Carbon-Dioxide-Enhanced Oil Production from the Citronelle Oil Field in the Rodessa Formation, South Alabama

DE-FC26-06NT43029

Goal

The partners Alabama A&M University, Denbury Resources Inc., Geological Survey of Alabama, Southern Company, University of Alabama, University of Alabama at Birmingham, and University of North Carolina at Charlotte will conduct CO_2 injection tests in Citronelle oilfield in Mobile County, AL. The project will introduce CO_2 enhanced oil recovery (EOR) for tertiary recovery from Alabama's uniquely structured oil reservoirs, providing oilfield operators and CO_2 producers with improved estimates of oil yields from EOR and the capacity of depleted reservoirs to sequester CO_2. The research work will improve the reliability of computer simulations of oil yield from CO_2-EOR and calculations of sequestration capacity and the rate at which CO_2 can be introduced into underground formations. The simulations of Citronelle field will be integrated with computer visualizations of the migration of oil, water, and CO_2, making the results accessible to reservoir engineers, geologists, utility planners, and climate-change modelers.

Performers

University of Alabama at Birmingham
Birmingham, AL

Alabama Agricultural and Mechanical University
Normal, AL

Denbury Resources Inc.
Plano, TX

Geological Survey of Alabama
Tuscaloosa, AL

Southern Company
Birmingham, AL

University of Alabama
Tuscaloosa, AL

University of North Carolina at Charlott
Charlotte, NC

Results

Agreement to begin work on the project was expected to be reached during February 2007.

Benefits

A successful demonstration of the technology in this project could open the door to new commercial CO_2 EOR and sequestration efforts across the Nation, including types of reservoirs where CO_2 EOR has so far not been applied, offering a potential two-for-one solution to the United States' energy security and environmental concerns.

Background

CO_2 EOR, is a well-established method for increasing oil recovery from the Permian Basin oilfields of Texas and New Mexico and in the Williston Basin of North Dakota and Montana. Denbury Resources has also been successful in applying the technique in Mississippi oilfields. Typically 20 percent more of the original oil present in a reservoir at the start of production can be recovered using CO_2 EOR. A recent study by Advanced Resources International of Arlington, VA, estimated that 64 million additional barrels of oil could be recovered from Citronelle field using this technique. When production is complete, the reservoir and adjacent formations can provide sites for storage of CO_2 produced from combustion of fossil fuels in power plants and other processes generating large quantities of CO_2. Southern Company is evaluating the capacity of such reservoirs as possible locations for permanent sequestration of CO_2 separated from coal and natural gas combustion products in its power plants.

Summary

Citronelle field is an ideal site for CO_2 EOR and sequestration, from both the reservoir engineering and geological perspectives. The field is mature and waterflooded, with existing infrastructure including deep wells and consists of fluvial-deltaic sandstone reservoirs in a simple structural dome. Because of the presence of the regionally extensive Ferry Lake Anhydrite seal, four-way structural closure, and lack of faulting, it is naturally stable with respect to CO_2 storage. However, the geology of the heterogeneous siliciclastic rocks in this field is very different from those where CO_2 EOR has been applied commercially, such as in the carbonate strata of the Permian and Williston basins. The proposed demonstration will introduce CO_2 EOR for tertiary recovery from Alabama's uniquely structured energy resources and thus realize benefits to the Nation from additional petroleum production.

Current Status (February 2007)

Agreement to begin work on the project is expected to be reached during February 2007.

Funding

This project was selected in response to DOE's Oil Exploration and Production solicitation DE-PS26-04NT15450-2C, February 10, 2004.

Publications

J. C. Pashin and R. A. Esposito, "Citronelle Dome: A Giant Opportunity for Multi-Zone Carbon Storage and Enhanced Oil Recovery in the Mississippi Interior Salt Basin of Alabama," Annual Convention and Exhibition of the American Association of Petroleum Geologists, Long Beach, CA, April 1-4, 2007.

R. A. Esposito, J. C. Pashin, and P. M. Walsh, "Citronelle Dome: A Giant Opportunity for Multi-Zone Carbon Storage and Enhanced Oil Recovery in the Mississippi Interior Salt Basin of Alabama," 2007 Annual Convention of the Gulf Coast Association of Geological Societies and the Gulf Coast Section of the Society for Sedimentary Geology, Corpus Christi, TX, October 21-23, 2007.

Project Start: January 1, 2007
Project End: December 31, 2012

Anticipated DOE Contribution: $2,999,404
Performer Contribution: $3,031,773 (50 percent of total)

Contact Information

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