PROJECT facts

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

Gasification Technologies

2/2006

INTEGRATED WARM GAS MULTICONTAMINANT CLEANUP TECHNOLOGIES FOR COAL-DERIVED SYNGAS

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Description

Integrated gasification combined cycle (IGCC) technology offers a means to utilize coal—the most abundant fuel in the United States—to produce a host of products ranging from electricity to value-added chemicals, including transportation fuels and hydrogen, in an efficient and highly environmentally friendly manner. However, the fact that the overall cost (capital, operating, and maintenance) of this technology is still higher than natural gas-fired power plants has impeded commercialization of IGCC technology. Although a number of factors contribute to the overall cost, the cost of cleaning the syngas to near zero contaminant levels is a major component, accounting for 7 to 15% of the overall capital cost. The keys to improving the economics of the syngas cleaning system are reducing these costs and, at the same time, increasing the thermal efficiency of conversion of coal into electricity and other products.

The extremely heterogeneous nature of coal and other carbonaceous feedstocks used to produce syngas by gasification presents a very complex and technically challenging situation for any comprehensive syngas cleaning system. These challenges include:

- Effectively treating multiple contaminants present at significantly different concentrations
- Effectively treating syngas with varying contaminant concentrations associated with
  - Natural variations in coal composition
  - Different gasification processes
- Effectively treating syngas to meet different product requirements for various syngas utilization processes (fuel cell, chemical production, combustion turbine, etc.)
- Developing treatment processes to simultaneously remove multiple contaminants including trace elements
- Designing treatment systems in spite of large variation in published and/or predicted concentrations of trace metals in syngas resulting from difficulties with accuracy and precision of measurement techniques.

The net result of these challenges is that syngas cleaning is a complex and costly process. Previous attempts to minimize the cost and maximize efficiency have relied on well-known commercial technologies with the results of reduced thermal efficiency and increased capital and operating costs.

PARTNERS

Research Triangle Institute (RTI)

SRI International (SRI)

Nexant, Inc. (Nexant)

Eastman Chemical Company (Eastman)

Süd-Chemie, Inc. (SCI)

URS Corporation (URS)

PROJECT COST

Total Project Value
$1,334,369

DOE/Non-DOE Share
$1,032,654 / $301,715

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

Primary Project Goals

The overall goal of this project is to develop a warm multi-contaminant syngas cleaning system for operation between 300 and 700 °F and 1,200 psig. This system will be composed of a bulk contaminant removal stage and a polishing removal stage. The specific goals are to:

- Reduce the H_2S and COS to less than 5 parts per million by volume (ppmv) using the regenerable RTI-3 sorbent in a bulk removal stage
- Reduce the HCl to less than 5 ppmv with the use of disposable sodium bicarbonate (nahcolite) sorbent in a bulk stage
- Reduce As, Se using the regenerable RTI-3 sorbent
- Reduce sulfur species and HCl to less than 50 ppbv and less than 800 ppbv, respectively, in the polishing stage
- Conduct system studies to guide material and process development and integration activities to reduce cost, increase thermal efficiency, and improve syngas cleaning performance

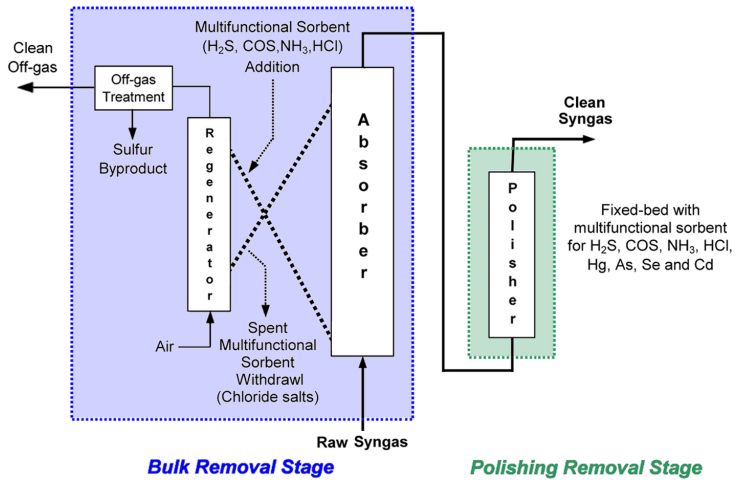
Accomplishments

Completed NEPA documentation

Benefits

This combination of technologies has the potential of achieving near-zero emissions of all targeted pollutants in a syngas cleanup system that:

- Can be easily adapted to effectively treat differences in syngas contaminant concentrations resulting from variations in coal concentrations and gasifier design,
- Can be easily modified in a cost effective manner to adapt contaminant control performance as required by syngas utilization objectives,
- Can be easily modified with minor retrofitting to improve contaminant control performance as regulatory requirements change,
- Has had its internal processes fully integrated with both the gasification and syngas utilization systems, and
- Leverages existing R&D results to accelerate the development and commercial deployment of this technology.



Process Schematic of Proposed Approach

Project395.pmd