

ENVIRONMENT

Could Texas profit by storing carbon dioxide underground?

Officials exploring how to capture power plant emissions, inject them beneath Gulf Coast, oil-rich Permian Basin.

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Facing the prospect of federal action on global warming, many states are encouraging businesses and consumers to limit their carbon dioxide emissions. But in Texas, government officials and university researchers are looking in a different direction: Stuff the greenhouse gas underground.

The state geologist has said that Texas could become a national repository for carbon dioxide, pointing out an irony: Texas, which is the country's largest emitter of greenhouse gases and has a Legislature reluctant to limit emissions, could end up reaping billions of dollars from federal caps on the gas.

Last month, the U.S. Environmental Protection Agency began a flurry of activity by proposing rules for carbon storage. And a U.S. House subcommittee on environment and hazardous materials took testimony on the topic. Texas lawmakers held their own hearings in the spring, and no fewer than three research teams at the University of Texas are studying the technical side of the issue.

The tactic, ambitious and distinctly Texan, would allow power plants to get rid of their carbon dioxide and companies ultimately to pump out more oil. State officials are exploring how to capture carbon dioxide from specially built power plants and inject it underground beneath the Gulf Coast and the oil-rich Permian Basin in West Texas.

Meanwhile, the issue has split environmental groups. Major players, including the Environmental Defense Fund and Natural Resources Defense Council, have generally supported carbon storage as another tool to ratchet down global warming.

'A big issue' for Texas

But some groups, such as Greenpeace, have described carbon capture and storage as a corporate boondoggle.

Texas emits at least 650 million tons of carbon dioxide each year — if the state were its own nation, it would be the seventh-largest emitter globally — and some officials say the state needs to prepare for the possibility of federal rules on carbon dioxide emissions.

"It's such a big issue for the state of Texas, we can't be caught standing at the gate," said state Rep. Warren Chisum, R-Pampa, who serves on the House Energy Resources Committee and supports the pumping of carbon below ground.

Carbon dioxide, which is naturally stored in oceans and used by plants, has been injected underground in Texas for at least three decades as part of a process known as enhanced oil recovery: The carbon dioxide creates a sort of aerosol, pushing out underground oil that is impossible to get by conventional means. The gas used in this process is typically extracted from natural underground reservoirs.

But with the possibility of federal curbs on emissions, companies are paying scientists to figure out how to capture carbon dioxide before it goes skyward. The gas produced by power plants would be pumped below ground into areas that are characterized by sandstone and limestone and are often filled with salt water, said Susan Havorka, a senior research scientist at UT's Gulf Coast Carbon Center in Austin.

"We're talking about the spaces between grains of sand," she said. "They're microscopic spaces, but they're nonetheless real."

But manufactured emissions of the gas have never been captured and stored on a commercial scale, and construction of the special power plants could be years away.

Adding carbon capture capabilities "doubles the capital cost of the power plant and reduces power output by 30 percent," said Gary Rochelle, a chemical engineering professor at UT who receives money from utilities to examine carbon capture. Teams of petroleum engineers and geologists are also studying the issue.

"If the whole U.S. does something (about carbon emissions), Texas will be best able to cope with it, and we'll be able to do it in the least costly way because we're blessed with places to put the carbon dioxide," Rochelle said.

An untested idea

Under laws passed during the last legislative session to encourage carbon capture and storage, utilities could get tax breaks in Texas for building facilities that capture carbon dioxide emissions and send them underground, and oil companies could get breaks for using the manufactured carbon dioxide emissions in their recovery efforts.

But no power plant in the world that operates on a commercial scale has separated carbon dioxide from other emissions and injected it underground, said Theresa Pugh, director of environmental services at the American Public Power Association, which represents more than 2,000 state and municipally owned utilities.

The most serious proposal for such a plant, the \$1.5 billion, federally funded FutureGen coal plant, fizzled after the Department of Energy effectively pulled the plug on the project before ground was broken earlier this year. (Texas had lost out to Illinois in final bidding for the plant.)

The best opportunities exist in places like Texas, where because of coal-fired electricity and oil production, large scale carbon dioxide generation and large volume carbon dioxide storage potential come together, Scott Tinker, the state geologist and director of UT's Bureau of Economic Geology, told the state House Carbon Caucus in June.

The state could encourage carbon capture and storage by leasing out state land for injection areas, taking on liability and streamlining regulation, he told the panel.

A boon for Texas?

As companies across the country prepare for possible federal caps on carbon dioxide — which failed to pass this year in Washington — states like Texas could take the gas off their hands, pipe it underground and find themselves sitting atop a gold mine, according to the bureau.

The bureau, which collaborates with oil and gas companies on some projects, said that expanding the carbon sequestration across the state could pump \$500 billion into the economy. The limestone shelf beneath Texas, in some places several miles thick, could store at least 60 billion tons of carbon dioxide, according to a carbon atlas prepared by the National Energy Technology Laboratory. A fraction of that carbon, about 700 million tons, could be used for enhanced oil recovery, according to the bureau.

Last year, the Texas Legislature passed tax incentives and established a \$30 million grant program for the storage of carbon dioxide.

