# Demystifying Carbon Dioxide Removal

## June roundup

**Dear all,**

The recent success of the CDR industry gained a lot of media coverage this month. But getting started and removing a billion tonnes of CO2 are two very different things - and there are many hurdles the industry faces before it can scale to the level of removals needed. We take a look at some of them.

We've also just had high level climate talks in Bonn and Brussels, and a suggestion that setting "twin targets" for reductions and removals may be a more effective approach to addressing climate ambition.

And in what has become regular programming in this newsletter - the ongoing debate over the use of the ocean for removals - we round up what the latest science has to say. Finally, we look at high hopes for biochar.

As always, please feel free to share this newsletter with anyone who may be interested. You can sign up here, or click here to see an archive of previous editions. Don't hesitate to get in touch if you have any questions, suggestions or feedback.

**Till next time,**
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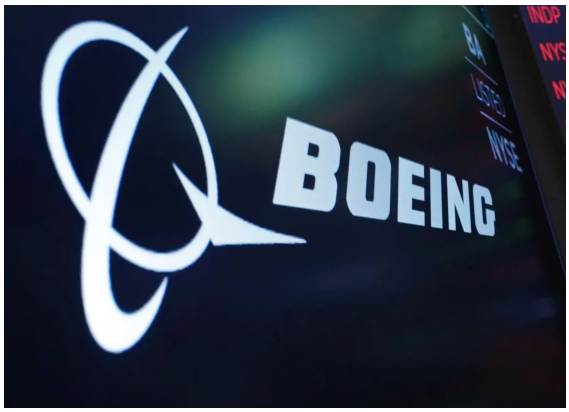
Stat of the month:

## 62,000 tonnes

The amount of CO2 that will be removed from the ocean to produce 2,100 tonnes of carbon-negative hydrogen for Boeing.




# Hurdles to growth

The CDR market has taken huge strides in recent years, with a 300% increase in removal credits bought over the past two months alone. There are strong demand signals from the public and private sectors, supply is increasing and the technology is less controversial than five years ago, when it "would have been uttered in the same breath as pie-in-sky climate solutions such as solar geo-engineering – i.e. artificially dimming the sun," according to Energy Monitor. Reporting on the recent Climeworks' direct air capture (DAC) summit, Bloomberg highlighted that, while there has been huge progress in getting the industry off the ground, getting past those "awkward teen years" is going to take a lot of work.

Attendees at the summit suggested that government support, in addition to research and development and tax incentives, like buying removal services directly, could be a way to bring down costs and boost sustainable, scalable growth. Concerns for the industry included falling in with the 'wrong crowd' (aka the fossil fuel industry), failing to hit the magical USD 100 per tonne price and low social acceptance of the technology. This is a real concern - NGO Food & Water Watch recently put together a letter, signed by over 100 climate groups, resisting the thousands of kilometres of pipelines that will have to be laid to transport CO2 from where it is removed to where it is stored. The letter outlined demands for improving the safety of pipelines before more are built. Ensuring proper monitoring, reporting and verification will also be a big hurdle for the industry to overcome.

There are also very real challenges for DAC implementation. CarbonCapture - which this month finalised a 400,000 tonne purchase from Boston Consulting Group - has been facing delays with its new facility, Project Bison, which aims to remove 5,000 tonnes of CO2 a year. The company originally claimed the initial phase of the project would be built this year, but hurdles, like permits for underground carbon storage, mean it hasn't even determined "where to site its direct air capture plant or how to power it, according to officials involved with the project," E&E News reported. Anu Khan, deputy director of science and innovation at the carbon removal advocacy group Carbon180, thinks we shouldn't be concerned about delays in the nascent field, which she says are inevitable during early-stage development.

One way companies seem to be boosting demand for CDR is by linking it with carbon negative fuels. Aerospace company Boeing recently signed a deal with start-up Equatic that will remove 62,000 tonnes of CO2 and supply 2,100 tonnes of hydrogen. Equatic recently spun out of a UCLA research team that was developing the technology, which involves sending an electric current through water to absorb carbon and produce hydrogen. The purchase represents a small step in the right direction from Boeing, but is currently dwarfed by its overall strategy that would see CO2 emissions growing for decades to come. Other companies are also looking into sustainable fuels. Crediting platform

Puro.earth has agreed to verify and issue carbon removal certificates from Cowboy Clean Fuels - an energy technology company that produces “carbon-negative, renewable energy gas”.

