

# Climate change: Tools and technology

“Reaching net zero emissions will not be the end of the climate struggle, but only the end of the beginning. For centuries thereafter, temperatures will remain elevated; climate damages will continue to accrue; and sea levels will continue to rise,” says the introduction to *Pandora’s Toolbox, The Hopes and Hazards of Climate Intervention*. **Emily Hough** speaks to the author, Wake Smith

The book’s introduction continues: “Even the urgent and utterly essential task of reaching net zero cannot be achieved rapidly by emissions reductions alone. To hasten net zero and minimise climate damages thereafter, we will also need massive carbon removal and storage. We may even need to reduce incoming solar radiation in order to lower unacceptably high temperatures. Such unproven and potentially risky climate interventions raise mind-blowing questions of governance and ethics.”

Smith describes technology that might be deployed, while engaging with the ethical, practical and operational questions that such deployment might engender. He outlines the potential effects of climate change in unflinching terms, including desertification, sea level rise leading to the retreat of communities, and heatwaves that could: “Slay tens of thousands of people in their beds and fields.” He also echoes the worries of other researchers about the impact of climate change as a conflict multiplier: “Anywhere threatened with food or water insecurity becomes a fertile cauldron for unrest.”

## Horsemen of the climate apocalypse

I ask about when he thinks that retreat will become a widely-accepted strategy. “I’m afraid all those horsemen of the climate apocalypse are in our future,” he replies. “The good news is that many of them – such as sea level rise – will come slowly. But the unfortunate fact is that even if we do achieve net zero, the vast majority of the sea level rise that the world is likely to experience will happen afterwards, because the oceans equilibrate to changes in the atmosphere over centuries, if not millennia. So even if we can stop emissions of carbon and other greenhouse gases, the waters will continue to come for centuries.”

It does mean, however, that we can see the trend and prepare for it. “Retreat will absolutely have to be a part of the toolkit by which the world deals with climate change. Both retreat from the rising seas, but also from desertification of places that currently support agriculture,” he explains. “The degree to which climate change is likely to affect atmospheric and circulation patterns is deeply worrisome, so it is not always clear where those areas will prove to be.” Some places that are currently

habitable will not be so in the future, while others will become more agriculturally viable. The question is how humanity would adapt to such transitions: “How would the world organise? How could you move hundreds of millions of people to areas that are habitable?” he asks.

The final component of the *IPCC’s Sixth Assessment Report (AR6)* is to be issued this September. Smith comments: “For too long, the IPCC has been a somewhat thoughtless cheerleader for the 1.5°C warming limit embedded in the *Paris Agreement*, with the result that the general public imagines we are on a trajectory largely consistent with that.

“The *AR6* on the other hand, is finally socialising the fact that we are more likely on a trajectory of around 3°C, which would bring vastly higher damages and

dramatically remake the world,” he says.

“There are no silver bullets to climate change, only silver buckshot,” Smith says, and we are likely to need: “Small solutions, everywhere.” In his book, he describes in detail many of the adaptive solutions that form part of this ‘toolbox’. These include better early warning systems, preservation or reintroduction of natural carbon sinks, and more thoughtful and proactive disaster management. However: “The upshot is that relative to the optimal policy response, the world will likely mitigate too little and adapt too much,” he warns.

“Geoengineering in any form sounds like a terrible concept,” Smith writes, “until you peer carefully into the future and realise that not geoengineering would likely prove worse.” He elaborates: “Because we are merely in the ideation phase of this, all kinds of crazy

ideas get tossed out as to how we might intervene in the future climate system. Some of them deserve very serious attention and urgent, well-funded research. Others are downright dumb,” adding that: “When faced then with a menu of uniformly unappetising options, people are naturally prone to grasp at specious ones – offerings that sound too good to be true, because they are.”

In Smith’s opinion, what is the most specious of those solutions? He doesn’t hesitate: “The idea that trees will be the climate solution. And yet, because everyone loves trees, they are so easy for shysters and equivocators to use.” It is difficult to verify whether trees are actually planted, despite the promises made by carbon offset schemes. And even if the trees are planted, we need ‘net’ new trees, not replacements for those that have already been cut down, he says: “And to be clear, the trees we plant can never be harvested... the problem is that we have dredged up carbon that was buried deep in the Earth’s crust. We have combusted it and put it into the air. If we are going to reverse climate change, we will have to take it from the air – which trees do – and then embed it permanently in the Earth’s crust – which trees don’t do.”

