the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Assessment of Factors Influencing Effective CO_2 Storage Capacity and Injectivity in Eastern Gas Shales

Background

The need exists to further conduct research on carbon sequestration technologies to capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer the potential for reducing CO_2 emissions, thereby mitigating global climate change, without adversely influencing energy use or hindering economic growth. Deployment of these technologies in commercial-scale applications requires determination of the existence of geologic formations capable of (1) sequestering large volumes of CO_2; (2) receiving CO_2 at an efficient and economic rate of injection; and (3) retaining CO_2 safely over extended periods. Research efforts are currently focused on several geologic storage formation types: deltaic, coal/shale, fluvial, alluvial, strandplain, turbidite, eolian, lacustrine, clastic shelf, carbonate shallow shelf, and reef. Basaltic interflow zones are also being considered as potential reservoirs. Organic shales can be found within multiple storage formation types. These formations contain different fluids such as saline water, oil and natural gas.

The DOE National Energy Technology Laboratory (NETL) is sponsoring a research project to examine the ability of organic shale formations to act as CO_2 storage formations as part of their CO_2 sequestration research efforts.

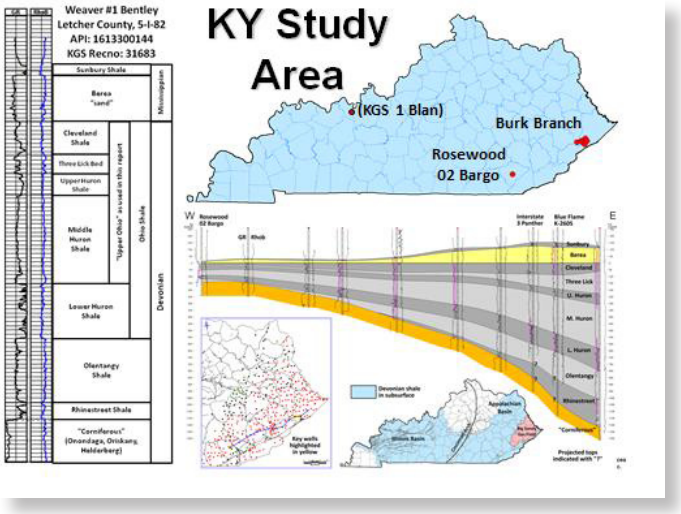

Figure 1: Key formation characteristics for planned CO_2 injection well test in Kentucky

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PARTNERS

New York State Research and Development Authority
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PROJECT DURATION

Start Date
9/1/2010

End Date
8/31/2012

COST

Total Project Value
$1,999,041

DOE/Non-DOE Share
$1,345,541/ $653,500

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U.S. DEPARTMENT OF ENERGY

Shale, the most common type of sedimentary rock, is characterized by thin, horizontal layers of rock with very low permeability, particularly in the vertical direction. Many gas shales contain one to two percent organic material in the form of hydrocarbons, which provide an adsorption substrate for CO_2 storage similar to CO_2 storage in coal seams.

Project Description

This project is designed to expand on previous and ongoing research to assess factors influencing effective CO_2 storage capacity and injectivity in selected eastern organic shale formations. The proposed work addresses approaches and/or technologies needed to improve injectivity and utilization of pore space and is specifically intended to promote better understanding of CO_2 trapping mechanisms leading to improved storage permanence and capacity estimates in gas shales. Advanced Resources International (ARI) project team will assess the effects of CO_2 storage on storage and injectivity given variable gas shale formation types, rock properties, and stratigraphic and structural properties. This work builds on previous research efforts, primarily in New York and Kentucky, assessing the CO_2 storage potential of gas shales. The primary focus will be on establishing the formation engineering and operational requirements needed to overcome the constraints imposed by shale formations and achieve cost-effective CO_2 storage. The research will include modeling and characterizing eastern organic shales to better understand their ability to act as storage formations and characterizing economic concerns and constraints that will help determine how to make shale storage cost-effective.

ARI is working with two sets of project partners: research organizations and industrial partners. The research organizations are contributing results from past and ongoing efforts to begin to characterize the potential of eastern organic shales to act as storage formations for CO_2. The industrial partners include several oil and gas operators that are currently involved in drilling and producing eastern shale wells. These companies are contributing (1) data related to selected wells in organic shales; (2) well sites for data gathering and/or injection tests; and (3) supplies of CO_2 for the injection tests. The effort is also supported by numerous state agencies.

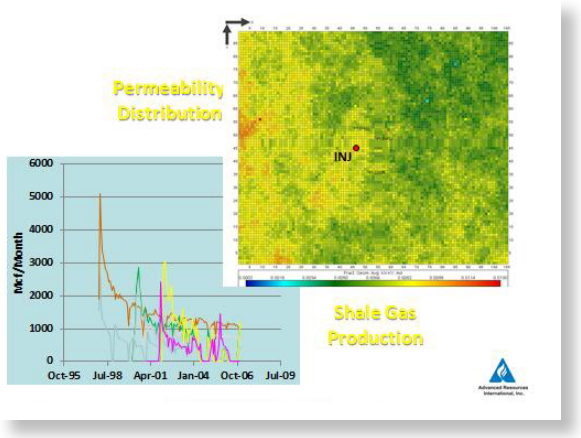

Figure 2: Simulation Results for Planned Kentucky Injection Test

Goals/Objectives

In this project, investigators will assess factors influencing effective CO_2 storage capacity and injectivity in selected eastern gas shale formations including the Marcellus shale, the Utica shale and equivalent shales in Vermont, and the Devonian Ohio shale. Project results will help to better understand the characteristics of eastern organic shales and their ability to act as a potential storage mediums for CO_2 emissions. Project objectives include:

- Analyzing data on the formation properties of selected eastern organic shales.
- Developing (through formation modeling) a better understanding of the characteristics of shales that impact CO_2 sealing integrity, storage capacity, and injectivity.
- Verifying this understanding of shale characteristics through targeted small-scale CO_2 injection tests to provide additional insight on CO_2 injection operations and monitoring.
- Testing a new technology for predicting the movement and fate of CO_2 in organic shales that can potentially be used before the start of CO_2 injection.
- Characterizing the potential constraints to economical CO_2 storage in organic shales.
- Assessing approaches for development of cost-effective CO_2 storage than overcome such constraints
- Developing a basin-level characterization of the CO_2 storage capacity and injectivity of selected eastern shale formations.

Benefits

The overall effort will provide greater insight into the potential for organic shale formations in the Eastern United States to safely and permanently store CO_2. The information gained from this endeavor will further DOE efforts to refine a national assessment of the capability and capacity for potential CO_2 storage in eastern organic shale formations.

Specifically, the project's ability to develop and utilize eastern organic shale formations for CO_2 storage could contribute significantly to the management of CO_2 emissions from various emission sources located in the Eastern United States.