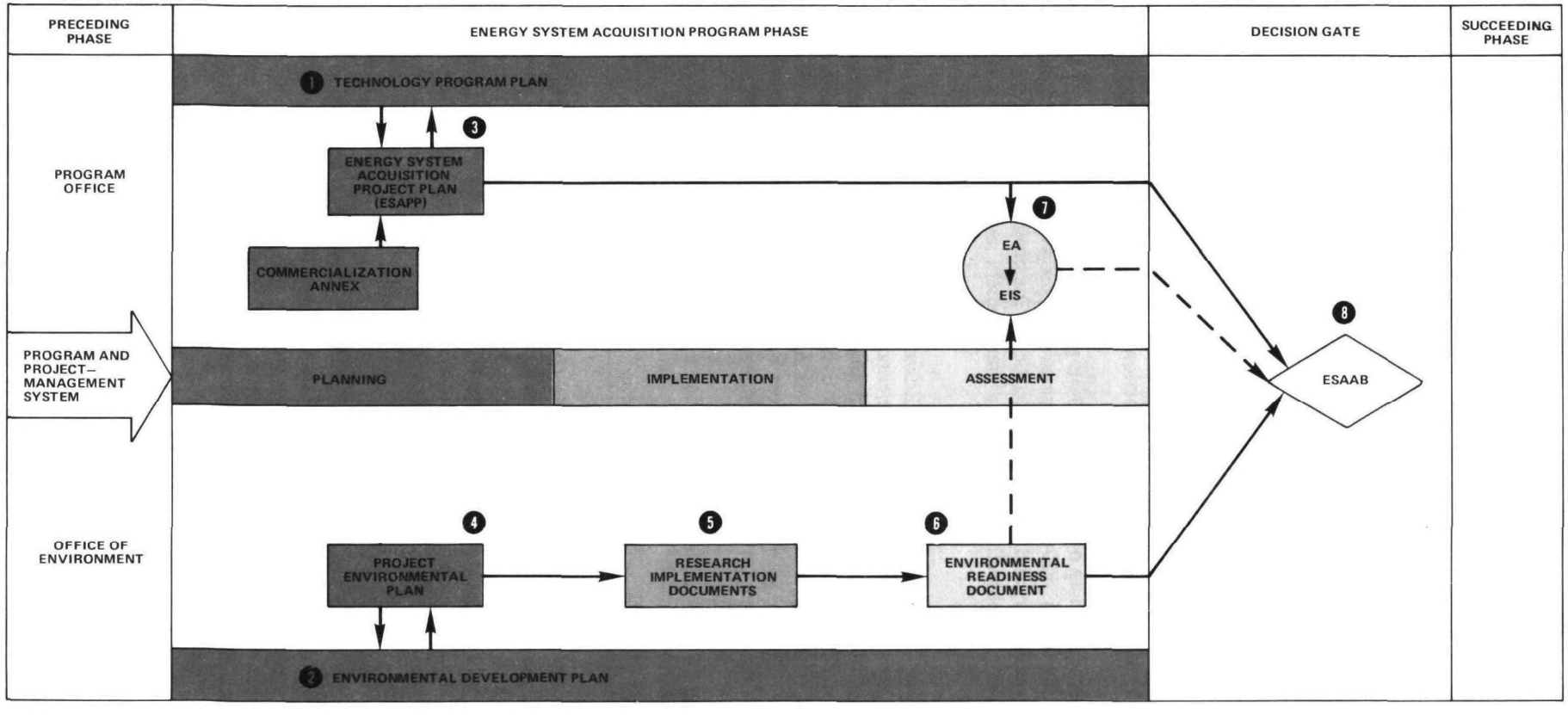
From Under Secretary Myers Memorandum May 31, 1978 "Program and Project Management System for DOE Outlay Programs"

TABLE 2. DOE MAJOR SYSTEMS

NON-NUCLEAR		NUCLEAR	
RESPON-SIBILITY	PROJECT	RESPON-SIBILITY	PROJECT
ET	Atmospheric Fluidized Bed Direct Combustion Demonstration Plant	ET	National Waste Terminal Storage Facility
ET	HYGAS Demonstration Plant	ET	Defense Waste Processing Facility, Savannah River
ET	Solvent Refined Coal Demonstration Plant (SRC-1 Solid or SRC-2)	ET	Advanced Isotope Separation Technology Engineering Demonstration Facility
ET	Magnetohydrodynamics Engineering Test Facility	ET	Waste Retrieval and Treatment Facility
ET	High BTU Synthetic Gas Pipeline Plant	ET	Waste Isolation Pilot Plant
ET	Low BTU Fuel Gas Industrial Demonstration Plant	ET	Tokamak Fusion Test Reactor
ET	"H" Coal Pilot Plant	ET	Mirror Fusion Test Facility
ET	10MWe Solar Thermal Central Receiver Pilot Plant	ET	Fusion Materials Irradiation Test Facility
ET	50MWe Geothermal Demonstration Plant	ET	Fluorinel Dissolution Process and Fuel Receiving Improvements
ET	Ocean Thermal Energy Conversion Test Platform	ER	Positron-Electron Project
CS	Heat Engines Project	RA	Centrifuge Add-on Plant (Portsmouth)
		DP	High Energy Laser Facility (NOVA)
		ER	ISABELLE
		ET	Fuel and Materials Examination Facility

ET – Office of Energy Technology
ER – Office of Energy Research
RA – Office of Resource Applications
DP – Office of Defense Programs
CS – Office of Conservation and Solar Applications
(Designation of DOE Major Systems Order 4240.1, February 1, 1979)

FIGURE 6. RELATIONSHIP OF DOE ENVIRONMENTAL PLANNING SYSTEM TO PPMS MAJOR SYSTEM ACQUISITION



PLANNING

1. TECHNOLOGY PROGRAM PLAN (TPP): Long range plan for developing emerging technology
2. ENVIRONMENTAL DEVELOPMENT PLAN (EDP): companion plan to TPP for synchronizing environmental needs with technology development
3. ENERGY SYSTEM ACQUISITION PROJECT PLAN (ESAPP): plan for specific projects within TPP addressing scientific, technological and engineering objectives
4. PROJECT ENVIRONMENTAL PLAN (PEP): Environmental Annex to ESAPP