A handy safety valve may lie with the Earth’s reflectivity – its albedo. Our planet absorbs about 70 per cent of sunlight, with 30 per cent bouncing back off clouds, snow, ice, sand or other light coloured surfaces. One possible solution to a heating Earth, therefore, lies in increasing its albedo: “If we could change this and only absorb 68 or 69 per cent of sunlight, that would have a huge temperature

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impact on the world,” explains Smith. Solar radiation management (SRM) – which increases the Earth’s albedo – warrants further research and investigation. “Stratospheric aerosol injection (SAI) involves deploying tonnes and tonnes of reflective particles that would deflect some of the incoming sunlight,” he continues. “I’m really worried that the Earth is going to get too hot in the future, so I looked at ideas that could cool it down. SRM is not a way to head off climate change in the first place; it’s a way to deal with too much climate change. If it does get too hot and we have to find a way to cool the Earth down, then SAI is the best bad idea that we currently have. But I’m all for less bad ideas or other ways to ensure that we don’t ever need this. I’m also entirely open to the idea that if we began to do SAI field experiments, we might find it does bad stuff that we didn’t intend.”

There are no good options at the moment, but at least we understand the physics of stratospheric aerosols thanks to volcanic activity and real-life eruptions that have demonstrated how sulphates in the stratosphere cool the Earth. “Sulphates are native to the stratosphere, so that removes one element of risk; whereas if we insert some element that is not native, there’s a risk of unintended consequences,” he explains.

The trouble is that so much of this research is embryonic and what research does exist often triggers a visceral but understandable response from people concerned about tinkering with our atmosphere. “We may very well need these tools and we don’t want to discover that we need them, but don’t understand them because we haven’t done the research,” Smith opines. “We absolutely need to start field research in respect of this technique. Not field research that would have an effect on climate, but to understand the composition of the stratosphere in different places, at different altitudes, at different times of the year. We’ve got utterly insufficient data.”

### Governance issues

Frankly, it is also a matter of will and co-operation. Like decarbonisation efforts, geoengineering interventions would be difficult to govern. Smith points out that the *Paris Agreement* is not yet working because global emissions are still growing. “Everything in the climate arena seems to be difficult to govern,” he laments.

It is possible that in the future our grandchildren or great grandchildren will be resentful of our failure to act in this era, Smith tells me. “It is tempting to imagine that today we are much more enlightened, that we have evolved. But it is perfectly likely that our descendants will view us in terms of our climate activity with the same levels of incomprehension that we feel when we look back at earlier eras, asking themselves how we could have behaved so badly.”

In terms of ethics, too, the question is more complex than it initially appears. In his book, Smith asks: “Instead of how much climate change do we want? The question becomes, how much poorer are we willing to be today to sacrifice for a more benign climate future that many of us will not live to see?” He reminds me that the projected economic growth of developed countries – if such growth becomes fact – suggests that their climate vulnerability will drop meaningfully by the end of the century. In the book, Smith suggests that: “Our current concern for the climate welfare of the future Global

South should be balanced against a recognition that, by the century’s end, much of it will likely rival the Global North in living standards.” This means that from the standpoint of the poorest global inhabitants: “Economic development is likely to trump climate change as the essential concern for a few generations at least.”

Of course, past examples of growth do not guarantee economic development in the future, he reminds me. But, if the next century unfolds economically as the last century did, the Global South is predicted to experience developmental phases: “If the past proves to be prologue, which it may not, it will catch up with the Global North. And if that proves true, it changes the moral framing that we are looking at all of this through.”

Going forward, Smith says that putting a price on carbon is: “Absolutely essential. Nobody likes taxes and so maybe we’ll find other terminology but, in the end, we need a fee.” He highlights an area in which the UK is pioneering, namely:

“Figuring out how to intervene in the economic system in order to put scrubbers onto large smoke stacks. This is something for which there is no world

market. People talk about carbon use, but we use about one per cent of the carbon we produce, the other 99 per cent is product for which we have no use, so we have to capture it and bury it back under the Earth’s crust. The UK has tried this twice, and failed twice, but it has learnt some lessons and now has a very impressive scheme to incentivise carbon scrubbers at fixed point emission sources, then link all of that to a new pipeline and sequestration infrastructure that pumps it back under the floor of the North Sea.”

Smith is adamant that adaptation is full of ‘freebies’ if we have the foresight. However, he repeats that decarbonisation is just one of the elements we will have to deploy in the face of climate change. “Technology is going to be absolutely necessary. But in the end, some personal sacrifice will be required.”

He is emphatic. “Let me take my hat off to the UK for being an extraordinary example of forward thinking in respect of climate. If we go back to the ethical and practical issues of solving the problem, it is difficult to get people to make local sacrifice for global benefit, and to undertake current sacrifice for future benefit. Both are really difficult,” he comments. “But the UK is among those countries that is volunteering to do exactly those things. Some countries in the EU are doing the same, they are also global leaders in this regard.

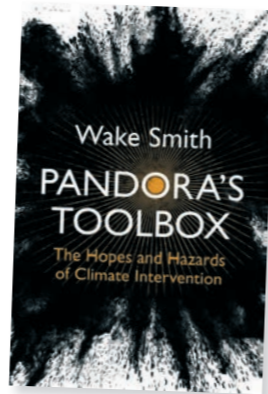
“Other countries, such as my own, are the complete opposite. We are stuck in neutral, if not in reverse, in respect of climate and I am sorry about that,” he concludes.

### Author



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Retreat will absolutely have to be a part of the toolkit by which the world deals with climate change



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