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Carbon capture technology: Efforts and Challenges

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Why in News: Carbon capture technology is needed to clean up industries like cement and chemicals — but today it is mainly used to suck more oil out of the ground

About Carbon Capture and Storage

Carbon capture and storage (CCS) is a way to catch carbon and trap it beneath the earth. It is different to carbon dioxide removal (CDR) where carbon is sucked out of the atmosphere although some of the technologies overlap.

The key difference is that CDR brings down the level of carbon dioxide in the atmosphere, cooling the planet, while CCS in fossil fuel plants and factories prevents the gas from getting out in the first place.

In its latest review of scientific research, the Intergovernmental Panel on Climate Change (IPCC) found both options will be needed for emissions that are hard to wipe out.

For chemical processes that release carbon dioxide, there are few alternatives to capturing CO₂ straight away or sucking it out of the air later.

Scientists see a big role for CCS in factories that make cement and fertiliser, as well as in plants that burn rubbish. They are split on whether it makes sense to use it to make steel and hydrogen, which have some greener alternatives.

Most of their skepticism goes to capturing carbon when making electricity, because there are already cheaper alternatives that work better, like wind turbines and solar panels.

In theory, it could play a role in gas plants as a back-up when the sun doesn't shine and wind doesn't blow — particularly in countries that are still building fossil fuel plants today — but it would have to quickly grow cheaper and more effective.

Climate models show a role for some oil and gas outside the rich world, said Margriet Kuijper, a former engineer with oil giant Shell who works as a consultant for environmental groups. Still, she said, "I agree with people that say we can probably get away with mainly renewables."

Significance of CCS

For decades, engineers have captured carbon from concentrated streams of gas — pushing it into tanks, scrubbing it clean and using it in industry or storing it underground. Some bioethanol plants, where the gas stream is pure, already report capturing more than 95% of the carbon emissions.

But when it comes to capturing carbon from dirtier gas streams, like those from factories and power plants, CCS projects have repeatedly overpromised and underdelivered.

While a handful of test facilities have managed to capture more than 90% of emissions from some dirty gas streams, commercial projects have been plagued with problems. Some have broken down or not been made to run all the time. Others have been designed to capture only a fraction of the total emissions.

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Still, experts see the failures of CCS more as an economic problem than a technical one. They say companies have little incentive to capture their pollution

Concerns with CCS

Activists have called out energy companies for failing to capture much carbon while at the same time drilling for oil and lobbying against laws to cut fossil fuel production.

They have pushed policymakers to put more weight on societal shifts — like cutting energy demand — rather than placing their faith in shaky technologies.

The danger is not just that the technology does not seem to work as advertised, said Genevieve Gunther, founder of End Climate Silence, a campaign group pushing journalists to cover climate change with more urgency.

CCS also gives companies fighting to burn fossil fuels access to policymakers and a “social license to operate,” she said, referring to public acceptance of their business model. “They’re not using carbon capture as a climate solution. They’re using it to actually enhance extraction.”

A big part of this is what fossil fuel companies call enhanced oil recovery — pumping carbon dioxide underground to push out more oil from drying wells. Historically, most captured carbon has been used for this purpose.

Scientists have also questioned how serious the industry is about its commitments. After decades of pushing the technology, there are only 30 working CCS facilities, according to industry data from last year, with 11 being built and 150 in planning.

A study in 2020 found more than 100 of the 149 CCS projects planned to be operational by 2020 have been scrapped or placed on indefinite hold.

Method of using CCS

Experts say momentum to capture carbon is starting to pick up.

In Norway, German industrial giant Heidelberg Materials is building the first facility to capture carbon from cement and store it underground.

The company claims a capture rate of close to 100% is possible. Still, it only plans to capture half of the emissions from the site.

Oil and gas companies are also starting to weaken their grip on the CCS industry. According to the International Energy Agency (IEA), a Paris-based organization led by the energy ministers of mostly rich countries, new companies are focusing on specific parts of the problem like transport and storage.

There’s now a bigger focus on storing CO₂ than using it to extract more oil

To make the technology grow cheaper and work better, analysts say governments need to tax carbon, make it easier to approve CCS projects and help set up the infrastructure around it. They are less sure about subsidizing the technology itself.

There needs to be a subsidy for green steel and green cement, because that’s really what’s going to push the people who can accelerate the development of CCS