IMPLEMENTATION

5. Research Implementation Documents, Research and development activities identified in the EDPs and the PEPs.

ASSESSMENT

6. ENVIRONMENTAL READINESS DOCUMENT (ERD): A review of research results used to decide the environmental *readiness of the technologies to move to the next developmental* stage. (i.e., demonstration to commercialization).
7. ENVIRONMENTAL ASSESSMENT (EA) AND ENVIRONMENTAL IMPACT STATEMENTS (EIS): EA–A preliminary analysis of the consequences of a proposed action or technology to determine the need for an EIS. EIS–In-depth analysis of the environmental impacts, mitigating measures and alternatives to the proposed action or technology.
8. DECISION GATE–Point at which the Under Secretary, following consultation with the Environmental System Acquisition Advisory Board (ESAAB) makes a decision, as to whether the technology is ready to advance to the next acquisition stage.

Further discussion of the objectives and purpose of the various environmental documents is made in Subsection F. Also see **Table 3**.

D. Energy System Acquisition Projects

There are seven phases in the DOE research, development, and commercialization effort through which all energy projects must pass. These seven phases are divided into two stages — Technology Base Activities and Energy System Acquisition. The first stage encompasses basic and applied research and exploratory development, which involve the conception and definition of technology options. When a specific project has been formalized, it passes from Phase 3 (exploratory development) into Phase 4 (technology development) and so enters the next stage, becoming an Energy System Acquisition Project. Although PPMS covers all seven phases in the research, development and commercialization effort, it is primarily focused on energy system acquisition projects.

When technical program plans encompass more than one technology, each specific technology is addressed in a detailed Energy System Acquisition Project Plan (ESAPP). For example, ESAPPs are prepared for the Solvent Refined Coal and H-Coal projects in the Direct Conversion Coal Liquefaction Technology Program Plan.

In general, the ESAPPs serve as baseline planning documents for DOE project activities and cover the project from its initial proposal through ultimate completion. ESAPPs are unique to each project, and the format and level of detail varies with the size, complexity, sensitivity, and other characteristics of the project. Generally, the elements of an ESAPP include a mission need and project objectives summary, a management and procurement strategy, and a risk assessment and resource plan.

In its original design, ESAPP included two mandatory annexes: Environmental Issues and Control Technology, and Commercialization and Market Development. The Environmental Technology Annex identified "the environmental barriers or questions associated with the specified technology or process and describes the control technology, supporting research, and other program efforts aimed at overcoming environmental constraints or problems." (Myers Memo May 31, 1978.) With such a broad mandate this Annex (now called a Project Environmental Plan) has developed into a companion document to the ESAPP. These Project Environmental Plans (PEPs) are derived from long-range environmental needs as set forth in the Environmental Development Plan.

The Commercialization and Market Development Annex identifies an early commercialization strategy which gradually becomes a well-defined and comprehensive market development plan.

E. Energy System Acquisition Advisory Board

To guide the development of a major energy system acquisition project and to serve as an advisory body to the DOE Under Secretary, the Energy System Acquisition Advisory Board (ESAAB) under PPMS was established. The Board authorizes each of the successive phases of technology development. It can modify an authorized phase approval or cancel a project. The ESABB is chaired by the Under Secretary, and the Assistant Chairman is the Assistant Secretary or Director whose major system acquisition project is presented for decision. The Assistant Secretary for Environment, several other Assistant Secretaries, the Deputy Under Secretaries, the Controller and Director of Procurement and Contracts Management serve on the ESAAB.

The ESAAB advises the Under Secretary at the four key decision points for energy system acquisition in the PPMS (shown in **Figure 5**). The first decision occurs when an energy technology is considered ready to move from research-related activities (exploratory development) to actual technology development and thus become a major energy system acquisition project. Other ESAAB reviews occur at subsequent transition points between technology and engineering development, engineering development and demonstration, and demonstration and commercialization.

Participation in the ESAAB is important to the Office of Environment because it is a direct link to the development, approval, and execution of DOE's major budgetary projects. This participation provides an opportunity for the Office of Environment to present their assessment of each major energy system and, if recommendations differ, provides access to the DOE Under Secretary for resolution.

TABLE 3. OVERVIEW OF MAJOR DOE ENVIRONMENTAL PLANNING AND REVIEW DOCUMENTS

DOCUMENT	PURPOSE	CONTENTS	PREPARER	TIMING
1 Environmental Development Plan (EDP)	Defines major environmental concerns associated with a particular energy technology and general environmental research requirements for addressing those concerns.	• Define environmental concerns. • Assess status and risk. • Identify R&D needs. • Describe R&D plan.	EV, in conjunction with ECC subcommittee for that technology	Annual revision of EDPs is formally called for, however, major updates of EDPs will likely coincide with PPMS phases in the future.
2 Energy System Project Environmental Plan (PEP)	Plans environmental R&D for a specific project.	• List research projects (including NEPA requirements). • Identify the sponsoring office. • Specify funding requirements. • Provide a research completion schedule.	EV, in conjunction with ECC subcommittee for that technology	In conjunction with the ESAPP.
3 Environmental Readiness Documents (ERD)	Review environmental status of a particular technology and serve as formal EV input to DOE technology development decisions.	• Assess environmental readiness of a technology to move on to the next development stage. • Discuss current and potential regulations affecting technology and control technology options. • Assess delays and costs associated with adverse environmental findings.	EV	Prior to PPMS decision gates.
4 Environmental Assessments (EA) and Environmental Impact Statements (EIS)	EAs evaluate if EIS should be prepared in order to meet NEPA requirements. EISs assess environmental impacts of proposed major Federal actions.	Describe: • proposed actions, probable impacts, unavoidable adverse impacts, possible alternatives.	Technology program manager.	Contained in the PEP.

