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EXECUTIVE SUMMARY

PROGRAM APPROVAL DOCUMENT

FISCAL YEAR 1976 and TRANSITION QUARTER

GEOHERMAL ENERGY DEVELOPMENT

SOLAR, GEOTHERMAL AND ADVANCED
ENERGY SYSTEMS DEVELOPMENT

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Submission Date
JUNE 1976

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OPERATING DRAFT

**PROGRAM APPROVAL DOCUMENT
FISCAL YEAR 1976**

EXECUTIVE SUMMARY

**Energy Research and Development Administration
Solar, Geothermal and Advanced Energy Systems Development**

GEOHERMAL ENERGY DEVELOPMENT

Date of Submission: June 1976

This Program Approval Document is an internal working document used to approve and control the execution of ERDA programs; it is, therefore, subject to changes characteristic of day-to-day program management.

Program Approval Document: Executive Summary

Energy Research and Development Administration

Geothermal Energy Development

Submission Date: June 1976

1. Program Title: Geothermal Energy

Budget Reporting Code: EB

Responsible Individual: Dr. E. H. Willis, Director
Division of Geothermal Energy

Organizational Elements: Division of Geothermal Energy,
with support from AES, DPR, AIA,
OPA, ISL, COM, and GAC.

2. Program Scope, Objectives, and Significant Milestones:

The basic objective of the Federal Geothermal Program is to provide the Nation with an option to develop and utilize the substantial geothermal resources which exist in the United States. ERDA/DGE is the lead agency for the Federal Geothermal Program, which encompasses activities of several other Federal agencies, principally the Department of Interior. The goals of ERDA's program, which consists of six RD&D subprograms and the Loan Guaranty Program, are as follows:

a. Engineering Research and Development (FY76 and TQ - \$12 M BO): Advance geothermal drilling and utilization technologies in order to improve their cost-effectiveness. Principal goals and milestones for FY76 and TQ include: continued improvement of conventional drilling technology to reduce costs; laboratory tests of advanced drilling technology; starting construction of devices for direct energy conversion of total fluid flow; field testing of scaling and corrosion reduction methods; first field tests of improved down-hole pumps.

b. Resource Exploration and Assessment (FY76 and TQ - \$4 M BO): Reduce the uncertainties in determining the magnitude, extent, and production characteristics of geothermal reservoirs. Principal goals and milestones for FY76 and TQ include: development of exploration techniques particularly applicable to geothermal resources; RD&D on specialized

down-hole instruments; starting development of geothermal reservoir computer modeling techniques; and planning for confirmation of models by production tests.

c. Hydrothermal Technology Applications (FY76 and TQ - \$15 M BO): Produce fully tested technology for early commercial utilization of liquid-dominated hydrothermal resources. Principal goals and milestones for FY76 and TQ include: tests of various technologies prerequisite to the utilization of high-temperature high-salinity resources for electric power generation; design of a field test facility for improved components and subsystems; design of a test facility for components and subsystems for moderate- to high-temperature moderate-salinity resources; design of a thermal loop test for a typical moderate-temperature resource; evaluation of the potential of a volcanic hydrothermal resource; studies of applications other than electric power generation for low- to moderate-temperature resources.

d. Advanced Technology Applications (FY76 and TQ - \$6 M BO): Provide basic technological information on geopressured and hot dry rock resources. Principal goals and milestones for FY76 and TQ include: testing of new and existing wells to establish the natural gas content, chemical properties, and behavior under production conditions of geopressured aquifers. Methods for extracting thermal energy from a hot dry rock resource will be further developed at the Fenton Hill site in the Jemez Mountains, New Mexico. At Coso Hot Springs, California, the testing of a slim-hole drilling technique will be combined with characterization of another potential hot dry rock resource that may be of a different type.

e. Demonstration Projects (FY76 and TQ - \$0 M BO): Demonstrate that the generation of electric power by energy derived from liquid-dominated hydrothermal resources is a valid option, in order to instill confidence in industry, financial institutions, regulatory bodies, and local communities by direct involvement. Commercial-scale projects are essential to demonstrate reliability and favorable economics, and to demonstrate environmental and social acceptability. (Commercial acceptability of electric power generation has been demonstrated from a vapor-dominated hydrothermal resource at The Geysers, California. Only two other such reservoirs are now known to exist in the U.S.; these are in National Parks and therefore unavailable.)