Money was never appropriated for the program, however, so no utilities have taken advantage of it, according to the State Energy Conservation Office.

"Of the mitigation strategies out there, (pumping the gas underground) offers the largest potential in terms of the volume of carbon reduction," said Darrick Eugene, general counsel for the Texas Carbon Capture and Storage Association, which represents utilities and energy companies hoping to make money on carbon storage.

Eugene said oil pumped out using the stored carbon dioxide should be called "green oil" because more carbon dioxide is stuffed underground than is generated by the oil when it burns.

The merits of carbon capture and storage, however, are being debated within the environmental community.

"We believe geologic sequestration is ready to begin deployment today," said Scott Anderson, an Environmental Defense Fund analyst. He said Congress should put together a cap on carbon dioxide emissions to spur a market for carbon capture.

But in May, Greenpeace issued a report titled False Hope: Why Carbon Capture and Storage Won't Save the Climate, which said carbon capture has not been commercially tested, distracts from efficiency measures in power plants and will cause power prices to rise. The report accused coal companies of trying to sell carbon capture as a way of staying in business, since carbon caps could crack down on their emissions.

The group said the government should invest in efficiency measures and alternative power technologies, like wind and solar, instead.

Is carbon capture and storage ready for prime time?

The combination of capturing carbon emissions from a large power plant and storing them underground is largely untested, and a scientific panel convened by the United Nations in 2005 concluded that 'the costs of these systems cannot be stated with a high degree of confidence at this time.'

But scientists say less than 1 percent of carbon dioxide will leak from geological deposits over 1,000 years. And they say local health, safety and environmental risks of geologic storage are comparable to the risks of current, regulated activities like natural gas storage and enhanced oil recovery.

Alternatives to carbon capture and storage include investing in energy-efficiency improvements, switching to less carbon-intensive fuels, building nuclear power plants, establishing renewable energy sources and reducing other greenhouse gas emissions, such as methane.

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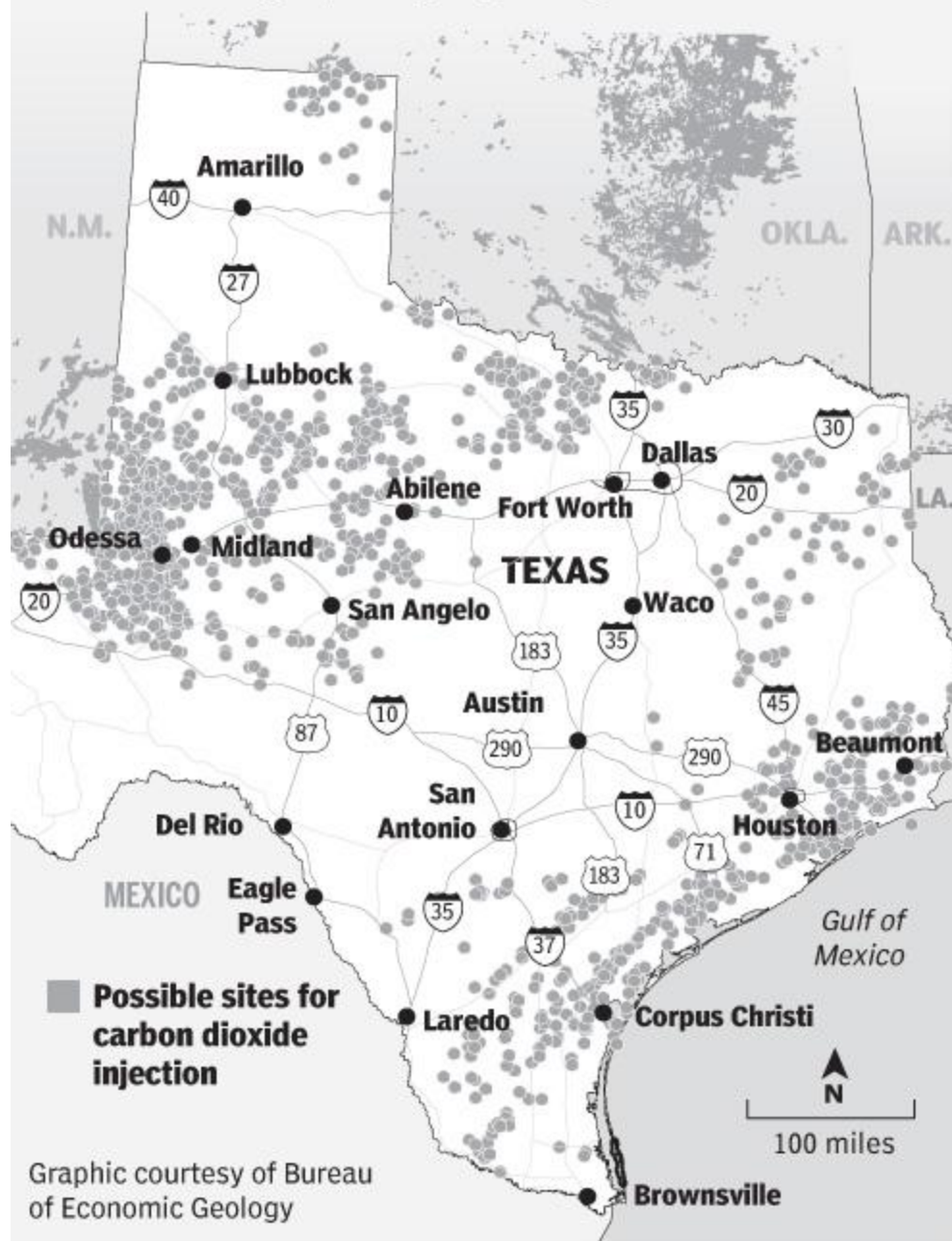


