

By [Benoît Morenne](#)

Follow

April 10, 2023 9:44 am ET

About fifty miles southwest of Midland, Texas, deep in the oil-saturated Permian Basin, more than 100 workers are busy laying out roads and water lines, preparing to build an elaborate complex of fans, each as large as a tennis court.

When they start running in 2024, the fans will suck massive amounts of carbon dioxide out of the air. The carbon will be funneled thousands of feet down deep wells into geological formations, where it should remain for centuries.

The company behind this environmental moonshot is [Occidental Petroleum Corp.](#), [OXY 0.73% increase; green up pointing triangle](#) one of the country's most successful oil-and-gas producers. It hopes the enterprise will give it license to keep operating as a driller decades into the future.

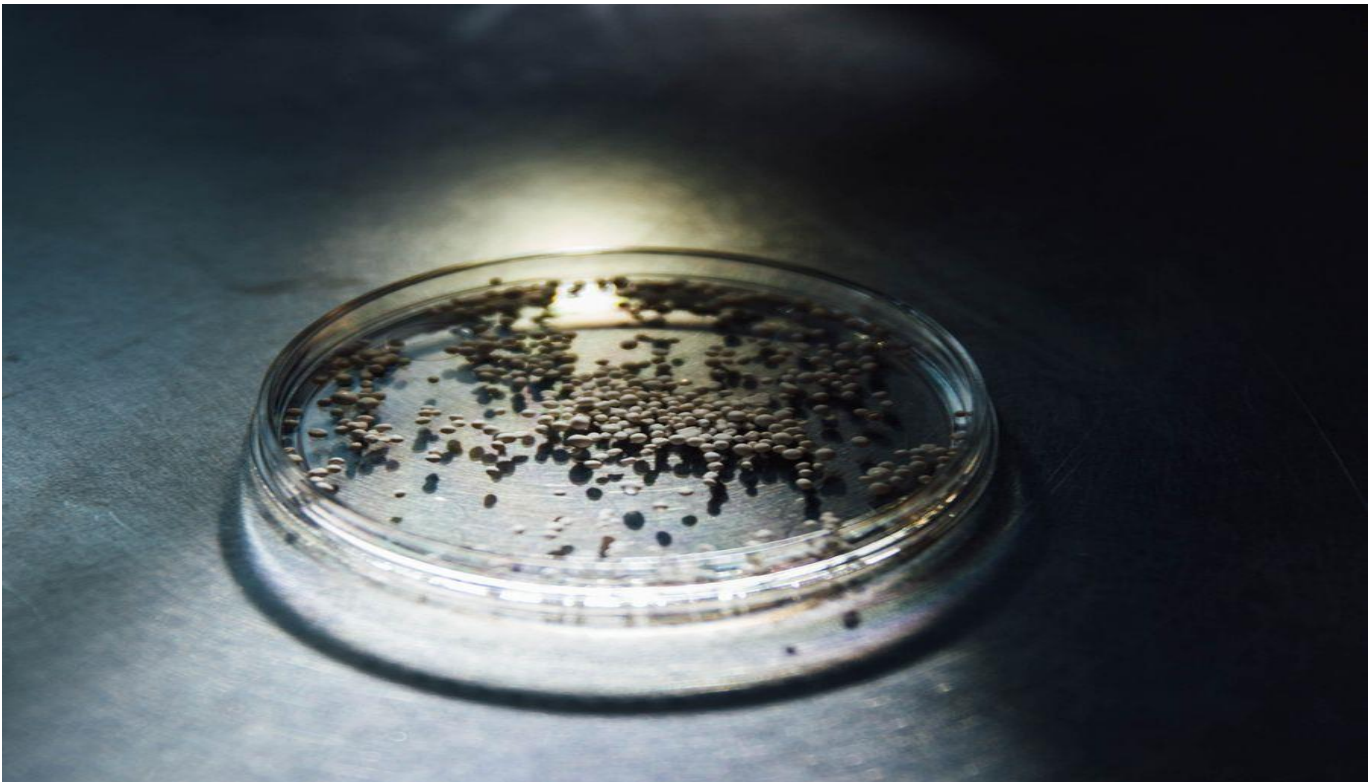
It is spending more than \$1 billion to build the first in a planned fleet of plants using [direct-air capture](#) to pull the CO₂ out of the air, a budding technology with fuzzy economics. Bolstering the move are generous tax incentives included in the climate package President Biden signed into law last year that cover up to 45% of Occidental's expected initial costs per metric ton.

Chief Executive Vicki Hollub, who has the [blessing of the company's largest investor, Warren Buffett](#), said the plan will help it reach net-zero emissions on all its operations, its own energy use and its customers' use of its products, by 2050, and allow it to keep investing in oil extraction.

