



the **ENERGY** lab

PROJECT FACTS

Carbon Sequestration

Southeast Regional Carbon Sequestration Partnership—Validation Phase

Background

The U.S. Department of Energy (DOE) has selected seven partnerships, through its Regional Carbon Sequestration Partnership (RCSP) initiative, to determine the best approaches for capturing and permanently storing carbon dioxide (CO₂), a greenhouse gas (GHG) which can contribute to global climate change. The RCSPs are made up of state and local agencies, coal companies, oil and gas companies, electric utilities, universities, private companies, and non-profit organizations that form the core of a nationwide network helping to establish the most suitable technologies, regulation, and infrastructure needs for carbon sequestration. The partnerships include more than 350 organizations, spanning 43 states and four Canadian provinces. The RCSPs are developing the framework needed to validate and deploy carbon sequestration technologies. The RCSPs will determine which of the numerous sequestration approaches are best suited for their specific regions of the country and identify regulatory and infrastructure requirements that will be needed should policy and economics indicate that sequestration be deployed on a wide scale. The RCSP initiative is being implemented in three phases. The Characterization Phase began in September 2003 with the seven partnerships working to develop the necessary framework to validate and potentially deploy carbon sequestration technologies. The Validation Phase of the RCSP effort (2005–2009) is focused on evaluating promising CO₂ sequestration opportunities through a series of field tests in the seven partnership regions. Presently, activities in the Development Phase (2008–2017) are proceeding and will continue the validation process to determine that CO₂ capture, transportation, injection, and storage can be achieved safely, permanently, and economically at a large scale. These tests will promote understanding of injectivity, capacity, and storability of CO₂ in the various geologic formations identified by the partnerships. Results and assessments from these efforts will assist commercialization efforts for future sequestration projects in North America.

Description

The Southeast Regional Carbon Sequestration Partnership (SECARB), led by the Southern States Energy Board (SSEB), represents the 11 southeastern states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia, plus counties in Kentucky and West Virginia. Currently, SECARB is comprised of more than 100 partners and stakeholders, representing federal and state governments, industry, academia, and non-profit organizations. SECARB is accomplishing its objectives of the Validation Phase by conducting four field studies

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Geologic Sequestration Opportunities

SECARB will conduct four geologic sequestration field tests during the Validation Phase. The information generated will allow for further characterization of potential carbon sequestration sinks in the Southeast. The “stacked formations,” oil fields overlying deep saline reservoirs along the Gulf Coast, and more specifically in the states of Alabama, Florida, Louisiana, Mississippi, and Texas, are a prime target area for geologic CO₂ storage. SECARB’s research estimated 34 billion tons (31 billion metric tons) of potential storage capacity in the region’s depleted oil and natural gas fields. Coal seams are among the most attractive potential CO₂ sinks occurring in the Southeastern United States, where a prolific coalbed methane industry, which has produced more than 2.3 trillion standard cubic feet (Tscf) of natural gas, is approaching maturity. An estimated 48 billion tons (44 billion metric tons) of potential storage capacity, at a minimum, exists in the region’s unmineable coal seams.

Saline formations are the primary CO₂ geologic storage options for the SECARB region because of the extensive saline formations that underlie many of the power plants in the region. SECARB’s research estimated a low-end storage potential quantity of 2,507 billion tons (2,275 billion metric tons) of potential sequestration in saline formations in the region. Work performed during the Characterization Phase showed that saline formations with favorable sequestration potential underlie Alabama, Florida, Louisiana, Mississippi, East Texas, and Tennessee.

Gulf Coast Stacked Storage Project (G1)

The Gulf Coast Stacked Storage project will demonstrate the concept of phased use of subsurface storage volume. This sequestration approach combines the early use of CO₂ for enhanced oil recovery (EOR) followed by subsequent injection into associated saline formations. This results in both short- and long-term benefits, as there is the immediate commercial benefit of EOR as a result of the injection of CO₂ (of setting infrastructure development costs), followed by large volume, long-term storage of CO₂ in saline-bearing formations. The field test is being conducted in the lower Tuscaloosa Formation in the Cranfield unit, located in southwestern Mississippi, at a depth of 10,300 feet. Injection rates of CO₂ in the commercial EOR food are estimated at 250,000–500,000 tons per year (226,750–453,500 metric tons per year). This one-year Validation Phase study will be followed by a large-volume injection into the brine-bearing formations down dip of the oil ring during the Development Phase.

Accomplishment Highlights:

- Site selected in the Cranfield Oil Field near Natchez, Mississippi.
- Site baseline characterization completed, including analysis of 200 existing wireline logs, new open-hole logs, core, and a new three-dimensional seismic survey.
- A plugged and abandoned production well, Ella G. Lees #7, was reentered to a depth of 10,300 feet and has been instrumented as a dedicated monitoring well, with real-time pressure and temperature read-outs to assess the progress of the CO₂.
- Injection of CO₂ for the EOR activity was initiated on July 15, 2008.
- A logging program in nearby producer wells is being conducted to measure evolution of pressure and movement of fluids as reservoir pressure builds.
- Soil gas studies at abandoned and plugged wells were conducted for baseline identification and will continue as part of the monitoring program.

PARTNERS & STAKEHOLDERS (cont.)

