Summary

GroundMetrics, Inc.
Borehole-deployed electric field sources and sensors for permanent monitoring of CO2 sequestration in deep reservoirs
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Topic: 13, Subtopic 13.b

Statement of the Problem or Situation that is Being Addressed – Mapping the distribution of CO2 injected into a subsurface formation is a critical requirement for monitoring, verification, and accounting (MVA) of CO2 sequestration. Most proposed schemes involve injecting CO2 into a brine aquifer multiple kilometers below ground. There is presently no existing remote sensing technology that can reliably and rapidly differentiate two fluids, such as water and CO2, in a deep subsurface formation over the area needed for CO2 MVA.

Statement of How this Problem or Situation is Being Addressed – One physical property that is distinctly different between CO2 and brine is their electrical resistivity. The newly developed borehole-to-surface electromagnetic (BSEM) method has been shown to map resistivity contrast in a deep hydrocarbon reservoir at distances of up to 4 km from the borehole. However as presently practiced, the EM source used for BSEM would be prohibitively expensive and unreliable if used for permanent monitoring, and safety concerns will likely prevent, or severely limit, its use in the US for related applications in imaging hydrocarbon reservoirs. GroundMetrics Inc (GMI) has developed an innovative EM source design that completely bypasses the present source problems. In Phase I GMI and collaborators will perform advanced numerical simulations to compare the new source with the existing BSEM source configuration and one being studied at Lawrence Berkeley National Laboratory. In addition we will conduct a verification test of the simplest embodiment of the source at a borehole made available by the Big Sky Carbon Sequestration Partnership (BSCSP), one of the DOE's seven Regional Carbon Sequestration Partnerships. In Phase II we will design and build a practical BSEM source that can be used to monitor the injection of CO2 slated to begin at BSCSP's Kevin Dome formation in 2014. Phase I will be the springboard for a Phase II program that will not only pioneer the use of a new type of deep EM imaging technology in the US, but provide actual value to a DOE CO2 sequestration site.

Commercial Applications and Other Benefits – There is worldwide public concern and considerable projected economic impact regarding the contributions of anthropogenic CO2 to climate change. Developing a reliable, economic method for MVA of CO2 sequestration is most likely critical for future carbon capture and storage programs. Very extensive parallel applications exist in imaging the oil-to-water contact in hydrocarbon reservoirs. There are approximately 7,000 square miles of oil fields in the U.S. and approximately 15,000 square miles in the rest of the world that are suitable candidates for installation of the Phase II technology.

Keywords: CO2 Sequestration, CO2 Monitoring, Resistivity Mapping, Borehole-to-Surface EM, CO2 Saturation, Reservoir Imaging, Enhanced Oil Recovery, EM Survey.

Summary for Members of Congress: The proposed technology offers the first way to image CO2 that has been injected onto a long-term storage site. The technology can also be used to image a hydrocarbon reservoir to increase net production, and to locate bypassed oil.