

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



DEVELOPMENT OF A HYDROGASIFICATION PROCESS FOR CO-PRODUCTION OF SUBSTITUTE NATURAL GAS (SNG) AND ELECTRIC POWER FROM WESTERN COALS DESCRIPTION

Description

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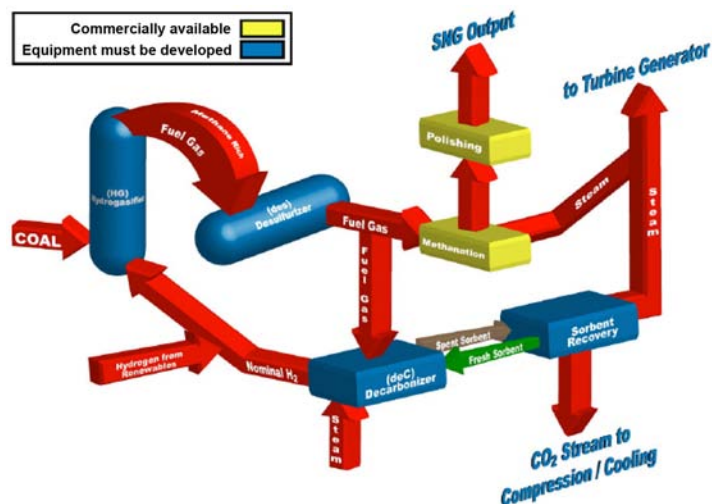
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In the next two decades, electric utilities serving the Western United States must install 60GW of new electric power generation to meet new loads, making selection of technology for the next generation of electric power plants of critical importance. Future natural gas price increases and potential natural gas shortages create significant risk of high cost and unreliability for natural gas fueled power plants. Arizona Public Services (APS) is investigating the production of substitute natural gas (SNG) from coal. This technology will

- Protect both existing and future power plants against fuel shortages and price shocks
- Allow the continued use of high-efficiency combined-cycle power plants
- Facilitate locating power plants near load centers to minimize the need for transmission lines and improve system reliability
- Minimize both fresh water use and wastewater production
- Provide the opportunity to economically introduce, renewable power-generation fuel

Today's electric power generation infrastructure has grown highly dependent on natural gas. Given the vast coal resources of the United States, efficient production of SNG from coal offers supply and price stability as well as an already-existing transportation infrastructure.



Proposed APS Advanced Hydrogasification Process



PARTNERS

Arizona Public Service
Gas Technology Institute
Nexant, LLC
WorleyParsons Group, Inc.
Electric Transportation Energy Corporation (ETEC)
Air Products
San Diego Gas & Electric
Salt River Project
BHP New Mexico Coal

AWARD DATE

March 31, 2006

END DATE

March 31, 2011

COST

Total Estimated Cost
\$12,951,552

DOE/Non-DOE Share
\$8,905,158 / \$4,046,394

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

APS has assembled an experienced cross-functional team that will develop a commercially viable advanced gasification process that will produce pipeline-quality SNG and electricity, with near zero emissions (including CO₂ capture) using western coals. APS's IGCC concept uses hydrogasification as its basis to produce SNG and electricity. As a fuel source for existing natural gas infrastructure, SNG will protect the fuel supply of existing natural gas-fired electric generation.

The R&D focus for a coal hydrogasification-based process for co-production of SNG and electricity with near-zero emissions will be conducted in a phased approach to evaluate the APS Advanced Hydrogasification Process (AHP), which integrates a hydrogasification reactor and a de-carbonizer to efficiently produce SNG and at the same time co-produce electricity with CO₂ capture. In Phase I, the hydrogasification concept will be defined through laboratory testing of the individual technology components (hydrogasification, high temperature sulfur, and CO₂ capture) as well as preliminary system engineering and economic analysis. In Phase II, the technology concept will be proven through bench-scale testing of the following:

- Individual technology components
- Engineering and economic evaluation of the integrated plant
- Development of a process-design package for an integrated engineering-scale field test

In Phase III, an engineering-scale facility will be constructed and tested in a real-world application.

Primary Project Goal

The primary goal of this project is to develop the APS Advanced Hydrogasification process that integrates a hydrogasification reactor and a de-carbonizer to efficiently produce SNG and co-produce electricity with CO₂ capture.

Objective and Benefits

The objective of the project is to develop and demonstrate at an engineering-scale, a coal hydrogasification-based process for co-production of SNG and electricity with near-zero emissions, meeting the following performance targets:

- (1) Overall process efficiency greater than 50 percent
- (2) SNG cost less than \$5/million Btu
- (3) Capture and sequestration of CO₂ equivalent to 90 percent of emissions from power production
- (4) Water usage to be at least 50 percent less than SNG from gasification / syngas methanation
- (5) Ability to use low-rank Western coals

Accomplishments as of August 2006:

- Identified a Fruitland formation of western sub-bituminous coal under control of a project participant that will act as the hydrogasifier fuel; completed chemical characterization of the coal; and have conducted initial TGA reactivity tests at 500 psi and 1500, 1600 and 1700 °F
- Conducted thermodynamic equilibrium analyses for various temperature (1500, 1600 and 1700 °F), pressure (500, 700, 1000 and 1500 psi), and gas makeup to identify the optimum conditions for methane production in the hydrogasifier.
- Fine-tuning is underway for an ASPEN process model that includes optimizations suggested by the results of TGA analysis.