Burial Plan Deep in the Sahara, BP Tries to Put Dent In Global Warming

Energy Giant, Partners Stuff CO2 a Mile Underground, But Will It Stay There?

Too Much Carbon for Perrier

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IN THE SAHARA, Algeria -- More than 100 miles from the nearest inhabited settlement, one of the world's biggest energy companies thinks it has found a cheap way to get rid of its global-warming problem: Bury it.

At a new natural-gas processing plant here in the desert, BP PLC and two partners have spent $100 million to take carbon dioxide that otherwise would be sent into the air and put it back where it came from: a mile underground. Carbon dioxide, or CO2, is believed to contribute to global warming by trapping the sun's rays in the atmosphere. It's produced whenever fossil fuels such as coal, oil and natural gas are processed or burned.

With the Kyoto Protocol, the treaty limiting global-warming emissions in most industrialized nations, set to enter into force Feb. 16, companies that will have to curb their emissions in compliance with their countries' caps are scrambling to figure out how to do so without killing their bottom lines. Even in the U.S., which has rejected the treaty, companies are looking for a solution, figuring it's only a matter of time before they face caps, too.

At their plant here, BP and its partners have found a way to keep pumping their core product -- fossil fuel -- even amid tightening global-warming constraints. The group, which switched on the plant in July, plans to inject one million tons of carbon dioxide back underground each year during the two decades it expects to pull gas from the reservoir below. That's about as much CO2 annually as 100,000 sport-utility vehicles emit.

One big question: Will the carbon dioxide stay underground long or could it come burping back up out of the earth? Even if the Algeria project succeeds, it will put only a tiny dent in the world's CO2 output. But the concept is drawing growing interest because it could curb global warming more quickly than switching to alternative energy sources or cutting energy use.

"This is the cheapest option we have," Iain Wright, BP's CO2 project manager, said one morning last month as he stood in jeans, hiking shoes and a hard hat beside a nine-foot-tall compressor that was shooting carbon dioxide back into the earth.

Other energy giants are looking into carbon-dioxide burial, also known as "geologic storage." Norway's Statoil ASA, one of BP's partners in Algeria, has operated for the past eight years a carbon-dioxide burying project in the North Sea that's nearly as large as the one here in the desert. ChevronTexaco Corp. is planning to spearhead a project off the coast of Australia that's expected to be nearly three times as large when it starts operations in 2009.

Governments including the U.S. and the European Union also are spending tens of millions of dollars annually looking into the concept. That's because it could prove a lifeline for a fossil fuel that's even dirtier than natural gas: coal.

A typical coal-fired power plant emits several million tons of CO2 each year. If carbon dioxide from coal could be captured, put into a pipe and shot underground, then coal might no longer present a global-warming problem.

Underground formations that scientists believe could hold large amounts of CO2 are strewn across vast stretches of the Earth, including coal-dependent regions such as the U.S. Midwest. The Paris-based International Energy Agency estimates there's enough capacity in these formations to hold twice as much carbon dioxide as the world is likely to emit over the next half century.

Lured by this prospect, the U.S. government has helped pay to drill a two-mile-deep hole in the parking lot of a West Virginia coal-fired power plant owned by American Electric Power Co., the nation's largest utility and one of its biggest CO2 emitters. The government and AEP are looking at the underground rock to see if it could store carbon dioxide from the plant.

"If we have to limit CO2 emissions, then we need a way to do that and be able to rely on coal as an energy option for the country going forward," says John McManus, vice president for environmental services for the Columbus, Ohio, utility.

The world emits about 24 billion tons of CO2 each year, making even the one million tons that the Algeria project is expected to store annually a drop in the bucket. But it's still a big drop: Most other projects under way to reduce carbon-dioxide emissions are a lot smaller. In a sign of growing interest, a United Nations panel on global warming is due to issue a report on CO2 burial later this year. People familiar with it say it's likely to be bullish, an outcome that could boost government support.

Some environmentalists worry that the prospect of burning fossil fuel without hurting the atmosphere will reduce interest in nonpolluting energy sources such as the sun and the wind. Others, however, say the world can't afford to wait to start slashing its CO2 emissions until alternatives are ready. "We're going to have to start cutting carbon before we stop using fossil fuels," says David Hawkins, director of the climate center at the Natural Resources Defense Council, a New York-based environmental group.

An underlying question is whether burying carbon dioxide is safe. In 1986, carbon dioxide and other gases that existed naturally below a volcanic lake in Cameroon suddenly rose into the air, asphyxiating more than 1,700 people nearby.

BP geologists say the reservoir they are shooting their carbon dioxide into is better sealed than a volcano, which essentially is a natural hole running deep into the earth. But they admit there are uncertainties.

