Research Brief

RAND PROJECT AIR FORCE and INFRASTRUCTURE, SAFETY, AND ENVIRONMENT

Assessing a Coal-to-Liquids Fuel Industry in the United States

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Abstract

Large U.S. coal reserves and viable technology give promise to a domestic industry producing liquid fuels from coal. Weighing benefits, costs, and environmental issues, it makes sense for the nation to pursue an insurance strategy by promoting a limited amount of early commercial experience in coal-to-liquids production and by preparing the foundation for managing associated greenhouse-gas emissions, in a way that both reduces uncertainties and emphasizes future capabilities.

Rising world oil prices have prompted renewed interest in producing and using liquid fuels from biomass, oil shale, and coal to displace petroleum-derived gasoline, diesel, and jet fuels. Of these sources, coal appears to show the greatest promise. Global, proven, recoverable reserves are estimated at 1 trillion tons, and the United States leads the world in recoverable coal reserves. Moreover, the technology for converting coal to liquid fuel already exists, and production costs from initial facilities appear competitive at world oil prices in the range of $55 to $70 per barrel.

Despite its promise, private investment in coal-to-liquids (CTL) is being impeded by uncertainties about where oil prices are heading, what it actually costs to produce coal-derived fuels, and how greenhouse-gas emissions will be regulated. The last issue is especially important, since without efforts to manage emissions, producing and using coal-derived liquids could roughly double the rate at which carbon dioxide (CO_2) is released into the atmosphere.

To understand how to deal with the competing policy objectives of achieving CTL's promise while reducing greenhouse-gas emissions, RAND researchers addressed a series of questions, summarized in this research brief.

What Are the Benefits of a Domestic CTL Industry?

A commercially competitive CTL industry could be producing as much as 3 million barrels per day of high-quality liquid fuels by 2030—about 15 percent of current U.S. oil demand. Given the cost reductions likely through early production experience, a domestic CTL industry of this size should be able to generate direct economic profits of between $20 billion and $60 billion per year at world oil prices of between $60 and $100 per barrel (2007 dollars). Through various taxes, between $7 billion and $20 billion per year would go to federal, state, and local governments.

Based on a model of the world oil market and potential Organization of the Petroleum Exporting Countries (OPEC) responses, the authors anticipate that world oil prices would drop by between 0.6 and 1.6 percent for each million barrels per day of unconventional-fuel production. By reducing oil prices, consumer and business users would benefit, with each barrel of CTL yielding a net societal benefit of between $6 and $24. These benefits accrue to the nation but are not captured by investors in CTL-production plants.

While reducing world oil prices would affect all producing countries, it could yield national security benefits by reducing revenues to unfriendly oil-exporting countries, thereby weakening their ability to increase military strength, undercut U.S. foreign policy objectives, or postpone needed societal reforms.

What Are the Key Environmental Issues of a Domestic CTL Industry?

Capturing the CO_2 from a CTL plant is straightforward and inexpensive, especially compared to electricity-generating plants. For CTL plants near

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oil fields, the captured carbon can be stored underground after being used to enhance petroleum recovery, yielding two barrels of conventional petroleum and one barrel of CTL fuels at overall greenhouse gas–emission levels comparable to those of conventional-petroleum production and use. Other means of geologically sequestering CO_2 are being developed. Results are promising, indicating a high probability of achieving the benefits of a domestic CTL industry without worsening greenhouse gas–emission levels.

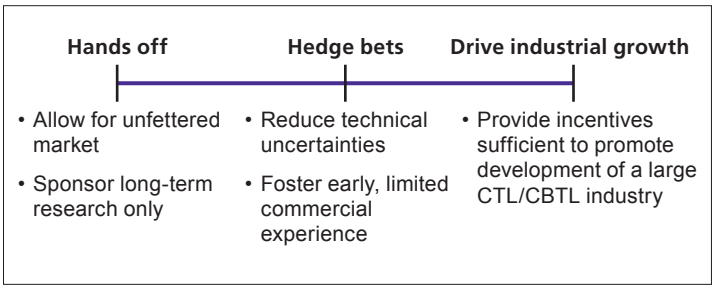
It may also be possible to produce unconventional liquids from coal at overall greenhouse gas–emission levels much lower than those from conventional petroleum. For this to occur, the CTL plant needs to be configured to accept a combination of coal and biomass and to capture and sequester nearly all the CO_2 generated at the plant site. The technology to coprocess both coal and biomass is not fully developed but could be within a few years. The analysis indicates that development risks for coal/biomass-to-liquids (CBTL) are very low.