F. Environmental Research Planning and Assessment Process

To aid in planning for needed environmental research, support the environmental evaluation required in the PPMS, and to utilize existing documentation requirements of the National Environmental Policy Act (NEPA), the Office of Environment (EV) established an internal Environmental Research Planning and Assessment Process. To help understand the formal outputs of this process (Environmental Development Plans, Project Environmental Plans and Environmental Readiness Documents) and how these outputs are utilized, the process can be separated into planning, implementation and assessments elements.

1. Planning

Environmental research planning is described in two specific documents: the Environmental Development Plan (EDP) and the Energy System Acquisition Project Environmental Plan (PEP). Key to the development of these documents is the Environmental Coordination Committee (ECC).

Environmental Development Plans

Initiated in 1976, the Environmental Development Plan (EDP) has evolved into the Office of Environment's primary planning document for synchronizing environmental research with technology RD&D schedules. The first generation of EDPs consisted of statements of environmental concerns, general research and development requirements, and milestone schedules. With the implementation of PPMS, the EDPs are jointly prepared by the technology program office and the Office of Environment, usually in advance of the development phase of a technology. This joint activity is necessary to assure that environmental research and decision-making are not out of phase with the technology development plans.

Energy System Acquisition Project Environmental Plan

The environmental planning document that addresses a specific research project is the Project Environmental Plan (PEP). Prepared by the Office of Environment staff in collaboration with the technical program office, a PEP is the environmental counterpart to the technology project plan (ESAPP). PEPs represent an agreement between the two offices concerning the specific environmental research to be accomplished in support of that technology project.

The PEP is similar to the relevant EDP in scope and content. But while the EDP addresses an entire technical program, the PEP is project—and—site specific to the particular phase of development. All research projects listed in the PEP should address the research requirements identified in the EDP, and the schedule for completing these research projects should be consistent with the technology development schedule.

Environmental Coordination Committee

To facilitate communications and interactions between the Office of Environment and the Program Offices in the preparation of the EDPs and PEPs, Environmental Coordination Committees (ECC) were formed. The functions of the ECC are to provide a forum for the exhange of viewpoints and requirements directed at preparation of EDPs and PEPs and to oversee their completion and implementation. "The ECCs have no direct program management responsibilty. Each ECC is a two-tier committee. The parent committee, comprised of the senior program managers from the Office of Environment and the technology offices, delegates responsibility for actual EDP and PEP preparation to subcommittees. Each subcommittee is identified with an energy system selected for development or commercialization, e.g., under the Fossil Energy ECC, a typical subcommittee is Coal Gasification. Subcommittees are comprised of project managers and staff engaged in planning and are chaired by Office of Environment staff members. The parent ECC, e.g., Fossil Energy, meets only irregularly to resolve conflicts and issues not remedied at subcommittee level." (Clusen Memo December 18, 1978.)

2. Implementation

The environmental planning documents (EDP/PEP) serve as the basis for developing budgets for environmental research activities. As part of each budget cycle, the Office of Environment issues guidance to DOE research centers and laboratories on research needs indentified in the EDP's. They respond with research proposals to meet these needs.

Generally, the facility which has primary responsibility for a specific technology prepares a research program plan. The plan describes in scientific terms the objectives, approach, method of analysis, and schedule for each of the environmental research projects associated with that technology program.

Periodically, environmental researchers are required to submit status reports to the Office of Environment project managers. These reports will support environmental assessments associated with the technology development process.

3. Assessment

Three documents — Environmental Readiness Documents, Environmental Assessments, and Environmental Impact Statements — are used to assess the environmental acceptability of an energy system acquisition project. However, only the Environmental Readiness Document (ERD), is produced as a formal output of the Planning and Assessment Process.

Environmental Readiness Documents

As an assessment prepared independently by the Office of Environment, ERDs are used by the Assistant Secretary for Environment to advise the ESAAB on the suitability of allowing an energy technology to move to the next phase in the energy system acquisition process.

In Fiscal Year 1978, as part of the DOE Commercialization Task Force Study, sixteen ERDs were prepared to assist in selecting candidate technologies for near term commercialization.

As part of PPMS, the ERD is designed to present the results of environmental R&D from the preceeding phase and provide further definition of concerns and research needs for the ensuing phase. ERDs support Environmental Impact Statement (EIS) preparation. As an analytical reference document, the ERD was designed to be useful in scoping environmental concerns and supplying quantitative information on specific pollutants as well as potential ambient impacts.

ERDs are reviewed by the ECC technology subcommittee, other DOE offices, and are available to the general public; but like the EDP, there is no system for widespread comment and review outside of DOE.

Environmental Impact Statements

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to prepare Environmental Impact Statements (EIS) for major actions that significantly affect the quality of the environment. An Environmental Assessment (EA) is a preliminary analysis to determine whether the impact of an action will be significant and is used to decide if preparation of an EIS is necessary.

The purpose of an EIS is to assess the environmental impact of an action, reasonable alternatives to that action, and to provide an opportunity for public review and comment on the action. EISs may cover a general technology program or specific projects within a program. EAs and EISs are prepared by technology program offices and are reviewed by the Office of Environment and the Office of General Counsel. Within PPMS, EAs and EISs can be prepared at any phase, but they will normally be required at the technology development phase and at appropriate decision points throughout the remaining phases.

Requirements, costs, responsibilities and schedules for completing EAs and EISs for technology projects are specified in the Project Environmental Plan.

Safety Analyses

A safety analysis is not prepared as part of the Environmental Planning and Assessment Process nor as part of NEPA requirements. It is prepared according to DOE procedures for an occupational and public health and safety review of a proposed facility. It is usually prepared in the design phase of a facility that DOE intends to procure and operate. The purpose of a safety analysis is to identify and limit risks to health and safety of the public and employees and to adequately protect property and the environment.

III. PRELIMINARY FINDINGS CONCERNING THE ENVIRONMENT PLANNING AND ASSESSMENT PROCESS

A. Introduction

A preliminary analysis of the Environmental Research Planning and Assessment Process provides three types of findings:

- the effect environmental planning and review has had on recent DOE technology decisions;
- identification of the procedural aspects of the environmental review process;
- opportunities for public participation in the process.

