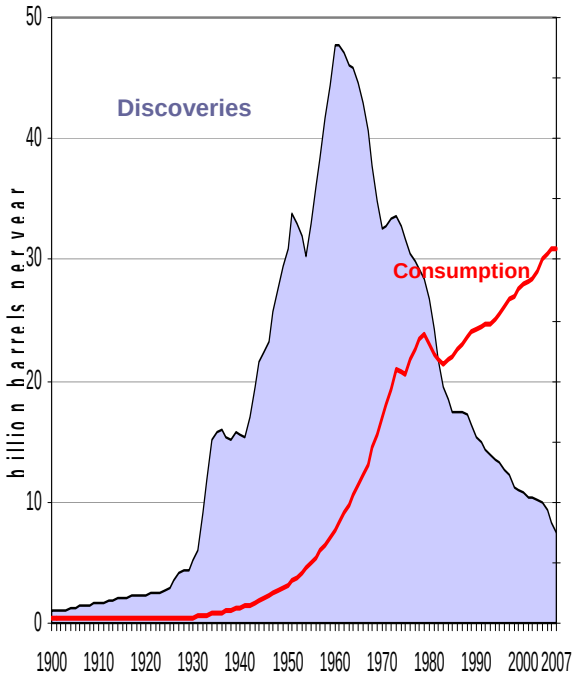
Liquid Fuels from Coal: Reducing Dependence on Imported Oil

World Oil Use Continues to Increase

World oil demand exceeds supply and is expected to increase more than 40 percent by 2030. Many experts say that global oil production has stalled and we may well be approaching (or may have already reached) global "peak oil" production.

FIGURE 1. WORLD OIL DISCOVERIES HAVE DECLINED AS CONSUMPTION HAS STEDILY INCREASED



(ASPO – Ireland, *Newsletter*, August 2007; U.S. Energy Information Administration, *World Petroleum Consumption*, 2008; and Management Information Services, Inc., 2008)

The U.S. imports over 60 percent of its oil, and this value continues to grow. Fortunately, commercially available technologies can provide a pathway out of this dilemma. Through established coal-to-liquids (CTL) processes, America's supply of coal can be transformed into liquid fuels which include high-grade diesel and jet fuels. CTL technology has a 60-year history of success, and CTL with carbon dioxide capture and storage (CCS), produces cleaner fuels with greenhouse gas emissions comparable to those from gasoline and diesel produced from petroleum.

Without substantial increases in domestic liquid fuel production, the U.S. faces the prospect of extended oil supply shortages, rising prices, continued large trade deficits and economic and national security vulnerability. Four key factors highlight America's vulnerability:

- The nation is increasingly dependent on the Organization of Petroleum Exporting Countries (OPEC) and other oil suppliers, a number of which have volatile political structures;
- Many experts believe that within the next decade, world conventional oil production will peak and begin a steady decline. Indeed, some analysts contend that peak has already occurred;
- The U.S. faces unprecedented global competition for oil from China, India and other developing nations, and this competition will grow more intense as supplies tighten and oil importing countries strive to secure oil supplies; and
- The current U.S. liquid fuels infrastructure is vulnerable to natural disasters such as those demonstrated by hurricanes Katrina and Ike.

The U.S. has the opportunity to provide price stability, improve future economic prosperity, enhance national security and reduce growing dependence on foreign oil. We can produce our own liquid fuels from America's greatest domestic energy resource—coal.

The Realities of Oil use

Oil accounts for about 40 percent of all U.S. energy use and consumption has increased by about 20% over the last two decades. The U.S. Energy Information Administration (EIA) projects this pattern will persist in American society through 2030. The realities of oil are stark:

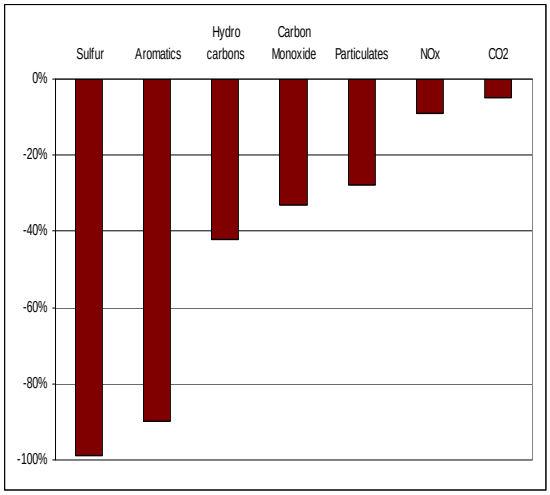
- The U.S. consumes more than 21 million barrels of petroleum products per day, over 60 percent of which is imported;
- Oil accounts for 95 percent of the energy used in the U.S. transportation sector;
- More than 7.7 million households, primarily in the northeastern United States, heat their homes with distillate fuel oil;
- Refined petroleum products are the basic feedstocks required in the production of many manufactured products, such as plastics;
- Oil refining produces asphalt and road oil and virtually all lubricants used in transportation and industry;
- The U.S. agricultural system is highly dependent on oil to seed, grow, manufacture, preserve, and ship food products, and fertilizers, pesticides, herbicides, irrigation and farm equipment all depend on oil;
- National security depends on the timely movement of military personnel and equipment; the Department of Defense (DOD) oil use totals 300,000 barrels per day (bpd). The DOD purchases more jet fuel than any other organization in the world and can serve as a catalyst for the commercial CTL industry to produce clean fuels for the military from secure domestic resources.