## Talks and twin targets

Climate talks took place in Bonn in preparation for negotiations at the end of the year at COP28. Outgoing IPCC Chair Ho Sung Lee reiterated that countries should be wary of depending on large scale carbon capture and CDR. Apart from the agreement to drop the idea of ‘tonne-year accounting’ - a way to measure the amount of carbon removed that has come under fire for not ensuring permanent storage - not much has been decided on carbon removal. Following the confusion from CDR institutions on the UNFCCC’s information note on carbon removals last month, the UNFCCC Supervisory Body indicated that it remains open to both natural and engineered carbon removals.

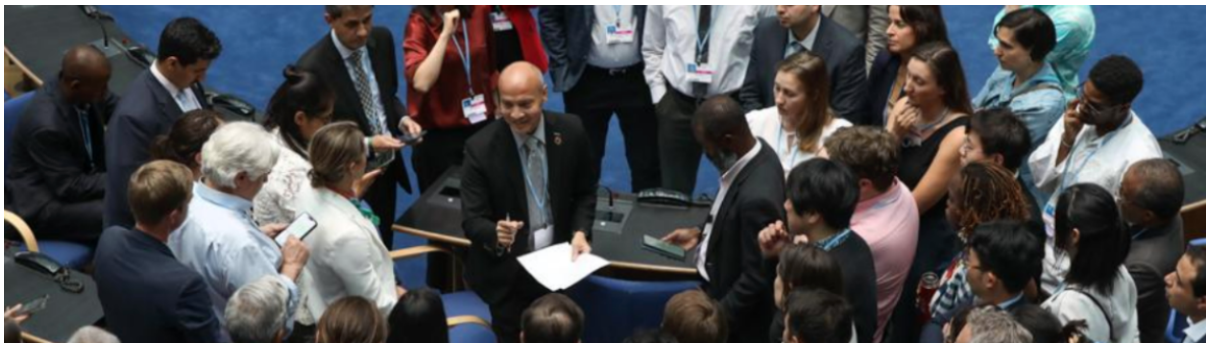
Looking to Europe, separate talks of the EU Expert Group on Carbon Removals took place in Brussels. The two-day session focused on nature-based carbon removals, such as soil carbon, forestry and peatlands. However, the meeting’s structure “left little time for meaningful discussion, comparison of methodologies, or in-depth consideration,” leaving many questions unanswered, according to EU policy NGO Bellona.

Also in the EU, the European Scientific Advisory Board on Climate Change has recommended an ambitious 2040 climate target in a new report, suggesting emission reductions of 90% to 95% by 2040, compared to 1990. The report highlights that the pathways chosen “also minimise the EU’s reliance on removal of CO2 from the atmosphere (either by novel carbon removal technologies or enhancing the natural land sink), thereby minimising the risks associated with relying on these approaches. However, even these pathways require carbon removal at scale in order to achieve climate neutrality.” The scenarios included in the report result in 390 and 1,165 million tonnes of residual greenhouse gas emissions in 2050, equivalent to 8% and 24% respectively of 1990 emissions levels.

**"The project set out to understand if seaweed farming for CDR on the level some are talking about is possible. To summarise, it isn’t."**

To reach carbon neutrality, countries are likely to need “twin targets” for reducing emissions and removals from residual emissions, according to the Carbon Business Council. Ben Rubin, executive director, writes that “having two simultaneous goals doesn’t mean that they’re equal”. Reducing emissions is “widely agreed to be the foremost priority in climate action. But there is scientific consensus that carbon removal also has a critical role to play,” he explains. This approach is also favoured by climate experts, and could look something like aiming for 90% reductions and 10% removals, which is recommended by the Science Based Targets Initiative.

In the UK, the Green Alliance released a report - The case for a UK Office for Carbon Removal - arguing that the government must take a more active role in shaping and regulating growth of the sector. New frameworks are needed to assess which emissions can be cut and which are genuinely residual and in need of offsetting with removal, it argues. The report proposes a new government Office for Carbon Removal to oversee the sector. It would take the form of a public body independent of the government and would have regulatory powers and provide policy proposals. This could enable the UK to become a global leader in the "rapidly growing global, multi-trillion dollar market” that “is an opportunity the UK cannot afford to lose,” according to Victoria Harvey, carbon removals research manager at BeZero Carbon.



## Seaweed and the ‘new black gold’

Ocean CDR is becoming a permanent fixture in this newsletter as the debate over the use of the ocean for large-scale carbon removal continues. A new study estimates that using seaweed to remove a billion tonnes of CO2 annually would require farming an area of over one million square kilometres of the most productive areas of the ocean. The study finds that the efficiency of harvesting seaweed dramatically decreases outside the most productive regions, meaning this large area of farming - equivalent to an area almost twice the size of France - would have to be done in the most productive zones of the ocean, located in the Pacific along the equator. The project set out to understand if seaweed farming for CDR on the level some are talking about is possible. To summarise, it isn’t. As Isabella Arzeno-Soltero, a postdoctoral scholar at Stanford University who worked on the project, told Bloomberg: “The industry is getting ahead of the science”.

