the ENERGY lab

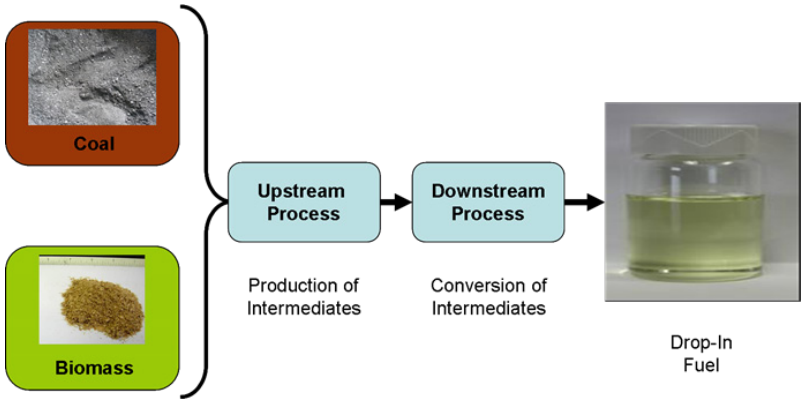
PROJECT FACTS

Fuels

Laboratory Scale Liquids Production and Assessment: Coal and Biomass to Drop-In Fuels

Background

A major problem with the production of liquid fuels from coal is that the production process and subsequent combustion of the fuel generate excessive greenhouse gases over the entire production and usage lifecycle. Adding lignocellulosic biomass (as a raw feed material) along with coal has the potential to reduce lifecycle greenhouse gas emissions to below those of petroleum products. Altex Technologies Corporation (Altex) has developed an innovative thermo-chemical process capable of converting coal and biomass to transportation fuel ready for blending. The Department of Energy (DOE) National Energy Technology Laboratory (NETL) has partnered with Altex to demonstrate the feasibility of producing liquid fuels from coal containing up to 15 percent lignocellulosic biomass.



Block diagram of the Altex Coal and Biomass to Drop-In Fuels process

Project Description

Project personnel will develop and test an integrated laboratory-scale coal and biomass-to-fuels system. Data gathered from operation of the bench unit will be used to determine the economic viability, sustainability, and market potential of the system. The proposed process consists of two stages: (1) an innovative upstream process that converts the solid feed into a highly reactive intermediate and (2) a downstream process which converts the intermediate product into liquid fuel using a low-temperature catalytic system. This approach eliminates the need to produce high-pressure hydrogen for hydrogenation of a liquid with high oxygen content.

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PARTNERS

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PROJECT DURATION

Start Date
10/01/2012

End Date
09/30/2015

COST

Total Project Value
$1,138,858

DOE/Non-DOE Share
$849,651 / $289,207

The project will leverage process test equipment already developed and used for similar process development at Altex to construct the laboratory-scale coal and biomass conversion test system, which will reduce cost and speed up the work. The project will be supported by experts on catalyst development from a major subcontractor, Pennsylvania State University (PSU). The economics of building and operating a plant producing 50,000 barrels per day of synthetic gasoline from a mixture of coal and biomass will be estimated based on the results of tests conducted at Altex and PSU.

Goal and Objectives

The main objective of the project is to fabricate and test a laboratory-scale unit to produce liquid fuel from coal containing a portion of biomass (such as corn stover and switchgrass) at a rate of two liters per day. Specific objectives are:

- To recondition the existing upstream process equipment.
- To modify and build new downstream process equipment.
- To operate an integrated test system to produce liquid fuels while feeding a coal and biomass mixture.
- To optimize operating conditions for the catalyst in order to maximize yield.
- To develop a process for large-scale catalyst production.
- To update the existing cost model for construction and operation of a 50,000 barrel-per-day liquid-fuel plant feeding a coal/biomass mixture with carbon dioxide (CO_2) sequestration based on bench-scale test results.
- To develop process flow and suitable piping and instrumentation diagrams as well as size the equipment needed for a commercial system.

Benefits

This innovative process can be used to produce a blend-ready, low cost fuel stream from a coal and biomass feed mixture. Application of a system of this size has the potential to substantially reduce petroleum use by billions of gallons per year, with a corresponding reduction in emissions of CO_2—an important greenhouse gas—by using a replacement fuel (biomass) along with coal to reduce total CO_2 production and capturing and storing CO_2 produced during operation.