Political obstacles to carbon capture and storage for carbon removal

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Standfirst

Using Carbon dioxide Capture and Storage (CCS) for carbon removal is crucial to climate policy, but implementation at-scale is at risk. Climate policies must avoid relying on empty promises of CCS for carbon removal that does not have the necessary financial resourcing, and support emissions reductions separately from carbon removal.

Capturing the CO_2 from point sources - fossil-fuelled power plants or heavy industries like cement works and storing it in geological reservoirs (Carbon dioxide Capture and Storage - CCS) - has been an emission reduction strategy since the 1990s. Since then, CCS has been a key technology in virtually all policy-oriented climate modelling, and is seen as necessary for reaching policy targets. However, such strategies enable the continuation of fossil energy and limit motivation for fossil fuel-phase out. The mere promise of CCS has been used to make reaching climate policy targets seem achievable, but the policy needed to make the promise of large-scale CCS deployment a reality has not materialised. With the Paris Agreement in 2015, the framing of climate policy became 'net zero' emissions, requiring 'carbon dioxide removal technologies' (that is, technologies that can produce a net reduction of CO_2 in the atmosphere, rather than reduce emissions) to offset hard-to-abate, 'residual' emissions. Technologies such as BioEnergy CCS (BECCS) and Direct Air Capture (DAC) with CCS hold promise of such large-scale carbon removal. But, again, centrality to climate policy does not mean there will necessarily be implementation at scale. In this Comment, I will outline some of the contention surrounding CCS-based carbon removal options, describe how the promise of carbon removal threatens emissions reduction efforts, and discuss policies that could counter this risk.

Developments in CCS technology

CCS applications for carbon removal (BECCS and DAC) are receiving a lot of policy interest today, and interesting projects are being pursued. Biomass-fuelled power plants with carbon capture and storage (BioEnergy CSS or BECCS) can produce electrical power, whilst also sequestering carbon. The growing of trees and other plants for fuel means carbon is taken up from the atmosphere, and emissions from the power plant subsequently captured and stored. BECCS technology is controversial on several counts, however, including the environmental and social impacts of biomass production and processing, the very large areas of forested land (a few times the area of India[1]) required for climate-relevant implementation, and the amount of power sacrificed to carbon capture.

As an example, in the UK, the power company DRAX has plans to convert an existing biomass-fuelled power plant to carbon capture. Through collaboration with other industry in the region, captured CO_2 will be transported in pipelines offshore, and injected into the Endurance saline aquifer in the Southern North Sea. The current ambition is to fit carbon capture to one of Drax's biomass-fuelled generating units by 2027, and two units by 2030, which would make Drax carbon negative. The project is, however, receiving a lot of critique, including about whether the biomass is just from processing residues as the company claims or also pristine forests, and about health impacts on residents living close to the plants producing the wood pellets.

Financial support for Drax's BECCS project depends on the UK Government. Given the size of the power plant (~ 4 GW) relative to UK power production capacity overall (~100 GW), and it being by far the largest UK biomass-fuelled power plant, the project is very important for the Government's short term climate plans. However, the UK Government's track record of enabling large-scale deployment of CCS is poor, with the Drax's BECCS project being part of a 4th round of attempts[2]. This scenario occurs all too often worldwide, as governments and emitting industry alike want to be seen to promote CCS (for both emissions reduction and carbon removal), as long as they don't have to pay for it. Delays, and even failure to deploy the technology, seem likely.

It is also possible to capture CO_2 directly from the atmosphere, filtering it out from the air (Direct Air Capture, DAC), and store it (with CCS). The relatively dilute concentration of CO_2 in air makes DAC much more energy intensive than capture from an industrial point source. A potential advantage, however, is that DAC needs not be physically connected to an emission source, and so offers locational flexibility.

For example, a company in Iceland, Carbfix, has been injecting dissolved CO_2 into local subsurface basalt formations, provoking CO_2 mineralisation within a few years and thus permanently fixing the injected carbon. Some of the CO_2 is sourced from air capture, making the overall operation part DAC, with the rest captured from point sources, nearby and abroad. The capture process gets its energy (and some CO_2) from a nearby geothermal power plant. Whilst rapid, secure storage is an exciting prospect, this case illustrates the importance of co-locating DAC with a source of low-carbon power, limiting the locational flexibility of DAC. In addition, low-carbon power is a scarce resource globally[3], which reinforces the importance of prioritising emissions reductions and minimising the use of power-hungry carbon removal.

Emissions reduction over removal

DAC, BECCS, and other carbon removal methods could play an important role in climate policy, but the promise of removal is also susceptible to being used as an excuse for reduced emissions reduction ambitions. Emissions reduction depends on using less fossil fuels, for the production and consumption of goods and services, and so threatens the profitability of the fossil industry (a similar argument can be made for other industries, e.g. steel production or animal husbandry), and they will be tempted to use the idea of carbon removal to argue that they can continue to emit, whilst not paying the cost of actually implementing removal, if they can get away with it. As industry influence over policy is substantial, governments are likely to not challenge industry strongly to pay up. And governments also benefit from being seen to support carbon removal as an idea, whilst being reluctant to pay themselves for this new environmental infrastructure. There is therefore a clear risk that removal methods like DAC and BECCS will be researched and promoted rhetorically, but not get secure financial backing to be implemented at climate-relevant scales.

For example, the petrochemicals industry has been shown to promote the vision of a 'circular carbon economy' where carbon dioxide, petrochemicals, plastics are reduced to flows of carbon in a way that manages to reconcile increased petrochemicals and plastics production with carbon neutrality[4]. Alternative options like reducing societal reliance on plastics and petrochemicals fade into the background. Similarly, biochar (a form of carbon removal that involves adding charcoal to soil, and does not involve CCS) has been proposed as a viable climate solution in Denmark in response to emissions from agriculture, rather than options like eating less meat and dairy products, which would reduce emissions[5].

What to do about it

The most fundamental thing to do to avoid carbon removal delaying necessary emission reductions further, is to challenge vested interests in fossil fuel industries. Policies that explicitly target and deliver a phasing out of fossil fuels are urgently needed. If that were done seriously, the temptation to promote carbon removal without implementation, to protect fossil industry profits, would be more manageable. Challenging these vested interests is obviously a difficult thing to do, but improved understanding of the political economy context (including the influence of industry over policy as discussed above) of carbon removal would help[6], and an ensuing greater scepticism of promises of new technology. Scrutiny of how residual, hard-to-abate emissions are defined and reported by states and corporations should reduce temptations to lower emissions reduction ambitions[7,8]. Regulation of markets for negative emissions for offsetting is also crucial to avoid trading in removal that is not well evidenced.

A second avenue for climate policy is to challenge the equivalence of emissions reductions efforts versus ‘negative emissions’ from carbon removal. Such equivalence underpins emissions trading and carbon offset markets, where the flexibility of using removals to cover-up continued emissions is profitable. If decision-makers instead set separate targets for carbon removal versus emissions reductions[9], and use separate policy instruments, the risk of inflated removal ambitions and deflated emissions reduction efforts could be countered.

The carbon in emissions versus removals have very different environmental and social impacts, but are treated as part of the same carbon budget when discussing global warming in isolation. The more the diversity of the different carbon flow impacts is recognised, the harder it will be for governments and industries to sustain the idea of their equivalence and over-rely on promises of carbon removals. A range of carbon removal assessment methods are needed that go far beyond the techno-economic, and include a range of environmental, cultural and political aspects of each removal method[10].

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Competing interests

The author declares no competing interests.

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