



CSSN Briefing

CSSN Position Paper 2021:2 Solar Geoengineering Research in the United States: Key Critical Questions

In anticipation of the March 25th release of the National Academies report: *Reflecting Sunlight: Recommendations for Solar Geoengineering Research and Research Governance*, this brief primer outlines three areas of key questions to ask about any effort to advance solar geoengineering research using public funds.

Background

Solar geoengineering, also referred to by the National Academies of Science, Engineering and Medicine (NASEM) as sunlight reflection or climate intervention, comprises prospective technologies that could potentially cool the planet by reflecting sunlight back to space (or, more technically, 'modifying Earth's albedo').¹ Proposed strategies include spraying aerosols into the stratosphere to block incoming sunlight (this is the leading solar geoengineering proposal known as Stratospheric Aerosol Injection (SAI)), enhancing the reflectivity of clouds over the ocean, and increasing the reflectivity of the Arctic by spreading glass microspheres across the ice. Once on the fringes of climate policy, solar geoengineering is gaining traction, particularly in the United States, where some are calling for substantial public investment in solar geoengineering research.² During the past five years, the U.S. has become the world leader in solar geoengineering research, with multiple philanthropic efforts funding research at major universities, including Harvard, where researchers are preparing to launch the first outdoor field experiments testing SAI technology in Sweden during summer 2021.³

These philanthropic-academic research efforts are expanding into federal policy, with Congressional appropriation of \$4 million to NOAA to advance solar geoengineering research,⁴ calls for a ten-fold increase in that funding from high-level science advisors in the Biden Administration,⁵ and the forthcoming National Academies (NASEM) report, which is expected to propose guidance on federal funding, research, and governance of solar geoengineering in the U.S.

¹ For a crisp review of the topic, see, Jinnah, Sikina, Simon Nicholson, David R. Morrow, Zachary Dove, Paul Wapner, Walter Valdivia, Leslie Paul Thiele, Catriona McKinnon, Andrew Light, Myanna Lahsen, Prakash Kashwan, Aarti Gupta, Alexander Gillespie, Richard Falk, Ken Conca, Dan Chong, and Netra Chhetri. (2019). "Governing Climate Engineering: A Proposal for Immediate Governance of Solar Radiation Management." *Sustainability* 11: 3954.

² Wanser and Konar (2019). Ensuring a Safe Climate: A National Imperative for Research in Climate Intervention and Earth System Prediction. *SilverLining*.
https://static1.squarespace.com/static/5bbac81c7788975063632c65/t/5f62959c55101d0ecc4676f4/1600296352377/SafeClimatePolicyReport_032419.pdf

³ Temple, J. (2021). A first-of-its-kind geoengineering experiment is about to take its first step. *MIT Technology Review*.
<https://www.technologyreview.com/2021/02/19/1018813/harvard-first-geoengineering-experiments-in-stratosphere-sweden/>

⁴ Fialka, J. (2020). U.S. geoengineering research gets a lift with \$4 million from Congress. *Science*.
<https://www.sciencemag.org/news/2020/01/us-geoengineering-research-gets-lift-4-million-congress>

⁵ Deutch, J. and M. Zuber (2021). How to Start Governing R&D to Mitigate Solar Radiation. *Issues in Science and Technology*.
<https://issues.org/solar-radiation-mitigation-research/>

Mitigation Delay, Obstruction, and Deterrence

How do proposals for research and funding avoid 'mitigation deterrence': the risk that supporting solar geoengineering research will encourage reliance on the promise of solar geoengineering, rather than prioritizing investments to end fossil fuel use, reduce emissions and transition to a renewable future?

Most current and proposed solar geoengineering research applies earth system modeling schemes designed to illustrate the optimum potential of solar geoengineering presuming highly simplified and unrealistic political conditions. To date, minimal attention has been paid to the political, economic, and social implications of investing in solar geoengineering while investments in a renewable transition continue to be insufficient.⁶ How is solar geoengineering being considered in the context of decarbonization and climate policy at both domestic and international levels? Introducing solar geoengineering into integrated assessment modeling, to identify 'least cost' pathways can be expected to suggest postponing expensive mitigation in favor of the immature and unproven - but financially apparently cheaper future technology. How could the proposed research, funding and governance be made to work to enhance rather than hinder rapid emissions reduction efforts?

What concrete steps are laid out to ensure that the fossil fuel industry and other corporate interests, who are strategically resisting the transition to renewables, are not shaping solar geoengineering policy in the US, or elsewhere for their benefit?

Are there adequate 'firewalls' to prevent influence on research from fossil fuel interests or climate denialists? This is of critical importance because those with vested interests in the continued reliance on fossil fuels, or in resisting mitigation for other reasons, may seek to promote solar geoengineering as a substitute for emissions reductions. To ensure transparency and responsible research, all sources and recipients of research funding should be publicly revealed.

How are issues of social justice being addressed in the proposed research agenda? Have marginalized and frontline communities participated in setting the research agenda?

Given widening income and wealth gaps, and the concentration of wealth and power among the elite (mostly wealthy white men), can solar geoengineering be advanced without exacerbating problematic power imbalances?⁷ How are diverse voices and those already suffering from the climate crisis participating in setting the research agenda? With a narrow technocratic perspective dominated by white men from the global north, who is prioritizing the social justice implications and how are injustices of solar geoengineering being considered?⁸

⁶ Gupta, Aarti, Ina Möller, Frank Biermann, Sikina Jinnah, Prakash Kashwan, Vikrom Mathur, David R. Morrow, and Simon Nicholson. 2020. "Anticipatory Governance of Solar Geoengineering: Conflicting Visions of the Future and Their Links to Governance Proposals." *Current Opinion in Environmental Sustainability* 45: 10-19.

