



BRIEF ANALYSIS

Increasing America's Domestic Fuel Supply

by H. Sterling Burnett

High gasoline prices and concern about energy security are driving entrepreneurs to explore a variety of ways to produce transportation fuels. For example, researchers are experimenting with technologies to turn turkey, chicken and pig litter, and used tires, into gasoline. On the less exotic side, Congress is pushing ethanol. Ethanol is renewable — processed from corn, sugar and, theoretically, grass or biomass — and homegrown. Midwestern farmers, ethanol producers and farm-state legislators argue that increasing U.S. biofuel production and building new bio-refineries could reduce America's dependence on fossil fuel imports while diversifying its fuel supply. Accordingly, the 2005 energy bill mandated the use of 8 billion gallons of ethanol in gasoline blends, and an energy bill recently passed by the U.S. Senate would increase the mandate to 36 billion gallons.

In addition to ethanol, though rarely discussed, the United States has abundant reserves of coal, shale oil and conventional oil.

Reducing oil imports will be a challenge since Americans used approximately 384.7 million gallons of gasoline each day in 2005 — an amount expected to increase by more than one-third in the next 20 years, according to U.S. Department of Energy estimates. Assuming that reducing America's dependence on foreign oil and diversifying its fuel stocks are worthwhile governmental goals, a number of additional sources of fuel will be required. Following is a discussion of potential production from some of them.

Coal Liquefaction. There is a well-developed process to turn coal into oil. South Africa's Sasol Co. produces 150,000 barrels of oil from coal per day. China is also bringing coal-to-oil plants online, with plans to produce as much as a million barrels of oil a day from coal by 2020.

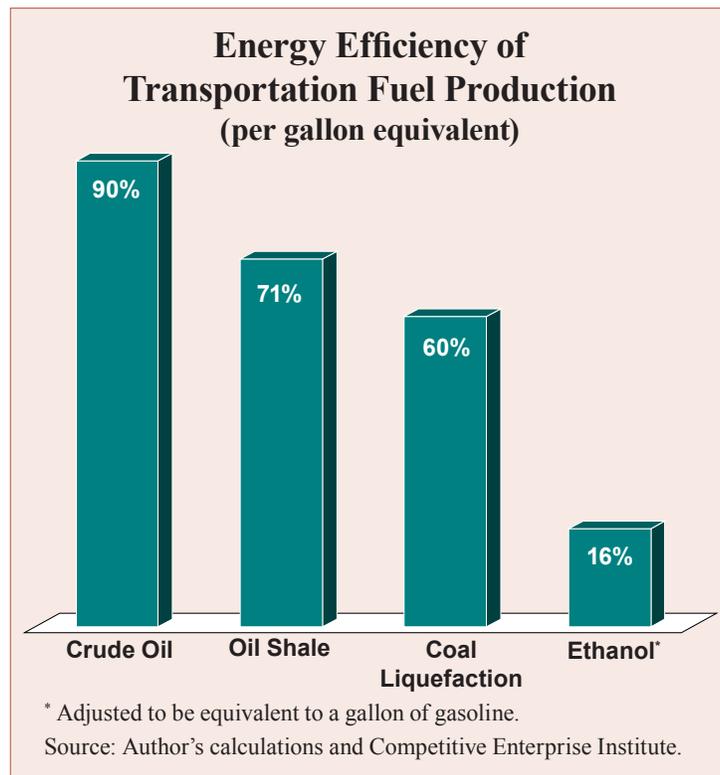
Commercial coal-to-oil plants have not been built in the United States because they require more long-term capital investment than conventional oil. Conventional oil has been relatively abundant and therefore, historically, prices have been far below

what would be needed to make synthetic oil competitive. This has changed.

The Energy Department has estimated that coal-to-liquids can compete if the price of conventional oil is above \$30 per barrel. The National Energy Technology Laboratory has estimated that a 50,000 barrel per day plant in Illinois could pay for itself in five years and produce a 20 percent return on investment every year thereafter if oil stays above \$60 per barrel.