Ms. Hollub told investors last year she also expects the clean-energy efforts to eventually become more lucrative than the company's chemical segment, which manufactures basic chemicals and petroleum-derived products such as vinyls, and is the next-biggest revenue generator after oil and gas. OxyChem's revenue was \$6.7 billion in 2022, roughly 19% of Occidental's revenue that year, according to the company.

Removing CO₂ from the atmosphere at this scale has never been done before, and the enterprise comes with abundant commercial and scientific uncertainties. It is unclear what the appetite for carbon removal will be, how much the service will eventually cost or how massive volumes of buried carbon dioxide will affect the subsurface in the long term.

Just three years ago, the company was wobbling, after an [expensive and disputed acquisition of Anadarko Petroleum Corp.](#) saddled it with debt right before pandemic lockdowns took a swipe at oil prices. The recovery in prices righted the company's finances, and the purchase [put Occidental in position to capitalize on prized shale assets](#).



In Carbon Engineering's technology, air passes over thin plastic surfaces where a solution of potassium hydroxide binds with carbon dioxide. The gas is further processed into pellets. JACKIE DIVES FOR THE WALL STREET JOURNAL

Occidental plans to make money with the CO₂ removal plant by selling [carbon-dioxide removal credits](#) to companies such as airlines, trucking and marine companies that can't currently switch to clean energy without breaking their business models. It also plans to turn some of the carbon dioxide into products to sell, including synthetic jet fuel, or use it in the process of pumping what the company calls net-zero oil from its own wells that it hopes to sell at a premium.

The plant's fans will pull up to 500,000 metric tons of carbon dioxide from the air a year—about as much as 111,000 American cars spew out in a year, according to the Environmental Protection Agency.

The Houston-based company said it wants to build up to 135 such plants by 2035, depending on public incentives and demand for carbon credits. That would be more than seven times the number of CO₂-removal facilities currently operating worldwide, according to the International Energy Agency. Occidental has leased more than 400 square miles from Texas to Louisiana to trap CO₂ underground, and has presold carbon credits to [Airbus SE](#), [Shopify Inc.](#) and [BMO Financial Group](#).

Ms. Hollub is embarking on the strategic expansion when Occidental's existing business, based almost entirely on fossil-fuel production, is healthy. Like its U.S. rivals [Chevron Corp.](#) and [ConocoPhillips](#), Occidental has ridden high energy prices to record profits. The company paid down more than \$20 billion in debt since the Anadarko acquisition. Its stock was the S&P 500's top performer last year.

Giant fans

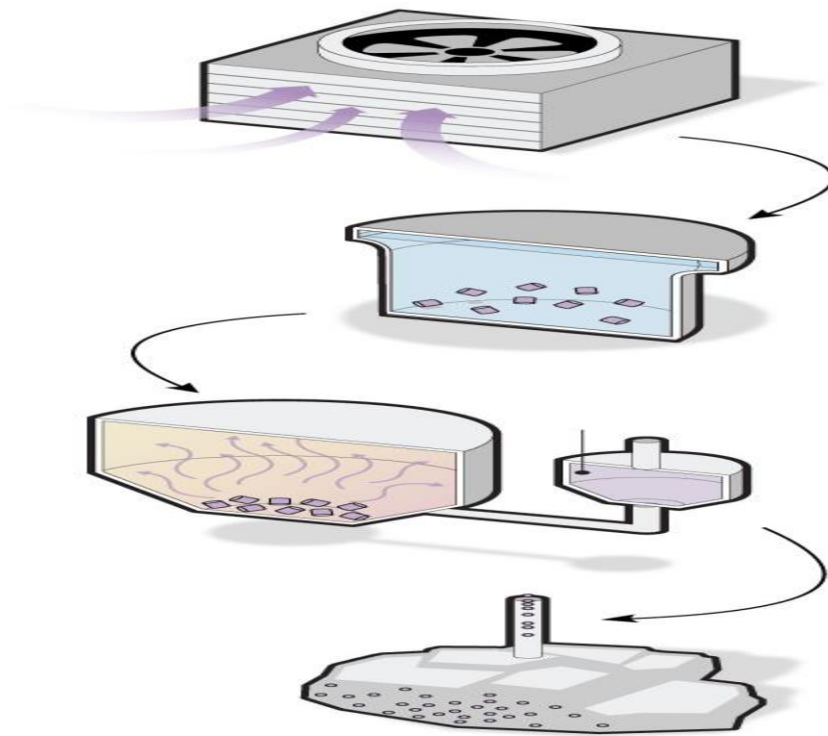
To [succeed in carbon capture](#), Occidental has to crank out plants at an unprecedented scale, figure out a way to operate them cheaply and find a market for the carbon credits.

Many industry experts doubt that direct-air capture can be done economically because the amounts of air that need to be scrubbed are so large. Operating the plants themselves will require massive amounts of energy, which will need to be emission-free to avoid defeating the purpose of the effort, they say.

