PROGRAM facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Sequestration

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SEQUESTRATION OF CARBON DIOXIDE EMISSIONS IN GEOLOGIC FORMATIONS

Sequestration of Carbon Dioxide Emissions in Geologic Formations

This project is based on the fact that geologic formations, such as oil fields, coalbeds, and saline aquifers, are likely to provide the first large-scale opportunity to sequester concentrated CO_2 emissions. Researchers are trying to determine what effective, safe, and cost-competitive options are available for geologic storage of CO_2 emissions generated from coal, oil, and gas power plants. The research targets formations within 500 km of each power plant in the U.S. The U.S. goal is to reduce the cost of carbon sequestration to $10 or less per net ton of carbon by 2015.

Geologic Sequestration of CO_2 in Deep, Unminable Coalbeds: An Integrated Research and Commercial-Scale Field Demonstration Project

Advanced Resources International, B-P Amoco and Shell Oil are using existing recovery technology to evaluate the viability of storing CO_2 in deep unminable coal seams in the San Juan Basin in northwest New Mexico and southwestern Colorado. The knowledge gained will be used to verify and validate gas storage mechanisms in coal reservoirs, and to develop a screening model to assess CO_2 sequestration potential.

Maximizing Storage Rate and Capacity, and Insuring the Environmental Integrity of Carbon Dioxide Sequestration in Geological Formations

Texas Tech University and its research partners are using nuclear-magnetic resonance well-logging techniques to identify suitable geologic formations for CO_2 storage. Understanding hydraulic fracturing will enable researchers to predict of the behavior of gas in targeted formations to minimize the number of injection wells, while increasing the injected gas volume.

PROJECTS

Geologic Sequestration of CO_2 in Deep, Unminable Coalbeds: An Integrated Research and Commercial-Scale Field Demonstration Project

Principal Investigator:
Scott Reeves, 713-780-0815

Partners: Advanced Resources International, Houston, Texas; B-P Amoco, Houston, Texas; Shell-CO_2, Houston, Texas

Maximizing Storage Rate and Capacity and Insuring the Environmental Integrity of Carbon Dioxide Sequestration in Geological Formations

Principal Investigator:
Alan Graham, 806-742-3553

Partners: Texas Tech University, Lubbock, Texas; Terra Tek, Salt Lake City, Utah; Sandia National Laboratory, Albuquerque, New Mexico; University of New Mexico, Albuquerque, New Mexico

Reactive, Multiphase Behavior of CO_2 in Saline Aquifers Beneath the Colorado Plateau

Principal Investigator:
Richard Allis, 801-581-7849

Partners: University of Utah, Energy and Geoscience Institute, Salt Lake City, UT; Industrial Research Limited (IRL), New Zealand

Geologic Screening Criteria for Sequestration of CO_2 in Coal: Quantifying the Potential of the Black Warrior Coalbed Methane Fairway, Alabama

Principal Investigator:
Jack Pashin, 205-349-2892

Partners: Geological Survey of Alabama, Tuscaloosa, AL; Alabama Power Company, Birmingham, Alabama; Jim Walter Resources, Brookwood, Alabama; University of Alabama, Birmingham, Alabama

Reactive, Multiphase Behavior of CO_2 in Saline Aquifers Beneath the Colorado Plateau

The University of Utah is leading an effort to conduct an in-depth study of deep saline reservoirs in the Colorado Plateau and Rocky Mountain region. The study will enable researchers to determine how much CO_2 can be stored, what happens to the stored gas, and the long-term environmental risks associated with the storage.

Geologic Screening Criteria for Sequestration of CO_2 in Coal: Quantifying the Potential of the Black Warrior Coalbed Methane Fairway, Alabama

The Geological Survey of Alabama and its partners are conducting research to determine the amount of CO_2 that can be stored in the Black Warrior coalbed methane region of Alabama. The effort is focused on developing a broad-based geologic screening model, quantifying CO_2 storage potential of the Black Warrior coalbed methane region, and applying the model to identify additional sites.

Experimental Evaluation of Chemical Sequestration of Carbon Dioxide in Deep Aquifer Media

This project involves Battelle Laboratories evaluating and examining factors that affect the geological and geochemical storage of CO_2 in deep saline formations in the Midwestern U.S. Research presently indicates that the most promising long-term option for sequestration is to dispose of CO_2 in a dense, supercritical phase in deep saline sandstone formations.

Optimal Geological Environments for Carbon Dioxide Disposal in Saline Aquifers in the United States

The University of Texas at Austin's Bureau of Economic Geology is developing criteria for characterizing optimal conditions and characteristics of saline aquifers that can be used for long-term storage of CO_2. A regional U.S. data inventory of saline water-bearing formations is also being developed.

Sequestering Carbon Dioxide in Coalbeds

Oklahoma State University is leading an effort to develop, test, and investigate the ability of injected carbon dioxide to enhance coalbed methane production. The research will investigate competitive adsorption behavior of methane, CO_2, and nitrogen on the surface of a variety of coals to determine how much CO_2 is needed to displace the methane.

The GEO-SEQ Project

Lawrence Berkeley, Lawrence Livermore, and Oak Ridge National Laboratories and their partners are investigating safe and cost-effective methods for geologic sequestration of CO_2. Targeted tasks address the following: (1) Siting, selection, and longevity of the optimal sequestration sites; (2) lowering the cost of geologic storage; and (3) Identification and demonstration of cost-effective and innovative monitoring technologies to track migration of CO_2.

