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GEOTHERMAL RESERVOIR TECHNOLOGY RESEARCH AT THE DOE IDAHO OPERATIONS OFFICE

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ABSTRACT

Geothermal reservoir technology research projects managed at the Department of Energy Idaho Falls Operations office (DOE-ID) account for a large portion of the Department of Energy funding for reservoir technology research (approximately 7 million dollars in FY-95). DOE-ID managed projects include industry coupled geothermal exploration drilling, cooperative research projects initiated through the Geothermal Technology Organization (GTO), and other geothermal reservoir technology research projects. A solicitation for cost-shared industry coupled drilling has been completed and one award has been made in FY-95. Another solicitation for industry coupled drilling may be conducted in the spring of 1996. A separate geothermal research technology research, development and demonstration solicitation will result in multiple year awards over the next 2 years. The goals of these solicitations are to ensure competition for federal money and to get the Government and the geothermal industry the most useful information for their research dollars.

INTRODUCTION

The objectives of the DOE Geothermal Division and its Geothermal Reservoir Technology Research Program are to promote the commercialization of geothermal energy for the production of electrical power and to reduce the dependence of the United States foreign energy supplies. By accomplishing these objectives it is anticipated that jobs will be created and that the nation's geothermal industry will be better positioned to compete and win in the global marketplace. Government support for geothermal research and development is required because of the current economic weakness of the geothermal industry and the resulting lack of a diverse and robust research, development and exploration infrastructure.

DOE-ID geothermal reservoir technology research projects support geothermal exploration and reservoir characterization research and development. Industry and government forums and partnerships are used to help DOE determine immediate and longer term industry needs. Current geothermal reservoir technology research projects at DOE-ID are focussed on the development of techniques to minimize risks and costs for exploration and development for new and existing geothermal power resources. DOE recognizes that the earth science techniques required to accomplish these objectives encompass a diverse suite of interrelated disciplines. The research and research products from these disciplines are focussed on three main issues: exploration technology, production and injection technology.

The primary mechanisms for implementing research in these areas are research contracts and financial assistance. Summaries of DOE-ID activities in these areas are given below.

DOE FUNDED RESEARCH

FY-95 funding at DOE-ID for contracts and financial assistance managed at DOE-ID was approximately 4.9 million dollars. Most of the projects directly funded by DOE-ID are shown in Table 1. Technology transfer of DOE research products to the geothermal industry is accomplished through the GTO, publication of research results in peer reviewed journals and conference proceedings, formal workshops and informal discussions with other researchers and industry partners. FY-96 funding for

Research Group	Tasks or products
Lawrence Berkeley National Laboratory	TOUGH2, multi-phase model development and use, Geysers core petrophysics and micro earthquake research, Basin and Range field studies
Lawrence Livermore National Laboratory	Geysers core geophysical properties, reservoir saturation from seismic images, self-potential modeling
Oak Ridge National Laboratory	HCl volatility, high temp chemistry and thermodynamics
Idaho National Engineering Laboratory	Geysers reservoir engineering and modeling research, international support, low temperature resource assessment
University of Utah/Earth Sciences Resource Institute	Case studies, numerical analysis, geophysical methods, tracer studies, water/rock geochemistry, fluid inclusions,Geysers geology research, low temperature resource assessment, technology transfer, core repository.
Stanford	Theoretical, experimental and applied multi-phase relative permeability, flow and adsorption studies; injection optimization studies
UC San Diego	Theory and computer codes for multi-component high temperature and concentration equilibria models
University of Maryland	Field and laboratory studies of the evolution of volatiles in granitic systems

Table 1. Geothermal Reservoir Technology Research at DOE-ID in FY-95.

the national laboratories will not be handled through DOE-ID (except for the Idaho National Engineering Laboratory). The tasks listed in Table 1 are generally consistent with industry needs and priorities.

New Research Solicitation

Proposals are being solicited for reservoir technology research, development and demonstration projects. Due dates for the proposals are roughly every three months over the next 2 years. Selection criteria and other details are contained in the solicitation which can be obtained from DOE-ID by calling Ms. Carol Bruns at 208-526-1534. Proposals will be evaluated and selected on a competitive basis by a merit review committee composed of representatives from industry and government.

