II.B.11 Development of a Hydrogasification Process for Co-Production of Substitute Natural Gas (SNG) and Electric Power from Western Coals

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Objectives

- Develop and demonstrate at an engineering-scale, a coal hydrogasification-based process for co-production of synthetic natural gas (SNG) and electricity with near-zero emissions.
- Design the process with overall process efficiency greater than 50%.
- Design the process to have SNG cost less than $5/million BTU.
- Design the process for capture and sequestration of CO_2 equivalent to 90% of emissions from power production.
- Design the process for water usage at least 50% less than SNG from gasification/syngas methanation.
- Design the process for the ability to use low-rank Western coals.

Introduction

In the next two decades, electric utilities serving the western United States must install 60 GW of new electric power generation to meet new loads, making selection of technology for the next generation of electric power plants of critical importance. Continued use of natural gas fueled power plants extends the efficiency and environmental compatibility, which the electric utility industry has enjoyed over the past two decades. However, future natural gas price increases and potential natural gas shortages create significant risk of high cost and unreliability for natural gas fueled power plants. Given the vast coal resources of the United States, efficient production of SNG from coal offers supply and price stability, as well as an existing transportation infrastructure, to an electric power generation infrastructure that has grown highly dependent on natural gas.

Approach

The projects seeks to conduct R&D 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 recipient's concept, the APS Advanced Hydrogasification Process, which integrates a hydrogasification reactor and a de-carbonizer to efficiently produce SNG, and co-produce electricity with CO_2 capture. In Phase I, the hydrogasification concept will be defined through laboratory testing of the individual technology components (hydrogasification, high temperature sulfur and CO_2 capture) and preliminary system engineering and economic analysis. In Phase II, the technology concept will be proven through bench-scale testing of the individual technology components, engineering and economic evaluation of the integrated plant, and 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 real-world application.

Accomplishments

The draft Research Management Plan.

Future Directions

- Phase I – Define the hydrogasification concept through laboratory testing of the individual technology components (hydrogasification, high temperature sulfur and CO_2 capture).
- Perform preliminary system engineering and economic analysis.
- Phase II – Prove the technology concept through bench-scale testing of the individual technology components, engineering and economic evaluation of the integrated plant.
- Develop a process design package for an integrated engineering-scale field test.
- Phase III – construct an engineering-scale facility and test in real-world application.