Three factors limit the conclusions that can be drawn with respect to the effectiveness of DOE environmental planning and assessment: (1) neither the PPMS process nor the environmental process were fully operational until late 1978, (2) a Departmental Order has not yet been developed for PPMS. (It is still operated by an Interim Guidance and Policy Statement issued in May, 1978. The DOE order for Environmental Development Plans was issued before PPMS was fully implemented. It does not mention the EDP as part of the PPMS review process), (3) only one non-nuclear technology project (the 50 megawatt Geothermal pilot plant in Baca, New Mexico) has passed through a PPMS decision gate.

B. Environmental Planning And Review And Technology Decisions

Several situations involving PPMS procedures and the environmental research planning and assessment process raise questions as to how extensively environmental factors have been included in DOE's recent decisions on non-nuclear technology RD&D projects. For example:

- Under PPMS procedures, the ESAAB (which includes the Assistant Secretary for Environment) meets to advise the Under Secretary on the movement of technologies through development phases. Though a significant portion of DOE's budget is for technology RD&D, the ESAAB (as of May, 1979) has met only three times in Fiscal Year 1979 (since October, 1978).

- The implementation of PPMS and the DOE Commercialization Task Force activities were not coordinated. In late 1978 sixteen technologies (both programs and projects) were selected for near term commercialization by the task force. Only one of these programs (geothermal) has gone through the ESAAB review, and this was after the Task Force announced the commercialization technologies selected. The fact that commercialization resource managers and analysts were selected for all these technologies suggests they passed, at least partially, into the commercialization phase; yet the formal PPMS review process — which calls for explicit consideration of environmental issues — was not used.

- Only **major** energy acquisition projects come under PPMS review. The projects that do not qualify as major systems are the responsibility of the Assistant Secretary guiding their implementation. As such, there is no formal process to insure environmental review by the Office of Environment (EV), though EV does prepare Project Environmental Plans (PEPs) for these projects.

- EAs and EISs being developed by the DOE Program Offices do not generally reference relevant ERD or environmental research in general. This raises a question about the focus of some of the Office of Environment research or an awareness of it within DOE.

As PPMS and its environmental planning and review procedures mature, some of the concerns raised by the above events should be resolved.

C. Procedural Aspects of the Environmental Review Process

In examining the Environmental Research Planning and Assessment Process, several relative strengths and weaknesses can be identified.

1. Strengths

Although components of the process are still in the early stages of development and use, there are three particular aspects that contribute to the process' actual and potential effectiveness:

Key elements of an effective management system are present. The Environmental Research Planning and Assessment Process contains the basic components of an effective management system: planning, controlling, and assessing. Although the process is usually defined in terms of the formal documents it produces (EDPs, ERDs, and PEPs), there are, in addition, a series of management tools and procedures which support it (e.g., the DOE budgeting process and intra-department subcommittees).

Available process documentation. A large number of outputs from the process (EDPs, ERDs, and PEPs) have been and continue to be produced. "In Fiscal Year 1978, DOE prepared twenty-eight EDPs and sixteen ERDs. In Fiscal Year 1979, thirty-three EDPs are being updated or prepared, sixty-four PEPs are being prepared, and fifteen-to-twenty new ERDs are being generated. For Fiscal Year 1980, DOE planned activities include preparing or revising twenty-to-thirty EDPs, generating or updating thirty ERDs and preparing or revising a large number of PEPs." (DOE Office of Technology Impacts, April 1979).

Improved process integration. Because programs and procedures varied widely across DOE's predecessor agencies, a Departmental Order (DOE 5420.1: Environmental Development Plans, August, 1978) was issued that simplified the EDP preparation process and designated departmental responsibility for integrating it into the then-existing DOE planning system. With the creation of the PPMS, this integration was improved since the EDP is considered to be the environmental counterpart to the Technology Program Plan.

2. Weaknesses

The process currently contains several shortcomings:

Lack of formal research feedback mechanism. Procedures for feeding the results of environmental research back to the technology and environmental program offices are not well defined. Although the results of research projects may appear in EDPs or ERDs, there is no formal requirement that the results of a specific research project be documented and delivered to ET or CS program managers. Periodic reports are prepared by some national laboratories, and research sponsored by the Office of Environment (EV) generally appears in the technical literature; however, these results are not systematically integrated at the technology program level.

Inability to identify ongoing research. It is difficult to identify the results of research tasks that have already been accomplished because PEPs list only proposed or needed research. EV is planning the development of an information processing capability to make this task simpler and in part solve the problem.

Unresolved process issues. The need for EDPs, ERDs, and PEPs is generally recognized within DOE, but there are significant differences of opinion concerning the content and frequency of updates for these documents. EDPs are criticized by some for being too general and by others for being too specific. Although it is intended that EDPs be written or updated at the beginning of an acquisition phase and not updated until the next phase, some internal DOE documentation prescribes annual updates.

ERDs are technology-specific and written as an environmental policy input for deciding whether a technology should move from one acquisition phase to the next (e.g., demonstration to commercialization). However, technology programs generally comprise several technical projects. It is not clear what happens when one technical approach is ready to move on to the next phase but another in the program is not. Will there be multiple ERDs for a technology? On the other hand, ERDs are prepared at the end of an acquisition phase, which means that several years may separate environmental assessments for a technology. Will there be interim assessments?

The significance of these problems is that their resolution will have a direct impact on the content and currency of the documents and ultimately on the use to which that information can be put. It also indicates that, although the process is generally sound in design, a number of important implementation issues remain to be resolved.

D. Public Participation

In the context that it is used in this section, public participants include public interest and environmental groups, the private sector, and others who are interested in the way environmental considerations are integrated into the DOE decision-making process. The potential significance and impact of emerging energy technologies at both the national and local site-specific levels makes it imperative that there is substantial public participation in DOE's planning and decision-making process. It is essential to determine how best to keep the public informed and how then to ensure they are **effectively** involved in the planning and decision-making process.

