



Coal-To-Liquids

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What is coal-to-liquids?

Coal is a combustible sedimentary rock that contains large amounts of carbon and is the most abundant fossil fuel produced in the United States. Coal was produced millions of years ago from decaying plants and other life forms. It is considered a nonrenewable energy source because it takes so long to create. Coal can be turned into a liquid fuel to power cars and other vehicles by several different processes.

How is it used?

Coal can be turned into liquid fuels such as gasoline, jet fuel, and diesel fuel. Coal as a liquid fuel is cleaner burning than solid coal. It has the potential to limit oil prices and meet our rising energy needs.

How is it produced?

Coal can be turned into a liquid through a number of different ways. During indirect liquefaction, coal is reacted with steam to convert it to a gas before being turned into a liquid. South Africa has been producing liquefied coal using this technology since the 1960s. Today, liquefied coal accounts for 40 percent of South Africa's transportation fuels.

During direct liquefaction, coal is turned directly into a liquid by adding hydrogen or removing the carbon. In one version of this process, coal is pulverized and mixed together with light-cycle oil, a distillate of petroleum that's already being produced at the refinery. The oil acts as



This coal-to-liquids plant in South Africa is the largest synthetic fuels facility in the world.

a solvent, drawing the energy-rich compounds out of the coal, and the liquid is then upgraded through standard refinery operations.

Both fuel production methods produce ash and release carbon dioxide, and both require very high capital investment and many years for construction of liquefaction plants. That is why some researches are considering adding coal, or coal-derived products, to the operations of existing oil refineries.

What is its potential in Pennsylvania?

Currently, there are no operating coal liquefaction plants in the United States, although indirect liquefaction has been proposed for a diesel fuel plant in Gilberton, PA. Indirect liquefaction supplies approximately 40 percent of South Africa's liquid fuels needs. Other plants are in discussion for US, China, and India.

Coal-to-liquids have the potential to produce a range of useful fuels and chemicals. One major benefit of coal-to-liquids fuels is their compatibility with currently existing vehicle technologies and fuel distribution systems. Coal-derived gasoline and diesel could be transported through existing pipelines, dispensed at existing fueling stations, and used to fuel today's gasoline- and diesel-powered vehicles.

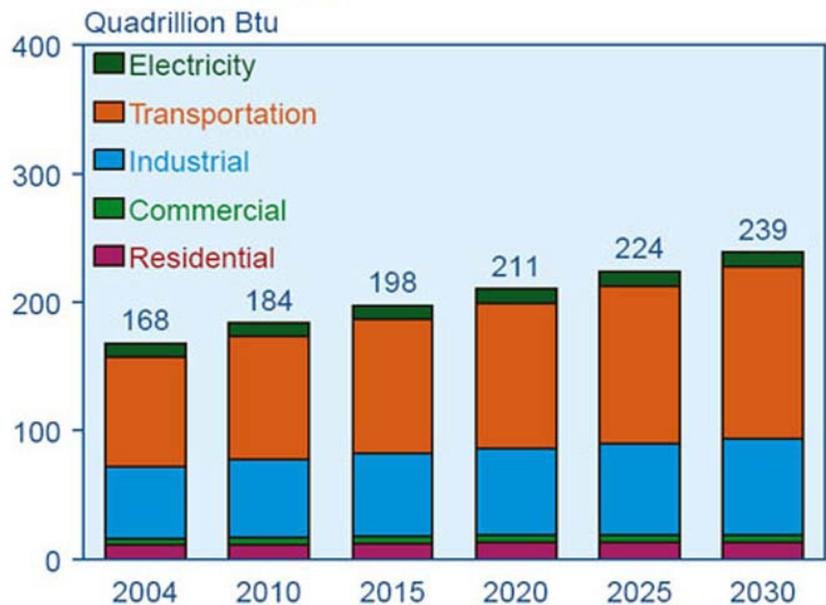
What issues are limiting it's use?

The biggest shortcoming for coal-to-liquids is high capital costs and the length of time required to build a new plant from the ground up. However, adapting existing oil refineries to allow for coal conversion should cost substantially less and it can be accomplished much more quickly. Another concern is that underground and surface mining can have significant environmental impacts. Without proper care, mining can destroy land and pollute water. The EPA's Clean Air Act (<http://www.epa.gov/air/caa/>) and the Clean Water Act (<http://www.epa.gov/watertrain/cwa/>) require the coal industry to reduce pollutants released into the air and the water. Today, restoring the land damaged by surface mining is an important part of the mining process. Because mining activities often come into contact with water resources, coal producers must also prevent damage to ground and surface waters.

In addition, the coal liquefaction process can generate significant amounts of carbon dioxide emissions. However, coal-to-liquids plants developed with new technologies can be more environmentally friendly than coal burning power

plants or oil refineries. The fuel that is produced can also be cleaner burning than petroleum.

Figure 33. World Liquids Consumption by Sector, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *System for the Analysis of Global Energy Markets* (2007).

Additional Resources

Penn State's Earth and Mineral Sciences Energy Institute
<http://www.energy.psu.edu/>

DCNR Coal in Pennsylvania Publication
<http://www.dcnr.state.pa.us/topogeo/education/coal/es7.pdf>

EMS Energy Institute Fact Sheets:
<http://www.energy.psu.edu/factsheets.html>