Policy Brief: Public perceptions of Carbon Dioxide Removal in the UK

Executive summary

To tackle climate change, we must dramatically reduce the amount of fossil fuels we produce and consume. In addition, we may also remove carbon dioxide from the atmosphere, using Carbon Dioxide Removal (CDR) techniques. When developing new techniques, it is important that we listen to people's opinions and their concerns. This study assessed public perceptions of CDR, using a nationally-representative survey and a series of two-day discussion workshops, where we discussed three major CDR proposals: Bioenergy with Carbon Capture and Storage (BECCS), Direct Air Capture with Storage (DACCS) and Enhanced Weathering.

Our UK participants felt that CDR might not tackle the root cause of climate change, and that CDR does not necessarily fit with their desired 'vision' for a sustainable future society. CDR at scale would probably only be supported alongside ambitious measures to reduce emissions in the first place. Research under well-controlled conditions is likely to be generally acceptable, although doing this in open environments (particularly the ocean) may be challenging. Participants perceived climate change as urgent and immediate, and were therefore concerned that novel CDR techniques would not be ready in time. BECCS, DACCS and Enhanced Weathering were all perceived as energy-intensive and industrial. However, people felt that BECCS was more 'natural' and many would support it under conditions of avoiding environmental harm. Extended discussion of Enhanced Weathering led to a significant improvement in perceptions, apparently because the extended dialogue improved feelings of familiarity, feasibility and trust.

Recommendations

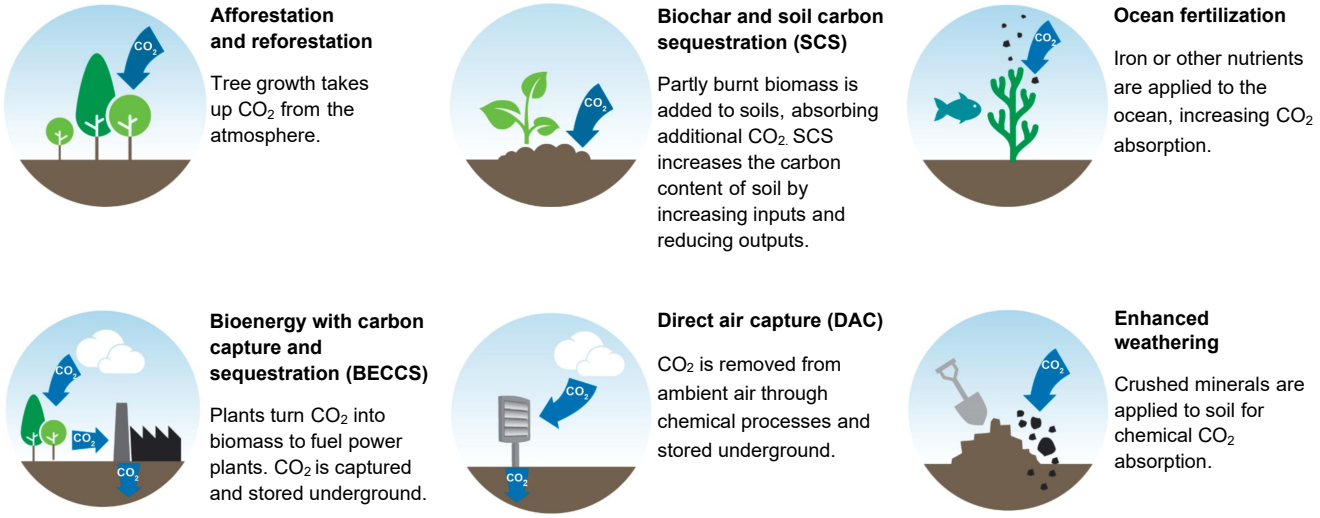
1. **Pursue a portfolio of options for tackling climate change**. *CDR is likely to be supported only alongside an ambitious package of policy measures to reduce emissions in the first place*.
2. **Stick to a coherent narrative for a sustainable future.** *People are less likely to support CDR if policy gives mixed messages, for instance supporting high-carbon activities in some sectors and promoting low-carbon activities in others.*
3. **Remember that climate change is not the only goal.** *Climate experts tend to fetishise CO_2; but people see sustainability much more broadly, and would not be willing to sacrifice other wellbeing goals.*
4. **Address temporal dilemmas.** *People see CDR as simultaneously too short-term and not short-term enough. Pursue ambitious emissions reductions; identify techniques likely to be scalable within an urgent timeframe; and avoid overshoot scenarios*.
5. **Build trust and promote inclusive dialogue.** *If CDR is to be scalable, trust will need to be built and maintained. We need early, two-way dialogue which prioritises listening to people rather than 'educating' them.*

