

Carbon dioxide removal: the tech that is polarising climate science

For some, CDR is crucial to staying below 1.5C. Others say it should not even be on the table. Why is it so controversial?

- [John Kerry: relying on technology to remove carbon dioxide is 'dangerous'](#)

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Tue 25 Apr 2023 14.00 BST



- Fans that suck carbon dioxide out of the air installed on the roof of an incinerator near Zurich, Switzerland. Photograph: Orjan Ellingvag/Alamy
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For some scientists, they are the inevitable next stage of staving off the existential threat of climate chaos. For others, they should not even be talked about.

Carbon dioxide removal (CDR) technologies, which provide a means of sucking carbon out of the atmosphere, are one of the hottest areas of climate research, but also the most controversial.

The debate over whether and how to develop CDR has been ignited by the release last month of the **final section of the comprehensive review** of climate science by the Intergovernmental Panel on Climate Change (IPCC). The report found that ways of **capturing and storing carbon dioxide**, though expensive, might play a role in trying to keep global temperatures within safe bounds.

But scientists and policymakers are divided. Some say the technology must be the immediate priority for research. Others urge caution, and warn against putting faith in untested technology before we have even fully deployed the reliable low-carbon technologies, such as renewable energy, that we already have.



David King is working with Cambridge University's department of engineering to try to find ways of refreezing the Arctic Photograph: NurPhoto/Getty Images

John Kerry, the US special presidential envoy for climate, **talked of his concerns**. “Some scientists suggest that it’s possible there could be an overshoot [of global temperatures, beyond the limit of 1.5C above pre-industrial levels that governments are targeting] and you could clawback, so to speak; you have technologies and other things that allow you to come back.

“The danger with that, which alarms me the most and motivates me the most, is that according to the science, and the best scientists in the world, we may be at or past several **tipping points** that they have been warning us about for some time,” he said. “That’s the danger, the irreversibility.”

The former UK government chief scientific adviser Sir David King strenuously disagrees. He believes CDR of many kinds will be needed, along with the means to “repair” the climate, such as by **refreezing the ice caps**, because the world is **almost certain to overshoot** the global target limit of 1.5C above pre-industrial levels.

“We are already at 1.35C above pre-industrial levels today,” he said. “We are already experiencing massive warming in the Arctic, where it’s more than 3C above the pre-industrial average.”

A rash of new technology startups bears witness to the potential business opportunity that many companies and investors see in CDR. These fledgling companies are exploring everything from “scrubbers” that chemically remove carbon dioxide from the air, to **biochar**, which creates fertiliser from burning wood waste without oxygen, and carbon capture and storage (CCS) by which carbon dioxide is liquefied and pumped into underground geological formations. They have taken the IPCC report as a spur to investment, and a stamp of approval.

“Growing carbon removal to be in line with the IPCC requires a massive scale-up in the next decade. Startups are meeting this climate challenge by developing a suite of approaches that can make a gigaton impact,” said Tania Timmermann, the chief technology officer of Andes, a company that plans to use **micro-organisms to sequester carbon in soil**.

Ben Rubin, the executive director of the Carbon Business Council, which represents several CDR specialists, said: “The IPCC report makes clear that the window of opportunity is closing quickly, highlighting the urgent need to reduce greenhouse gas emissions. Reducing emissions is crucial but not enough: the report affirms that gigatonnes of carbon removal are required to help restore the climate,” he said. “Innovators are actively working to meet this climate challenge, by finding cost-effective and responsible ways to deploy carbon removal.”

But the key section of the IPCC report, which ignited the controversy, was fiercely fought over by scientists and governments up until the last moments before the document was finalised. The handful of mentions of CDR in the final 36-page summary for policymakers – which distils the key messages and is compiled by scientists alongside government representatives from any UN member that wants to take part – were only inserted after hours of desperate wrangling.

Saudi Arabia and other oil-producing countries were most insistent that CDR and CCS should be included and emphasised. In the end, nine references to CDR were left in the summary, and several more to CCS.

“Saudi Arabia brought 10 very experienced negotiators,” said one person. “They tried to take out references to renewable energy and tried to insist that references to carbon capture should be in there instead of, or at least as well as, renewables.”



A CCS facility in Alberta, Canada. Photograph: Todd Korol/Reuters

But many scientists, campaigners and green experts are unhappy with the references. They fear that giving the impression there are viable options for removing carbon dioxide might engender a false sense of security. **Most CDR technologies** are unproven, are likely to be limited in scope, take years to develop and will cost large amounts of money.

Lili Fuhr, the director of the climate and energy programme at the Center for International Environmental Law, said: “We need to challenge the idea that we have to do less now, because we can do more later, with **technofixes**. This is a dangerous idea.”

Friederike Otto, a lead author of the IPCC, and senior lecturer at the Grantham Institute at Imperial College London, said: “My feeling about CDR is that we should pretend it is not an option. We should act as if CDR will never be achievable. We do not have a technology at the moment that works at scale ... so we should make our policies as if CDR is not an option.”

She said pursuing CDR could be a dangerous distraction, and questioned whether it was a good idea to spend money on technologies that offered highly uncertain future benefits, when viable ways of reducing emissions now were not

being deployed fast enough. “CDR has already been used as an excuse to dither and delay,” she said.

Otto said: “It’s very important to highlight that we still can keep to 1.5C – we have the knowledge and the tools to do it. But what we do not have is a sense of urgency and political will.”

King acknowledges that some scientists have concerns about CDR, but he believes it is needed because of the failure to act before now. “[Those who object] are taking the exact position I took in 2015, when I was leading global negotiations for the UK,” he said. “But there is no time for messing about now.”

King, who is working with Cambridge University’s department of engineering to try to **find ways of refreezing the Arctic**, points out that the IPCC report found only a narrow opportunity for the world to limit heating to 1.5C, that relies on massive reductions in greenhouse gases in the next few years, which is unlikely to happen.

“The IPCC does not go nearly far enough on CDR,” he said. “I believe it is more than likely we will hit 1.5C by the end of the decade. It’s false thinking, that the IPCC is saying we can manage [to stay below that level] with reducing emissions. The carbon we have put up [in the atmosphere] will have to be removed. It may cost a fortune, but we have to recognise that the alternative is to lose our civilisation.”