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University of Texas chemical engineering professor Gary Rochelle, left, is researching the possibility of capturing manufactured carbon dioxide, liquefying it and injecting it underground. Frank Seibert, right, manages a J.J. Pickle Research Campus plant in North Austin, where the carbon dioxide scrubbing study is being conducted.

Stuffing carbon dioxide underground

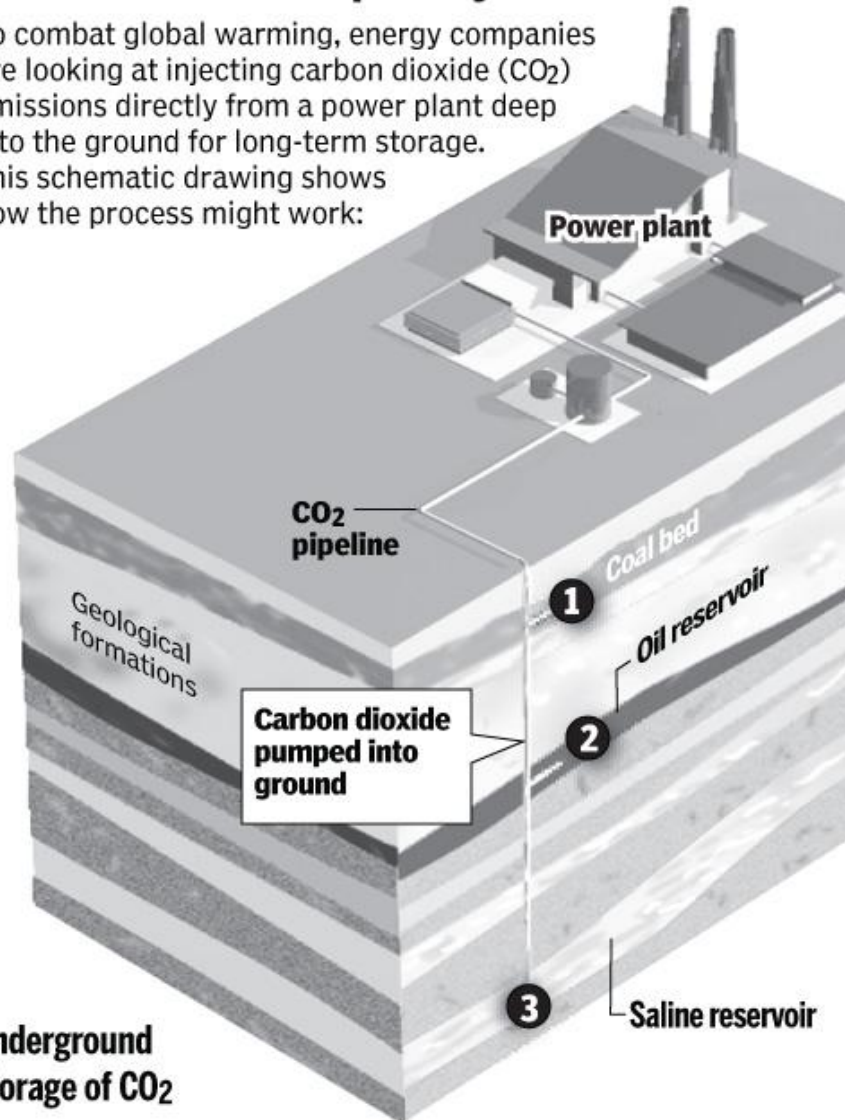
As other states are seeking to draw down their carbon dioxide emissions in the face of national action on global warming, Texas is looking at putting CO₂ underground.



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Will Texas become a repository for CO₂ emissions?

To combat global warming, energy companies are looking at injecting carbon dioxide (CO₂) emissions directly from a power plant deep into the ground for long-term storage. This schematic drawing shows how the process might work:



Underground storage of CO₂

① Coal bed: 1,000-1,500 feet

Absorbs gas; chemical bond between coal and CO₂ displaces methane in coal; methane can be pumped out to power plants or gas turbines to produce electricity.

② Oil reservoir: 2,500-5,000 feet

CO₂ dissolves in oil; it makes oil thinner, less sticky, easier to be pushed up and recovered; leftover CO₂ remains inert in oil reservoir.

③ Saline formation: 6,000-10,000 feet

At this depth, pressure liquefies CO₂, which is stored in small pores of rocks.

Sources: FutureGen, Illinois State Geological Survey, Midwest Geological Sequestration Consortium, Tele Atlas, Popular Science magazine

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