Overview

To tackle climate change, we must dramatically reduce the amount of fossil fuels we produce and consume. However, we must also remove some carbon dioxide from the atmosphere, using Carbon Dioxide Removal (CDR) techniques. Many industrialised economies will require some large-scale CDR in order to meet their climate change targets. For instance, projections suggest that meeting the UK target of 'net zero' emissions may require 130 million tonnes of carbon dioxide to be removed each year by 2050.

Developing effective techniques is not just about getting them to work in a lab or a field. It's also about using them in the real world, in ways which will interact with ordinary people and everyday lives, as well as governments. To get them right, it is important that we listen to people's opinions and their concerns.

Several CDR options have been proposed:



Source: Minx et al (2017) Fast-growing research on negative emissions. Env. Research Letters, 12(3): 035007. Image credit MCC

This study aimed to find out about people's attitudes to Carbon Dioxide Removal techniques. We conducted a nationally-representative UK survey (n=1000) and three discussion workshops in different locations (n=24), with participants randomly recruited from the general population.[1] Survey participants were given a paragraph describing CDR, and were then asked questions relating to CDR risks and benefits (see graphs below). Workshop participants were recruited for a mix of age, gender, ethnicity and socio-economic status, across different urban and rural locations. The workshops started with a discussion about mitigating and adapting to climate change, followed by a brief introduction to the concept of CDR, then posters describing BECCS, DACCS, and terrestrial Enhanced Weathering. The first day of the workshops focused on these three proposals, and the general concept of removing CO_2 from the atmosphere. The second day focused in more detail on Enhanced Weathering. The methodology and poster information are shown in the accompanying report, available at the LC3M website.

[1] The research was cross-national: the survey was also conducted in the US (n=1026) and Australia (n=1000), and the workshops were also conducted in three locations in Illinois (n=23). This policy brief focuses on the UK results, and is aimed primarily at UK policy-makers. The results of cross-national comparisons are reported in the Carbon Brief piece 'How public attitudes toward CO_2 removal differ in the UK and US'.

Key findings

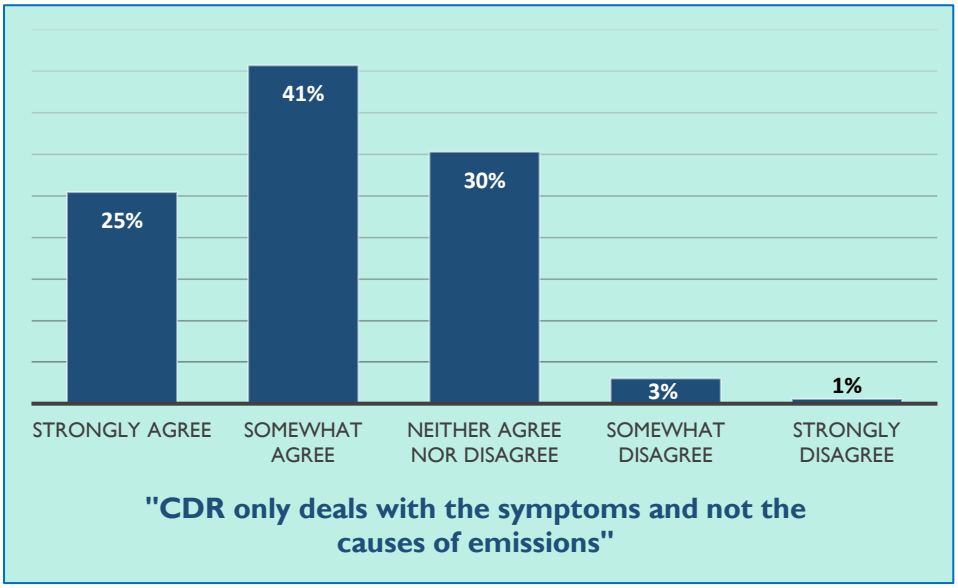
A 'non-transition': One of the biggest concerns with the CDR techniques studied here is that they do not necessarily reflect people's vision for a sustainable future society. Participants were concerned about energy-intensive and 'industrial' aspects of all three techniques. Participants spoke of the desired transition in a very broad sense, including environmental goals such as air and water quality and biodiversity, and societal goals such as reducing inequality. People felt strongly that tackling climate change isn't worth degrading the environment in other ways; this sentiment was common across all three CDR techniques, although of the three, the ocean interactions of Enhanced Weathering sparked the most concern about environmental impacts.

