

With groundbreaking, large-scale carbon capture finds a home in the oil patch

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THOMPSONS, Texas -- The elusive dream of commercial carbon capture and storage may finally be moving closer to reality, in part thanks to the nation's crude oil boom.

NRG Energy Inc. and its partner JX Nippon Oil & Gas Exploration Corp. broke ground Friday on a project here that both companies believe will be one for the record books. The 50-50 venture aims to pull carbon dioxide from the waste stream coming from a coal-fired power plant just southwest of Houston and make money by selling the CO₂ to nearby oil producers.

The concept has been around for many years, but until very recently it has mostly been just talk. The power industry has theorized for some time that heat-trapping emissions like CO₂ could be taken out of smokestacks and sequestered deep underground, where geological formations should hold it. And the oil and gas industry has long been seen as likely the first major sector to embrace the technology, as drillers for decades have used CO₂ in enhanced oil recovery (EOR).

One pilot post-combustion CO₂ plant has already been built in Alabama, but on a much smaller scale. The Petra Nova project now under construction scales this same technology up considerably. It will be the first large-scale, profit-oriented carbon capture and storage (CCS) project in the United States.

"What's happening here has global implications," U.S. Deputy Secretary of Energy Daniel Poneman said during a gathering organized to celebrate the start of construction of Petra Nova.

According to data compiled by the Massachusetts Institute of Technology, there are about two dozen power plant CCS projects globally, but nearly all of them exist on paper alone. Aside from a spattering of pilot projects worldwide, CCS technology today is largely insignificant in the power sector and as a means of mitigating climate change in general.

But in the U.S., activity is finally starting to pick up. Last week U.S. EPA approved the FutureGen Alliance's request for a permit to sequester CO₂ from a coal-fired plant in western Illinois. The \$1.65 billion project has been in development for at least a decade but is just now getting close to a construction start date.

Petra Nova, which will be next to NRG's W.A. Parish coal-fired plant in Fort Bend County, used to be on the "planning" list too but is now officially under construction. Project investors say they hope to have it running by the end of 2016.

'Market-based project'

Petra Nova differs from FutureGen in that it has mostly secured financing from private sources. Whereas FutureGen is getting a big financial boost from the Department of Energy, the \$1 billion project unveiled by executives here Friday is getting some DOE grant support, but the rest is privately financed.

Around \$167 million in DOE funds is allocated to Petra Nova. NRG and Tokyo-based JX Nippon are contributing equity of about \$300 million each. Japanese banks are financing the rest.

NRG CEO David Crane made clear that his company sees Petra Nova as the beginning of a new business model. The CO₂ captured from burnt coal will be sent by pipeline 80 miles southwest to the West Ranch Oil Field in Jackson County, where the aim is to sell it to private oil and gas company Hilcorp. Part of the CO₂ stream could be sent to other oil fields for use in EOR in the future.

"First and foremost this is now a market-based project, and so the project will be a commercial success depending in significant part on oil prices, and so that will be an important factor," Crane told reporters at a briefing. "The carbon flooding of the field leading to the oil production part has to work as well."

Crane acknowledged that looming federal regulations of CO₂ from power plants influenced his company's thinking on the project as well. But even without more stringent emissions rules, Crane said he and the project's partners are attracted by the basic economics of the deal. He pointed to a "whole series of [oil] fields in this area of Texas" that are attractive options for using CO₂ in enhanced oil production.

"As long as we can get a pipeline there and we can separate the carbon, we have plenty of opportunities even beyond the West Ranch field," Crane said.

Coupling carbon flooding with sequestration

The project is relying on more than money from Japan. Mitsubishi Heavy Industries Ltd. and Kansai Electric Power Co. are supplying engineering talent and technology to bring Petra Nova to reality.

A Mitsubishi engineer said the system is an ultra-efficient method for extracting CO₂ from flue gas using a proprietary solvent that forms a temporary bond with the CO₂, removing about 90 percent of it from the waste gas. A slight reheating of this mixture then releases the CO₂ from the solvent, leaving behind pure carbon dioxide that will be piped to the oil field.

Mitsubishi has built about 10 similar units at other projects around the world, but those mostly removed CO₂ from natural gas post-combustion waste.

At an oil field near Victoria, Texas, the CO₂ will be injected deep underground at high pressure, where it will form bonds with oil and improve the viscosity of the crude oil, making it easier to pump out of the ground. Hilcorp estimates that by applying EOR to its West Ranch field it can expand production there from about 500 barrels a day today to about 15,000 barrels per day.

The oil and CO₂ will be separated again at the surface, with the CO₂ diverted back underground in a loop cycle to take even more crude out of the field. Though the principal aim is to use the CO₂ for oil recovery and not necessarily for permanent sequestration, JX president and CEO Shunsaku Miyake insisted that large volumes of CO₂ will be sequestered by the process, meaning that Petra Nova does tackle climate change to some extent.

"It addresses a global environmental issue," Miyake said.

NRG estimates that Petra Nova will remove around 1.6 million tons of CO₂ annually, greenhouse gases that would otherwise be left to build in the atmosphere.

If successful, Petra Nova could be the catalyst for a whole new business model for some of the nation's coal-fired power plants, but only for a small number of the total. Coal is the source of about 40 percent of the U.S. electricity supply.

Crane estimated that only about 5 percent of U.S. coal plants could be retrofitted to capturing and selling CO₂ to the oil and gas industry.

The next such project to become reality may also be built in Texas.

Developers of the Texas Clean Energy Project (TCEP), planned to occupy a former possible FutureGen candidate site in the West Texas oil patch, say they are still moving forward with their goal of capturing CO₂ from coal combustion and marketing it to neighboring drillers for EOR. TCEP's developers say they hope to secure financing for the venture by April 2015 and to begin construction the following summer, with an estimated startup date in 2018.