

## **FY09 Geothermal Technology Program Enhanced Geothermal Systems Funding Opportunity Announcements Special Notice**

On February 6, 2009, immediately prior to the Stanford Geothermal Workshop (February 9-11, 2009), the U.S. Department of Energy's (DOE's) Geothermal Technology Program (GTP) intends to issue two Funding Opportunity Announcements (FOAs) to continue its partnership with the geothermal community to develop Enhanced Geothermal Systems (EGS). This special advance notice is intended to provide potential applicants the opportunity to develop partnerships and begin the process of gathering data to prepare their application. Brief descriptions of the two FOAs are as follows:

### **Systems Demonstration FOA (open for 90days)**

The purpose of this prospective FOA is to partner with field developers/operators to successfully create commercial-scale EGS reservoirs utilizing un-productive or under-productive wells. In addition, the development of "green field" sites for the purpose of employing EGS technologies will also be considered. The objective of this FOA is to seek projects in a variety of geologic formations that will quantitatively demonstrate and validate reservoir creation techniques that successfully sustain sufficient fluid flow and heat extraction to produce new and or increase existing geothermal electricity production. Reservoir creation includes, but is not limited to, enhancement of natural reservoirs that lack the permeability necessary to produce electricity in its current state. Subject to annual appropriations, DOE will provide \$49.0 million to awardees over the project period. Fifty percent cost share will be required.

### **EGS Research and Development FOA (open for 60 days)**

The purpose of this prospective FOA is to address key aspects of engineered reservoir creation, management, and utilization of EGS in environments with temperatures as high as 300°C and depths as great as 10,000 meters. GTP understands that research and development conducted under this FOA may only be able to advance existing technology incrementally. Areas of interest include:

- **Air Cooling** – To develop a lab-based analysis of hybrid-water/air systems, an examination the inter-action of turbine design and cooling needs to optimize/minimize performance/costs, and an examination of the output variability of air cooling systems to identify areas of opportunity to improve performance;
- **Drilling Systems** – To reduce the cost, while maintaining or increasing the rate of penetration and performance of drilling systems for use in hard rock in high temperature and pressure zones and deep wells;
- **High Temperature Downhole Tools** – To develop tools capable of tolerating the extreme environment of supercritical reservoirs (374 °C and 22 MPa for pure water). These instruments may include: temperature and pressure sensors, flow meters, fluid samplers, inclination and direction sensors, acoustic instruments (high and low frequency), resistivity probes, natural gamma ray detectors, epithermal neutron scattering gauges, rock density gauges (gamma and sonic), casing monitoring devices (e.g. cement bond logs and casing collar locators), fluid conductivity, pH indicators and well dimension probes (caliper).

- **High-Temperature-High-Volume Lifting** – To define the well fluids lifting requirements criteria required by the industry for the foreseeable future; review alternative lifting systems and their potential for development to meet industry requirements; and research, design, develop, test and demonstrate a well fluid lifting system which will provide lifting of well fluid to meet the foreseeable pressure, temperature and longevity needs of the EGS industry for the coming 10 years.
- **High-Pressure-High-Volume Pumping** – To define the pressure, flowrate and temperature requirements criteria for both stimulating and circulating fluids required by the industry for the foreseeable future; review alternative available and conceived surface pumping systems and their potential for development to meet industry requirements; and research, design, develop, test and demonstrate a pumping system for stimulating and for circulation to meet the foreseeable pressure, temperature and longevity needs of the EGS industry for the coming 10 years.
- **Integrated Chemical, Thermal, Mechanical and Hydrological Modeling** – To design a modeling tool that integrates thermal, mechanical, hydrological and chemical modeling
- **Image Fluid Flow** – To accurately image fluid in created and/or pre-existing fractures so as to map flow through the reservoir;
- **Induced Seismicity** - To identify causal mechanisms of induced seismicity and develop new and improved methods to use microearthquakes (MEQ) to image the physical properties of the reservoir and model the relationship between MEQ and injection and production;
- **Smart Tracers** – To develop reservoir tracers to record physical conditions in the reservoir using nano-electronics technology for injection into geothermal reservoir and recovery at production wells;
- **Stimulation Prediction Models** – To develop and validate model to predict a reservoir's response to a stimulation;
- **Supercritical Carbon Dioxide/Reservoir Rock Chemical Interactions** – To develop a chemical model or modify an existing chemical model capable of modeling the chemical interactions between supercritical carbon dioxide and EGS reservoir rocks of various compositions in aqueous and non-aqueous environments;
- **Systems Engineering/Analysis** - To develop/adapt lifecycle analytical models that address baseline systems cost, installed capital cost for different penetration levels, characterize and evaluate the impacts of specific technology improvements, and forecast potential employments for EGS, conventional hydrothermal, low temperature geothermal, coproduced fluids, ground source heating and cooling, and direct use;
- **Temporary Sealing of Fractures** – To develop techniques to temporarily limit the inflow of formation fluids into the wellbore during drilling for better control of the drilling process;
- **Tracers and Tracer Interpretation** – To adapt or develop reservoir tracers and/or tracer interpretation techniques that provide information beyond well-to-well connectivity such as fracture surface area or fracture spacing;
- **Zonal Isolation** – To isolate wellbore zones in high pressure and temperature

environments in open (uncased) and cased holes using packers, expandable tubulars or other methods capable of providing zonal isolation; and

- **Working Fluids for Binary Power Plants** – To identify non-azeotropic mixtures of working fluids for improved utilization of available energy in subcritical cycles, and characterize the composition, and thermophysical and transport properties of those mixtures; and to identify working fluids for supercritical cycles and trilateral cycles and characterize the composition, and thermophysical and transport properties of those working fluids.

These technology improvements are discussed in greater detail in the report, “An Evaluation of Enhanced Geothermal Systems Technology,” posted on the DOE website: [http://www1.eere.energy.gov/geothermal/pdfs/evaluation\\_egs\\_tech\\_2008.pdf](http://www1.eere.energy.gov/geothermal/pdfs/evaluation_egs_tech_2008.pdf). Subject to annual appropriations, DOE will provide \$10 million to awardees over the project period of up to three years. A minimum of 20% cost share will be required. Requests for R&D funding for mature technologies are encouraged to cost share at a level higher than 20%.

This Special Announcement is intended to provide potential applicants advance notice of two upcoming GTP FOAs. Prospective applicants should begin developing partnerships, formulating ideas, and gathering data in anticipation of the issuance of these FOAs scheduled for February, 6, 2009. Please do not respond or submit questions in response to this Special Announcement.