High hopes for carbon capture, underground storage

May 8 2024

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Capturing carbon dioxide (CO_2) from the atmosphere to store underground "sounds too good to be true", a climate expert told AFP, yet the technology to increase its capacity tenfold is already being tested.

The Intergovernmental Panel on Climate Change (IPCC) recognizes carbon capture and storage among the solutions for eliminating CO_2, without giving it a central place in its models.

"The small DACCS (direct air capture with carbon storage) ecosystem gets more diverse... but we're not exactly sure where this will lead to" in the fight against climate change, said Oliver Geden, an IPCC member and specialist on carbon dioxide removal.

Even if the capacity to capture CO_2 reaches two billion tonnes in 2050, compared with just 10,000 today, as suggested by optimistic projections in a report by the University of Oxford, experts are categorical: we must first massively reduce emissions of greenhouse gases like CO_2 into the atmosphere and consider carbon capture and storage only for emissions that can't be eliminated.

Companies like Microsoft, Amazon, Airbus and even Lego are already paying upwards of $1,000 per tonne of CO_2 captured and stored—in the form of carbon credits—to offset their emissions.

How it works

Molecules of CO_2 in the air pass through large fans and are absorbed by a liquid filter or deposited on a solid filter.

Once the filters are full, the fans close and the filters are heated to high temperatures upwards of 120 degrees Celsius for solid filters and 900 degrees Celsius for liquid filters in order to release pure CO_2.

This heating requires substantial use of energy and the development of these technologies on a large scale depends on the availability of electricity or heat from renewable energy.

While the chemical compounds can be reused, the environmental impact of their large-scale production has yet to be studied.

The CO_2, in a compressed gaseous form or dissolved in large volumes of water, is then transported and injected into porous rock located hundreds of metres (several thousand feet) below the surface.

Where its happening

Three commercial facilities are operational but only Orca in Iceland stores CO_2 rather than reusing it as an ingredient in synthetic fuels, construction materials or soft drinks.

Since 2021, Orca has been absorbing 4,000 tonnes of CO_2 per year—the equivalent of a few seconds of global emissions.

Its neighbour Mammoth, also developed by the Swiss start-up Climeworks with Icelandic partners and unveiled on Wednesday, will absorb up to 36,000 tonnes per year.

In comparison, two billion tonnes of CO_2 is "eliminated" each year primarily through reforestation and forest protections, according the University of Oxford. That compares to the 40 billion tonnes emitted worldwide last year.

Nearly 30 projects have been commissioned in the United States, United Kingdom, Iceland, Gulf states and Kenya with a capacity to store close to 10 million tonnes of CO_2 by 2030, according to the International Energy Agency.

More than 100 others with and without storage are being developed, but lack financial assurances.

The United States has put $3.5 billion on the table but this includes CO_2 reutilisation projects.

The European Commission, Canada, the United Kingdom and Japan are also exploring the option.

The costs

While carbon capture and reuse by the oil and gas industry dates back to the 1970s, direct capture from the air is a much more recent development, since it was not considered economical.

The cost of these technologies are estimated between $600 and $1,000 per tonne of CO_2 captured, according to the IPCC, but could drop between $100 and $300 in the coming years.

Geden applauded the proliferation of start-ups in the sector, but said he believes "a line has been crossed" when pioneering Canadian firm Carbon Engineering was bought by American giant Oxy Petroleum in 2023 for $1.1 billion.

Since then, the fate of carbon capture has been in doubt, since its reuse rather than storage is likely to be more profitable to major oil firms positioning themselves in the expanding market.

Citation: High hopes for carbon capture, underground storage (2024, May 8) retrieved 3 June 2024 from https://phys.org/news/2024-05-high-carbon-capture-underground-storage.html