GREEN
EUROPEAN
JOURNAL

# The Promises and Perils of Geoengineering

**Article by Martin Vrba**
June 12, 2024

With decarbonisation proceeding too slowly and the Earth overheating faster than expected, some voices within the climate movement are starting to advocate for publicly funded research into solar geoengineering technologies. Is the case for once-unthinkable climate solutions growing stronger?

Rogue billionaire T. R. Schmidt develops a launcher to shoot massive amounts of sulphur into the stratosphere. His goal is straightforward: to cool our overheated Earth and thus stymie the havoc that climate change is causing. His efforts inspire both hope and terror, splitting the world into two camps: those opposing his experiments, and those favouring them.

This is the basic synopsis of *Termination Shock*, a 2021 novel of speculative climate fiction by Neal Stephenson. The book presents some of the key controversies surrounding solar geoengineering technologies: their unforeseen consequences for the environment, the absence of international cooperation on their use, and the dangers of their unilateral deployment by private actors without public oversight.

But it also echoes some of the experimentation currently underway. In 2022, US startup Make Sunsets, owned by Schmidt's real-life alter ego, American entrepreneur Luke Iseman, released two weather balloons in Mexico's Baja California. They contained sulphur dioxide. The purpose was to spread the chemical in the stratosphere to deflect sunlight and then measure the cooling effects.

The experiment provoked a strong response from the Mexican government, which began drafting new legislation to ban any unauthorised use of climate-altering technologies. Having become the first country to adopt solar geoengineering laws, it then began lobbying other countries to create common planetary standards on the use of such technology. But so far, there is neither political nor scientific consensus on whether solar geoengineering efforts (otherwise known as solar radiation management – SRM) could do more harm than good.

## Cooling by unnatural means?

Geoengineering refers to attempts at cooling the planet by two very different methods: removing carbon dioxide from the atmosphere, or deflecting incoming solar radiation.

Of the two, the first – known as carbon sequestration or carbon capture and storage (CCS) – is usually the less controversial, partly because it can be done by natural means. For example, "negative emission strategies" like soil-based carbon sequestration aim at storing carbon in agricultural soil.

There are good reasons for putting our hopes in the ground. Soils contain two to three times more carbon than the atmosphere, and plants consume about one third of the CO2 that humans produce. According to estimates, soils could sequester over a billion additional tonnes of carbon each year. In practice, such "carbon farming" would push agricultural farmers to focus more on certain kinds of

perennial crops, such as miscanthus, poplar, willow, or conventional grasses, that store higher amounts of carbon in the soil.

Carbon can also be captured and stored underground by technological means. As philosopher Benjamin Bratton characterises it, “Instead of taking something out of the ground and spitting it into the sky, you’re taking something out of the sky and putting it in the ground.” While the most effective way of doing that is contested, the necessity of carbon sequestration is not. In March 2024, the measured concentration of carbon dioxide in the atmosphere was 425 parts per million (ppm) – a 50 per cent increase on pre-industrial figures.

According to environmental organisation 350. org, as well as many climate scientists, the “safe” level of CO2 in the atmosphere is 350 ppm. That implies that not only do we need to stop emitting additional carbon into the atmosphere, we also need to capture a lot of the carbon already there. This is why the oft-cited target of achieving a net zero economy is not enough. In 2024, we are already in what French philosopher Bruno Latour called a “new climatic regime”. If we want to stabilise our climate, we must follow a negative emissions scenario.

## Learning from natural disaster

The real controversy starts with the second method of geoengineering. By deflecting solar radiation, some of the sun’s heat won’t make it into our atmosphere, and so won’t be trapped by the greenhouse effect. This partial desolarisation will have a cooling effect on the Earth’s surface. Its most discussed and developed variant so far is “stratospheric aerosol injection” (SAI). This is what Make Sunsets, and for that matter, T. R. Schmidt, were experimenting with, and is inspired by a natural occurrence: the eruption of a volcano, and the atmosphere-cooling aerosols that this produces.

