PROJECT facts

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

Gasification Technologies
Hydrogen & Syngas Technologies

01/2007

CO-PRODUCTION OF SUBSTITUTE NATURAL GAS / ELECTRICITY VIA CATALYTIC COAL GASIFICATION

CONTACTS

Gary J. Stiegel
Gasification Technology Manager
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-4499
gary.stiegel@netl.doe.gov

Daniel C. Cicero
Hydrogen & Syngas Technology Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4826
daniel.cicero@netl.doe.gov

Elaine Everitt
Project Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4491
elaine.everitt@netl.doe.gov

Description

The United States has vast reserves of low-cost coal, estimated to be sufficient for the next 250 years. Gasification-based technology, such as integrated gasification combined cycle (IGCC), is the only environmentally friendly technology that provides the flexibility to co-produce hydrogen, substitute natural gas (SNG), premium hydrocarbon liquids including transportation fuels, and electric power in desired combinations from coal and other carbonaceous feedstocks. Rising costs and limited domestic supply of crude oil and natural gas provide a strong incentive for the development of coal gasification-based co-production processes. This project addresses the co-production of SNG and electricity from coal via gasification in a central station facility.

Research Triangle Institute (RTI) will develop and evaluate a system for producing SNG and electricity from lignite or subbituminous coals. In the proposed process, coal is initially preprocessed in a transport pyrolyzer at temperatures between 1,200 and 1,600 °F to convert the coal into a mixture of gas phase carbon species, hydrogen, and solid char fines. The char is utilized to generate electricity, and the gaseous effluent from the transport pyrolyzer is upgraded to a methane-rich syngas in a catalytic fluidized-bed reactor. An active catalyst material loaded on a support will remain fixed in the catalytic reactor while the catalyst promotes the conversion of the gas phase carbon species and hydrogen to methane. Sulfur species, ammonia, and carbon dioxide (CO_2) remaining in the syngas will be treated in gas clean-up steps to produce a clean SNG and a high-pressure sequestration-ready CO_2 by-product stream.

The project will be carried out in a three-phase program. In Phase I, experimental bench-scale testing will be conducted to demonstrate the technical and economic feasibility of the transport pyrolysis process; the catalytic fluidized-bed process will be evaluated for producing a methane-rich syngas; a process for evaluating simultaneous carbon monoxide shift and CO_2 capture will be explored; and char combustion experiments will be conducted. In Phase II, bench-scale optimization studies will be conducted for the transport pyrolysis process and catalytic fluid-bed gas processing. If preceding phases indicate technological and economic merit, the project will proceed to Phase III where a field test system will be designed, built and tested at an appropriate industrial host site.

CONTACTS (cont.)

Brian Turk
Principal Investigator
Research Triangle Institute
3040 Cornwallis Rd.
Research Triangle Park, NC 27709
919-541-8024
bst@rti.org

COST

Total Estimated Cost
$3,759,270

DOE/Non-DOE Share
$3,006,792 / $752,478

ADDRESS

National Energy Technology Laboratory
1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street,
Suite 1400
Tulsa, OK 74103-3519
918-699-2000

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

Primary Project Goal

The goal of this project is to develop commercial application for co-production of electricity and SNG at a cost of less than $5 per MMBtu while also achieving near zero emissions.

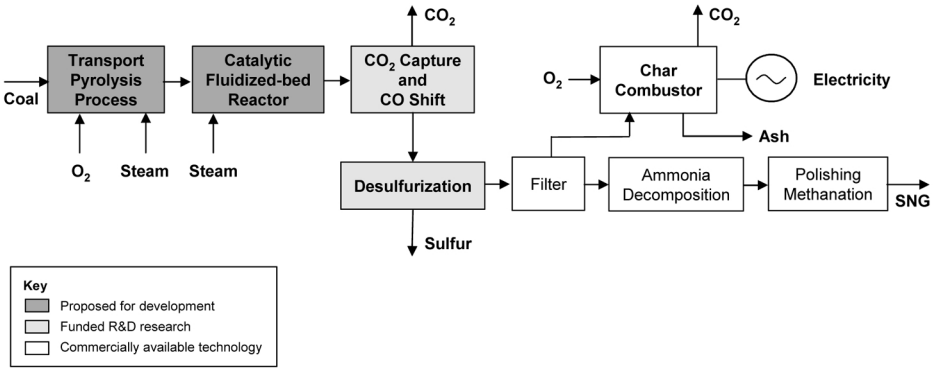
Accomplishments

Multi-cycle parametric testing of RTI's regenerable CO_2 sorbent for greater than 90 percent CO_2 removal has been completed, and the testing demonstrated the technical feasibility of RTI's regenerable sorbent material for the proposed process.

Char combustion experiments have been initiated, and preliminary results indicate that greater than 75 percent of heavy metals in the char derived from Illinois bituminous coal and Freedom lignite remain trapped on the ash during combustion.

Benefits

The efficient production of SNG from abundant, domestic coal will result in supply and price stability to an electric power generation infrastructure that has grown highly dependent on natural gas.



Proposed Process for the Co-Production of SNG and Electricity via Catalytic Coal Gasification