the ENERGY lab

PROJECT FACTS

Existing Plants, Emissions & Capture

Low-cost Sorbent for Capturing CO_2 Emissions Generated by Existing Coal-fired Power Plants

Background

Pulverized coal-fired (PC) power plants are the largest point source for carbon dioxide (CO_2) emissions. This could lead to regulations for the electric utility industry. At this time, no cost-effective technologies capable of capturing CO_2 generated at PC power plants exist. TDA Research, Inc. will address this need by designing a new, low-cost solid sorbent-based process that will capture 90 percent CO_2 from existing PC plants.

Description

TDA will produce a low-cost solid sorbent, evaluate its cyclic life, and measure its performance in a bench-scale test apparatus, which will run on a slip stream of a coal-derived flue gas at Western Research Institute's (WRI's) coal combustion test facility. The mass and energy balances for a commercial-scale PC-fired power plant retrofit with TDA's CO_2 capture system will be modeled and losses in plant efficiency will be calculated by Louisiana State University (LSU) using ASPEN-Plus. The experimental and simulation data will be used to carry out an extensive engineering and economic analysis of the post-combustion CO_2 capture system. The analysis will be done using the U.S. Department of Energy's (DOE) National Energy Technology Laboratory's (NETL) (2005) "Carbon Capture and Sequestration Systems Analysis Guidelines."

WRI's Combustion Test Facility

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PARTNERS

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PERIOD OF PERFORMANCE

11/1/2008 to 10/31/2011

COST

Total Project Value
$1,374,380

DOE/Non-DOE Share
$1,097,839 / $276,541

Primary Project Goal

The goal for this project is to develop a low-cost, regenerable CO_2 sorbent system capable of removing and concentrating 90 percent CO_2 emissions produced from existing coal plants' flue gas.

Objectives

The objective of this project is to demonstrate that TDA's low-cost sorbent can cost-effectively and efficiently capture CO_2 produced by existing PC-fired power plants. More specifically, this project will develop a low-cost CO_2 sorbent and evaluate its performance by fabricating a bench-scale unit, testing using simulated and real coal-derived flue gases, modeling the mass and energy balances, and calculating the loss in plant efficiency for a commercial-scale PC-fired power plant.

Benefits

This project will demonstrate a new, sorbent-based CO_2 capture system that can be added to existing PC-fired power plants that has the potential to capture 90 percent of the CO_2 emissions with less than a 35 percent penalty in the cost of energy.

TDA's system can be designed to be self-contained so that no steam is removed from the main plant boiler or turbine.

Planned Activities

In the first year of this project, TDA will:

- Develop a low-cost sorbent.
- Evaluate sorbent performance (loading, cycling rate, and resistance to sulfur dioxide and nitrogen oxides).
- Conduct ASPEN-Plus modeling of the CO_2 capture system.
- Calculate the cost for CO_2 captured and avoided.

In the second year, TDA will:

- Conduct an extended test on the selected sorbent.
- Revise the ASPEN-Plus model based on the experimental data.
- Revise the cost estimate.
- Prepare a preliminary design of the bench-scale unit.

In the third year, TDA will:

- Fabricate a bench-scale unit.
- Test the unit in simulated coal gases at TDA.
- Test the unit in real coal gases at WRI.
- Revise their costs for CO_2 captured and avoided in accordance with the latest DOE guidelines for CO_2 capture and sequestration.