Occidental executives said it would power the Permian plant with solar energy and additional renewable power from the grid, and **it has also looked into potentially powering its plants with mini-nuclear reactors, according to people familiar with the matter.** The company also said it is exploring using energy from natural-gas powered plants that capture their own CO₂, an early-stages technology in which it has invested.

How to Capture Carbon

Occidental will use technology by Carbon Engineering to isolate carbon dioxide from the ambient air using a chemical process.



Fans that are about the size of a tennis court pull air into containers.

A solution of potassium hydroxide binds with CO₂ and traps the molecules as a carbonate salt, which is then further processed into pellets.

CO₂

The pellets are heated, releasing pure carbon dioxide. The processed pellets can be used again.

The CO₂ is compressed. Now in a state between liquid and gas called 'supercritical,' it can then be injected deep underground into geological formations

to be stored permanently, or be used in enhanced oil recovery or to make other products.

Source: Carbon Engineering Ltd.

Adrienne Tong/THE WALL STREET JOURNAL

The company also has to convince shareholders that the new area can deliver juicy returns outside its core oil business. While Exxon Mobil Corp. and Chevron have said they intend to spend billions of dollars on carbon capture through 2030, their plans don't call for a monumental build-out of new technology. They plan [carbon capture from smokestacks](#), as well as investments in alternative fuels such as hydrogen and biofuels.

"I think you have to be careful on the amount of capital you're [allocating] to any of these carbon-capture efforts," said Kevin Holt, an executive at Occidental shareholder [Invesco](#) Ltd., an investment firm, saying he wasn't commenting specifically on the company's plans. "I prefer the moving-slowly path for anybody with a new technology, as opposed to just sprinting."

Some environmental groups say carbon capture will prolong the world's dependence on fossil fuel and divert investments that could be poured into renewable energy. Energy consultancy Wood Mackenzie estimates that \$156 billion will be invested in infrastructure worldwide to capture, transport and store CO2 over the next 10 years.

Occidental in 2019 took a stake in Carbon Engineering, a Canadian startup backed by Bill Gates, which developed the system to capture, purify and compress [carbon dioxide, a greenhouse gas](#) that traps heat in the Earth's atmosphere and causes climate change.

Fans pull air into containers, where chemicals bind with the CO2 to separate it from the air, eventually creating pellets. The pellets are heated to release pure carbon dioxide, which is compressed to be transported through pipelines and funneled deep underground.

For now, plants need to be located in places where cheap renewable power is available, and ideally near the geological storage sites. Since CO2 spreads throughout the atmosphere, they don't need to be near heavy producers of the gas. Academics say the CO2 can be safely stored underground and that the storage doesn't affect the land at the surface, but that it is uncertain how CO2 will behave under the surface over very long periods of time.

Occidental is set to fund the first plant and will be seeking investors to help finance additional plants, company executives said.

Today, 18 direct-air capture plants are in operation around the world, [most operated by Swiss company Climeworks](#), which uses a different technology than what Occidental plans to use. The startup earlier this year said it had successfully pulled CO2 from the atmosphere and stored it underground. Some other facilities transform carbon dioxide into modest volumes of synthetic fuels. Occidental's rollout would make it one of the largest operators of direct-air-capture plants.

'CO2 into value'

Selling carbon-removal credits and what Occidental is calling net-zero oil will initially yield the most revenue, said Richard Jackson, Occidental's president of U.S. onshore resources and carbon management. "We can turn CO2 into value," he said.

To produce net-zero oil, Occidental said it would pull CO2 from the atmosphere, and then use it in a pumping process known to the industry as enhanced oil recovery, which permanently stores the carbon

underground. This way, the company said, it will eliminate as much or more CO2 than made by the production, transportation and burning of the oil.

SK Trading International, part of the Korean conglomerate SK Group, has signed up to receive up to 200,000 barrels of the net-zero oil per year for five years, according to the companies.

The production of the barrels will lock up about 100,000 metric tons of atmospheric CO2, which Occidental said is about the amount of emissions the crude will produce over its lifetime.

Companies now voluntarily buy carbon credits to meet their own environmental goals, but some expect carbon regulations to require them to make more efforts to reduce their emissions.

Carbon emitters today can buy [nature-based offsets](#) linked [to reforestation or CO2-eating crops](#), but these don't offer the same guarantee that carbon dioxide will remain trapped as plans to pump it underground, sustainability experts said.

Airbus has prepurchased credits from Occidental covering 100,000 metric tons of carbon removal a year over four years, according to the companies. The Houston Texans football team in January said it had purchased enough credits to offset the emissions linked to the team's future air travel to regular season away games over three seasons, according to the company. In March, the Astros baseball team announced an agreement for an unspecified amount of credits.