Goals for FY76 and TQ are to commence preliminary design and planning studies, including cost-sharing initiatives. There are no identifiable significant milestones prior to FY 77, when preparations for proposed subsequent actions will be completed. Approval for Demonstration Plant #1, a 50 MW power plant using a binary, flashed steam, or hybrid conversion system coupled to a high-temperature liquid-dominated hydrothermal resource, will be sought in FY 78. A different type of hydrothermal resource and power conversion system will subsequently be proposed for Demonstration Plant #2, probably in a volcanic region.

f. Environmental Control and Institutional Studies (FY76 and TQ - \$3 M BO): Conduct research and baseline studies to support the establishment of environmental, health, and safety standards, and develop control technologies to meet them; analyze institutional factors affecting commercial development including siting criteria, and recommend appropriate actions or policies to reduce unnecessary or counterproductive barriers or to provide incentives; formulate and periodically update Federal program plans; assist local and regional planning. Principal goals and milestones for FY 76 and TQ include: continue development of control technologies for hydrogen sulfide emissions and subsidence; continue development of guidelines for EIA/EISs, site selection, and monitoring; commence cooperative regional/community planning studies and public awareness programs in California and on the Gulf Coast; commence studies of Federal, state and local regulatory, legal, leasing, tax, and other relevant socio-economic policies and problems; update Federal program definition.

g. Geothermal Resources Development Fund (Loan Guaranty Program) (FY76 and TQ \$0 M BO): Encourage private geothermal development by reducing the lender's financial risk. Principal goals and milestones for FY 76 and TQ include: commence planning and market assessment as a continuing function; analyze comments on proposed loan guaranty regulations and issue final regulations; start accepting loan guaranty applications; start issuing loan guaranties; propose amendments of PL 93-410 to authorize borrowing from the Treasury whenever moneys in the Geothermal Resources Development Fund are insufficient to meet current obligations arising from the Program, to pledge the full faith and credit of the United States to the payment of all guaranties issued under the Program, and to provide for the

collection of annual guaranty fees sufficient to cover administrative costs, and not to exceed three quarters of one percent to cover probable losses.

3. Management Plan:

The ERDA Geothermal Energy Program, a responsibility of the Assistant Administrator for Solar, Geothermal and Advanced Systems, is managed by the Director of the Division of Geothermal Energy (DGE). The six RD&D subprograms (2a through f, above) are implemented by the Assistant Directors for Research and Advanced Technology, for Resource Utilization, and for Policy and Planning. The Geothermal Loan Guaranty Program, responsibility for which is assigned to the Administrator by statute, is administered by DGE's Assistant Director for Administration.

DGE program funding is distributed among ERDA laboratories, private industry, universities and other nonprofit institutions, other Federal agencies, and state and local governments, with overall management and programming by Headquarters.

ERDA/DGE exercises its lead agency function for the Federal Geothermal Program through the interagency Geothermal Advisory Council, which is chaired by the Assistant Administrator for Solar, Geothermal, and Advanced Energy Systems, and through the Council's Staff Committee, which is chaired by the Director of DGE. Support is provided by interagency Panels for Resources, for Research and Technology, and for Institutional Barriers.

The total national effort in geothermal resource development includes much more than the Federal Program. DGE's communication and coordination with the non-Federal sector is accomplished in accordance with its Consumer Representation Plan (April 1976) and in cooperation with OPA and ISL. Its "out-of-house" programs, which also serve as an effective means of communication with the non-Federal sector, will be supplemented by the Geothermal Advisory Committee, whose membership includes representatives of state and local authorities, public interest groups, the academic community, and several sectors of private industry, under the "umbrella" of the GAC. DGE's Industrial Relations Branch, working with OPA, ISL, and ASGA, also implements broad industrial and public awareness programs. Communication and cooperation with other nations having significant geothermal energy programs are being established in coordination with AIA.