⁷ See, Biermann, Frank, and Ina Möller. 2019. "Rich Man's Solution? Climate Engineering Discourses and the Marginalization of the Global South." *International Environmental Agreements: Politics, Law and Economics*.

⁸ See Stephens & Surprise, 2020 The Hidden Injustices of Advancing Solar Geoengineering Research. *Global Sustainability*. <https://doi.org/10.1017/sus.2019.28>

Governing Research⁹

Does the proposed governance framework adequately address concerns about irreducible uncertainties, the responsible use of models and experiments, and overconfidence?

Not all uncertainties about climate systems and geoengineering can be resolved through more research, and proposals for research and research governance that presume they can be will inevitably fall short.

Although models only provide experimental settings to explore possible futures, they are widely interpreted as providing meaningful forecasts. Overconfidence in models, laboratory experiments, and small-scale field experiments could lead to hasty or premature adoption of the technologies, or the undue inclusion of unproven technologies in climate policy.

How does the proposed research governance address and enable public and civil society engagement?

Which groups or publics are identified as important stakeholders? What are the metrics or criteria used in this decision making? How will public, civil society, stakeholder input be used in governance decisions? Will such input shape decisions on whether to research solar geoengineering, or simply how to research it? How do the proposals engage with the challenges of convening fair and unbiased public engagement around a topic on which there is little public knowledge and widespread academic disagreement? The implications of solar geoengineering are planetary, and thus demand wide international involvement of publics and stakeholders before decisions could be legitimately made to fund research.

What measures does the proposed governance framework suggest to prevent a 'slippery slope' to deployment of solar geoengineering?

Research into novel technologies does not necessarily lead to deployment, but explicit governance measures are desirable where meaningful experimentation is hard to separate from deployment (because of the difficulty of attributing effects from small-scale interventions). Even modelling research can prejudice the likelihood of deployment where integrated assessment models inevitably recommend slower emissions reduction in the presence of apparently cheap future alternatives.

The U.S. and international climate policy, security, and unilateral geoengineering¹⁰

What measures are proposed to ensure that solar geoengineering would not be developed in the absence of an international agreement? How can it be assured that research would contribute to internationally agreed goals and comply with internationally agreed methods and approaches?

This is particularly relevant in the context of recent international efforts to stimulate governance of solar geoengineering in a broad multilateral setting. At the 2019 UN Environment Assembly, the US led opposition to a resolution tabled by the Swiss and several global South nations. The resolution called on UNEA to commission an assessment of geoengineering and possible governance measures. In resisting this, the US helped to pre-empt further development of governance in a precautionary manner in pursuit of overarching

⁹ For an up-to-date review of research governance in this area see: McLaren & Corry (2021) The politics and governance of research into solar geoengineering. *WIREs Climate Change*. <https://doi.org/10.1002/wcc.707>.

¹⁰ For an extensive review and development of arguments for international governance of solar radiation management, see, Chhetri, Netra, Dan Chong, Ken Conca, Richard Falk, Alexander Gillespie, Aarti Gupta, Sikina Jinnah, Prakash Kashwan, Myanna Lahsen, and Andrew Light. (2018). *Governing Solar Radiation Management*, Forum for Climate Engineering Assessment, American University, Washington.

goals of sustainability and justice. How does the report ensure that any solar geoengineering-related research is responsive to societal needs and concerns to the greatest extent possible?

What measures does the report propose to ensure that solar geoengineering research accounts for the potentially catastrophic social and environmental consequences?

Solar geoengineering entails changing the global average temperatures, which has serious implications for global hydrological cycles and other related climatic phenomena, such as the Asian and African monsoons.¹¹ These effects can vary dramatically between countries and even within some of the large countries. Earth system modeling schemes designed to illustrate the optimum potential of solar geoengineering fail to account for such sub-regional and subnational variations. What concrete measures does the report suggest to ensure that these effects and the associated human and environmental effects are not neglected?

Do the proposals acknowledge negative global perceptions of US climate policy, and the risks that such perceptions might hamper international cooperation on solar geoengineering research or development? Do the proposals take into account how support and finance for solar geoengineering research in the US might influence climate strategies and policies of other states?

The international implications of US solar geoengineering proposals are particularly important at this time when the new administration is seeking to demonstrate climate leadership. The administration's embrace of "climate security" has led to some concern over the military's role in responding to climate change. Concerns about the militarization and securitization of climate geoengineering technologies are present throughout the world. While weaponization of solar geoengineering might seem unlikely for now, international trust in a research program would depend upon the explicit exclusion of security interests. What concrete measures are proposed to avoid or prohibit the involvement of the U.S. military and intelligence agencies in solar geoengineering research or deployment?¹²

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¹¹ Simpson, I. R., S. Tilmes, J. H. Richter, B. Kravitz, D. G. MacMartin, M. J. Mills, J. T. Fasullo, and A. G. Pendergrass. 2019. "The Regional Hydroclimate Response to Stratospheric Sulfate Geoengineering and the Role of Stratospheric Heating." *Journal of Geophysical Research: Atmospheres* 124: 12587-616.

¹² See Surprise, K. (2020). Geopolitical ecology of solar geoengineering: from a 'logic of multilateralism' to logics of militarization. *Journal of Political Ecology*, 27(1), 213-235. <https://journals.librarypublishing.arizona.edu/jpe/article/id/2230/>