*Of all the possible solutions to the climate emergency, solar geoengineering seems to be the least desirable.*

When Mount Tambora in Indonesia erupted in 1815, it released a massive cloud of particles that quickly spread by stratospheric jet streams, eventually forming an invisible cloud of aerosols across the Earth. For years after, the global climate cooled (according to simulations, by approximately 1 degree Celsius). The following year became known in Europe and North America as a “year without summer”. It saw mass movements of people, failed harvests, famines, food riots, epidemics, and social unrest across the world. It is those cooling effects that have attracted the attention of some researchers who argue we may need to include these technologies in our climate strategy.

## A capitalist ruse?

Of all the possible solutions to the climate emergency, solar geoengineering seems to be the least desirable. Climate movements and discourses usually consider it a delusional technofix, if not a delaying strategy of the fossil fuel industry to make its decarbonisation efforts appear less urgent. After all, if we start to believe we can effectively manipulate the climate, governments might be even less inclined to phase out fossil fuels at the speed that’s required.

Even worse could be the consequences of such massive intervention in an otherwise fragile climate system. Disturbance of weather patterns, widespread damage to ecosystems, planetary pollution, a decline of public health – with risks like these, what is there to discuss?

There is a strong anti-industrial current in the green movement that regards technology and technological civilisation as a problem in and of itself, and instead advocates for nature-based solutions. It argues that it is our alienation from the natural world that has caused such indifference to planetary health, and that we therefore need to reconnect with nature rather than rely on technological solutions. Similarly, the anticapitalist green left sees geoengineering as a capitalist pseudo-solution.

Experts have also expressed their reservations. In 2022, concerned scientists from universities and research institutes across the world launched a "solar geoengineering non-use agreement" initiative. In an open letter, they called for "immediate political action from governments, the United Nations and other actors to prevent the normalisation of solar geoengineering as a climate policy option". More than 450 scholars have since signed the letter. According to signatories, any attempt to open a discussion on solar geoengineering would simply legitimise what should remain a taboo. The initiative is primarily an attempt to tighten existing restrictions – after all, a partial moratorium on the development of solar geoengineering was declared during the UN Convention on Biodiversity back in 2010.

However, excluding solar geoengineering from the set of legitimate options for tackling the warming of the planet could backfire. Holly Jean Buck, Assistant Professor of Environment and Sustainability at the University at Buffalo in New York, argued in her response to the open letter that if a ban on geoengineering were to be enforced, any possibility of publicly funded and transparent research into its risks and benefits would vanish. That in turn would open the field to hazardous, clandestine, and illegal research that could result in scenes like the one portrayed in Stephenson's novel. In short, if research is banned, the risk of rogue and irresponsible trials of geoengineering methods increases.

## Geoengineering as an emergency response

In May, *The Guardian* surveyed hundreds of climate scientists from the Intergovernmental Panel on Climate Change (IPCC), asking them what degree of global heating they expect. The results are sobering: almost 80 per cent of respondents foresee temperatures rising at least 2.5 degrees Celsius above pre-industrial levels. A 2018 article published in *Nature* had already shown there was a "good chance" that the "safe" threshold of 1.5 degrees Celsius would be breached by 2030, rather than by 2040 as the IPCC predicted. This, the authors of the article argued, was a result of three trends: rising emissions, natural climate cycles, and declining air pollution.

"Governments are cleaning up air pollution faster than the IPCC and most climate modellers have assumed," the authors of the paper noted. "Aerosols, including sulphates, nitrates and organic compounds, reflect sunlight. This shield of aerosols has kept the planet cooler, possibly by as much as 0.7°C globally."

