

## DE-FOA-0000522 Webinar Transcript

### **Slide 1:**

Greetings, I'm Chuck Christensen with the Department of Energy and I will be joined by Bill Vandermeer in this webinar, highlighting key areas of Funding Opportunity Announcement (or FOA) 522, entitled Geothermal Technology Advancement for Rapid Development of Resources in the U.S., which was posted on June 8<sup>th</sup>. This webinar will be posted on the Geothermal Technologies Program home page until the close date of the FOA, July 15<sup>th</sup>. All applications must be submitted by this date. DOE anticipates making awards by September 30<sup>th</sup>.

### **Slide 2:**

These are several one-time actions that need to be completed before submitting an Application in response to this FOA.

All application submissions are to be made via EERE eXCHANGE and answers to questions will be posted on the eXCHANGE website under this FOA, so applicants are encouraged to review the posted Questions and Answers daily through the full application due date. The screen shot on this slide shows the Funding Opportunity Announcements list in eXCHANGE. Once you click on the link for FOA 522 you may view the latest FOA amendment, access the latest Q&A (updated daily), or submit your application documents.

As a reminder, all questions related to the FOA should be submitted no later than July 12<sup>th</sup>, 2011 to FOA522@go.doe.gov.

### **Slide 3:**

Here is an overview of the Funding Opportunity Announcement Document structure. Part I is a description of the funding opportunity including Topic Area and phase descriptions, as well as information on a cost share waiver that was granted for certain awardees under this FOA. Part II is award information including award duration and anticipated funding levels by Topic Area. Part III is eligibility information. Part IV contains application and submission information including Mandatory Content as well as other required application materials. Part V is application review information including Merit Review Criteria and Program Policy Factors. Part VI is award administration information. Part VII is questions and agency contacts, and Part VIII is other information. There are several appendices included with the Funding Opportunity Announcement: First is definitions; second is Personally Identifiable Information, or PII; third is cost share information; and fourth is information on Technology Readiness Levels, or TRLs.

### **Slide 4:**

The main objective of this FOA is to accelerate the development and use of geothermal energy by 1) addressing the high exploration risks and costs of geothermal development and 2) the key technical

barriers for Enhanced Geothermal Systems, or EGS, as they relate to reservoir creation and sustainability.

There are six Topic Areas under this Funding Opportunity Announcement:

1. Advanced Exploratory Drilling Technologies
2. Advanced Well Completion Technologies
3. Zonal Isolation
4. Observation Tools and Data Collection Systems for Reservoir Stimulation
5. Geophysical Exploration Technologies
6. Geochemistry/Rock-Fluid Interactions

Additional detail will be provided on each Topic Area in subsequent slides of this webinar.

Please note that a single organization may submit separate applications to more than one Topic Area, with a maximum of five applications per organization as the Prime applicant.

**Slide 5:**

For this FOA, the Geothermal Technologies Program has included Technology Readiness Level (TRL) definitions to evaluate the maturity of evolving geothermal technologies. There are 9 TRL definitions, and this FOA is focused on TRLs 2 through 5.

TRL 1 means that basic principles for the given technological concept have been observed and reported. TRL 2 means that the technology concept and/or application has been formulated. An example of this might be a numerical model. TRL 3 means that analytical and experimental critical function and/or characteristic Proof of Concept has been completed. An example of this might be laboratory testing of system components or preliminary engineering design. TRL 4 means that component and/or system validation has been completed in a laboratory environment. An example here might be laboratory testing of a small scale submersible pump at room temperature. TRL 5 means that laboratory scale or similar system validation testing in a relevant environment has occurred. An example of this would be laboratory testing of packer components in a high temperature/high pressure environment. TRLs 6 through 9 include prototype testing and demonstration through system qualification and operation. Please refer to Appendix D for additional information on TRLs.

**Slide 6:**

The Period of Performance for all awards may be up to three years. DOE reserves the right to make an award for projects that include Phase I only, Phase II only, or both Phases I and II. The definitions for the Phases are shown on this slide and are tied to specific Technology Readiness Levels: TRLs 2 and 3 for Phase I and TRLs 4 and 5 for Phase II. Also, for the purpose of budget estimates, Budget Period 1 is Phase I and Budget Period 2 is Phase II. In order to proceed directly into Phase II, the applicant must provide Proof of Concept documentation with their application.