A temporal dilemma: Participants saw climate change as immediate and urgent, a finding supported by several recent survey studies. This meant that participants were concerned that new CDR techniques might not be ready quickly enough: they felt that it would be unwise to roll them out before they have been tested properly, but this means they may be too slow to tackle the urgent problem of climate change. At the same time though, they felt that these proposals may not be sustainable in the long-term. Therefore, publics may see CDR as both too short-term and not short-term enough.

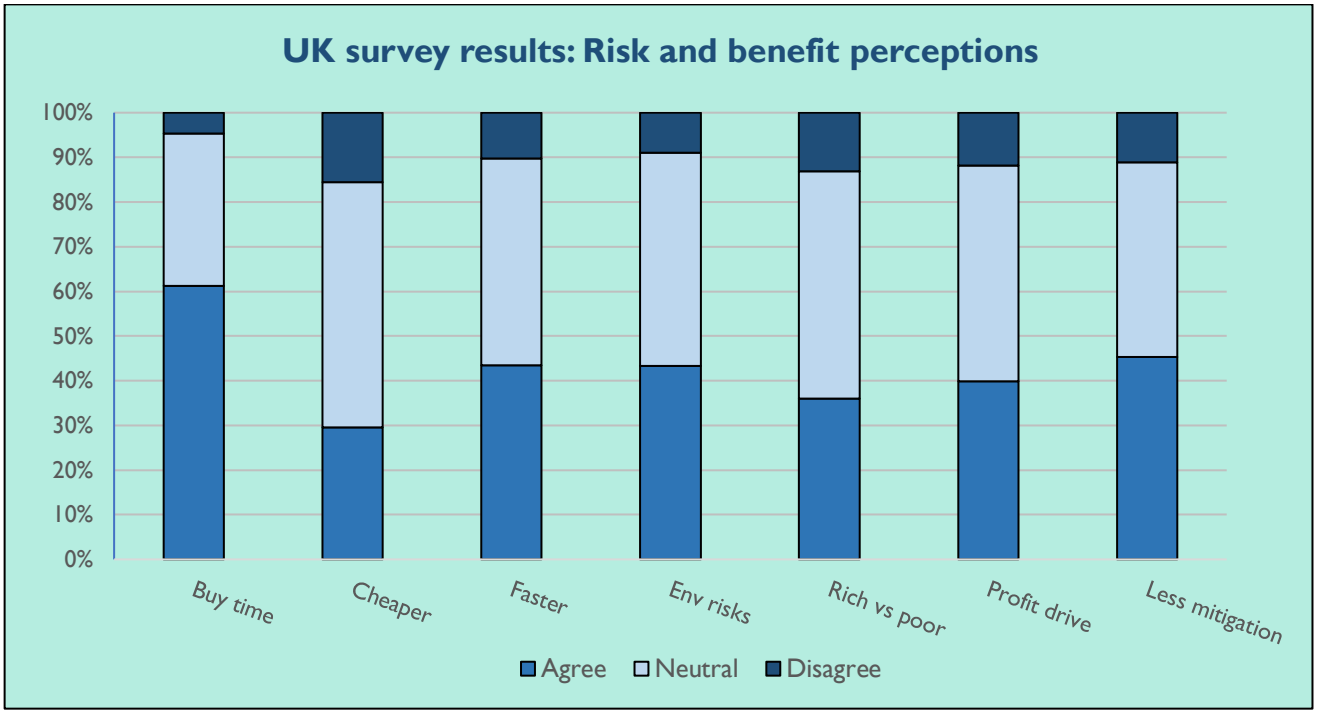
Support for research: The general concept of removing CO_2 from the atmosphere was generally well supported. Research under well-controlled conditions is likely to be generally acceptable. However, some things are harder to test and control, and techniques which interact with the ocean might be seen as particularly risky.