These views were reiterated by physicist and oceanographer Helen Czerski, in The Guardian. She writes: “You can’t ‘just’ fertilise the ocean, or change its alkalinity, or park huge new farms there, or dump billions of tonnes of biomass into the deep sea without affecting the existing ocean physics, chemistry and biology”. Indeed there are still “foundational scientific knowledge gaps we need to address about ocean CDR,” according to Ocean CO2 removal expert Dr Sifang Chen at Carbon180.

There are growing calls for the need for more research and regulation. Newly-launched nonprofit group Carbon to Sea Initiative is looking to answer some of the questions around ocean alkalinity

enhancement, which refers to adding alkaline substances, like crushed minerals, into the ocean so it can absorb more carbon. The initiative will conduct research and small-scale trials on how and, more importantly, if the process works.

Moving from the ocean to land, biochar has been heralded as the next big thing in CDR. A type of charcoal that stores carbon from heated biomass, it has been used since ancient times, primarily in farming. Each tonne of biochar can store 2.5 to 3 tonnes of CO2 "for centuries," according to David Houben, an environmental scientist at the UniLaSalle institute in France. The IPCC suggests that biochar has the potential to store two billion tonnes of CO2 each year by 2050, or "almost as much as India emits in a year".

Now, CDR is driving interest in the industry, which could more than double in value by 2030 to USD 450 million, according to one estimate. Bloomberg highlights this newly-found popularity stems from the shift within voluntary carbon markets away from avoidance credits to projects that actually remove carbon. The demand for biochar also comes from farmers who spread it over fields to provide nutrients to the soil. There is also evidence that biochar can store water, helping crops to be more resilient in times of drought and to adapt to the impacts of climate change. Researcher Tom Bott, who is leading a biochar trial in the UK, told Sky News that "the technique could help the country reach net zero".

Concerns raised about biochar focus on the costs and ensuring that emissions removals are maximised by reducing emissions from other parts of the supply chain. Research has also found that its benefits differ widely due to the diversity of biochar used, as well as the type of soil where it is applied. Additionally, while it is estimated that biochar can hold carbon for centuries, further studies are needed to bring greater confidence about its permanence. From an environmental perspective, it's also important to bear in mind that biochar may release harmful substances, such as heavy metals and organic pollutants, into the soil, water and atmosphere, depending on the type of biochar and how it was produced.

# Our pick of the news

Why Kenya could take the lead in carbon removal (The Economist)
Kenya's key attributes make it well suited to DAC development, which could be a huge opportunity.

New Land Grab by Oil Giants Is Deep Underground (The Wall Street Journal)
Oil and gas companies are offering large sums of money for the porous rock under rural properties suitable for carbon storage.

EU Looks to Boost Efforts to Store Captured Carbon Underground (Bloomberg)

The EU is beginning to plan how it will store millions of tonnes of CO2, which will be key to its plans to reach climate neutrality by the middle of the century.

Inside the quest to engineer climate-saving “super trees” (MIT Technology Review)
Genetically modifying trees to improve their carbon absorbing capacities could be a useful climate solution, but might not live up to the hype.

Supercharging Nature to Suck Carbon From the Air (The Wall Street Journal)
Scientists and start-ups are getting creative in their approach to using nature to boost removal efforts.

## Useful resources this month

Announcement: Carbon mineralisation company Arca announced it is working with producers of nickel to advance CDR at mine sites on three continents.

Article: Grist explores the age-old natural vs. engineered removals CDR debate.

Briefs: The Carbon Business Council has released new briefs on monitoring, reporting and verification, and on policies to unlock gigaton scale removals.

Strategy: The US National Oceanic and Atmospheric Administration released its Strategy on CDR research.

Story: In Canada, “ancient Indigenous 'clam gardens' could be a modern-day climate solution”.

Study: A new study in Nature Sustainability suggests that restoring mangroves can lead to substantial local ocean alkalinity enhancement.

E-book: Carbon credit platform Puro.org has put together an essential toolkit for carbon removal.

Research: Scientists think inside-out heating and ambient wind could make DAC cheaper and more efficient.

Paper: New research has found that rock “flour” produced by the grinding under Greenland’s glaciers can sequester CO2 when spread on farm fields.

New to the newsletter? Subscribe here!

Each month the demystifying carbon dioxide removal newsletter digs into the world of CDR to bring you the latest stories on everything from carbon credits and net-zero plans to nature-based solutions (NbS) and new technologies. Feel free to forward this email to your colleagues!

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