the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Development of a Dry Sorbent-Based Post Combustion CO_2 Capture Technology for Retrofit in Existing Power Plants

Background

Currently available commercial processes to remove carbon dioxide (CO_2) from flue gas streams are costly and energy intensive. RTI International is heading a research team to continue development and scale-up of an innovative process for CO_2 capture that has significant potential to be less expensive and less energy intensive than conventional technologies. The "Dry Carbonate Process" utilizes a dry, regenerable, carbonate-based sorbent that captures CO_2 in the presence of water to form bicarbonate. Upon heating, the bicarbonate decomposes into a CO_2/steam mixture that can be converted to a pure CO_2 gas stream suitable for industrial use or sequestration. This process is ideally suited for retrofit in existing coal-fired power plants. With process modifications, it is anticipated the technology can also be used for CO_2 control from natural gas plants, cement plants, and refineries.

Description

To achieve the objectives of this project, RTI will continue research and development (R&D) work performed under a previous cooperative agreement with the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL). The project will be initiated by conducting technical and economic evaluations of various configurations of the Dry Carbonate Process. A down-selection process will be performed to identify the most promising process configuration. The project team will then fabricate and test process components at bench scale to confirm the feasibility of the selected process design. Following successful bench-scale testing, RTI and team members will design and fabricate a skid-mounted validation unit capable of capturing at least one ton of CO_2 per day. This unit will be fully commissioned at RTI. The unit will then be moved to the U.S. Environmental Protection Agency's (EPA's) site in Research Triangle Park, NC, where it will be tested extensively for one year with a slipstream of flue gas from the EPA's coal-fired combustion unit. Using data collected from this testing, the project team will optimize the process design and perform an economic evaluation for a commercial embodiment of the process. These results will be used to develop both a process package for a larger slipstream test unit (STU) and a detailed technology commercialization plan intended to attract utility company interest.

CONTACTS

Sean Plasynski
Sequestration Technology Manager
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4867
sean.plasynski@netl.doe.gov

José D.Figueroa
Project Manager
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4966
jose.figueroa@netl.doe.gov

Thomas Nelson
Principal Investigator
RTI International
3040 Cornwallis Rd.
Research Triangle Park, NC 27709-2194
713-203-6737
tnelson@rti.org

PARTNERS

RTI International
(RTI International is the trade name of Research Triangle Institute)

BOC Gases

EPRI / Nexant

ADA-ES

ARCADIS

PERFORMANCE PERIOD

03/07/2007 to 03/06/2010

COST

Total Project Value
$4,020,100

DOE/Non-DOE Share
$3,217,056 / $803,044

NATIONAL ENERGY TECHNOLOGY LABORATORY

Albany, OR • Fairbanks, AK • Morgantown, WV • Pittsburgh, PA • Sugar Land, TX

Website: www.netl.doe.gov

Customer Service: 1-800-553-7681

U.S. DEPARTMENT OF ENERGY

Primary Project Goal

The overall objective of this project is to perform the necessary research to scale up and test a commercially viable CO_2 capture process based on the reaction of sodium carbonate with CO_2 and water vapor present in the flue gas from a coal-fired combustion system.

Objectives

In addition to the overall objective, specific project objectives include:

- Demonstrating the operational feasibility of all process components.
- Demonstrating the process capacity to remove >90 percent of the CO_2 from flue gas.
- Demonstrating the sustained chemical and mechanical stability of the carbonate-based sorbent during testing.
- Demonstrating the process capacity to produce a pure CO_2 by-product stream.
- Demonstrating (through detailed analyses) the economic feasibility of the Dry Carbonate Process and the capability to meet DOE/NETL's economic benchmarks.

Benefits

This technology will provide conventional coal-fired power plants, natural gas-fired plants, and advanced power generation systems with a less costly and less energy intensive process for removing CO_2 from flue gas.

Accomplishments

RTI and project team members have selected several process configurations that are currently being evaluated through technical and economic analyses. Several novel designs are being considered that are expected to address many of the process challenges associated with the Dry Carbonate Process. RTI is currently conducting laboratory testing to support theoretical calculations showing that significant improvements for heat control, heat transfer, sorbent inventory, and CO_2 removal capacity are possible with these new process designs.

Planned Activities

Additional bench-scale testing of various process components will be carried out following successful completion of the technical and economic evaluations mentioned above. The project team will put together a process design report for DOE/NETL review.