"Nothing's 100%. What we're talking about is something a mile underground," says Fred Riddiford, an engineer who has spent eight years planning the project. "But we've done as much as we can to mitigate the risk."

It's hard to imagine a less hospitable spot to conduct a high-stakes science project. The project is named In Salah for the nearest inhabited settlement in this stretch of the Sahara. The nearest sizable city, the Algerian oil town of Hassi Messaoud, is about 300 miles to the northeast. Temperatures can swing from below freezing in the winter to 130 degrees in the summer.

The project dates to 1995, when BP signed an agreement with Sonatrach, Algeria's state-controlled oil and gas company, to explore the possibility of tapping gas in the central Sahara to help supply Europe.

Natural gas typically comes up from the ground tinged with concentrations of carbon dioxide that are too great for most power plants or appliances to handle. Natural-gas processing involves stripping off much of that carbon dioxide. Typically, the CO2 goes into the air.

As the project was ramping up, governments around the world were starting to push for carbon-dioxide emissions constraints. Moreover, BP's chief executive, John Browne, was embracing the idea that business needed to reduce its global-warming emissions. In 1998, the year after the Kyoto Protocol was negotiated, Lord Browne announced that by 2010, BP would cut its annual emissions of CO2 and other global-warming gases 10% below its 1990 level.

By the time of Lord Browne's speech, the In Salah engineers had spent more than a year considering where to put their CO2. There are examples around the world of carbon dioxide from industrial sources being cleaned and used in food and drink production, and the engineers considered that option. But they rejected it as impractical given the large amount of CO2 their project was going to produce. "It's a lot of bloody Perrier," Mr. Riddiford says.

So they decided burial was the best option. But it would be too expensive to bury all of the carbon dioxide. Just reinjecting the carbon dioxide from the natural gas was raising the Algerian project's cost by $100 million, to $2 billion. In Salah also would be producing CO2 from all the machinery on-site that would be burning some of the natural gas. BP and Sonatrach invested in beefier machinery to try to reduce those emissions, but they concluded it would be too expensive to try to avoid those emissions altogether. They decided to let about 400,000 tons of CO2 each year -- 40% of the amount they would be injecting underground -- go up into the air.

To figure out how to safely inject the carbon dioxide into the ground, the In Salah team hunkered down in "hives," windowless rooms at BP's main office park outside London in which three-dimensional computer models of underground geology can be manipulated on wide screens.

The reservoir into which they were going to inject their CO2 is known as Krechba and sits a mile underground. Like other oil or natural-gas reservoirs, it's a rock filled with tiny pores in which the oil or gas sits. The Krechba reservoir resembles an oval-shaped butter dish that's been turned upside down. In the center of the dish, the pores contain gas. Near the edges of the dish, the pores contain water.

The team decided it would drill four holes into the center of the reservoir. These "producer wells" would suck out the natural gas. The team would drill other holes into the edges of the reservoir. These "injector wells" would shoot the waste carbon dioxide back in.

The reservoir sits directly under a half-mile-thick layer of essentially impermeable "cap rock." The main concern was that the carbon dioxide shot back into the reservoir might find its way back up through the man-made holes in the cap rock: the wells that were going to pull up the natural gas. So it would be important to position the wells injecting the carbon dioxide as far as possible from the wells sucking out the natural gas.

The team settled on spots for five injector wells. But the three it liked most were outside the government-approved drilling area. Algerian officials nixed them, worried that the CO2 would scare off other companies from investing in nearby natural-gas production in the future, according to several people involved in the discussions.

So the three wells were drilled closer in, and In Salah began processing natural gas in July. A problem cropped up a few months later. One of the two big compressors that In Salah had custom-ordered to shoot the CO2 underground didn't work properly. Probably, officials say, some sand got lodged in the compressor, and in the haste to get the plant running, someone failed to clean the compressor thoroughly.

Now that compressor sits in pieces as repairs continue. Next to it, the other compressor is functioning, but it can't handle all the carbon dioxide that the plant is producing. The upshot: About 30% of the CO2 that was supposed to be stored underground is being sent into the air through a pipe. In Salah officials hope to have the second compressor fixed in a few days.

"This is not what we invested for," Mr. Riddiford said last month, standing by the pipe. "We invested so that all of that would be going into the ground."

From now on, the main challenge will be to monitor the underground carbon dioxide and make sure it's not leaking. Last August, BP paid a pair of researchers from the British Geological Survey to stick a machine in the sand to sample the carbon-dioxide content of the soil above the reservoir at various points. If future tests reveal the CO2 content has risen, that would suggest a leak.