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## What they don't tell you about climate change

Stopping the flow of carbon dioxide into the atmosphere is not enough. It has to be sucked out, too.



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General view of the U.S. 'We Are Still In' pavilion at the COP 23 United Nations Climate Change Conference on November 11, 2017 in Bonn, Germany—Lukas Schulze/Getty Images

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Two years ago the world pledged to keep global warming “well below” 2°C hotter than pre-industrial times. Climate scientists and campaigners purred. Politicians patted themselves on the back. Despite the Paris agreement’s ambiguities and some setbacks, including President Donald Trump’s decision to yank America out of the deal, the air of self-congratulation was still on show among those who gathered in Bonn this month for a follow-up summit.

Yet the most damaging thing about America’s renewed spasm of climate-change rejection may not be the effect on its own emissions, which could turn out to be negligible. It is the cover America has given other countries to avoid acknowledging the problems of the agreement America is abandoning.

The Paris agreement assumes, in effect, that the world will find ways to suck CO<sub>2</sub> out of the air. That is because, in any realistic scenario, emissions cannot be cut fast enough to keep the total stock of greenhouse gases sufficiently small to limit the rise in temperature successfully. But there is barely any public discussion of how to bring about the extra “negative emissions” needed to reduce the stock of CO<sub>2</sub> (and even less about the more radical idea of lowering the temperature by blocking out sunlight). Unless that changes, the promise of limiting the harm of climate change is almost certain to be broken.

**Don’t be so positive**

Fully 101 of the 116 models the Intergovernmental Panel on Climate Change uses to chart what lies ahead assume that carbon will be taken out of the air in order for the world to have a good chance of meeting the 2°C target. The total amount of CO<sub>2</sub> to be soaked up by 2100 could be a staggering 810bn tonnes, as much as the world's economy produces in 20 years at today's rate. Putting in place carbon-removal schemes of this magnitude would be an epic endeavour even if tried-and-tested techniques existed.

They do not. A few power stations and industrial facilities capture CO<sub>2</sub> that would otherwise end up in the air and store it away underground, a practice known as carbon capture and storage. But this long-touted approach to cutting emissions still operates on only a very small scale, dealing with just a few tens of millions of tonnes of CO<sub>2</sub> a year. And such schemes merely lower emissions; they do not reverse them.

What might? One option is to plant more forests (which act as a carbon sink) or to replace the deep-ploughing of fields with shallow tillage (which helps soils absorb and retain more CO<sub>2</sub>). Another is to apply carbon capture and storage to biomass-burning power plants, stashing the carbon sucked up by crops or trees burnt as fuel. Fancier ideas exist. Carbon could be seized directly from the air, using chemical filters, and stored. Or minerals could be ground up and sowed over land or sea, accelerating from aeons to years the natural weathering process that binds them to CO<sub>2</sub> to form carbonate rocks.

Whether any of these technologies can do the job in time is unknown. All of them are very expensive and none is proven at scale. Persuading Earth's swelling population to plant an India's worth of new trees or crops to produce energy, as the climate simulations require, looks highly improbable. Changing agricultural practices would be cheaper, but scientists doubt that this would suck up enough CO<sub>2</sub> even to offset the greenhouse gases released by farming. Direct air capture and enhanced weathering use less land, but both are costlier. Though renewable energy could profitably generate a fair share of the world's electricity, nobody knows how to get rich simply by removing greenhouse gases.

When the need is great, the science is nascent and commercial incentives are missing, the task falls to government and private foundations. But they are falling short.

More science would serve as a collective insurance policy against a grave threat. However, this year Britain became just the first country to devote cash to such projects; America is eyeing grants, too, despite Mr Trump. Britain's one-off £8.6m (\$11.3m) is footling. Roughly \$15bn a year goes to research into all low-carbon technologies; that pot needs to increase, and more of it should be channelled to extracting carbon.

### **Another form of climate denial**

A big market for CO<sub>2</sub> would provide an extra incentive to mine it from the atmosphere. But its uses are still limited. If regulators forced industries that cannot convert to electricity, such as

aviation, to use synthetic fuels rather than fossil ones, demand for the CO<sub>2</sub> that is the raw material for those fuels could increase greatly. The industries, though, would resist.

If the market will not provide an incentive, governments could. The case for a proper price on carbon (this paper has favoured a tax) is strong. Its absence is one of the reasons carbon capture and storage has not taken off as a way of reducing emissions from fossil-fuel plants; the kit needed can double the price of electricity. Yet, setting a price high enough to encourage negative emissions would asphyxiate the economy.

Subsidies are another option. Without them, renewables would have taken longer to compete with fossil fuels. But they are wasteful. Germany has lavished \$1trn on low-carbon electricity, and even then still depends on fossil fuels for over half its power. Still, governments could offer a reward for every tonne of CO<sub>2</sub> that is extracted and stored. In theory such a bounty should be paid from a fund bankrolled by countries according to their cumulative historical emissions (top comes America followed by Europe, with China rapidly closing the gap). In practice no mechanism exists to get them to cough up.

Indeed, facing the shortcomings of Paris is beyond most governments. Under Mr Trump, America is not prepared to reduce the flow of emissions, let alone the stock. But the problem would not magically be solved even if America returned to the fold. Many rich countries say they are already doing their bit by cutting emissions more steeply than developing countries. In fact, taking carbon dioxide from the atmosphere is not an alternative to belching out less greenhouse gas. It is necessary in its own right. Unless policymakers take negative emissions seriously, the promises of Paris will ring ever more hollow.

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