The climatologist James Hansen followed with warnings that reducing… aerosol emissions from industries, especially shipping, might cause an increase in global temperatures. In other words, air pollution has so far been doing what stratospheric aerosol injection aims to do: cooling the planet using the reflective properties of small particles. In a way, we are already geoengineering the planet – not intentionally, but as a side-effect of industrial pollution.

In China, a decade-long fight against pollution caused a 90 per cent drop in sulphur dioxide emissions, which saved hundreds of thousands of lives but contributed to a 0.7-degree increase in the country's average temperature over the same period.

With an overshoot scenario (crossing the 1.5-degree threshold) becoming more likely, it is no surprise

that some progressive voices have started to take the idea of solar geoengineering seriously.

## A pathway to deep decarbonisation

In a recent collection of essays edited by Andreas Malm, Holly Jean Buck, and J. P. Sapinski, a group of authors reflect on whether geoengineering efforts might be needed in the era of temperature overshoot. Contrary to the critique that geotechnologies are mere capitalist technofixes that shield governments from the need for radical transformation, Malm, a prominent voice in the climate movement, argues that solar geoengineering could achieve long-term success provided that there is a shift from a free market economy to democratic planning. In this scenario, a central planner would lead a temporary effort to implement a global solar geoengineering programme in which all states collaborate for the public good, and from which private, profit-oriented actors are excluded.

The book makes a plea for a "critical political ecology of geoengineering", arguing that we should avoid technophilic and technophobic presuppositions about these technologies and instead consider them part of a complex, well-composed climate emergency strategy of deep decarbonisation and adaptation.

*International cooperation would enable us to better understand both the risks and possibilities of technologies we know so little about.*

It's also a strategy that, according to a recent study, is gaining currency among countries in the Global South. "The distinguishing feature between Global North and Global South that emerges as most significant [when it comes to how geoengineering is viewed] is the (mean) age of a country's population," it notes. "Those living in a country with a younger population […] tend to express significantly greater support for climate-intervention technologies." It is a part of a broader trend in which younger generations who will experience the effects of the climate crisis well into the future tend to be more receptive in general to responses to it.

## No engineering without research

Rather than passing moratoriums on geoengineering and thereby opening the door to private and unmonitored endeavours, the international community should aim at doing what Buck and others (including UN-appointed experts) have advocated for: creating a "a global network of climate research centres to produce reliable and legitimate solar geoengineering research". This international cooperation would enable us to better understand both the risks and possibilities of technologies we know so little about.

According to Buck, a model for such a network could be the CGIAR centres that promote food security, agroecology, and research to prevent famine. Unfortunately, however, we are nowhere near such an arrangement: geoengineering research is scattered, marginal, and lacking in public funds. Currently, the leading centre of solar engineering modelmaking is the Harvard Solar Geoengineering Research Program (HSGRP), which is backed by 16 million dollars in philanthropic funding from individuals and private foundations. Such a lack of public oversight is neither desirable nor necessary.

Currently, there are at least two publicly funded research programmes that are worth mentioning: the Earth's Radiation Budget (ERB) Initiative within the US National Oceanic and Atmospheric

Administration, and the EU's GeoEngineering and Negative Emissions pathways in Europe (GENIE). Contrary to various moratorium initiatives, the best way forward may be to expand such public infrastructure, taking the field of climatealtering technologies towards international cooperation and interdisciplinary research.

Done transparently and in consultation with the public, research will be the best way to determine whether solar engineering should become part of a viable climate strategy or if it is a technological dead end whose perils outweigh its benefits. As philosopher Peter Singer puts it, "We currently have no idea whether the risks of attempting SRM outweigh the risks of not attempting it. We would be wise to try to find out."

---

Martin Vrba is a Czech journalist, essayist, and researcher. Based in Prague, he writes about systemic emergencies such as the climate and ecological crises and their political, cultural, and socio-economic implications.

Published June 12, 2024
Article in English
Published in the *Green European Journal*
Downloaded from https://www.greeneuropeanjournal.eu/the-promises-and-perils-of-geoengineering/