the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Actualistic and Geomechanical Modeling of Reservoir Rock, CO_2 and Formation Fluid Interaction, Citronelle Oil Field, Alabama

Background

Increased attention is being placed on research into technologies that capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and, in turn, mitigating global climate change without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCS specialties that are currently under-represented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) has selected 43 projects to receive more than $12.7 million in funding, the majority of which is provided by the American Recovery and Reinvestment Act (ARRA) of 2009, to conduct geologic sequestration training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects will include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

NETL is partnering with the University of Alabama (UA) to conduct a three-year study of the Citronelle field located in Mobile County, Alabama, to determine the diagenetic (physical, chemical, and biological) alteration of reservoir rock and formation fluid properties due to injection of supercritical CO_2 (CO_2 that has been subjected to conditions of temperature and pressure that give it the properties of both a liquid and a gas) into mature, conventional hydrocarbon reservoirs. The study will use comprehensive geochemical assessments of core and formation fluid from

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PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2012

COST

Total Project Value
$299, 966

DOE/Non-DOE Share
$299,966 / $0

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

the Citronelle field to test a reactive transport model for prediction of supercritical CO_2-fluid-rock interactions. This modeling can be used to predict dissolution and/or mineral trapping in the reservoir rock and guide engineering, assessment of sequestration capacity, development, and monitoring of CO_2 sequestration sites.

The Citronelle oil field (Figure 1) is an ideal site for CO_2 sequestration because of its geology and the pre-existing CO_2 infrastructure in the region. The Citronelle field is currently the focus of an on-going CO_2-enhanced oil recovery (EOR) project led by UA and NETL. CO_2-EOR has been viewed as the most promising near term approach for CO2 sequestration, due to the economic return from extracted oil. Thus, this study will be highly relevant to emerging technologies. Also, a state-of-the-art geologic model of the Rodessa Formation reservoir, a major oil and gas reservoir in the East Texas Basin and promising EOR target, has been created as a result of the on-going CO_2-EOR DOE project.

Goals/Objectives

The main goal of the project is to develop a comprehensive geochemical model to predict supercritical CO_2-fluid-rock interactions in the Citronelle oil field. The project objectives include:

- Reservoir geochemical characterization performed on reservoir and seal rock samples from the Rodessa Formation of the Citronelle site.
- Fluid geochemistry analysis of solutes in pre- and post-injection reservoir aqueous pore fluids.
- Geochemical modeling of CO_2-fluid-rock interaction.
- Comparing the geochemical modeling with reservoir characteristics.

Benefits

Overall the results of the project will make a vital contribution to the scientific, technical, and institutional knowledge base needed to establish frameworks for the development of commercial-scale CCS. The results of this research are expected to provide technological advancements in modeling and predicting the behavior of rock-fluid interactions of CO_2 storage reservoirs, particularly in combined CO_2 sequestration/enhanced oil recovery operation projects.

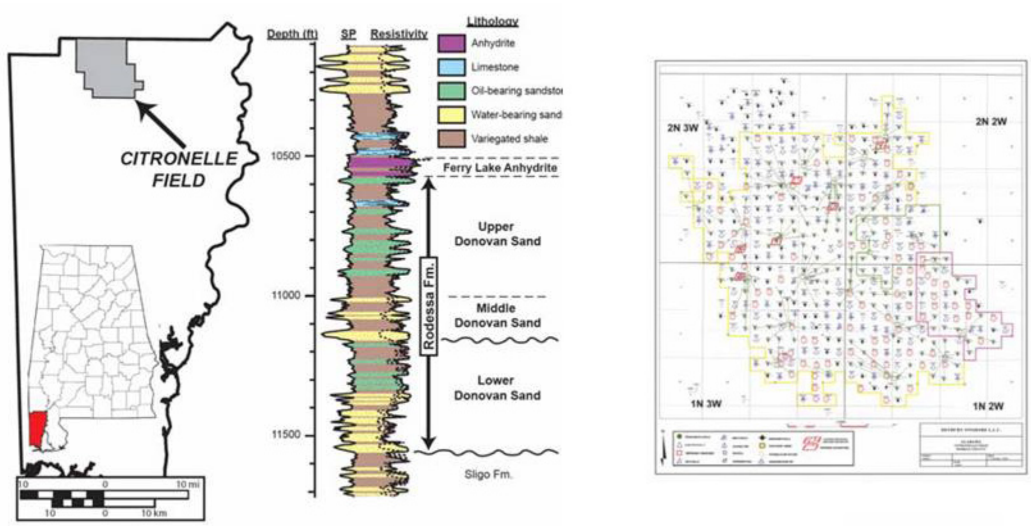

Figure 1. Location and detailed map of wells in the Citronelle field with a display of characteristic log signatures of reservoir and non-reservoir facies in the Rodessa Formation.