



Carbon Dioxide Coal Slurry for Feeding Low-Rank Coal to Gasifiers

Background

Gasification of coal or other solid feedstocks (wood waste, petcoke, etc.) is a clean way to generate electricity and produce or co-produce a variety of commercial products. The major challenge is cost reduction; current integrated gasification combined cycle (IGCC) technology is estimated to produce power at a cost higher than that of pulverized coal combustion. However, the U.S. Department of Energy (DOE) Gasification Program is developing technologies with the potential to produce electric power with greater than 90 percent carbon capture at a lower cost of electricity than any other coal-fueled power generation technology with carbon capture. The public benefits of the Gasification Program are significant—lower cost power, cleaner environment, smaller carbon footprint, less water use, reduced dependence on imports, U.S. technological competitiveness, and high-value U.S. jobs.

In alignment with DOE Gasification Program goals, the National Energy Technology Laboratory (NETL) has teamed with Electric Power Research Institute (EPRI) to research a liquid carbon dioxide (liquid CO₂; LCO₂) coal slurry method for feeding low-rank coal (LRC) to gasifiers.

Compared to water, LCO₂ has several property differences that make it attractive for preparing coal slurries for use in coal gasification plants. EPRI has been investigating this concept for some time, and its recent work shows that LRC/LCO₂ slurries can potentially reduce the cost and significantly increase the efficiency of IGCC power plants with carbon capture and storage (CCS).

Project Description

This project will exploit the availability of CO₂ in a gasification power island for the benefit of IGCC-CCS integrated plants. EPRI will leverage the findings of laboratory tests to support the development and evaluation of mechanical engineering designs of LRC/LCO₂ slurry preparation systems, which in turn will be used to develop higher resolution IGCC plant performance and cost models. The project aims to validate that LCO₂ can achieve higher solid loading than water slurry, study the design criteria for a LCO₂-coal slurry preparation/mixing system that is superior to conventional feed systems, and demonstrate potential plant thermal efficiency improvement over a water-coal slurry-based feed system.

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PROJECT DURATION

Start Date	End Date
10/01/2011	09/30/2012

COST

Total Project Value
\$995,603

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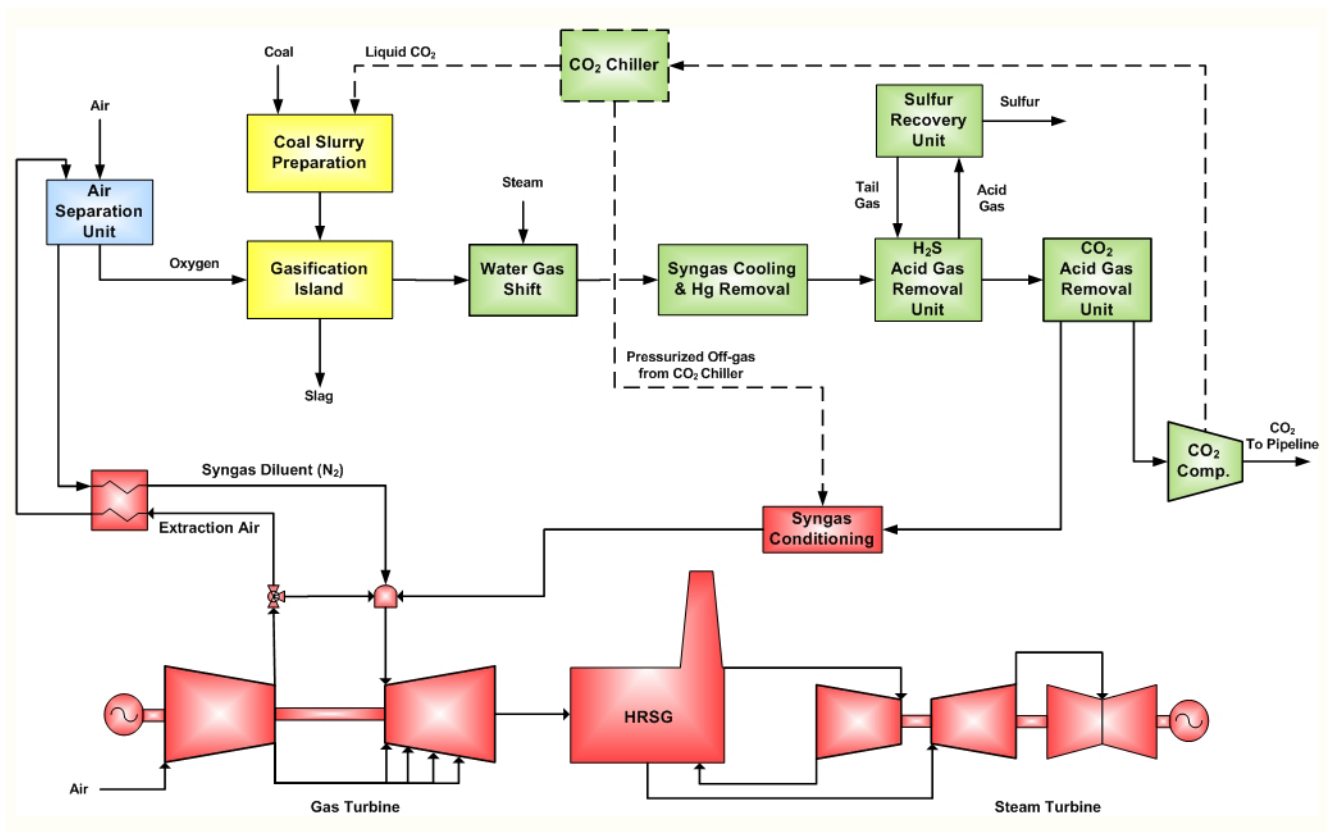
Goals and Objectives

The project aims to reduce cost and improve efficiency of IGCC with CCS by using a portion of the existing high-CO₂ product stream as the carrier fluid to feed LRC into the gasifier. The specific objectives are to gain a greater understanding and confirm the potential advantages of using LRC/LCO₂ slurries by:

- Conducting plant-wide technical and economic simulations,
- Developing a preliminary design and cost estimate of an LRC/LCO₂ slurry preparation and mixing system,
- Performing laboratory tests to increase knowledge and understanding of the maximum solids loading capability for three specified coals,
- Defining a technology development roadmap to commercialization.

Benefits

IGCC offers significant potential to provide a low-cost option, with high efficiency and reliability, for producing electric power and/or producing or co-producing fuels and chemicals with smaller carbon footprints than conventional power production systems. The outcome of the proposed effort will help integrate LRC/LCO₂ slurry feed systems for prototype testing at an IGCC power plant with CCS and validate efficiency improvement.



Process flow diagram of a gasification plant with coal-liquid CO₂ slurry feed

