Climate change: 6 priorities for pulling carbon out of the air

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Credit: AI-generated image (disclaimer)

To reach net zero emissions by 2050, global emissions must be cut faster and deeper than the world has yet managed. But even then, some hard-to-treat sources of pollution—in aviation, agriculture and cement making—may linger for longer than we would like. It will take time for clean alternatives to arrive and replace them.

That means the world also needs to find and ramp up ways of taking CO_2 out of the atmosphere to stabilize the climate. Just meeting the UK's net zero target is likely to require the removal of 100 million tons of CO_2 a year, similar in size to current emissions from the country's largest-emitting sector, road transport, but in reverse.

The UK government's announcement of £31.5 million (US$44.7 million) in support for research and development of carbon removal is welcome. And while trials of new tech will help, there are many social issues that need to be tackled if removing greenhouse gases is to succeed.

Done right, carbon removal could be the perfect accompaniment to emissions cuts, bringing the climate back into balance. Done badly, it could be a dangerous distraction.

Getting removal right

Greenhouse gases can be removed from the atmosphere in several different ways. CO_2 can be captured by plants as they grow or absorbed by soils, minerals or chemicals, and locked up in the biosphere, oceans, underground, or even in long-lived products such as construction materials (including timber or aggregates).

These stores vary in size and stability, and methods for getting carbon into them vary in cost and readiness. Trees, for instance, are literally a shovel-ready way to soak up carbon with many additional benefits. But the carbon they store can be released by fires, pests or logging. Storing CO_2 underground offers a more stable reservoir and could hold 100 times as much, but methods of injecting it from the air are expensive and at an early stage of development. Nevertheless, a raft of innovations, competitions and start-ups are emerging.

Some experts worry that carbon removal could prove to be a

mirage—particularly at the massive scales assumed in some pathways for reaching net zero—which distracts from the critical task of reducing emissions. So how do we get removals right?

As the scientists who will lead a national greenhouse gas removal hub, we've sketched out six priorities.

1. A clear vision

The UK government has yet to decide how much CO_2 it wants to remove from the atmosphere, the specific methods it prefers, and whether 2050 is an endpoint or a stepping stone to more removals beyond. A clear vision would help people see the merits of investing to remove CO_2, while also indicating which emissions sources should be stopped entirely.

2. Public support

Carbon removal at the scales under discussion will have big implications for communities and the environment. Entire landscapes and livelihoods will change. The government already aims to plant enough trees to cover twice the area of Bristol each year.

These changes need to offer other benefits and align with the values of local people. People care not only about the removal techniques themselves, but also how they are funded and supported, and will want to see that reducing emissions remains the priority.

Consultation is vital. Democratic processes, such as citizen assemblies, can help to find solutions that are attractive to different communities, increasing their legitimacy.

3. Innovation

The types of approaches that remove CO_2 permanently are at an early stage of development and cost hundreds of pounds per ton of CO_2 removed. They are more expensive than most decarbonisation measures such as energy efficient lighting, insulation, solar and wind power or electric cars. Government support for research and development, and policies to encourage deployment are also crucial to stimulate innovation and bring down costs.

4. Incentives

How does a business earn a profit from removing CO_2 from the air? Except for trees, there are no long-term, government-backed incentives for the removal and storage of carbon.

The UK government can learn from efforts in other countries. The 45Q tax rebate and Californian Low-Carbon Fuel Standard and the Australian Carbon Farming Initiative both incentivise businesses to capture and store CO_2.

Leaving the EU Common Agriculture Policy means the UK has its own opportunity to pay farmers to put carbon into their soils, trees and crops.

5. Monitoring, reporting and verifying

This is the vital but unglamorous work of ensuring carbon removal is properly documented and accurately measured. Without it, citizens would rightly worry whether any of this was real, and whether governments were simply handing out public money to companies for nothing in return.

Monitoring, reporting and verifying carbon storage in soil is a major challenge, requiring a complex system of in-field sampling, satellites and

models. Even for trees there are gaps in international reporting in many countries, and no agreed method for reporting direct air capture and storage, which uses chemicals to absorb CO_2 from the air.

6. Decision-making

A lot of information about CO_2 removal resides in academic literature and focuses on global-scale scenarios. But actually doing it will involve people ranging from local farmers to international financiers. All will need tools to help them make better decisions, from easy-to-read manuals to improved models.

These priorities will guide our research, and will be things to look out for in the government's emerging removal strategy. They need to involve businesses and citizens, not just policymakers and scientists.

Unfortunately, it is so late in the day that we can't afford to get this wrong. But we are optimistic that there is plenty of scope to get it right.

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