Presently, the major existing opportunity for public participation is the NEPA process, which requires public hearings and comment on EISs. Newly proposed NEPA regulations (effective July 1979) for EIS preparation pose further questions regarding how these documents mesh with the DOE planning processes. For instance, how specifically are EAs and EISs linked to key decision points in the technology development process and also to the outputs of the Environmental Research Planning and Assessment Process?

The Assistant Secretary for Environment has stressed the importance of public participation in interpreting the environmental consequences of emerging technologies. One of the duties of the Office of Program Coordination within the Office of the Assistant Secretary is a program in public participation. The range and scope of this participation in the evaluation of information on the environment has recently expanded. However, the issue of DOE's actual integration of this public review into the Program and Project Management System (which guides technology development) still remains.

The issues and options in this section are presented to stimulate further analysis and public discussion at the 1979 Section 11 Regional Workshops and the National Public Hearing in order to assist in the development of recommendations for increasing public involvement.

1. ***What is the most effective way to keep the public informed?***

DOE's Environmental Research Planning and Assessment Process is fundamentally an internal management system. As such, its outputs may not have the content or the detail that would allow an outsider to fully understand the status, direction, and content of DOE's environmental research.

The information needs of the public will differ. Some segments of the public will be interested in obtaining more information and detail than that contained in the formal process documents. However, placing such information in EDPs or PEPs could make their production burdensome enough to defeat their purpose as management documents. Possible steps that would help meet the information needs of the informed public include:

- Increasing the range and detail in EDPs and PEPs. This step would not apply to the ERDs since they are assessment documents that should already contain that detail.

- Producing new documents to meet information needs. One possibility is the use of "technology assessments" — brief papers concerning a particular process or technology;

- Making "readable" research plans and results available to the public.

- Developing a standard sequence of contacts and contact points between DOE headquarters, regional offices and the public that provide for information exchange and a system of accountability regarding specific concerns.

Other members of the public may be particularly interested in site specific projects that directly affect local areas (e.g., construction of a nearby demonstration plant). These information needs could **possibly** be met by the following actions:

- More frequent production and active distribution of ERDs (or ERD equivalents in content) since they appear to be a document that meets many of the public needs; and

- Workshops and informal meetings at the earliest planning stages of each proposed pilot and demonstration plant site to allow local concerns to be voiced and incorporated.

2. How effective is DOE's internal research management process in allowing opportunities for the public to participate effectively in the decision process?

Among the options available for determining public attitudes and concerns about energy technologies are:

- Distribution of formal documents (EDPs, PEPs, ERDs) in draft or final form for review and comment;

- Periodic public meetings to discuss the status of environmental research within one technology or a group of technologies; and

- Workshops and conferences focusing on technical, scientific and environmental issues within a technology.

To help insure that public concerns which have been raised are included at key points in the decision-making process, possible options are:

- Participation of selected representatives from interested groups in ECC subcommittee meetings dealing with EDP and PEP preparation and the setting of research priorities; and

- Creation of advisory groups for specific technologies that would include representatives of the public and would provide a **formal** role for these groups in the process.

Some of these activities are presently in use in the Environmental Research Planning and Assessment Process. Within the Office of Environment, the attention paid to public participation has increased. The issues of environmental protection are technically complex and the process of public communication and review quite difficult. It is imperative that present and future programs in public participation prove effective in generating a consensus on the proper course of RD&D investments in emerging technologies.

IV. CASE STUDY: DOE's ENVIRONMENTAL RESEARCH PLANNING AND ASSESSMENT PROCESS FOR GEOTHERMAL ENERGY

The regional workshops will focus on specific technologies and will provide participants with the opportunity to learn how the DOE environmental planning process works. This case study examines one technology and the ways in which its development has been influenced by the process.

A. Evaluation Criteria

The Environmental Research Planning and Assessment Process can be evaluated by examining how it functions in the case of Geothermal Energy Systems on a program and project specific basis. This techology was chosen for three reasons: (1) DOE has decided to move this technology (in particular, hydrothermal energy) towards commercialization; (2) a considerable amount of DOE environmental research documentation (three EDPs, one ERD, and one PEP) has been generated for this technology; and (3) DOE generally regards geothermal energy development as having a good potential to effectively involve all local concerned parties in its environmental management process.

Four criteria should be used as the basis for evaluating the Environmental Research Planning and Assessment Process:

- The extent to which DOE has followed the process;
- The extent to which DOE has carried out the planned environmental research;
- The extent to which the results of DOE's environmental research has affected technology development decisions in the geothermal industry.
- The opportunities for the concerned public, local, State and Federal Agencies and the Geothermal Industry to participate in the process.

This evaluation will be complicated because a major portion of geothermal development occurred prior to the existence of the Office of Environment's Planning and Assessment Process.

B. Background: Technology and Environmental Concerns

1. Geothermal Technology

"Geothermal energy is derived from the earth's natural heat and stored in hot or molten rock and in the water and steam that fill underground rock pores and fractures. Hydrothermal systems — vapor or liquid-dominated reservoirs — account for all the electricity currently produced from the world's geothermal reserves; California's hydrothermal resource accounts for over 70 percent of the electrical energy potentially recoverable from such reservoirs in the United States" (Rand Corporation Study, Jan. 1979). Fourteen western states contain geothermal reservoirs under approximately 100 million acres, 60% of which the Federal government controls. The largest geothermal power plant in the world is located at The Geysers dry steam reservoir in northern California's Known Geothermal Resource Area (KGRA)*. Electricity is about to be produced commercially in the liquid-dominated reservoirs in Southern California's Imperial Valley. Mexico is generating electricity from it's liquid dominated reservoir at Cerro Prieto, just below the Imperial Valley; the facility will soon be expanded to 225 MWe.

DOE is currently investigating three major types of geothermal resource: hydrothermal, geopressured, and hot dry rock. Of these, only hydrothermal has gone through the environmental review process. This discussion, therefore, addresses only hydrothermal.

