the ENERGY lab

PROJECT FACTS

Carbon Sequestration

"Carbonsheds" as a Framework Optimizing U.S. CCS Pipeline Transport on a Regional to National Scale

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 Duke University (Duke) to use "carbonsheds," a concept developed by Duke, as a framework for optimizing CO_2 transport on an integrated technical, economic, societal, and environmental basis. Duke defines the carbonsheds concept as a region in which the estimated cost of transporting CO_2 from any (plant) location in the region to the storage site it might use is more cost effective than piping the CO_2 to a storage site outside the region. Duke has mapped out carbonsheds on a regional-to-national scale using Geospatial Information System (GIS) software (Figure 1). The principal inputs to GIS are the locations of all storage sites to be considered and a cost map for pipeline construction, operation, and maintenance that was developed from digital maps of U.S. land cover types, surface slopes, major infrastructure, and demographics. The end result subdivides the country into regions of economically efficient CO_2 transport from a range of possible source locations to a major sink.

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U.S. DEPARTMENT OF ENERGY

PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2012

COST

Total Project Value
$298,633

DOE/Non-DOE Share
$298,633 / $0

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

The scope of this project will include estimations of optimal CO_2 pipeline transport pathways from possible CO_2 capture sites to possible storage options. Computational modeling is being coupled with GIS to characterize and optimize the transport system under current and possible future technological, economic, social, and environmental constraints. A key source of information for the effort will be the National Carbon Sequestration Database and Information System (NATCARB). NATCARB is a project designed to explore the geologic sequestration of CO_2 by linking geologic and emission databases from several regional centers into a single interactive mapping system. Duke will use GIS to integrate the NATCARB data with other available information to build geographically based economic and environmental models of CO_2 transport on a regional-to-national scale. These models will then be used to explore system design options and their dynamics under possible national economic/policy scenarios.

Goals/Objectives

The goal of the project is to broaden and improve the approach for defining carbonsheds and for understanding how these regions might evolve with time under different carbon mitigation scenarios. Project objectives include:

- Carbonshed analysis with the other major types of potential CO_2 storage sites identified and catalogued by NATCARB: carbonate saline reservoirs, oil and gas reservoirs, and unmineable coal seams.
- Examining the potential offshore extension of U.S. carbonsheds where sub-seafloor CO_2 storage may be viable.
- Exploring the impacts of different economic/policy scenarios on the future demand for CO_2 transport within different carbonsheds using socio-economic modeling.

Benefits

Overall the project will provide insight into and future understanding of CCS transport development. Results from the study will illustrate the infrastructure demands, needed for safe and effective CCS in the future. The students involved in the project will graduate with a whole-systems, multidisciplinary understanding of CCS.

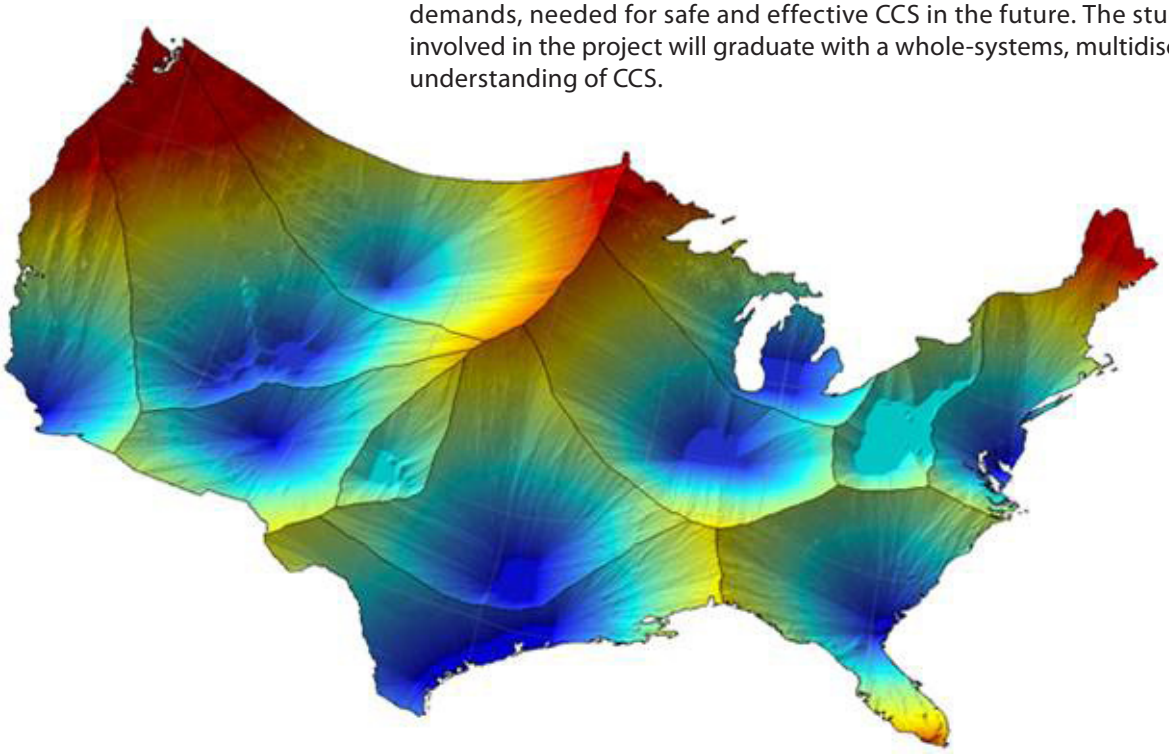

Figure 1. Perspective image of carbonsheds for saline reservoirs identified by NATCARB as potentially major U.S. CO_2 storage sites. The color blue indicates a region of economically efficient CO_2 transport from a range of possible source locations to a major sink.