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Black Gold

South Africa Has a Way to Get More Oil: Make It From Coal

Company's Method Attracts Interest From U.S., China; CO2 Emissions Are an Issue

Woody by Montana Governor

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SECUNDA, South Africa -- Every day, conveyor belts haul about 120,000 metric tons of coal into an industrial complex here two hours east of Johannesburg.

The facility -- resembling a nuclear power plant, with concrete silos looming over nearby potato farms -- superheats the coal to more than 2,000 degrees Fahrenheit. It adds steam and oxygen, cranks up the pressure, and pushes the coal through a series of chemical reactions.

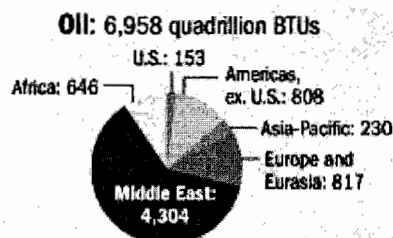
Then it spits out something extraordinary: 160,000 barrels of oil a day.

For decades, scientists have known how to convert coal into a liquid that can be refined into gasoline or diesel fuel. But everyone thought the process was too expensive to be practical.

The lone exception was South Africa, a one-time pariah state that had huge reserves of coal and, thanks to anti-apartheid sanctions, limited access to foreign oil. **Sasol** Ltd., a partly state-owned company, built several coal-to-liquids plants, including the ones at Secunda, and became the world's leading purveyor of coal-to-liquids technology.

Barrels and Lumps

The U.S. has 27% of the world's coal reserves and just over 2% of oil reserves. Global proved reserves, measured by energy output:



Now, oil prices are above \$70 a barrel, and Sasol has emerged as the key player at the center of the world's latest alternative-energy boom.

China is building a coal-to-oil plant costing several billion dollars in Inner Mongolia and may add as many as 27 facilities -- including some with Sasol's help -- over the next several years, according to a recent tally by Credit Suisse.

In the U.S., the Defense Department is studying coal-to-oil technology as a way to reduce the American military's

dependence on Middle Eastern crude oil. And the National Coal Council, an industry association, is pushing for government incentives to help generate some 2.6 million barrels of liquid fuel a day from coal by 2025. That would satisfy some 10% of America's expected oil demand that year. The plan would require 475 million tons of coal a year, which represents more than 40% of current annual U.S. production. Industry officials believe America's coal reserves are big enough to allow for the extra production.

Coal-to-liquids "is not going to replace oil," says Lean Strauss, a Sasol executive who directs the company's overseas energy business. "But it's an important substitute. It is one of the solutions to energy security."

In June, two senators from coal-producing states, Barack Obama of Illinois and Jim Bunning of Kentucky, introduced a bill to offer loan guarantees and tax incentives for U.S. coal-to-liquid plants.

Sasol has found a particularly receptive audience in Montana's Democratic governor, Brian Schweitzer, who says he carries a lump of coal and a vial of liquefied coal with him at all times. He is lobbying coal companies and others to build coal-to-liquid plants across his state, which has some of the biggest coal reserves in the U.S.

Current estimates indicate the world has just 41 years of known oil reserves and 65 years of natural-gas supplies. It has enough coal reserves to last an estimated 155 years, with some of the largest reserves in the two biggest oil-consuming countries, the U.S. and China.

It's far from clear, however, that the world would be better off -- economically or environmentally -- by burning more coal to fuel cars and trucks.

One problem is that coal-to-oil projects are extremely expensive. A single plant capable of producing about 80,000 barrels of oil equivalent a day -- less than 0.5% of America's daily oil diet -- would cost an estimated \$6 billion or more to build.

Energy analysts reckon that some coal-to-liquids projects can offer an acceptable return on investment when oil is priced as low as \$30 or \$35 a barrel, though such ventures might require government tax incentives to reduce operating costs. It seems likely that oil prices will stay above that level for a while, but the longer-term outlook is anyone's guess. An earlier flurry of interest in coal-to-oil facilities in the U.S. during the Carter administration in the late 1970s died after oil prices collapsed.

Coal-to-oil projects also pose serious environmental questions. When the South African facility superheats coal and turns it into a gas, one of the main waste products is carbon dioxide, thought to be a significant cause of global warming.