Superior Emission Profile with Coal-to-Liquid Fuels

CTL with CCS will have lower overall greenhouse gas emissions than those from gasoline and diesel. Co-processing the coal with 10 to 50 percent locally-derived biomass can further decrease overall plant CO_2 emissions to near zero. CTL fuels are biodegradable, clean, clear and colorless and provide an immediate replacement fuel for vehicles and aircraft. CTL emissions originate from a single source and can be controlled to levels below current petroleum refinery standards.

When compared to the diesel fuel currently used in vehicles, CTL-derived diesel has a lower emission profile. In fact, compared to typical diesel emissions, the cleaner Fischer-Tropsch diesel has an estimated 99 percent less sulfur, 90 percent less aromatics, 42 percent less hydrocarbons, 33 percent less carbon monoxide, 28 percent less particulates, 9 percent less nitrogen oxides and 5 percent less CO_2.

FIGURE 2. COAL-TO-LIQUID FUELS HAVE LOWER EMISSIONS THAN CONVENTIONAL DIESEL



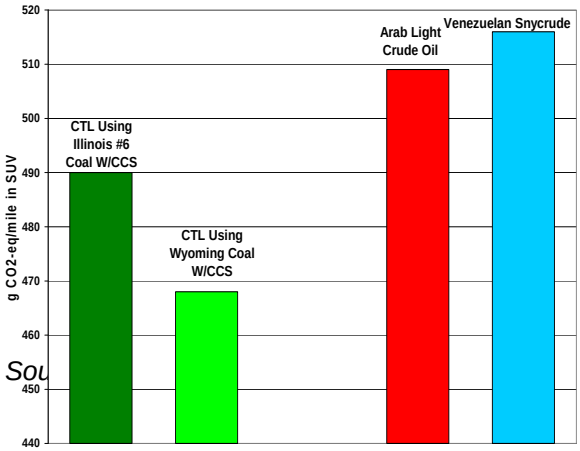
(Rentech, Inc., "Emissions and Environmental Performance of Coal-to-Liquids Fischer-Tropsch Fuels," April 12, 2007)

Further, lifecycle CTL greenhouse gas emissions can eventually be reduced to levels **below** those of imported oil, with advanced CCS technology, which is a critical factor in securing federal government support and prospective military use of CTL fuels. The DOD seeks to ensure secure and

reliable sources of energy, reduce supply chain vulnerability, and obtain cleaner, better and fewer fuels with thermal stability for advanced engines.

Finally, CTL produces ultra-clean liquid fuels that are compatible with the existing transportation liquid fuels infrastructure. In addition, CTL can provide an immediate replacement fuel for military and civilian aircraft, which have highly specialized fuel requirements. Unlike biofuels, which are not compatible with aircraft requirements, CTL fuels meet current aviation specifications and require no aircraft redesign. Coal-derived aviation fuels are presently being commercially used in South Africa and have been successfully tested by the DOD.

FIGURE 3. COAL-TO-LIQUIDS WITH CCS IS CLEANER THAN IMPORTED OIL



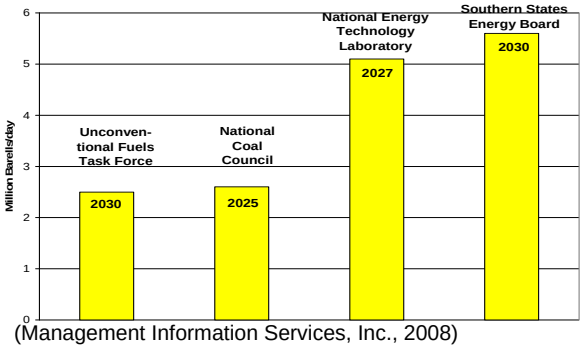
Sou

(*Life-Cycle Greenhouse-Gas Emissions Inventory for Fischer-Tropsch Fuels, report prepared for the U.S. DOE-NETL , 2001, and Management Information Services, Inc., 2008)*

Coal-to-Liquids Potential in the U.S.

The U.S. is endowed with the largest coal reserves in the world. In 2005, the U.S. produced 1.13 billion tons of coal, second only to China. Based on EIA's reserve estimate, the U.S. has a 240-year supply of coal at current production rates. Even if production were to be doubled, the recoverable reserve base estimated by EIA would last for more than a century.

FIGURE 4. GROWING POTENTIAL FOR CTL



(Management Information Services, Inc., 2008)

Mechanisms Recommended to Accelerate CTL Production

In recent reports, the Council has made the following recommendations to the Secretary of Energy:

- Congress should extend the 50 cent per gallon alternative liquid fuels excise tax credit. Also, the federal government should provide assistance to industry to attract private capital for new facilities.

- The federal government should increase its support of gasification technologies, and research should be directed toward improving conversion processes for CTL and coal/biomass-to-liquids (CBTL) in bench and pilot studies of catalysis, processes to minimize CO_2 production, and with different coal types.

- The federal government should develop clearly defined permitting processes for siting, constructing and operating CTL plants. Federal agencies should work with local, state and tribal agencies to establish a well-defined permitting process for the siting, construction and operation of CTL plants.

- The federal government should authorize and fund military purchases of CTL fuels under long-term contracts, in order to provide the basis needed for the large capital investments needed for CTL plants. Congress should support DOD's Total Energy Development Program, including extending its long-term contracting capabilities from five years to as long as 25 years.

As a public advisory committee to the Secretary of Energy initially chartered in 1984, The National Coal Council has compiled over 30 reports at the Secretary's request on numerous issues affecting coal and U.S. energy policy. The factual information in this paper, and the conclusions based thereon, are drawn from these studies and the documents used to compile them, all of which have been submitted to the Secretary of Energy.