DOE - INDUSTRY COST SHARED RESEARCH

Industry involvement in DOE geothermal research is crucial for meeting the technology commercialization objectives of DOE. Feedback from our industrial partners on existing projects and industry proposals and participation in new projects provides DOE research initiatives with credibility and immediate and more certain technology transfer potential

Geothermal Technology Organization

The primary vehicle for DOE-Industry cost shared research since 1987 has been the Geothermal Technology Organization (GTO) with DOE providing 1.1 million dollars in financial support for 3.8 million dollars in industry sponsored research. GTO projects are listed in Table 2. Through the GTO, cooperative research and development objectives are met with a minimum of administrative and legal hurdles. The GTO was a viable cooperative research and development instrument before such agreements became popular throughout DOE.

Getting a proposal funded through the GTO

Proposals can be generated by GTO members or submitted to the GTO to determine industry interest. Potential research and technology development proposals generated by or submitted to the GTO are discussed at meetings held during geothermal conferences such as the annual Geothermal

Participants	Projects
Unocal, PG&E, NCPA, and Calpine	Geysers long term injection tests
California Energy Company Inc. (CECI), US Navy, University of Kansas	Structural interpretation at Coso geothermal field and adjacent regions
CECI, US Navy and the University of North Carolina	Subsurface fracture characterization by shear wave splitting
Unocal, Barber-Nichols, and PG&E	Increased efficiency of turbine driven gas compressors
CECI, US Navy, Duke University	Interpretation of Coso seismic data
Calpine, NCPA, PG&E, Central California Power Corp., Entropy, Inc.	Interpretation of non-condensable gas occurrences at the Geysers
Unocal, Calpine, NCPA, PG&E	Geothermal test of DOE developed tracers
Geothermal Resources International, Unocal, LBNL	Installation and operation of the NE Geysers micro seismic network.

Table 2. Geothermal Technology Organization participants and projects.

Resources Council meeting or other forums. A one time fee of $500 and your signature on the GTO charter are required to become a GTO member. The geothermal reservoir technology research program manager at DOE is then contacted to determine programmatic interest in the proposed research and available funding. If there is sufficient interest and funding, a more formal proposal is written and routed to GTO members, DOE-HQ, and DOE-ID for approval.

After you have had your proposal approved by the GTO and DOE, a cooperative agreement award is made by DOE-ID to fund your proposal. The time between proposal approval and award can take from 3 to 9 months but reimbursable costs can be incurred up to 90 days before the actual award.

Geysers-Lake County Effluent Pipeline Project

The Geysers-Lake County Effluent Project is a cooperative effort involving DOE, Lake County, Unocal, Calpine, Pacific Gas and Electric (PG&E), and Northern California Power Association (NCPA). The pipeline will solve two otherwise intractable problems. First, it will provide The Geysers geothermal field with water to inject into the reservoir and recover as electrical power generating steam. Restrictive California water laws preclude the impoundment of surface waters for injection at The Geysers. Second, it will solve a severe sewage disposal problem in Lake County. The lack of additional sewage treatment capacity has hindered construction and economic growth in Lake County.

This project solves these problems through the construction of a 29 mile long pipeline for the transportation of secondarily treated waste water and water from Clear Lake for injection into the Geysers geothermal reservoir. Typical pipeline flow rates are expected to be on the order of 5,200 gallons per minute. Previous GTO sponsored injection studies have identified promising areas for injection with potential electrical power generation increases at the Geysers of 50 MW to 100 MW due to the flashing of steam from pipeline injectate. A similar sewage injection project is being planned for the City of Santa Rosa.

DOE Industry Coupled Geothermal Exploration Drilling Solicitation

Oxbow Power Corporation has been awarded funding to drill an untested area near Carson Lake, Nevada. Information gathered during exploration, drilling, and testing activities resulting from awards under this solicitation will be non-proprietary and available to the geothermal community at large. Another solicitation may be held in the spring of 1996 depending on programmatic considerations and the availability of funding.

CONCLUSIONS

The DOE Reservoir Technology Research Program has attempted to address immediate industry needs and longer term DOE objectives in the areas of geothermal exploration and reservoir technology development through the implementation of contracts and financial assistance agreements through DOE-ID.

The GTO has been and will likely continue to be successful as a funding mechanism for cost-shared industry supported research. DOE and the GTO place a high priority on the demonstration and testing of research products and reservoir management strategies that have the most potential to meet immediate industry needs.

Funding opportunities for geothermal research exist in competitive solicitations run by the DOE-ID office. Recent examples of these solicitations include the recently completed cost-shared industry coupled drilling solicitation and the on going geothermal reservoir technology research, development and demonstration solicitation. Another solicitation for industry coupled drilling may be held in the spring of 1996 depending on programmatic considerations and the availability of funding.

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