Cross-national differences: Compared to the US and Australia, UK participants were more worried about climate change. They perceived more potential benefits from CDR, particularly the idea that CDR could buy time to reduce emissions. This may be because UK participants were relatively optimistic about future generations being environmentally friendly. However, they also felt concerned about the temporal dilemma, particularly in relation to novel techniques still under development.

Fracking policy has created problems: Government policies have created public stigma around fracking in the UK and contributed to loss of trust in the ability of actors to adequately predict and control risks. This has spilled over onto CDR, even for techniques like Enhanced Weathering which are quite unlike fracking. Importantly, loss of trust appears to extend to a range of actors, including government and decision-makers, scientists, experts and regulators. Policy decisions in one sector have important knock-on impacts on other sectors and other technologies.



UK survey responses (n=1000) to the question "CDR only deals with the symptoms and not the causes of emissions"



UK Survey responses (n=1000) to three 'benefit' questions and four 'risk' questions: "CDR technologies could help to provide more time to reduce emissions"; "It will be cheaper to use CDR than to reduce the consumption of fossil fuels"; "CDR will help slow climate change down faster than by simply cutting greenhouse gas emissions"; "There may be negative impacts of CDR technologies on the environment"; "CDR would mainly benefit rich countries and impact on poor countries"; "CDR are being driven more by profit than by the public interest"; "CDR will lower the drive to cut carbon emissions".

BECCS receives some conditional public support: People generally saw BECCS as more natural and more feasible than DACCS or Enhanced Weathering. However, support was conditional on the avoidance of other environmental problems, and afforestation was generally much more preferred than any of the three options we discussed. With BECCS there are well-documented public concerns about storing CO_2 underground, which may be a major issue for DACCS as well. Several participants expressed a preference for using the CO_2 rather than storing it; however, CO_2 utilisation technologies are currently unable to remove and sequester CO_2 at scale.

DACCS is less easy to understand: For DACCS, the main issues related to lack of engagement and understanding. The process of capturing carbon dioxide from the air is not intuitive, and we struggled to provide easily-understandable information about how the chemical capture process inside the unit actually works. Many participants conflated DACCS with air pollution measures, and there is therefore a risk that units sited in less polluted areas may be met with uncertainty or even outright scepticism about the purpose of the project. Apart from this, the main concerns around DACCS were CO_2 storage underground (the same as for BECCS); and concerns about energy requirements. Participants queried the logic of building technologies requiring large amounts of low-carbon electricity, and felt that available renewable resources would be better used to cut emissions in the first place.

Enhanced Weathering is perceived as risky: People initially saw Enhanced Weathering as too energy-intensive and too industrial. However, people also said that there are currently "too many maybes" around this technique and would mostly support more research. The biggest concern was around ocean impacts, related to scepticism about our ability to predict and control unintended consequences in an open environment. Better understanding of the ocean interactions of Enhanced Weathering will be needed. The idea of opening new mines for the rock resource was also rejected by

the vast majority of our participants; some (although not all) became more favourable when considering using by-product from existing mines or industrial activities. When discussing co-benefits such as benefits to crops and soils, our participants became split, with some unsure that the co-benefits would outweigh the risks.

