

There's a carbon-capture gold rush. Some warn better solutions exist.

To stem climate change, billionaires, politicians and philanthropists say sucking carbon out of the air and storing it underground could work. Critics fiercely disagree.

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In White House halls, Davos conference rooms and [billionaires'](#) Twitter feeds, one climate change solution is gaining traction: carbon-capture technology.

In recent months, the Biden administration, Elon Musk and companies such as Alphabet and Meta have poured millions — in some cases, billions — into investment funds, research proposals, grant opportunities and competitions to develop the method. Scientists argue carbon capture, which takes carbon dioxide from the air and stores it deep underground, has the potential to quickly slow Earth's rapidly warming climate.

The method takes multiple forms. One attaches industrial plants to factories, reusing or transporting carbon emitted directly from smokestacks. A more experimental version envisions large facilities that could capture air, remove the carbon dioxide and store it underground. Others propose using mine waste, algae farms or bio waste to decrease emissions.

The focus comes at a [crisis moment](#). In February, the United Nations warned climate change has reached a tipping point, where island nations could soon be flooded, millions may have to flee their homes in the face of drought and famine, underwater habitats would wither, and deaths related to heat, pollution and malnutrition will rise.

There are 27 carbon-capture projects operational worldwide and 14 in the United States, according to an [October report](#) from the Global CCS Institute, a think tank. Another 108 are in development worldwide in various stages of production.

Despite the growth in projects, fierce debate remains. Critics contend that carbon capture technology is expensive, ineffective and difficult to scale. Moreover, they argue, money spent developing the tool distracts from funding proven solutions, like renewable energy, while encouraging oil and gas companies and other heavy carbon emitters to continue their operations unabated.

“The idea that this is going to be the fix to the global problem of massive emissions and accelerating climate change is just not borne out by reality,” said Nikki Reisch, the director of climate programs at the Center for International Environmental Law. “It’s unfortunately an attractive myth by the oil industry to perpetuate the idea that we can ... have our cake and eat it, too.”

Carbon capture builds on natural processes such as photosynthesis, which allows trees and plants to take carbon dioxide and turn it into a usable energy source. But as the world industrialized, natural ways to process and remove carbon from the air were not enough to keep balance in order.

In the early 1970s, oil and gas companies began using a chemical process to separate carbon dioxide from gas pumped on-site and steer it back into oil fields to get more oil from the ground. Years later, the process getting the most out of a waste product became a way to mitigate climate change. Companies built plants to take carbon out of concrete, cement and steel factories to be repurposed or stored in geological formations permanently.

Carl Greenfield, an analyst at the International Energy Agency, said carbon-capture technology can be successful at reducing carbon emissions in tricky places, such as cement factories, triggering excitement in the industry.

He added that carbon-capture technology has evolved from the 1970s, when it was meant to enhance gas production, into a stronger focus on carbon dioxide reduction. Government initiatives, such as a U.S. program that provides tax credits for each metric ton of carbon a company captures, have created economic incentives.

“The drivers we’re seeing this time around is really different,” he said. We’re “hoping that’s enough to translate this momentum into implementation.”

But simply diverting carbon emissions from factory smokestacks won’t do the job, many experts said, especially since the system must be attached to an emission-emitting factory, making it difficult to scale quickly. Direct air capture, which uses chemical reactions to capture carbon dioxide directly from the air and reroute it underground permanently, is gaining backers because of its easy setup.

Though critics say the technology is years away from implementation, it hasn’t stopped funding efforts. The Biden administration in late May earmarked \$3.5 billion toward this effort, intending to build four “direct air capture hubs” across the country.

“The UN’s latest climate report made clear that removing legacy carbon pollution from the air through direct air capture and safely storing it is an essential weapon in our fight against the climate crisis,” Energy Secretary Jennifer M. Granholm said in a statement.

In April, the Elon Musk Foundation, along with the nonprofit XPRIZE, provided 15 groups \$1 million in funding to scale up promising carbon-capture solutions. Six projects are focused on capturing and storing carbon dioxide from the air.

In four years, they will choose a grand prize winner to get \$50 million, while three runners-up will split \$30 million in funding.

Cam Hosie, the chief executive of 8 Rivers and one of the prize winners of Musk’s competition, said his project is on the path to being an inexpensive solution that can scale quicker than other attempts.

His creation allows air to pass through a warehouse filled with calcium hydroxide. A natural process turns the carbon dioxide into calcium carbonate crystals. Those would then be recycled and allow the carbon dioxide to be trapped underground in many places across the world, making it easy to build facilities. “It’s immediately deliverable and immensely scalable,” Hosie added.

But many climate advocates strongly disagree with efforts to create new plants that capture carbon from factories or directly from the air.

Dominic Eagleton, a senior campaigner for Global Witness, pointed to research showing that 78 percent of large-scale projects to capture air from a factory's point of pollution have been canceled or put on hold because of challenges with funding and economic feasibility.

Eagleton said this underlines a notable problem: These types of plants require significant upfront expenses, sometimes as much as \$1 billion, and are unprofitable and costly to run long term.

"The investment case for carbon capture and storage is weak," he said. "There's not really that much you can do with [it]."

Reisch, of the Center for International Environmental Law, added that carbon-capture plants that attach to factories, such as coal plants, extend the life of fuel sources that should be retired. She added that it takes significant energy and complex chemical processes to run carbon-capture plants, so scaling this technology could increase other harmful pollutants into the environment.

As for the solutions promising to capture carbon from the air, she said, those are scientifically unproven. Since air does not have high levels of carbon dioxide concentration, it will take immense energy to make factories that pull it out of the air. It would be wiser for governments and philanthropists to scale proven technologies, such as wind and solar energy, and focus more on creating more policies that curb levels of carbon dioxide emissions, she argued.

"People want to believe there's a quick fix — but there really isn't," she said. "We need systemic, structural change."