

IS THERE A PLACE FOR GEOENGINEERING IN ADDRESSING CLIMATE CHANGE?

The seventh of a set of seven briefing notes summarising the findings of the Climate Geoengineering Governance Project



GEOENGINEERING
GOVERNANCE RESEARCH

The Climate Geoengineering Governance (CGG) project has brought together a broad range of expertise from the social sciences and humanities to examine the challenges of governance and regulation of climate geoengineering and to suggest ways forward

BRIEFING
NOTE 7

Slow political action on climate change has caused despair in a section of the scientific community, leading it to advocate research and development of technologies for “the deliberate manipulation of planetary systems to counteract anthropogenic climate change”. At this stage such ideas are simply proposals [Box 1]. Computer modellers have investigated the potential effects of such proposals and some laboratory work has been done on engineering processes, but there is, as yet, nothing approaching a socio-technical system capable of delivering any deliberate and controlled geo-engineering effect. However these ideas remain highly controversial.

Box 1. Types of geoengineering

There are essentially two geoengineering strategies. One is to reflect more of the sun’s energy away from earth (known as Solar Radiation Management - SRM - or Albedo Enhancement). The other is to suck carbon out of the atmosphere (usually called Carbon Dioxide Removal - CDR). Both of these can be achieved either by enhancing natural earth process (putting sulphate aerosols into the stratosphere to reflect sunlight or iron into parts of the ocean to cause plankton growth) or by building machines such as space mirrors or artificial trees.

How should we think about the potential contributions of CDR and SRM?

Technologies designed to remove carbon from ambient air generally attract less controversy than solar geo-engineering proposals. Indeed, many commentators argue that CDR is merely an extension of existing land management practices and carbon capture and storage from power stations and should simply be regarded as greenhouse gas mitigation technology. However, there have been strong objections to experiments with iron fertilization of the ocean. The most animated debate revolves around proposals to inject sulphate aerosols into the stratosphere.

SRM with sulphate aerosols has both promises and pitfalls. It promises to be fast acting and high leverage. That is to say the cooling effect would be nearly instantaneous and would be significant for relatively low project costs as compared to extensive conventional mitigation. However, the potential drawbacks in the event of the technology failing to perform as expected might include disruption of agriculture, due to undesirable changes in precipitation patterns, and international tension between countries pursuing the technology and those believing themselves to be potentially harmed by it.

SRM seemingly presents society with the decision of whether to trade off the risks of deliberately tinkering with the earth’s radiation balance against the risks of a seemingly inevitably warming world.

Some commentators have gone so far as to suggest that even doing research into the potential of SRM is



unacceptable. Their arguments are various and wide ranging. Some are concerned about so-called moral hazard: that even the prospect of a relatively low-cost geoengineering option will be seen by some as a “Get Out of Jail Free Card”, justifying less-vigorous mitigation efforts than would be required otherwise. The social science evidence is divided. Some studies seem to indicate that this concern is real, while others suggest that the prospect of geoengineering would actually encourage greater efforts at reducing emissions. Other critics suggest that it is simply hubristic to “play God with the atmosphere” - research merely makes the unthinkable, thinkable. Concern has been expressed about a slippery slope whereby even researching SRM will lead inevitably to the formation of vested interests that will ensure its deployment. Although the vast expenditure on Fast Breeder Reactors that came to naught suggests that such a path is far from inevitable. At least one expert argues that science is, in principle, incapable of providing the level of confidence in the income that would be necessary to deploy SRM and that awareness of such ignorance should save us from folly [Box 2].

Box 2. Hulme: Dangers of SRM

To embark on this course of action would indeed be to conduct a giant experiment, to take a leap in the dark. It is not possible to know what the consequences of such engineering would be. ...I do not believe the human mind has the ability to fathom the intricacies of how the planet functions. The simulation models upon which aerosol injection technology would rely are like calculative cartoons when it comes to making long-term predictions. There are limits to human knowledge; our species is a product of evolution, not its author or controller” (Hulme 2014:112)



Box 3. Keith: Benefits of SRM research

Real-world experience gives confidence that those risks can be understood. To understand the risk of injecting a million tons of sulfur into the atmosphere, for example, we can study the 1991 eruption of Mt Pinatubo, which put eight million tons of sulfur into the stratosphere. And each year humans pump roughly fifty million tons of sulfur into the atmosphere as air pollution. This is not an argument that we should ignore the risk of putting one million tons of sulfur into the atmosphere for geoengineering, but it should give confidence that there is a strong empirical basis on which to assess these risks, and it is a reason to expect that risks will be comparatively small (Keith 2013: 11-12).

Those with a more positive view of SRM argue that we actually have sufficient knowledge from natural analogues, such as volcanic eruptions and computer models, to justify a carefully escalating programme of research [Box 3].

Not to explore the option, they claim, would be irresponsible in the face of inexorably rising greenhouse gas concentrations in the atmosphere. It is better, they argue, to do the research now so that the implications of deployment will be better understood if the time ever comes when there is pressure to resort to such measures.

A role for geoengineering?

Such pressures are viewed in some quarters as inevitable because even if governments agree on

effective measures to limit global greenhouse gas emissions, it would take truly heroic efforts to limit global average temperature rise to the 2°C by mid-century. Indeed, the only pathway to this outcome modelled by the Intergovernmental Panel on Climate Change assumes a significant new capacity for carbon capture and sequestration using biomass, which would itself have significant implications for biodiversity and food security. This raises serious questions about the time scales on which either SRM or CDR could be capable of playing a significant role in reducing the pressures of climate change.

Although the time required to develop a capacity to deploy SRM could be measured in years rather than decades, concerns about its potential side effects mean that it would be unlikely to be done without some kind of international treaty. Based on past experience, this would probably take many years to negotiate. It is also hard to see how financial capital could be mobilized behind such efforts except through direct government expenditure, as there seem to be few, if any, opportunities to extract value from the technology.

By contrast, there seem to be few obstacles to the prompt development and implementation of CDR technologies under existing national planning and environmental laws. A stable and reasonably high global carbon price would provide commercial incentives to develop and operate such technology. But such a price does not seem to be a realistic early prospect. Furthermore, developing a global capacity to remove carbon from the atmosphere and safely store it would require enormous resources and many decades to scale-up. Once in place, it will also take several further decades before the removal of carbon from the atmosphere affect global temperatures, due to the long life of some greenhouse gasses.

For different reasons, neither SRM nor CDR would seem to be capable of making a significant impact on global warming in the near term and are unlikely to be able to prevent the earth from heating beyond the 2°C target.

What does the CGG project conclude and recommend?

Given all of these considerations, is there a place for geoengineering in addressing climate change?

- Geoengineering should certainly not be considered a magic bullet that will make the challenges of adaptation and mitigation go away;
- Indeed, it is wise to always consider geoengineering in the context of mitigation and adaptation;
- It is probably too soon to know whether it could be a wedge alongside other measures that could help to reduce the severity of the problem at some point in the future;
- In the meantime the global warming stakes are sufficiently high that some modest public investment in careful and responsibly conducted research to bring us a bit closer to evaluating the potential contribution of geoengineering would seem justified.

Further Resources:

Intergovernmental Panel on Climate Change (IPCC).
Available at: <http://www.ipcc.ch>

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<http://geoengineering-governance-research.org/results-reports-and-publications.php>

About us

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Project Website

<http://geoengineering-governance-research.org>

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