Under this FOA, DOE is allowing applicants to partner and have a different lead organization for each phase. Please refer to the latest FOA amendment for more information on this scenario.

This slide also shows estimated funding levels per topic per fiscal year. Also note that future funding beyond FY11 is dependent upon Congressional approval.

**Slide 7:**

Under this FOA, the minimum cost share requirement is 20% for both phases; however, DOE has granted a Phase I cost share waiver to certain entities conducting “Proof of Concept” activities at TRLs 2 and 3. (TRLs were explained in previous slides.)

In the event that a selected project includes subrecipients that are not the same type of entity as the prime recipient, then the applicability of the cost share waiver is dependent upon the entity type of each subrecipient.

Just to emphasize, the cost share waiver is only applicable to Phase I activities for eligible entities.

**Slide 8:**

There are 5 mandatory items that must be included with each application to this FOA. These mandatory items are also specified in detail in Parts I and IV of the FOA document. If any these items are not included in the application, it will not be considered for Merit Review.

The first mandatory item is the Technology and Performance Description, which includes the current state and cost of the technology, how the proposed project will improve the technology, lower the cost of the technology, and the impact of the improvement upon the LCOE. Also, specific performance metrics for the proposed topic area should be included in the Technology and Performance Description.

The second mandatory item is Levelized Cost of Electricity analysis. Applicants must use the GETEM model to estimate the impact of their technological improvement upon LCOE. The results of this analysis must also be presented in the Metrics Table format as shown on this slide.

**Slide 9:**

The third Mandatory Item that must be included with each application is a Commercialization Plan. This Commercialization Plan should identify the likely vehicle for moving the proposed technology into the geothermal market as applicable to the topic area. It should also identify a commercial entity or developer interested in furthering development of the technology after the government funding has been expended. Lastly, the Commercialization Plan should also provide a written commitment from the applicant that the work will be published in high-impact, peer-reviewed journals during the project period.

The fourth Mandatory Item is a Data Plan. The Data Plan should detail the data being generated by the project, the formats in which the data will be generated, and how data sets (including geospatial, performance, and cost data) will eventually be transferred to DOE.

The fifth and final Mandatory Item is the Proof of Financial Viability and Capability. This will assist DOE in determining the likelihood of the applicant to provide the required cost share. FFRDCs, State and Local Governments, and Educational Institutions are exempt from providing the Proof of Financial Viability and Capability.

Again, if any of the five mandatory content items are not included in the application, it will not be considered for Merit Review.

**Slide 10:**

As specified earlier, GETEM analysis is a mandatory component of applications. GETEM, or the Geothermal Electrical Technologies Evaluation Model, is a detailed model of the estimated performance and costs of currently available geothermal power systems that can be used to analyze and evaluate currently available technologies and to estimate the cost of certain technologies or improvements to those technologies at present and in the future. The reason that DOE is including GETEM analysis is to gauge which technologies might offer the most improvements for the taxpayer dollar. A link to download GETEM is shown on the slide, and a screenshot from GETEM is shown below for reference.

**Slide 11:**

GETEM is a macro-enabled spreadsheet that estimates LCOE based on user input. Scenarios are included for both hydrothermal and EGS systems, as well as binary or flash plants. At the top of the Input and Summary tabs is a block of cells that identify the scenario being evaluated, including LCOE. There is both a reference scenario and an improved scenario. The user defines the Reference Scenario, then inputs a multiplier that is applied to a particular input parameter, or technology, to represent a technology change or improvement.

For instance, one would apply an appropriate multiplier to represent the effect of a proposed improvement to the cost of drilling a production well, and the effect on LCOE would be displayed on both the Input and Summary tabs.

There are six Topic Areas under this FOA, and there are many technologies listed in the expandable dropdown boxes found on the left side of the GETEM screen. In particular, the expandable fields listed under "RESOURCE EXPLORATION", "RESOURCE CONFIRMATION", "WELL FIELD DEVELOPMENT", and "RESERVOIR DEFINITION" are most applicable to the Topic Areas in this FOA. GETEM also includes a "Read-me" file in the first tab found on the far left of the screen, and again, GETEM analysis is a mandatory component of applications.