Also buying Occidental's credits are firms seeking to jump-start the direct-air capture industry, such as e-commerce tools provider Shopify, which prebought 10,000 metric tons. Stacy Kauk, head of sustainability at Shopify, said it wants to have access to the credits to comply with potential future regulations on emissions. If that happens, she said, prices for the certificates could rise.

"We're very comfortable paying that early adopter premium...in order for us to determine if this is actually going to work," she said.



Climeworks carbon-removal plant, in Iceland in 2021, which uses a somewhat different technology to reduce carbon dioxide in the air. PHOTO: ASSOCIATED PRESS

The companies declined to say how much they paid for the credits. Individual and small to medium corporate customers of Climeworks, the Swiss company that operates most existing plants around the world, pay \$1,200 per metric ton, though larger companies likely pay less per ton.

Occidental said it could use some of the pure carbon dioxide removed from the air to make synthetic aviation fuel, which can result in lower greenhouse gas emissions. It also said it could sell CO₂ as a raw material to make [new low-carbon products](#), such as building materials or clothes.

A U.N. climate panel in March said that if nations are able to remove as much greenhouse gas as they emit sometime around midcentury, the Earth's [temperature could begin stabilizing](#) a decade or so later.

Holding down costs

To be successful, Occidental will need to bring the cost of capture and containment down by hundreds of dollars per metric ton of CO₂, according to energy executives and analysts.

Occidental estimated its initial cost to remove a metric ton of CO₂ would be between \$400 and \$500. It said that as it manufactures more plants and efficiencies kick in, it will be able to roughly halve that to between \$200 and \$250 a ton by the end of the decade, according to the company. None of the figures include federal tax credits.

Scientists said that for CO₂-removal to reach a meaningful scale, costs would need to plummet to \$100 per metric ton.



Vicki Hollub, Occidental's CEO, shown at a conference in March, said the carbon-capture plan will help it

reach net-zero emissions on all its operations, its own energy use and its customers' use of its products, by 2050. PHOTO: F. CARTER SMITH/BLOOMBERG NEWS

The **Inflation Reduction Act**, signed into law by President Biden last year, rewards companies that capture and store atmospheric CO2 with a **\$180 tax credit per metric ton contained permanently, up from \$50**. Credits for capturing atmospheric CO2 and using it in enhanced oil recovery rose to \$130 a metric ton, up from \$35. The bill also offers incentives to companies that capture CO2 at industrial plants and sequester it, which Occidental also plans to do.

The credits can be received for a 12-year period beginning when a plant starts operating.

Occidental expects to generate between \$400 and \$630 in revenue per metric ton of atmospheric CO2 captured this decade, including federal tax credits, it said.

The company has also applied to generate credits through California's low-carbon fuel standard, which requires providers of transportation fuels there to reduce the carbon footprint of their product. It will be able to stack federal credits and the California credits, according to the company.

Analysts said collecting CO2 from smokestacks requires much less energy and is therefore cheaper.

Howard Herzog, a leading researcher on carbon capture at the Massachusetts Institute of Technology, said he didn't think bringing the cost of direct-air capture down to around \$100 a metric ton was a realistic goal. Occidental is "probably more bullish on direct-air capture than I would be," he said. But he added that how much buyers of carbon credits are willing to pay will also determine how profitable direct-air capture turns out to be.

Ms. Hollub told The Wall Street Journal in August that Occidental's efforts on carbon capture and on becoming a net-zero emitter would allow it to keep up its investments in oil and gas. She warned that underinvestment in fossil fuels, which she says will be needed for years even amid the broader transition to clean energy, will lead to a scarcity of supplies. In contrast, she said, other oil majors such as BP PLC and Shell PLC have shrunk their oil segment and invested in renewables.

Oil companies will have to find ways to remove as much carbon dioxide as they emit "if they want to be the last producer standing in the world," Ms. Hollub said.



Occidental is building the first in a fleet of planned direct-air capture plants in the Permian Basin in Texas, above. PHOTO: DAVID GOLDMAN/ASSOCIATED PRESS

Write to Benoît Morenne at benoit.morenne@wsj.com

Corrections & Amplifications

Occidental expects to generate between \$400 and \$630 in revenue per metric ton of atmospheric CO₂ captured this decade, including federal tax credits. An earlier version of this article incorrectly said it expected to generate between \$430 and \$630. Additionally, federal tax credits for capturing atmospheric CO₂ and using it in enhanced oil recovery rose to \$130 a metric ton, up from \$35. An earlier version gave the value of credits for carbon captured from industrial facilities. (Corrected on April 10)

ADVERTISEMENT

Copyright ©2023 Dow Jones & Company, Inc. All Rights Reserved.
87990cbe856818d5eddac44c7b1cdeb8

Appeared in the April 11, 2023, print edition as 'Occidental's Green Bet To Keep Pumping Oil'.