The type of hydrothermal fluid used to generate electricity depends on the nature of the hydrothermal reservoir, which can vary in phase (vapor or liquid), pressure, temperature, and salinity.

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*A KGRA is defined as "an area in which the geology, nearby discoveries, competitive interests, or other indicia....engender a belief that the prospects for extraction of geothermal steam or associated resources are good enough to warrant expenditures ....for that purpose." (PL 91-581 Geothermal Steam Act of 1970).

Key unresolved technical issues for hydrothermal electricity are the control of H_2S emissions and reinjection of spent geothermal fluids from liquid dominated reservoirs. Other barriers to rapid development are a shortage of geological data about the location, size and types of geothermal fields and shortage of drilling equipment. Many groups feel the legal problems relating to leasing and the resource classification of geothermal energy are more important than any technical considerations at this time.

Outside of the California Known Geothermal Resource Areas there are areas where hydrothermal electricity generating projects are under development. These projects are primarily in the Western United States (Idaho, New Mexico, Oregon) and Hawaii.

2. Environmental Concerns

The development of geothermal energy has raised a number of environmental concerns: air quality, water quality, ecological effects, noise, subsidence, enhances seismicity, and other local impacts. A summary of these concerns — taken from the DOE and EPA environmental research documents for geothermal energy — is contained in **Table 4.**

These environmental problems vary in significance at different geothermal projects. For example, at the Geysers (a vapor dominated reservoir), the hydrogen sulfide emissions may be more of a problem than at liquid-dominated reservoirs in the Imperial Valley. Decisions concerning development sites are further constrained because electricity that is generated at the site must then be transported to the point of utilization. Resulting land use disturbances due to the placement of transmission lines may exceed those resulting from the initial development project.

Some mitigation of the environmental problems associated with geothermal energy is occurring through the use of existing control technologies; however, much research and development of new control technologies continues — the major control technologies are shown in **Table 4**.

C. Evaluation of the Environmental Planning and Assessment Process for Geothermal Energy

This evaluation should be made by examining how closely DOE has followed the Environmental Planning and Assessment Process outlined earlier in Section II of this report.

1. The extent to which DOE has followed its Environmental Research Planning and Assessment Process

Over the past two years, three (3) geothermal program and project specific Environmental Development Plans have been completed. In June 1977, an EDP for Hydrothermal Energy System Projects was issued. In March 1978, an EDP for the Geothermal Energy Program was issued. This EDP was updated and reissued in April 1979. The project EDP and the program EDP were similar in content — summarizing environmental, health, and safety issues; describing the planned Environmental Projects and discussing control technologies for the more significant concerns.

The updated Geothermal Program EDP — utilizing environmental research data gained from a variety of geothermal projects — contains a much more detailed and comprehensive discussion of the technology, the environmental concerns, and an updated listing of environmental research requirements. The second Geothermal Program EDP clearly is an improvement over the earlier program EDP.

A project specific Environmental Readiness Document (ERD) was prepared for Hydrothermal Electric and Direct Heat as an input to the DOE Commercialization Task Force Study. This Task Force identified those energy technologies (programs and projects) that would be considered for commercialization. In late 1978, DOE appointed a commercialization resource manager for geothermal/hydrothermal energy. It is not clear what effect the ERD — which assessed the existing knowledge of each environmental concern in the EDP — had on the decision to push the development of hydrothermal energy.

When the Energy System Acquisition Advisory Board met in late 1978 to review the 50 MWe Hydrothermal Pilot Plant for Baca, New Mexico, only the first two EDPs and the ERD were available. At that time, DOE decided to go

TABLE 4. MAJOR GEOTHERMAL ENVIRONMENTAL CONCERNS AND CONTROL TECHNOLOGIES

ENVIRONMENTAL CONCERN	DESCRIPTION OF ENVIRONMENTAL CONCERNS	POSSIBLE CONTROL TECHNOLOGIES
Air Quality - Air quality concerns involve non-condensible gases contained in geothermal fluids. These gases are released to the atmosphere through the cooling tower and when the plant shuts down.	• Hydrogen sulfide represents the most significant concern due to its noxious odor and low detection threshold. It is also toxic, but only at concentrations much higher than the odor detection threshold. Community complaints have been received in the case of the Geysers. • Small amounts of boron are released which, in the case of the Geysers, have had a measureable effect on nearby vegetation.	• There are four major processes under consideration for controlling airborne emissions: -- Stretford Process -- Iron Catalyst Process -- EIC Process -- Dow Process The Stretford Process has been used in the paper and pulp industries. The EIC Process removes hydrogen sulfide from raw geothermal steam and therefore eliminates the corrosive effects of hydrogen sulfide on the turbine and piping. The Dow Oxygeneration Process removes hydrogen sulfide from the geothermal brine at the wellhead, but is at an earlier stage of development. From the standpoint of cost and effectiveness, the Stretford and EIC processes appear most promising. The key issue at each site will be the amount of airborne emissions as opposed to the efficiency of the process.
Water Quality - Water quality concerns involve the disposal of spent geothermal fluids and, in certain cases, water use problems.	• The disposal of large volumes of spent geothermal fluids present an environmental concern due to the potentially high salinity of the fluid. This may preclude the discharge to surface waters of untreated geothermal fluids. • In areas of scarce water resources, water use (for cooling purposes) may conflict with other local needs.	• The most promising control technology is the reinjection of spent geothermal fluids into the ground. Care must be taken that aquifers are not disturbed. Reinjection technology has not been demonstrated on a large scale and has experienced problems with the scaling and plugging of injection wells which may result in the need for pretreating the fluid to remove certain compounds (e.g., silica). Other means of disposal include evaporation ponds and ocean disposal (for suitably located sites). Water treatment technologies include sedimentation, chemical precipitation, filtration, reverse osmosis and evaporation. Although individual efficiencies of these technologies may not be high, they usually can be grouped in series to yield a satisfactory result.
Noise - Concerns with noise include both site development and operations.	• The two major sources of noise are well drilling operations and the venting of stream during plant shutdowns. Citizen complaints have been received at the Geysers. It is expected that noise problems will not be as significant at KGRAs with liquid-dominated resources.	• High noise levels can generally be controlled through appropriate operating procedures and by using mufflers or expansion towers.