More information makes people more favourable: After an extended discussion about Enhanced Weathering on the second day, people's perceptions of it improved significantly, according to numerical questionnaire data collected at different points during the workshops. There were many reasons for this improvement, but feelings of trust and familiarity were important. For very novel techniques, extended dialogue appeared to make the technique seem more 'real' to people, and thus more feasible. For some participants, information about using waste rock resource and about the potential for pH benefits to watercourses improved attitudes; however, others remained sceptical of scientific assurances.

Policy Recommendations

1. Pursue a portfolio of options for tackling climate change

For many people, Carbon Dioxide Removal (CDR) is likely to be supported only alongside an ambitious package of policy measures to reduce emissions in the first place. This could help to ease concerns about CDR not tackling the root cause of climate change, or about it being a 'non transition'. Large-scale, engineered CDR techniques may be crucial for mitigating climate change, but reducing emissions in the first place must always take priority.

2. Stick to a coherent narrative for a sustainable future

People feel as though policy-making is currently missing a coherent narrative on the direction in which we wish to head. People are less likely to support CDR if policy gives mixed messages, for instance supporting high-carbon activities in some sectors and promoting low-carbon activities in others. A coherent narrative, across all sectors, will be vital; for example, a 'net zero test' for new infrastructure. Some countries have been experimenting with overarching frameworks for policy action consistent with societal wellbeing; such approaches require more work, but deserve attention as a possible means of organising this narrative.

3. Remember that climate change is not the only goal

In developing a coherent narrative for a sustainable future, it is important to remember that most people feel that tackling climate change is crucial but not necessarily worth sacrificing other aspects of human and environmental wellbeing in the process. CDRs which also generate non-climate benefits would come closer to meeting conditions of 'sustainability' in the broad way that most publics see it. It would be worth exploring whether CDR policy should be aligned more closely to the Sustainable Development Goals (SDGs).

4. Address temporal dilemmas

Our research showed that people see novel CDR proposals as simultaneously too short-term and not short-term enough to tackle the urgent problem of climate change. Pursuing CDR alongside ambitious emissions reduction policies may help to reduce this dilemma. However, there is also a need for research to immediately identify and focus on the techniques which are likely to be scalable, in a safe and controllable manner, within the required urgent timescale for action on climate change. 'Overshoot' scenarios, where long-term CDR is used to compensate for higher emissions in the short term, have been shown to be highly risky and should be avoided.

5. Build trust and promote inclusive dialogue

There is a strong body of evidence showing that loss of trust can be instrumental in project and technology failure, yet lessons are often not learnt from one technology to another. If CDR is to be scalable, trust will need to be built and maintained. Alongside recommendations 1-4, we also recommend supporting two-way dialogue with publics, early on in the innovation process. Non-experts can arrive at thoughtful, well-argued judgements when given sufficient time and resources to do so, and there is a need to listen to people's concerns and to take them seriously. We must avoid the temptation to ignore or downplay risks, even in cases of scientific uncertainty, and must recognise that attempting to 'educate' people into supporting something is seldom successful. For government, dialogue processes such as citizens' assemblies have shown some promise in enabling diverse viewpoints to be heard. All engagement processes must be inclusive, transparent, and ready to change or even abandon plans in the event that they turn out to be socially undesirable. Engagement should prioritise listening rather than talking; the overarching goal is not to educate people, but to learn from them and to change plans accordingly.

Further information

This research was funded by a Leverhulme Trust Research Centre award.

A full accompanying report of the project findings is available on the LC^{3}M website www.lc3m.org

Headline findings published in Cox, E., Spence, E. and Pidgeon, N. (2020) Public Perceptions of Carbon Dioxide Removal in the United States and the United Kingdom. *Nature Climate Change,* 10, 744-749

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