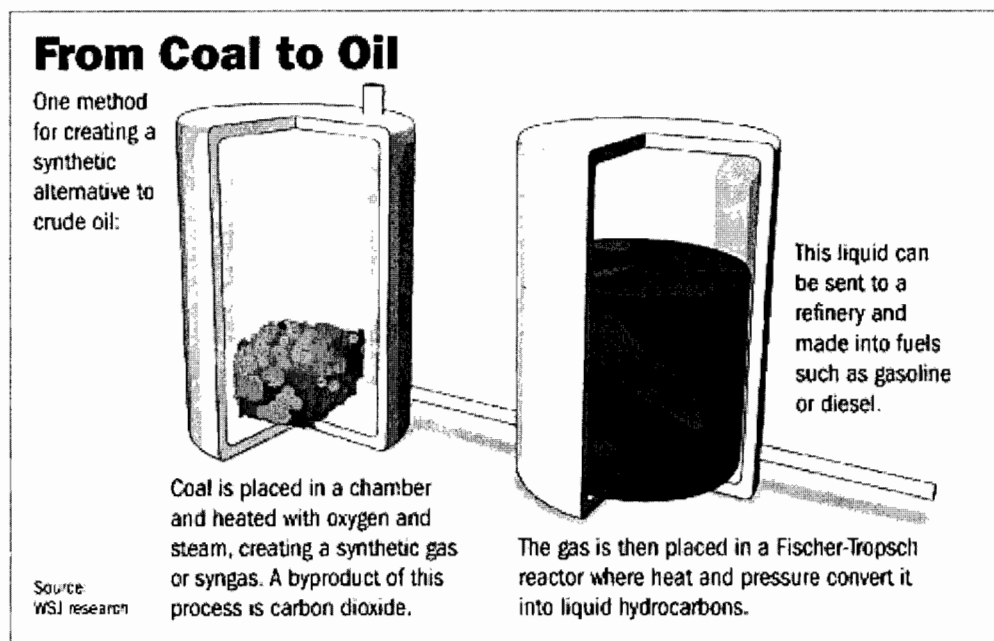
The Natural Resources Defense Council, a U.S.-based environmental advocacy group, estimates that the production and use of gasoline, diesel fuel, jet fuel and other fuels from crude oil release about 27.5 pounds of carbon dioxide per gallon. The production and use of a gallon of liquid fuel originating in coal emit about 49.5 pounds of carbon dioxide, they estimate. Even some boosters of the coal-to-oil plants describe them as carbon-dioxide factories that produce energy on the side.

"Before deciding whether to invest scores -- perhaps hundreds -- of billions of dollars in a new industry like coal-to-liquids, we need a much more serious assessment of whether this is an

industry that should proceed at all," said David Hawkins, director of the Climate Center at the Natural Resources Defense Council, at a recent U.S. Senate hearing.

Coal-to-oil is one of several promising but potentially polluting technologies that are receiving new attention amid high oil prices. Energy companies are trying to unlock natural gas trapped in shale and other difficult rock formations. They're also tapping oil-soaked sands in Canada and so-called heavy oils in politically challenging places such as Venezuela. Environmentalists fear these new sources will outshine conservation as the way to address the world's growing thirst for energy.

In South Africa, environmental groups say Sasol's facilities have emitted huge volumes of carbon dioxide and pollutants, including sulfur dioxide. They say these have caused a host of respiratory problems in nearby communities. Sasol says its emissions of these pollutants are small compared to emissions by other companies' coal-burning electricity plants in the region.



Sasol officials acknowledge their facilities emit greenhouse gases and that building more coal-to-liquids facilities around the world "could have potentially significant implications, in the long run, for our commitment to reducing carbon intensity," according to a recent company report on its social and environmental programs.

Sasol says it plans to reduce its greenhouse-gas emissions per ton of product by 10% by 2015. Sasol and many other coal-to-oil proponents say that future coal-to-liquids plants can be built with newer technologies that trap carbon dioxide and store it, sharply reducing their emissions.

Success Story

To many South Africans, Sasol is a huge success story. The company's daily production now meets about 30% of South Africa's transport-fuel needs. The country's 50-rand bank note even features a picture of one of Sasol's plants.

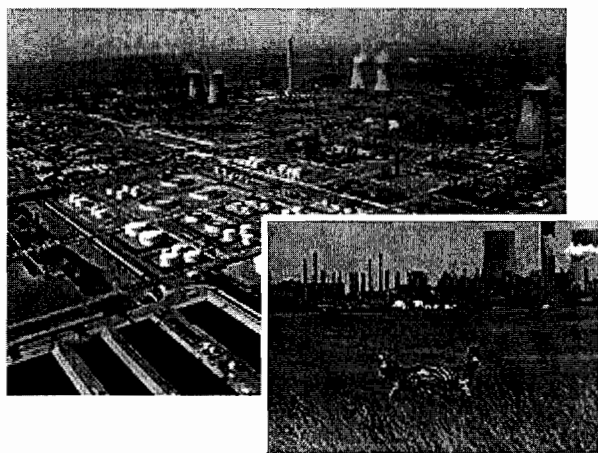
Sasol's share price has more than tripled over the past three years. Analysts estimate it earned about \$2 billion in the year ended June 30, about 35% higher than the year before -- such a sharp rise that South African authorities are contemplating a "windfall tax" on the company.