TABLE 4. MAJOR GEOTHERMAL ENVIRONMENTAL CONCERNS AND CONTROL TECHNOLOGIES (CON'T.)

ENVIRONMENTAL CONCERN	DESCRIPTION OF ENVIRONMENTAL CONCERNS	POSSIBLE CONTROL TECHNOLOGIES
Ecological Effects - Ecological effects include both the short and long term effects of geothermal development on the surrounding area.	• Of particular concern are the effects of geothermal development on any rare and endangered plant and animal species in a KGRA.	
Subsidence and Seismicity - Subsidence refers to the sinking or settling of the land that may accompany the removal of large amounts of geothermal fluid from a reservoir.	• Subsidence is a major concern in the Imperial Valley, an agricultural area with an extensive irrigation system.	• Subidence is most easily controlled through the reinjection of geothermal fluids.
Seismicity refers to the potential for an increased number of seismic events due to the removal or injection of geothermal fluids.	• Increased seismicity is a concern in areas already possessing high levels of seismic activity.	• If seismicity is a concern at a particular site, reinjection could aggravate the problem.
Local Impacts - Geothermal development can significantly effect local economies through capital investment, job creation, and tax revenues.	• Geothermal development can result in land use difficulties and can be perceived as detracting from the quality of life or other segments of the local economy (e.g., tourism) in areas with scenic, pristine characteristics.	

ahead with the Pilot Plant. They later issued a revised Program EDP and a Project Environmental Plan. An EDP and PEP were prepared in early 1979 to guide development of the succeeding phases in the development process (see **Figure 6** in Section II).

Both site specific and more general geothermal and hydrothermal Environmental Assessments (EA) and Environmental Impact Statements (EIS) have been prepared, though most were completed prior to implementation of the Environmental Research Planning and Assessment Process. One exception, however, is the EIS for the 50 MWe facility at Baca, New Mexico, which, as of June 1979, has not yet been completed.

2. The extent to which DOE has carried out the planned environmental research

Environmental research projects are generally based on an assessment of environmental concerns and a set of budget decisions reflecting those concerns — i.e., decisions to undertake research related to the most pressing concerns.

The EDPs prepared for geothermal energy identified the following environmental and socio-economic concerns (these concerns are a further subdivision of those listed in Table 4): release of airborne effluents; release of waterborne effluents; noise, subsidence; enhanced seismicity; water use; land use; social services and community structure; and system safety and occupational health. Although much of the planned research is being carried out on schedule, there are still large research gaps, notably in the design and implementation of long term baseline studies and in the development of wet-steam systems. Many groups feel that little progress has been made in solving the land use, political, legal and institutional issues.

3. The extent to which the results of DOE's environmental research has affected technology development decisions in the Geothermal Industry.

It is possible to point to current research activities which may cause significant variations in the technology, depending upon whether methods can be developed to mitigate possible adverse environmental consequences. For example, if reinjection of large amounts of spent geothermal fluids does not prove feasible, new control technologies must be found or the course of geothermal energy development will be changed. Similarly, if measurements of subsidence prove significant or if detection of public health problems from geothermal emissions (Hydrogen Sulfide, Mercury, Radon) occurs, development in particular areas may be curtailed. There is also some concern that because research results are not widely publicized, there may be some redundancy among the various research programs.

4. The opportunities for the concerned public, local, State and Federal agencies and members of the geothermal industry to participate in the process.

A major objective of the Environmental Planning and Assessment Process should be to collect data on issues of concern to interested parties as early in the planning process as possible. A major issue concerning public participation is that many parties are brought into the planning process at the final stages after the course of RD&D has been established. These parties are often suspicious of information, prior motives and decisions on research priorities. Thus, they are often forced into an adversary role with the government or developers that results in long delays.

A second major objective of the Environmental Planning and Assessment Process should be the dissemination of information. Ready availability of data on research and government and industry performance might reduce uncertainty regarding the Federal geothermal RD&D effort. In addition, it could help eliminate redundancy in research efforts, point out gaps in the programs, and establish a network for the entry of and access to new information.

The notion of public participation in geothermal energy development activities is not new to many western states. For instance, Caliornia has an extensive network of commissions, committees, agencies, advisory panels, task forces and study groups that have been formally or informally dealing with the problems surrounding geothermal development since the early 1960's. The dominance of local agencies has been further enhanced by the strong tradition of home rule in the West.

In California, the Air Pollution Control District and the Regional Water Quality Control Board play dominant roles in that each has the power to confer or deny crucial permits at each stage of development at the state level. Both the California Energy Commission and the State Geothermal Resources Council deal with geothermal issues.

In 1978, the Boards of Supervisors of four California northern counties approved a Joint Powers Agreement formalizing creation of a commission to prepare a Geothermal Resource Impact Project Study (GRIPS), the first California local government agency established solely to deal with geothermal development. The GRIPS Commission's primary function is to assist agencies involved in the geothermal development permitting process in speeding up environmentally sound decision-making. These agencies include the County Boards of Supervisors, Planning Departments and Air Pollution Control Districts, the California State Division of Oil and Gas, the State Energy Commission, DOE, EPA and the Department of the Interior.

The Commission intends to sponsor research, collate and disseminate information and review research progress. In addition, they have planned for an aggressive program of local citizen involvement by holding workshops, publishing reports and establishing Citizens Advisory Councils and Study Groups.

The GRIPS Commission appears to have sufficient credibility and the local support necessary to successfully integrate the interests of Federal, State and local agencies and developers in planning the development of geothermal resources. However, the program has not yet developed according to plans.

The Commission received initial funding from DOE, the California Energy Commission and participating counties for planning and program development. Although DOE played a positive role in facilitating the formation of the GRIPS Commission, as of June 1979, no apparent decisions have been made regarding funding of the various activities that are necessary if the organization is to accomplish its intended purpose.

