the ENERGY lab

PROJECT FACTS

Fuels

Feasibility of a Coal-Biomass to Liquids Plant in Southern West Virginia

Background

Concerns regarding global supplies of oil, energy security, and climate change have generated renewed interest in alternative energy sources. The production of liquid fuels from coal provides an option for reducing petroleum use in the U.S. transportation sector and enhancing national and economic security by decreasing the nation's reliance on foreign oil. Two basic methods can be employed to produce liquid fuels from coal: direct coal liquefaction (DCL) and indirect coal liquefaction (ICL). Today, most of the world's coal-to-liquids (CTL) production occurs in South Africa, based on locally available low cost coal. Coal liquefaction is also given high priority in China. China's largest coal producer, Shenhua Group, has launched the world's first DCL plant with a capacity of 24,000 barrels per day. The obvious drawback of CTL technologies is the high carbon footprint of the process; the life-cycle greenhouse-gas (GHG) emissions are about twice that of petroleum-based fuels. The ability to capture and store carbon dioxide is essential to future use of CTL technology. Carbon capture and storage technologies could reduce life-cycle GHG emissions by 5 to 12 percent when compared to the average emissions profile of petroleum-derived diesel.

Biomass, the only carbon-based renewable energy resource, is especially valuable for producing carbon-bearing liquid transportation fuels. The introduction of biomass in a CTL process as coal-biomass to liquids (CBTL) could further reduce GHG emissions. The carbon contained in the biomass is not counted as a carbon input because it is generated by photosynthesis from atmospheric CO_2. A study by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) reported that a mixture of 8 percent biomass and 92 percent coal (by weight) can produce fuels which have 20 percent lower lifecycle GHG emissions than petroleum-derived diesel fuel. The advantages of CBTL have generated a renewed interest in a CBTL energy resource, resulting in an NETL partnership with West Virginia University (WVU) to conduct a comprehensive feasibility study for a CBTL plant in southern West Virginia.

Project Description

This project will determine the feasibility of a CBTL facility in southern West Virginia. The study will include economic, technical, financial feasibility, and market analyses for CBTL fuel. For the analyses, three production scenarios will be used to determine the best technology and a multi-objective programming tool will be used to identify the best strategies for feedstock management, facility operations, and siting.

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PARTNERS

LyondellBasell/Lyondell Chemical Co.

PROJECT DURATION

Start Date
10/01/2012

End Date
09/30/2015

COST

Total Project Value
$374,313

DOE/Non-DOE Share
$299,432/ $74,881

Goals and Objectives

The main goal of this project is to determine the economic, technical, market, and financial feasibility of a CBTL facility in southern West Virginia. Four individual studies will be conducted in support of this goal.

An economic feasibility study will (1) identify potential suitable sites for the construction of a CBTL fuels facility; (2) quantify the economic and technically available supply of coal and biomass—including forest residue, mill residue, surface mining residue, and short-rotation woody crops—from the cultivation of marginal farmland and abandoned mine lands; (3) perform an economic impact assessment for the local area and region; and (4) quantify the projected impacts on the environment, resource levels, and public health.

A technical feasibility study will (1) develop and validate process models for different case scenarios, including varying the compositions of coal and biomass; (2) design the equipment and estimate the capital cost; (3) evaluate the technical merit of the projects; and (4) gauge sensitivity to the key variables.

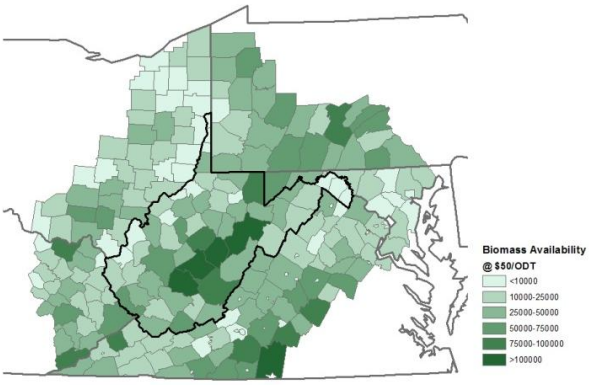

Figure 1. Biomass Availability

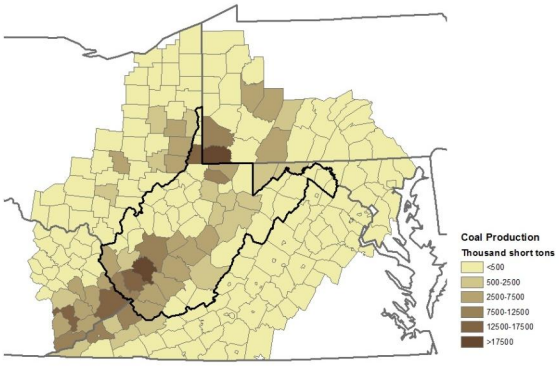

Figure 2. Coal Production

Figure 3. Biomass left on surface mining site

A market feasibility study will (1) develop a marketing plan based on an expanded integrated model of market planning, and (2) evaluate risks related to the development of a CBTL fuels plant, including an assessment of technology readiness level.

A financial feasibility study will (1) develop projected balance sheets, income statements, and cash flow projections for the proposed facility; (2) perform a sensitivity analysis, which includes feedstock price and fuel purchase price; and (3) determine the interest of potential customers, suppliers, and investors.

Benefits

This project will enable an assessment of the benefits, costs, and risks of building a CBTL fuel facility in southern West Virginia. Two of the benefits of building such a facility are a reduction in levels of GHG emissions attributable to petroleum fuel refining and reduced dependence on imported oil. Furthermore, development of a CBTL fuel facility in southern West Virginia would promote rural development in the region with associated economic benefits.