**Slide 12:**

We will now present the individual topic areas by first providing the objectives and approaches and then presenting some of the technology challenges that currently face the industry in each topic area; the list of challenges is not meant to be all inclusive. Next we will list the specific performance targets and technologies of interest as listed in the FOA for each topic area.

The first topic area is “Advanced Exploratory Drilling Technologies”. The objective of this topic is to lower the cost and risk of drilling geothermal wells by targeting key cost drivers and developing non-traditional and/or innovative drilling technologies.

Some of the current technology challenges are slow rates of penetration, drill bit performance, frequent trips or long flat times, and component performance at high temperatures and pressures in corrosive environments.

The Performance Targets that must be presented by the applicants include a preliminary plan for integration into a full-scale rig or drill; and the Mandatory Content items listed in the FOA for all Topic Areas.

The Technologies of Interest include but are not limited to, innovative rock reduction technologies, advanced drilling bits, and casing while drilling systems.

**Slide 13:**

Topic Area 2 is Advanced Well Completion Technologies. The objective is to reduce well completion costs and increase geothermal well lifetimes. The approach is to lower well completion and maintenance costs and develop innovative well completion technologies.

Technology Challenges for this Topic Area include under-reaming systems, the high number of casing strings typically required for a geothermal well, mechanical failure of systems at high temperature, component level reliability in high pressure/high corrosivity environments, and the lack of measurement/logging systems during well drilling operations.

Performance targets include specifying the current state and cost of the technology, how the proposed project will improve the technology and impact LCOE, and inclusion of specific performance metrics.

Technologies of interest include under-reamers, leaner casing designs, pressure and corrosion resistant casing and coating materials, innovative well completion technologies, and logging-while-drilling systems.

**Slide 14:**

Topic Area 3 is “Zonal Isolation”. The objective of this Topic Area is to eliminate lost circulation zones and to facilitate the creation of multiple fracture zones by improving the performance and increasing the temperature and pressure range of operation of zonal isolation tools and technologies.

Some of technology challenges are temporary devices that leave damaging residues, existing systems that are not durable enough, and high differential pressures combined with larger borehole diameters.

In addition to the Mandatory Content required, the Performance Targets to be met are:

- Operating in wellbore diameters from 6 5/8” to 10 5/8”;
- Differential pressures of 6,000 psi or greater; and

- For Retrievable Tools, temperatures of 300°C or more.

For drillable hardware, the device should operate until mechanically removed. For retrievable hardware, the device should operate for 1,000 hours, at depths greater than 8,000 feet. Degradable non-mechanical packers should have by-products that do not damage the formation after degradation.

The technologies of interest include, but are not limited to: packers, tubular materials, valves, or non-mechanical diverters; and lost circulation materials that are drillable, retrievable, or degradable.

**Slide 15:**

Topic Area 4 is Observation Tools and Data Collection Systems for Reservoir Stimulation. The objective is to develop new data collection techniques to effectively understand reservoir evolution during EGS stimulation activities. The approach within this Topic Area is to advance data collection techniques, components, and tools.

Technology challenges include the lack of efficient monitoring and observation capabilities, the relatively low accuracy of subsurface measurements, and the durability of measurement devices.

Performance targets include sensors that are 50% cheaper and consume 30% less power than the 2011 model of a comparable sensor. Sensors should collect data at 10 to 1,000 Hz frequency, and last for at least 1,000 hours at 200°C. Seismic sensors should have high-sensitivity of 50 to 200 Volts/meter/second. Sensor systems should be able to operate for a period of years.

Technologies of interest include components and data collection techniques for high precision seismic monitoring, fluid flow, downhole pressure measurement, and other monitoring devices to support reservoir stimulation activities. Also, combinations of new sensor designs and innovative sensor placements are welcomed.

**Slide 16:**

Topic Area 5 is “Geophysical Exploration Technologies”. The objective of this topic is to improve blind resource discovery by better determining permeability at depth without drilling.

Some of the technology challenges are the inconsistent ability to predict temperature and permeability at depth, limitations in resolution and depth of sensors, and a lack of prescribed combinations of techniques.

For Performance Targets, applicants must present the mandatory content items listed for all Topic Areas, including the three listed on this slide.