Based on predictions that the era of cheap oil is over, a consortium of companies including General Electric, Rentech and Arch Coal plans to produce low-sulfur diesel from coal mined in Wyoming, and a company in Illinois expects to bring a commercial plant on line by 2010. The potential is substantial:

- U.S. production of oil from coal could reach 1.7 million barrels per day by 2030, according to government estimates.
- The coal industry estimates even higher future production of 2.6 million barrels per day.



- The process of transforming coal to transportation fuel also produces natural gas that can be used for heating or electric power generation.

Coal liquefaction has an ancillary environmental benefit: It removes more than 30 percent of the pollutants (mercury, sulfur dioxide and heavy metals) that are released when coal is burned to produce electricity.

Oil Shale. Another potentially huge supply of oil and natural gas is trapped in oil shale, found largely in the western states. According to geologist David Deming:

- Rock strata in Colorado, Utah and Wyoming alone contain 1,500 billion barrels of oil.
- Worldwide, the oil-shale resource base could easily be as large as 14 trillion barrels — more than 500 years of oil supply at year 2000 production rates.

Previous government efforts to extract oil from shale were very expensive, used a lot of energy and labor, and produced relatively little oil. However, research at private oil companies has produced a technological revolution. Shell Oil Co., for example, has developed a process to heat the rocks in the ground, trap the oil and extract it. On a 20 foot by 35 foot test plot, Shell produced 1,500 barrels of light crude (and 50 percent more in energy-equivalent natural gas). Shell estimates it could produce more than 1 million barrels of oil per acre or a billion barrels per square mile. In the Green River Basin of Colorado alone, there are more than 1,000 square miles of oil shale. The new technology can profitably produce oil as long as the price of conventional oil is above \$30 per barrel.

Off-Shore Drilling. There are also vast untapped conventional oil reserves under the crust of the Outer Continental Shelf (OCS) and the coastal plain of the Arctic National Wildlife Refuge (ANWR). There is more than four times as much oil under the OCS as all other current U.S. oil reserves — more than 85 billion barrels, the Interior Department's Minerals Management Service estimates. In addition, the ANWR coast contains 6 billion to 16 billion barrels of economically recoverable oil at \$20 a barrel — and up to double that amount at \$40 a barrel.

Unfortunately, all of the oil in ANWR and much of the oil under the OCS is off limits to production due to federal laws.

Ethanol. A number of scientists have calculated that it takes more energy to produce a gallon of ethanol than

the energy it generates when burned in an automobile engine. However, the U.S. Department of Agriculture estimates ethanol production takes only 75 percent as much energy as the distilled ethanol provides, for a net gain in usable energy of 25 percent. By contrast, other studies note that the production of transportation fuels (gasoline and diesel) from fossilized hydrocarbons is more efficient:

- Only 10 percent of the energy available in a barrel of crude oil is required to transform it into gasoline (and other refined petroleum products) — 90 percent of the usable energy is left. [See the figure.]
- Producing oil from shale uses almost 29 percent of its available energy — more than 71 percent of the usable energy is left.
- Transforming coal into a transportation fuel uses 40 percent of its available energy — 60 percent is left.

Furthermore, adjusting for the fact that ethanol contains 35 percent less energy than gasoline per volume, the net energy per gallon equivalent is only 16 percent.

Prominent proponents of coal-to-oil and shale oil production are pushing for government subsidies to provide security for their investment, although they argue their subsidies would be less costly than subsidies for ethanol. However, whether for nontraditional sources of oil or for ethanol, subsidies distort energy prices and investment decisions — reducing the efficiency of supply and production, and therefore the security of America's energy future.

Conclusion. Each of the options discussed above has environmental benefits and drawbacks that should be analyzed and debated before ramping up production.

Producing transportation fuels from ethanol might make sense as part of a package to diversify our sources of transportation fuel. However, before Congress mandates any expensive program to replace a small portion of the nation's gasoline with ethanol, or to produce oil from either coal or shale, it should first allow the market to explore potentially more productive sources of conventional and unconventional domestic oil by removing barriers to their exploitation. This would include ending the ban on oil exploration and production on the OCS and in ANWR and allowing the development of oil shale on public lands in the West.

H. Sterling Burnett is a senior fellow with the National Center for Policy Analysis.

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