

PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Carbon Sequestration

04/2008



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) Program, 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 Partnerships are made up of state agencies, universities, private companies, and nonprofit 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 41 states, three Indian nations, and four Canadian provinces. The RCSPs are developing the framework needed to validate and deploy carbon sequestration technologies. They will evaluate and determine which of the numerous sequestration approaches are best suited for their specific regions of the country and are studying possible regulatory and infrastructure requirements that will be needed should policy and economics indicate that sequestration be deployed on a wide scale. The Validation Phase (2005–2009) of the Partnership Program is focused on validating promising CO₂ sequestration opportunities through a series of field tests in the seven Partnership regions.

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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 by conducting four field validation studies in four of the most promising geologic formations in the region; validating injectivity, capacity and containment; advancing the state-of-the-art in monitoring, mitigation and verification (MMV) techniques and instrumentation; further characterizing geologic sinks in the Southeast for future readiness; identifying and addressing issues for sequestration technology deployment; and fostering local, regional and national public involvement and education programs. CO₂ sources, sinks, and transport requirements have been described and entered into a geographical information system. An assessment of public involvement and educational needs is ongoing, and an outreach plan has been developed so that stakeholders can help identify and implement regional CO₂ sequestration measures. Safety, regulatory, and permitting requirements within the region are being assessed in consultation with regulatory agencies, state public utility commissions, and oil and natural gas commissions. Assessment of ecosystem impacts and an action plan to address impact issues have been developed. Monitoring and verification requirements are being established, along with protocols for geologic sequestration.



PARTNERS

Advanced Resources International
AGL Resources
Alabama Oil & Gas Board
Alawest
Alpha Natural Resources
America Electric Power
Amvest Gas Resources
Applied Geo Technologies
Arch Coal
Arkansas Oil and Gas Commission
Association of American Railroads
Augusta Systems, Incorporated
Big Rivers Electric Corporation
BP America
Buchanan Energy Company of Virginia, LLC
Buckhorn Coal Company
CDX Gas, LLC
CEMEX
Center for Energy & Economic Development (CEED)
ChevronTexaco Corporation
Clean Coal Technology Foundation of Texas
Clean Energy Systems, Inc.
CNX Gas
CO₂ Capture Project
Composite Technology Corporation
CONSOL Energy, Inc.
Core Laboratories
Dart Oil & Gas Corporation
Denbury Resources, Inc.
Dominion
Duke Energy
Eastern Coal Council
Edison Electric Institute
Electric Power Research Institute (EPRI)
Entergy Services, Inc.
Equitable Resources
Florida Municipal Electric Association
Florida Power & Light Company
Geological Survey of Alabama
GeoMet, Inc.
Georgia Environmental Facilities Authority

Primary Project Goal

Develop the necessary framework and infrastructure and conduct validation field tests of carbon sequestration technologies, and evaluate options and potential opportunities for carbon sequestration in the region.

Objectives

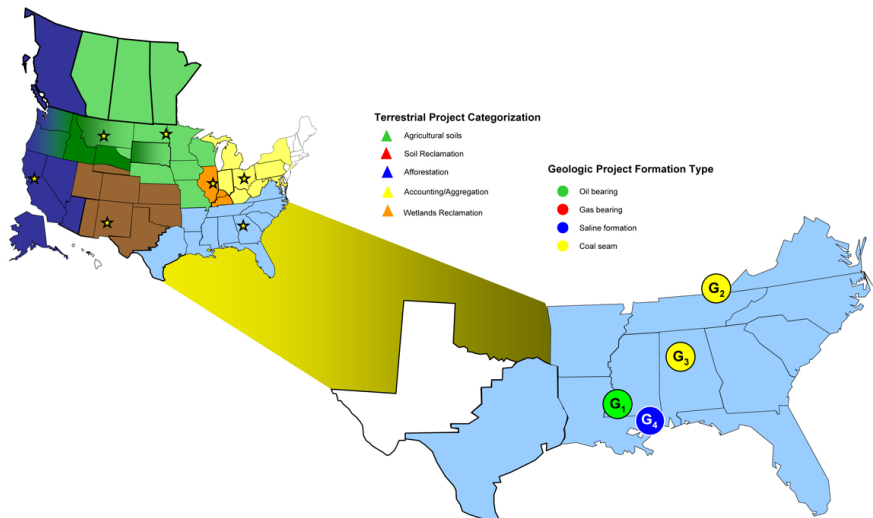
- Further characterize the region relative to sources, sinks, transport, sequestration options, and existing and future infrastructure requirements.
- Continue to examine issues, such as regulations, monitoring, safety, etc., involved with technology deployment.
- Engage the public and elected officials at all levels in dialogue on the issues and value associated with geologic sequestration.
- Conduct four small-scale CO₂ injection field tests in the region's deep geologic formations to demonstrate the safety and effectiveness of geologic sequestration.
- Develop MMV protocols that can be effectively applied to commercial-scale operations.