There are other important environmental impacts. For example, a CTL industry of 3 million barrels per day would require mining roughly 550 million tons of coal per year. Because of advances in environmental-control technologies, CTL-plant operations should not pose significant threats to air and water quality, but it is difficult to predict how CTL plants would manage water consumption, especially in arid regions of Montana and Wyoming, which hold enormous coal resources. This issue remains unresolved.

What Is the Appropriate Federal Role in Developing a Domestic CTL or CBTL Industry?

The government role falls along the spectrum in the figure below. The government could take a hands-off position (what it is now doing) and allow for the free operation of the market and private decisionmaking. This would support long-term CTL or CBTL research but not near-term technology development or demonstration activities. It places little value on the societal benefits of CTL production.

Or the government could provide incentives, such as the large subsidies already in place for alcohol fuels, that would drive the development of a large-scale CTL industry. Given uncertainties about future world oil prices, greenhouse-gas regulations and control methods, and CTL/CBTL production costs, this approach could be very costly.



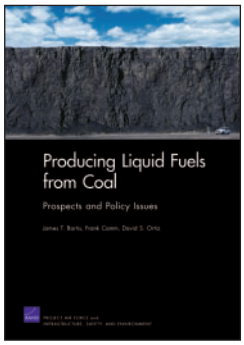
In the middle, the government could hedge its bets, reducing technical uncertainties and fostering early, but limited, commercial experience.

Given CTL's promise but the still-significant uncertainties that are impeding industrial investment in first-of-a-kind CTL plants in the United States, the middle course seems most appropriate, providing something of an insurance policy by accelerating CTL commercial development but in a way that recognizes uncertainties and emphasizes future capabilities.

Key to implementing this approach is a government commitment to advance CBTL technology and to expand its ongoing carbon-sequestration program to include larger-scale and longer-duration demonstrations.

To foster a limited amount of early commercial experience, the authors argue that offering a flexible package of incentives would draw the interest of those firms most capable of constructing and operating multibillion-dollar CTL or CBTL plants. Their research indicates that a combination of an investment tax credit and a floor price guarantee could be highly effective. To compensate the government for reducing investment risks, they suggest a profit-sharing agreement if high oil prices occur during the plant's operating life. They argue against loan guarantees unless the government is confident that it can conduct the level of oversight and control required to prevent less capable firms from participating and ensure that the federal stake is protected, especially during the construction years.

The United States has many opportunities—including coal and oil shale, renewables, improved energy efficiency, and fiscal and regulatory actions—that can promote greater energy security. CTL can be an important part of the portfolio as the nation responds to the realities of world energy markets, the presence of growing global energy demand, and the need to protect the environment. ■



This research brief describes work done for RAND Project AIR FORCE and RAND Infrastructure, Safety, and Environment documented in *Producing Liquid Fuels from Coal: Prospects and Policy Issues*, by James T. Bartis, Frank Camm, and David S. Ortiz, MG-754-AF/NETL (available at http://www.rand.org/pubs/monographs/MG754/), 2008, 198 pp., $33, ISBN: 978-0-8330-4511-9; and *Federal Financial Incentives to Induce Early Experience Producing Unconventional Liquid Fuels*, by Frank Camm, James T. Bartis, and Charles J. Bushman, TR-586-AF/NETL (available at http://www.rand.org/pubs/technical_reports/TR586/), 2008, 96 pp., $31.50, ISBN: 978-0-8330-4510-2. This research brief was written by Paul Steinberg.

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