McJunkin Appalachian Oil Field
Supply Company
Mississippi Power Company
Mississippi State University
National Coal Council
National Mining Association
Natural Resource Partners
Norfolk Southern
North American Coal Corporation
North Carolina State Energy Office
Nuclear Energy Institute
Oak Ridge National Laboratory
Old Dominion Electric Cooperative
Peabody Energy
Penn Virginia Corporation
Phillips Group, The
Pine Mountain Oil & Gas, Inc.
Pocahontas Land Corporation
Powell River Project
Praxair
Progress Energy
QEA, LLC
Rentech, Inc.
RMB Earth Science Consultants
RMS Strategies
SCANA Energy
Schlumberger
Shell Oil Company
Smith Energy
South Carolina Department of
Agriculture
South Carolina Electric & Gas Company
South Carolina Public Service
Authority/Santee Cooper
Southern Company
Southern Natural Gas
Southern States Energy Board
Susan Rice and Associates, Inc.
Tampa Electric Company
Tennessee Valley Authority
Texas Bureau of Economic Geology
TXU Corporation (Luminant Energy)
United Company, The
University of Alabama
University of British Columbia
Virginia Center for Coal and Energy
Research
Virginia Department of Mines, Minerals
and Energy
Walden Consulting
Winrock International

COST

Total Project Value

\$28,872,892

DOE/Non-DOE Share

\$19,753,101 / \$9,119,791

Central Appalachian Basin Coal Test (G2)

This test will validate sequestration opportunities in the unmineable coal seams of the Central Appalachian Basin, a northeast-to-southwest-trending basin encompassing 10,000 square miles in southwestern Virginia and southern West Virginia. The principal area of investigation includes portions of five counties in Virginia (Buchanan, Dickenson, Russell, Tazewell, and Wise) and four counties in West Virginia (Fayette, McDowell, Raleigh and Wyoming). The project is evaluating the injection of 1,000 tons (907 metric tons) of CO₂ into multiple coal seams of the Pocahontas Formation and Lee Formation at depths ranging between 1,400 and 2,200 feet. The project also includes coalbed methane (CBM) recovery operations, adding economic value to the project. The primary project objective is to demonstrate geologic sequestration in unmineable Appalachian coals as a safe and permanent method to mitigate GHG emissions.

Accomplishment Highlights:

- Completed a detailed regional assessment of the potential Central Appalachian Basin carbon sequestration capacity.
- Comprehensive suite of production maps for the active CBM wells in the Central Appalachian Basin has been performed and finalized.
- Site selection of a donated CNX Gas CBM well along with the initial reservoir modeling, site permitting, and well design for the field test site have been completed.
- Injection was accomplished from January 15, 2009 to February 9, 2009, with monitoring activities at the site continuing.

Black Warrior Basin Coal Test (G3)

As in the Central Appalachian Basin, the objectives of the Black Warrior Basin test are to determine if sequestration of CO₂ in mature CBM reservoirs is a safe and effective method to mitigate GHG emissions and to determine if sufficient injectivity exists to efficiently drive CO₂-enhanced coalbed methane (ECBM) recovery. The test will take place in the Deerlick Creek Coal Degasification Field near Tuscaloosa County, Alabama. An existing CBM well will be utilized for injection into the Black Creek, Mary Lee, and Pratt coal zones of the Pennsylvanian-age Pottsville Formation, and three monitoring wells will be drilled and instrumented. The three coal seams, whose depths range from 1,000–2,000 feet, will be injected with 1,000 tons (907 metric tons) of CO₂ (approximately 333 tons per coal seam).

Accomplishment Highlights:

- Assessment of sequestration opportunities in coal of the Black Warrior Basin and southern Appalachian thrust belt has been completed.
- Test site selected in the Black Warrior Basin at southern Deerlick Creek Field.

- National Environmental Policy Act (NEPA) and project design documents have been completed for the site.
- Pre-injection monitoring activities are underway with injection operations planned for fall 2009.

Saline Reservoir Field Test: The Mississippi Test Site (G4)

The primary objective of this project is to locate and evaluate suitable saline formations for storage of CO₂ in close proximity to large coal-fired power plants along the Mississippi Gulf Coast. The target formation for this field test is the Lower Tuscaloosa Massive Sand Unit in Jackson County, Mississippi. The test includes building detailed geological and reservoir maps to further assess the test site and conducting reservoir simulations to estimate injectivity, storage capacity, and long-term fate of injected CO₂. Injection of 3,000 tons (2,720 metric tons) of CO₂ at an approximate depth of 9,500 feet has taken place at Mississippi Power Company's Plant Daniel, located near Escatawpa, Mississippi.

Accomplishment Highlights:

- Developed a plan to conduct the sequestration experiment on the grounds of the Plant Daniel Electric Generating Facility, approved in April 2006 by Mississippi Power Company.
- Received a Class V Experimental Well injection permit from the Mississippi Department of Environmental Quality (MDEQ) and drilling permits for injection and observation wells from the Mississippi Oil and Gas Board.
- Completed monitoring and observation wells at Plant Daniel in Spring 2008.
- Injection of 3,000 tons of CO₂ was completed in October 2008.
- Vertical seismic profile (VSP) survey was conducted in December 2008 for post-injection comparison to the baseline VSP conducted in April 2008.

Benefits

- Supports DOE's Carbon Sequestration Program by promoting the development of the framework and infrastructure necessary for the deployment of carbon sequestration technologies and validating those technologies through field tests.
- Supports the President's Global Climate Change Initiative goal of reducing GHG intensity by 18 percent by 2012.
- Provides options and potential opportunities for regional CO₂ sequestration and whether long-term storage can be done safely, permanently, and economically.