Coal-to-oil technology dates back to the 1920s, when two German chemists, Franz Fischer and

Hans Tropsch, developed a process to convert coal into a gas and then use it to make synthetic fuels. Coal-to-oil technology helped fuel the Nazi war machine, which lacked access to sufficient crude oil. International oil companies also experimented with the process but put it aside because oil was cheaper.

South Africa took a different view. The country lacked oil, but had enormous deposits of coal, much of which had limited market value because of its poor quality. In 1950, the government set up Sasol as a state-owned company and authorized funding for its first project, a coal-to-liquids facility called Sasolburg in the South African countryside.

When oil prices soared in the 1970s, South African officials decided to up the ante. They lent Sasol \$6 billion to build two new facilities at Secunda -- each 10 times as large as Sasolburg. The government also privatized the company, listing it on the Johannesburg Stock Exchange in 1979. (The government maintains a 23.5% stake).



Sasol's Secunda, South Africa, complex converts tons of coal into 150,000 barrels of oil each day.

By the time the facilities were completed in the early 1980s, international oil prices were collapsing. The project was nonetheless a success for the white-dominated apartheid government because international sanctions were restricting South Africa's ability to buy foreign oil. The plants managed to stay profitable by continually boosting efficiency and expanding their end products to include plastics, fertilizers and explosives.

Besides the government loans, Sasol at various times received cash payments from the government when oil prices fell below a certain level. It eventually paid back the loans and stopped receiving subsidies for its coal-to-oil

business by 2000.

Today, Secunda is a buzzing industrial hub with 16,000 employees, miles of interlocking pipes and cables, and eight colossal silos. The silos, each big enough to contain a football field, cool steam involved in the conversion process. Fuel trucks wait along the edge of the facility to fill up with gasoline. Nearby mines produce more than 40 million metric tons of coal a year -- as much as all of Illinois.

Outside the plant gates, Secunda has a boomtown feel. It has some 35,000 people, a BMW dealership and a multistory casino hotel called Graceland designed to evoke the "grand old age of Colonial America."

A growing focus for Sasol is marketing its technology overseas. The company first tried to do so in the 1990s, after apartheid ended, but executives found doors slammed in their faces. Oil was trading for less than \$25 a barrel at the time. "We sat in corridors waiting for meetings that never happened because they didn't even know who Sasol was," recalls Pat Davies, Sasol's chief executive.

First Inroads

Sasol made its first inroads in countries such as Qatar that have big stockpiles of hard-to-transport natural gas. These countries were interested in Sasol's technology for turning natural gas into liquid fuel.

As oil prices began to perk up, Sasol drew interest on the coal front from China, with its big coal reserves and energy needs. In marketing materials produced for Chinese government officials and investors, Sasol offers a simple message: By 2015, 70% of China's oil imports will come from the Middle East. Yet the country has coal reserves equivalent to more than half the oil in the Middle East.

By 2004, Chinese energy planners began meeting with Sasol executives in Beijing to discuss the coal-to-oil process. That was followed by a series of meetings with policy makers and Chinese companies, capped by a gathering in Cape Town in June attended by visiting Chinese Premier Wen Jiabao.

Coal-generated pollution is emerging as a major environmental crisis in China. Yet Chinese officials are apparently willing to accept more coal use if it means improving the country's energy security, especially if local companies can design facilities to use relatively clean-burning varieties of coal.

Shenhua Group, China's largest coal producer, has started work on China's first commercial coal-to-oil facility, designed eventually to produce as many as 200,000 barrels of oil equivalent a day. Although that plant uses a different process from Sasol's at Secunda, Shenhua officials are in negotiations with Sasol to jointly build at least one additional 80,000-barrel-a-day plant using the South African company's technique.

While Sasol would charge a fee for licensing its technology, its main interest is to share ownership in the facilities once they're built because it wants a share of the long-term profits. In China, Sasol is asking for a 50% equity stake in the projects. A Shenhua official says negotiations are going smoothly and the company hopes to begin construction soon.

In Montana, at least two companies, including the world's largest private-sector coal company, **Peabody Energy Corp.** of St. Louis, have said they are looking at potential coal-to-oil sites. Montana's Gov. Schweitzer says any excess carbon dioxide from a facility could be given to oil companies to be injected back into the ground to enhance recovery from old wells.

Bringing Sasol on board is critical, says Gov. Schweitzer. He says Wall Street banks want the South Africans to play a role because Sasol is the only company with a track record in the business. To woo Sasol executives, he says, he took them on a flight over Montana coal country last year.

"These are the guys everyone wants to take to the prom," Gov. Schweitzer says.

Sasol officials say they're interested in Montana and other potential sites in the U.S., provided they can find a suitable partner and receive tax or other incentives.

Coal-to-oil "is coming to the United States," Gov. Schweitzer proclaims. When it does, he says, other countries "will be scrambling to protect their oil supplies -- and we'll be energy independent."

–Shai Oster in Beijing contributed to this article.

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