Geologic Sequestration of CO_2

Sandia National Laboratory and Los Alamos National Laboratory have partnered with an independent producer, Strata Production Company, to investigate down-hole injection of CO_2 into a depleted oil reservoir. A comprehensive suite of computer simulations, laboratory tests, field measurements, and monitoring efforts will be used to understand, predict, and monitor the geomechanical, geochemical, and hydrogeologic processes involved. The observations will be used to calibrate, modify, and validate the modeling and simulation tools.

Experimental Evaluation of Chemical Sequestration of Carbon Dioxide in Deep Aquifer Media

Principal Investigator:
Neeraj Gupta, 614-424-3820

Participant: Battelle Columbus Laboratories, Columbus, Ohio

Optimal Geological Environments for Carbon Dioxide Disposal in Saline Aquifers in the United States

Principal Investigator:
Susan Hovorka, 512-471-1534

Participant: University of Texas at Austin, Bureau of Economic Geology, Austin, TX

Sequestering Carbon Dioxide in Coalbeds

Principal Investigators:
K. Gasem and R. Robinson, 405-744-9498

Partners: Oklahoma State University, Stillwater, Oklahoma; Pennsylvania State University, Department of Energy and Geo-Environmental Engineering, State College, PA

The GEO-SEQ Project

Principal Investigator:
Sally Benson, 510-486-7071/7714

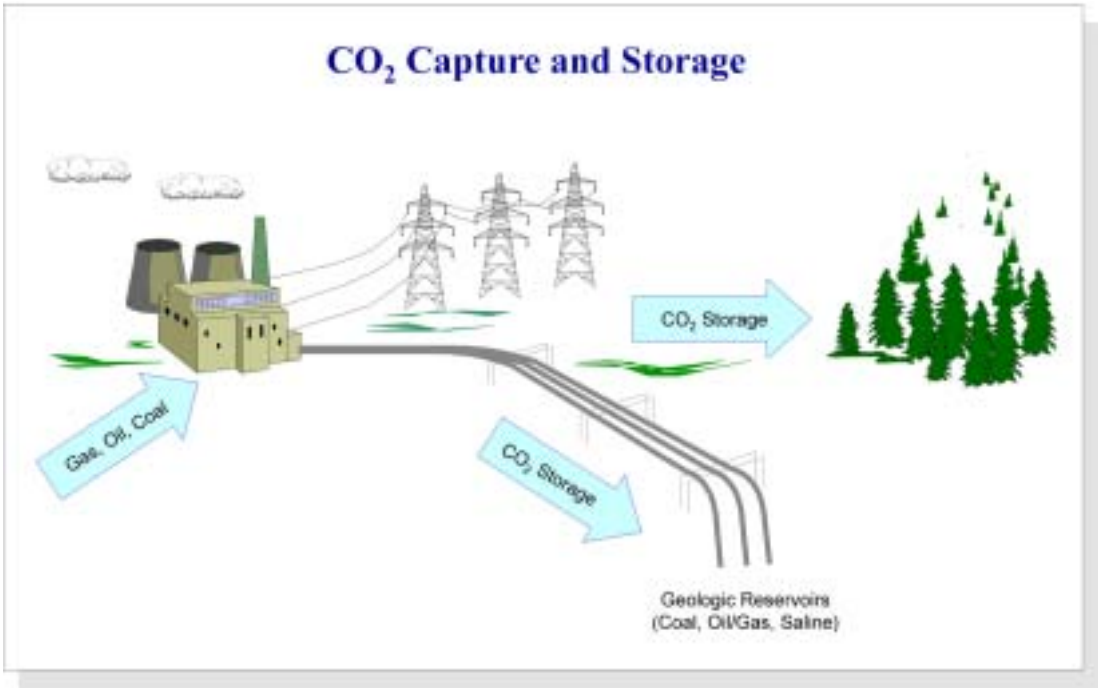
Partners: Lawrence Berkeley National Laboratory, Berkley, California; Lawrence Livermore National Laboratory, Livermore, California; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Stanford University, USGS, Texas Bureau of Economic Geology, Alberta Research Council, Chevron, Texaco, Pan Canadian Resources, Shell CO_2, BP-Amoco, and Statoil, Norway

Geologic Sequestration of CO_2

Principal Investigator:
Henry Westrich, 505-844-9092

Partners: Sandia National Laboratory, Los Alamos National Laboratory, Strata Production Company

Sequestration of Carbon Dioxide Emissions in Geologic Formations



Range of Estimates for CO_2 Sequestration in U.S. Geologic Formations

Geologic Formation	Capacity Estimate (GtC)	Source
Deep saline reservoirs	1-130	Bergman and Winter 1995
Natural gas reservoirs in the United States	25 [a] 10 [b]	R.C. Burruss 1977
Active gas fields in the United States	0.3 / year [c]	Baes et al. 1980
Enhanced coal-bed methane production in the United States	10	Stevens, Kuuskraa, and Spector 1998

a. Assuming all gas capacity in the United States is used for sequestration
b. Assuming cumulative production of natural gas is replaced by CO_2
c. Assuming that produced natural gas is replaced by CO_2 at the original reservoir pressure