Accomplishments

SECARB's Phase II program, which began in October of 2005, focuses on the most promising opportunities for geologic sequestration within the region that promote the development of a framework and infrastructure necessary for the validation and deployment of carbon sequestration technologies. Phase II refines Phase I concepts and begins to validate, through field testing in four locations, sequestration technologies and corresponding infrastructure approaches related to regulatory, permitting, and outreach. The multi-partner collaborations developed during Phase I continue into Phase II.

Geologic Sequestration Opportunities

SECARB will conduct four field validation tests for geologic sequestration projects during the Validation Phase. The information generated will allow for further characterization of potential carbon sequestration sinks in the Southeast. Enhanced oil recovery (EOR) stacked formations 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 31 billion metric tonnes (34 billion 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 82.1 billion metric tonnes (90.3 billion tons) of potential storage capacity exists in the region's unmineable coal seams.



Southeast Regional Carbon Sequestration Partnership Validation Phase Field Tests

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 1,440 billion metric tonnes (1,584 billion 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 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 (offsetting infrastructure development costs) followed by large volume, long-term storage of CO₂ in saline-bearing formations. The field test will be conducted in the lower Tuscaloosa Formation in the Cranfield unit, located in southwestern Mississippi, at a depth of 10,300 feet. Injection rates in the commercial EOR flood are estimated between 100,000 and 500,000 tons per year of CO₂. The Phase II injection will be followed by a novel Phase III large volume injection into brine-bearing formations down dip of the oil ring.

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 10,301 feet and will become a dedicated monitoring well, with real-time pressure and temperature read-outs to assess the progress of the CO₂
- A logging program in nearby producer wells will measure evolution of pressure and movement of fluids as reservoir pressure builds.

Central Appalachian Basin Coal Test (G2)

This test will validate sequestration opportunities in 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 will test the injection of 1,000 tons of CO₂ into four coal seams in the Pocahontas Formation and four coal seams in the Lee Formation at depths ranging between 1,600 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 greenhouse gas (GHG) emissions.

Accomplishment Highlights:

- Completed a detailed regional assessment of the Central Appalachian Basin potential 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 for the field validation test site has been completed.
- Initial reservoir modeling on field validation test site has been completed.
- Permitting, design, characterization and monitoring activities at the site are on-going.
- Technology transfer and outreach programs have been initiated; including websites, publications, and numerous technical and non-technical presentations at conferences and workshops.

PARTNERS (cont.)

- Georgia Forestry Commission
- Georgia Power Company
- Halliburton
- Integrated Utility Services, Inc.
- International Coal Group
- Interstate Oil and Gas Compact Commission
- Kentucky Geological Survey
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Louisiana Department of Environmental Quality
- Louisiana Geological Survey
- Marshall Miller & Associates
- Massachusetts Institute of Technology
- 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

PARTNERS (cont.)

South Carolina Department of Agriculture
South Carolina Electric & Gas Company
South Carolina Public Service Authority/Santee Cooper
Southern Company
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
\$20,344,442

DOE/Non-DOE Share
\$14,663,953 / \$5,680,489

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

Black Warrior Basin Coal Test (G3)

The principal objectives of the Black Warrior 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. This project will use CO₂ injection testing into Black Warrior basin coal seams to determine the capability of these seams to adsorb significant volumes of CO₂ for geologic carbon sequestration and ECBM recovery. The test will take place in Tuscaloosa County, Alabama, and the Black Creek, Mary Lee, and Pratt coal zones of the Pennsylvanian-age Pottsville Formation have been selected for testing. Three coal seams will be injected with 1,000 tons of CO₂ (approximately 333 tons per coal seam) at an approximate depth of 1,500-2,500 feet.

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.
- Vigorous technology transfer and outreach program has been developed and instituted through the internet, publications, and presentations at technical and non-technical meetings.

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

The primary objective of this project is to locate and test suitable saline formations for storage of CO₂ in 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 will include 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 of CO₂ at an approximate depth of 8,600 feet will take place at Mississippi Power Company's Plant Daniel, located near Escatawpa, Mississippi.

Accomplishment Highlights:

- Developed plan to conduct the sequestration experiment on the grounds of the Plant Daniel Electric Generating Facility, approved in April 2006 by Mississippi Power Company.
- Participated in a Mississippi Power sponsored "neighbor meeting" to discuss the project and inform the public.
- Received a Class V Experimental Well permit from the Mississippi Department of Environmental Quality (MDEQ).
- Received drilling permits for the planned injection and observation wells from the Mississippi Oil and Gas Board.
- Drilled monitoring well and observation well at Plant Daniel during March-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 greenhouse gas 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.