4. Resources

Operating Expenses in millions of dollars

<u>Responsible Individual</u>	<u>Program/ Subprogram</u>	<u>BRC</u>	<u>Funding For FY₂1976</u>		<u>Transition Quarter</u>	
			<u>Obs.</u>	<u>BO</u>	<u>BA</u>	<u>BO</u>
R.S.H. Toms	Engineering Research and Development	EB01	10.6	9.3	3.5	2.5
	Resource Exploration and Assessment	EB02	3.6	3.2	1.5	1.0
L.B. Werner	Hydrothermal Technology Applications	EB03	10.8	11.8	2.4	2.8
	Advanced Technology Applications	EB04	4.9	4.4	2.9	1.6
	Demonstration Projects	EB05	0	0	0	0
F.G. Blake	Environmental Control and Institutional Studies	EB06	3.0	2.5	1.4	0.9
E. H. Willis (acting)	Geothermal Resources Development Fund (Loan Guaranty)	EB07	0	0	0	0
TOTALS ¹			32.9	31.2	11.7	8.8

Plant and Capital Equipment in millions of dollars

<u>Responsible Individual</u>	<u>Program/ Subprogram</u>	<u>BRC</u>	<u>Funding For FY 1976</u>		<u>Transition Quarter</u>	
			<u>Obs.</u>	<u>BO</u>	<u>BA</u>	<u>BO</u>
E.H. Willis	Geothermal Energy	EB	0.62	0.49	0.20	0.15

¹Totals may not agree with sum of columns due to rounding.

²For FY76, obligational authority is shown (rather than nominal BAs) as more representative of actual program plans.

5. Additional Considerations and Special Issues

There are two major issues tied to DGE's program strategy that are critical to the effectiveness of the Federal Geothermal Program:

- o First, in order to reduce uncertainties in the assessment of geothermal resources, strong support is required from the Department of the Interior, in particular from the U.S. Geological Survey. The Survey's statutory programs of national and regional geothermal exploration and of assessment of the resource base are an essential element of overall Federal program planning. These programs are also essential support for the leasing and environmental impact assessment programs of the Bureau of Land Management, the Forest Service, and the Environmental Protection Agency. Reduction of the Survey's efforts would seriously hamper the national program.
- o Second, in order to encourage the growth of the fledgling geothermal industry, confidence must be developed in the industrial and financial communities that they can satisfactorily estimate the risks involved and that they can receive acceptable returns on investment. Of equal importance, confidence must be developed among state and local authorities, and in the general public, that environmental and other socioeconomic impacts can be controlled and on balance will be favorable. The most effective means for accelerating the development of this confidence in such a broad spectrum of diverse groups is by successful commercial-scale demonstrations that will provide "hands-on" experience, and by removal of counter-productive institutional barriers as soon as possible. The Loan Guaranty Program, which appears, on the basis of extensive interviews and comments received, to be attractive to small industries but not to large ones, cannot substitute for a demonstration program, because its requirements include a prior finding of economic feasibility. Any significant further delay in approval for the construction of commercial-scale power plant modules will make our goals for geothermal energy "on line" in the next decade impossible to achieve.

ERDA/DGE is therefore giving special importance not only to critical technical RD&D programs, but also to comprehensive program planning and analysis, to policy and economic research, to interagency cooperation, and to industrial, state, and local participation.

6. Signatory Understanding

- A. The Program Approval Document is recognized as being a satisfactory context for the FY 76 and TQ work activities.
- B. We accept for planning purposes the overall program logic presented in Section 3.1 of the Program Approval Document and the individual key project milestone schedules for each subprogram as set forth in Section 3.2 of the Program Approval Document.
- C. We accept Attachment 1 to the Program Approval Document as an acceptable list of FY 1976 and TQ work activities for program control purposes.
- D. We agree that those items identified on Attachment 1 by a double asterisk are considered to be critical items and the ASGA will keep the Administrator currently informed on progress and status.
- E. We designate the following as milestones that the Administrator chooses to control and any changes proposed must be approved by the Administrator:

<u>Detail/Project</u>	<u>Activity</u>	<u>Date</u>
Hydrothermal Technology Applications/Raft River	Decision to Construct 10 MW Thermal Loop	Aug 76
Environmental Control and Institutional Studies/Planning	Annual Program Definition Report to Congress (ERDA-86)	Oct 75
Geothermal Resources Development Fund/Loan Guaranty Program	Establishment of Regulations, Program Operational	May 76
	First Loan Guaranty Implemented	Sept 76

8. Signatory Approval

Submitted by:

Assistant Administrator for Solar,
Geothermal and Advanced Energy Systems

Date: JUNE 8, 1976

Approved by:

Administrator

Date: JUNE 8, 1976