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DOE Investing $11.5 Million to Advance Geologic Carbon Storage and Geothermal

Exploration

WASHINGTON – The The U.S. Department of Energy (DOE) has announced the selection of eight new research and development projects to receive a total of $11.5 million in federal funding under DOE's Subsurface Technology and Engineering Research, Development, and Demonstration Crosscut initiative. The new projects are focused on furthering geothermal energy and carbon storage technologies, and will be funded by the Office of Energy Efficiency and Renewable Energy's Geothermal Technologies Office (GTO) and the Office of Fossil Energy's (FE) Carbon Storage program.

"The projects selected today will advance our ability to store captured carbon pollution from the burning of fossil fuels and improve our understanding of renewable geothermal resources – both of which will help us achieve our nation's climate and clean energy goals," said DOE's Under Secretary for Science and Energy Franklin Orr. "The announcement of these selections also underscores the importance of the crosscutting initiatives that Secretary Moniz has encouraged throughout DOE. Sharing expertise and experiences across the Department is helping us make progress on challenging energy science and technology that demand expertise across the science and engineering disciplines."

Many opportunities exist to use the rocks beneath the earth's surface to improve the way we use energy – including next generation geothermal energy, safely storing greenhouse gases that are contributing to climate change, mitigating the impacts of fossil energy development, and nuclear waste storage and disposal. Across those varied challenges, the Subsurface Crosscut addresses a number of common technical issues. In particular, it plans and implements research, development, and field demonstrations emphasizing four pillars: Wellbore Integrity, Subsurface Stress and Induced Seismicity, Permeability Manipulation, and New Subsurface Signals.

Today's selections fall under two objectives: (1) deploy and validate prototype carbon storage monitoring, verification, and accounting (MVA) technologies in an operational field environment, and (2) identify and validate new subsurface signals to characterize and image the subsurface, advancing the state of knowledge in geothermal exploration.

Projects under the first objective are required to deploy technologies or techniques associated with near-surface and/or subsurface monitoring at a large- or commercial-scale site for validation. These projects are:

- Robust In Situ Strain Measurements to Monitor CO2 Storage: Clemson University (Clemson, SC) and the Georgia Institute of Technology aim to advance the design of optical fiber borehole strainmeters, which measure deformation of the Earth, and test the improved designs at a commercial-scale injection site. The project seeks to demonstrate a monitoring method that would improve the ability to track changes in pressure and strain in order to identify the location of possible release pathways. DOE: $1,775,434

- Advancing the Integration of Geophysical and Reservoir Simulation Tools to Monitor CO2 Movement and Storage Permanence: The Colorado School of Mines (Golden, CO), the United States Geological Survey, and the University of Utah seek to advance the integration of geophysical and reservoir simulation tools to monitor CO2 movement and storage permanence at a site in Farnsworth, TX. Researchers will deploy a system of technologies to understand the migration and long-term distribution of CO2 in the subsurface, including a modified controlled source electromagnetic remote-sensing technology. DOE: $1,114,398

- Automated High Power Permanent Seismic Source System for Long-Term Monitoring of Subsurface CO2 Containment and Storage: GPUSA Inc. (Chatsworth, CA), Lawrence Berkley National Laboratory, and the Carbon Management Canada Containment and Monitoring Institute will seek to validate, in an operational field environment, GPUSA's powerful low-cost automated borehole seismic source systems. The project will deploy two downhole seismic sources: one for high-

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resolution cross-well surveys and one for high-resolution vertical seismic profile surveys. Both types of sources are needed for effective CO2 monitoring, and both will be designed for permanent installation. DOE: $683,699

- Field Demonstration of the Krauklis Seismic Wave in a Novel MVA Method for Geologic CO2 Storage: The University of North Dakota Energy & Environmental Research Center (Grand Forks, ND) – along with Seismos Inc., CMG Inc., and Denbury Resources Inc.—will deploy for validation a new, low-impact method to monitor injected CO2 from the surface at the Bell Creek Field in southeastern Montana. The method is noninvasive and employs a new subsurface signal, the Krauklis wave (K wave), which has unique propagation and frequency characteristics. The system has the potential to mitigate several shortcomings of traditional seismic monitoring methods, such as high cost, disruptive surface impacts, and long intervals between surveys, while providing timely, actionable information to the field operator. DOE: $2,475,424

- Validation of MVA Tools for Offshore Carbon Capture and Sequestration: Novel Ultra-High-Resolution 3D Marine Seismic Technology Integrated with Coring and Geochemistry: The Gulf Coast Carbon Center at the Bureau of Economic Geology, a unit of the Jackson School of Geosciences at University of Texas at Austin (Austin, TX), will deploy and validate a novel, ultrahigh-resolution 3D marine seismic technology for carbon storage MVA at the Tomakomai Site, a fully developed carbon capture and storage project offshore the Japanese island of Hokkaido. The project seeks to demonstrate significantly improved spatial resolution over a commercially meaningful offshore area with improved accuracy and economic viability, thus decreasing the cost and uncertainty in the measurements. DOE: $2,498,656

The projects selected under the second objective will develop new approaches to characterize and image subsurface systems. These projects are:

- Development of a Novel, Near Real Time Approach to Geothermal Seismic Exploration and Monitoring via Ambient Seismic Noise Interferometry: Baylor University (Waco, TX), the University of Nevada–Reno, and Hi-Q Geophysical Inc. will advance the state of the art in geothermal exploration and monitoring through the development of new computer hardware and software. The team will build a 150-node seismic system consisting of commercial, off-the-shelf digitizer/recorders and geophones augmented by a device called the RaPiER, which is based on the Raspberry Pi single-board computer. The team will integrate the RaPiER-based seismic system with ambient-noise signal processing software developed at the University of Nevada–Reno and then perform validation tests at Baylor University and at two geothermal sites in Nevada. DOE: $879,802

- Geothermal Fault Zone Dilatancy and Fluid Imaging through Integrated Geophysical, Geological, Geochemical and Probabilistic Analysis: The University of Utah (Salt Lake City, UT), Quantec Geoscience Inc., and Geotech Ltd. will advance geothermal energy development by improving technologies that map fluid-bearing, permeable subsurface fractures connected to high-temperature heat sources. Drawing upon several new in-house technology developments, the team will integrate electromagnetic and seismic geophysics, structural geology, and isotope geochemistry to demonstrate that it is possible to discriminate fault zones in the subsurface carrying high-temperature geothermal fluids. DOE: $620,000

- A Novel Approach to Map Geothermal Permeability Using Passive Seismic Emission Tomography and Joint Inversion of Active Seismic and EM Data: U.S. Geothermal Inc. (Boise, ID), Lawrence Berkeley National Laboratory, and Optim Inc. will work to advance the imaging and characterization of geothermal permeability. Geophysical techniques have advanced, yet still fail to consistently image permeability, and no technique to effectively and robustly map subsurface permeability of geothermal resources has been developed. The techniques developed by the team will be validated at the San Emidio Geothermal Plant in Nevada, where the current geothermal resource produces 9 net megawatts, and at Crescent Valley, NV, where a commercial geothermal resource has yet to be identified. DOE: $1,497,016

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