The pattern of public, local and state involvement in geothermal development planning followed a different course in the Imperial Valley in Southern California. Residents of the area have not had experience with a commercially operated plant and many still do not fully understand the impacts of geothermal energy development. However, elected officials are aware of the potential problems and they have expressed concerns about controlling geothermal development and minimizing environmental impacts on the area's rich agricultural lands.

In 1975, the Energy Research and Development Administration (ERDA), partially as a result of the lessons they learned at the Geysers area, attempted to coordinate the participation of existing state and local agencies in the geothermal development process. This approach, the Imperial Valley Environmental Project (IVEP), brought together existing concerned groups to develop a comprehensive assessment of regional issues associates with geothermal energy development.

The IVEP was designed to accomplish two objectives: (1) to produce an environmental baseline (information and measurements on environmental quality in the Imperial Valley before any major development, and also monitoring networks for detecting future changes); and (2) to identify the types of involvement (e.g., concerned regulatory agencies, and local planners) needed for a regional environmental assessment. Although successful, the IVEP was a one-time, short term project that failed to provide the continuity needed to deal with long term research and development problems.

Based on the experience of IVEP, the DOE Office of Environment, in 1977, developed the Geothermal Environmental Overview Program as the mechanism for conducting preliminary environmental assessments and gaining public participation at selected, high priority KGRAs. The preliminary assessments — which are based on the objectives of the Imperial Valley Environmental Project — are intended to provide regional assessment "snapshots" for energy technology development. The Geothermal Environmental Overview Program is managed within the Office of Environment and involves the DOE San Francisco Operations Office and the Lawrence Livermore Laboratory for field management and technical support.

For each project, the Geothermal Environmental Overview Program establishes a close working relationship with state and local agencies and produces a preliminary project assessment for use by the Office of Environment in research and development planning. Copies of project specific preliminary assessments are provided to the Environmental Coordinating Committee (ECC) subcommittee for use in preparing and updating Environmental Development Plans and Program Environmental Plans.

Citizen involvement in the planning and decision-making process has been encouraged by the Geothermal Resources Council, a regional non-profit professional society founded in 1972. The council was founded to encourage and promote research on all aspects of geothermal resources development, to collect and disseminate information related to these activities, to serve as a public forum to provide objective and unbiased information on geothermal energy and to facilitate cooperation and coordination among various interested parties. The council teaches short

courses, publishes reports and has participated in or coordinated several workshops on Geothermal Environmental Problems sponsored by the National Science Foundation and the U.S. Bureau of Mines.

At the National Level there are at least five Federal agencies or departments that have separate mandates, programs and procedures for dealing with geothermal resources. Among these, the Department of Energy, the Department of the Interior and the Environmental Protection Agency have major roles. In addition to the separate agency specific programs there are several levels of cooperative programs designed to integrate the multi-agency involvement in research, planning and development. For instance, there is an Intergovernmental Geothermal Coordinating Committee, several Regional Federal Research Councils and the Geothermal Energy Advisory Panel. The latter organization was established by the Secretary of the Interior in 1974 to advise responsible officials of the Department and others regarding environmental problems associated with the exploration and development of geothermal energy on Federal leased lands carried out under provisions of the Geothermal Steam Act of 1970. Membership of the Panel is drawn from the Interior Department, Geologic Survey, Bureau of Mines, Bureau of Land Management, Bureau of Reclamation, Heritage Conservation and Recreation Service, Fish and Wildlife Service, National Park Service and Office of the Solicitor General. Other Federal Agencies represented include the EPA, DOE, Department of Labor, and Department of Defense.

The Panel was established to act as the final level of review of environmental constraints applicable to geothermal operators on Federally leased lands. The meetings, although infrequent, are announced in the media and open to the public. The Panel has the potential to function as an important interface between the public, industry, environmental groups, and the Department of the Interior. However, the role of the Panel is strictly advisory and it is only authorized to deal with activities on Federal lands. Major issues concerning Federal leasing arrangements that appear to fall under the purview of the Panel remained unresolved after several years of discussion. Thus, while the Panel has afforded a channel by which local concerns can be heard and responded to, it is not clear how the Panel's findings are used in planning for Federal, state and private RD&D.

Further inter-agency cooperation with respect to geothermal energy was promoted by the Geothermal Energy Research, Development, and Demonstration Act of 1974 which created the Interagency Geothermal Coordinating Council (now the Geothermal Advisory Council). Its membership consists primarily of DOE, the Environmental Protection Agency (EPA), the Department of Interior, the Department of Agriculture, and the National Science Foundation.

In 1976 the Council requested regulatory guidance for geothermal energy from EPA. EPA responded by producing in 1978, a Pollution Control Guidance Document (EPA, June 1978) which identified major environmental research needs and recommended guidelines for: hydrogen sulfide emissions, surface discharge of spent fluids, containment of solid wastes, noise, and monitoring of air and water emissions gram concerns that were addressed in the EDP. EPA has also prepared a position paper outlining possible regulatory approaches for geothermal energy and identifying information needs in order to make DOE more aware of likely EPA actions related to geothermal technology.

In summary, a large number of organizations exist for the expressed purpose of assessing the impacts of geothermal energy development. An almost equally large number of groups, some with overlapping membership and similar mandates, exist to coordinate the activities of these organizations. In addition, DOE has developed its own regional assessment model (i.e. the Overview Program) for involving the public at sites where geothermal development is being considered.

Although an extensive network of local, state and Federal action and coordinating committees exists, very few of these groups are familiar with DOE's environmental review process or planning documents (PEPs, EDP, ERD's).

Thus, in spite of the original objectives of the Environmental Development Plans to "allow the public to help DOE evaluate its progress toward...the development of environmentally acceptable and commercially viable technologies", there does not appear to be any mechanism to incorporate a wide spectrum of non-DOE views, reviews or research efforts into the formal Environmental Research Planning and Assessment Process except in an *ad hoc* fashion.

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