Some of the technologies of interest include, but are not limited to, new geophysical surveying techniques, improved data interpretation techniques, combinations of survey systems in platforms or tools, high temperature logging tools; and improved remote sensing techniques.

Please note, for Topic Area 5, DOE will NOT accept or review applications proposing the development of existing shallow (or 2 meter) temperature surveys or tools; and temperature gradient, slimhole, or production well drilling.

**Slide 17:**

Topic Area 6 is Geochemistry and Rock/Fluid interactions. The objective of this Topic Area is to lower the upfront risk and cost of geothermal resource discovery and increase reservoir sustainability. The approach is to advance remote temperature prediction through better understanding of geochemistry and development of improved exploration tools.

Technology challenges include the inability to accurately predict temperature at depth, the inability to accurately predict permeability using chemical signatures, the lack of robust geochemistry tools, and expensive reconnaissance tools.

Performance targets under this Topic Area include specifying the current state and cost of the technology, how the proposed project will improve the technology and impact LCOE, and inclusion of specific performance metrics.

Technologies of interest include new geothermometers and geochemical tools, techniques that use chemical signatures to understand permeability, remote prediction of temperature at depth using geochemical signatures, and fluid/rock interaction research.

**Slide 18:**

We will now discuss the Merit Review Criteria and how applications will be evaluated. Prior to a comprehensive merit evaluation, DOE will perform an initial compliance review in accordance with Section 5 of the FOA, entitled “Application Review Information”. If an application passes this initial review then it may be evaluated against the merit review criteria. There are three merit review criteria for this FOA, each with its own weight and bulleted measures.

The criterion shown on this slide is “Technical Merit, Innovation, and Impact”, which carries a weight of 50% and includes “Scientific Innovation and Technical Merit” and “Impact of Technology Advancement”. “Scientific Innovation and Technical Merit” includes:

- The extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- The degree to which the current state of the technology and the proposed advancement are clearly described;
- The extent to which the application demonstrates how the applicant will move the state of the art to the proposed advancement; and
- The sufficiency of technical detail.

“Impact of Technology Advancement” includes:

- How the project supports the topic area description; and
- Probability of, and potential impact on, lowering the LCOE.

**Slide 19:**

The next criterion is “Project Research and Commercialization Plan”, with a weight of 30%. This criterion includes:

- Research approach and work plan;
- Identification of technical risks;
- Baseline, metrics, and deliverables; and
- Commercialization Plan.

“Research approach and work plan” includes the approach and critical path; task descriptions; and budget and spend plan.

“Identification of technical risks” includes key technical risk areas and mitigation strategies.

“Baseline, metrics, and deliverables” includes the baseline, metrics and milestones; and quantifiable metrics, milestones, and mid-point deliverables.

“Commercialization Plan” includes target market, competitors, and distribution channels; barriers to market penetration, including mitigation plan; and comprehensiveness of the commercialization plan.

**Slide 20:**

The third and final Merit Review Criterion is Team and Resources, weighted at 20%. This criterion includes the capability of the Principal Investigator(s) and proposed team including their qualifications, relevant expertise, and time commitments. It also includes the sufficiency of facilities, and degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of their proposed technologies. It also includes the level of participation of project partners as evidenced by letters of commitment. That concludes the Merit Review Criteria for this FOA.

There are also Other Selection Factors that may be applied by the Selection Official. These are: project diversity, in conjunction with the existing portfolio of projects funded by DOE; the degree of technical and environmental risks and benefits associated with a project; degree that the applicant’s proposed cost share would best leverage DOE’s resources; the level of industry involvement and ability to commercialize the technology; the degree to which students are integrated into the work plan or to which educational and workforce development are included; and lastly, the financial capability/viability of the prime applicant.



**Slide 21:**

This is the concluding slide for our webinar, and here are some reminders. Please remember to complete registration requirements as soon as possible. Also, refer to the FOA for all requirements, and please remember to all questions related to the FOA to the email box [FOA522@go.doe.gov](mailto:FOA522@go.doe.gov). Also, the FOA can be downloaded at the link shown on the slide, GETEM can be accessed at the link shown on the slide for LCOE calculations, and this webinar will be posted on the GTP home page at the link shown on the slide. The DOE Geothermal Technologies Program thanks you for your interest.