Carnegie Climate Geoengineering Governance Initiative

POLICY BRIEFS

an initiative of CARNEGIE COUNCIL for Ethics in International Affairs

Governing Solar Radiation Modification (SRM)

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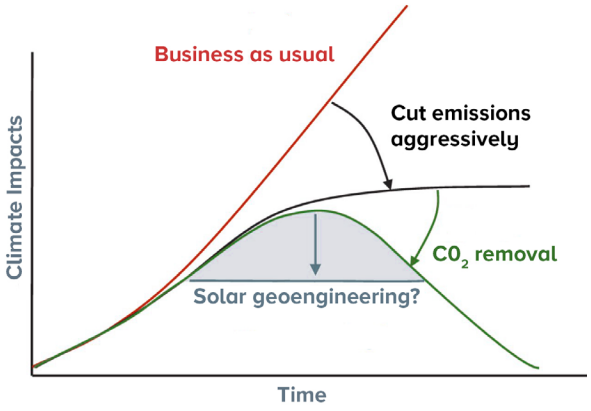
Solar Radiation Modification (SRM), also known as Solar Radiation Management, Radiation Modification Measures or Solar Geoengineering, would aim to address a symptom of climate change by reflecting more sunlight back into space, or by allowing more infrared radiation from Earth to escape, in order to reduce the Earth's temperature. It includes numerous proposed methods which differ significantly. None are ready for deployment. **Solar Radiation Modification could not be a substitute for reducing emissions, or removing atmospheric CO_2.**

Interest is rising in the potential for SRM to temporarily reduce the amount and duration of an overshoot of temperature targets, should reduction and removal of CO_2 emissions not happen fast enough. The **IPCC Special Report on Global Warming of 1.5°C** notes: "SRM measures are not included in any of the available assessed pathways. Although some SRM measures may be theoretically effective in reducing an overshoot, they face large uncertainties and knowledge gaps as well as substantial risks, institutional and social constraints to deployment related to governance, ethics, and impacts on sustainable development. They also do not mitigate ocean acidification."



Priorities for governance

The international community does not know enough about the risks, costs and potential benefits of SRM methods, as well as their governance requirements, to understand if they could be effective, and — if so — whether, when or how to deploy them.

One immediate challenge is the governance of SRM research, which is already taking place. Outdoor experiments of some methods are likely to begin soon. Research governance could include codes of conduct and safeguards to ensure research doesn't automatically head down a slippery slope towards testing and deployment.

In the longer term, if SRM technologies were ever deployed, they could create large and potentially long-term transboundary risks and challenges which would need to be addressed in multiple fora.

C2G2 has a 3-step approach to catalyzing governance:

CATALYZE
- **Bring issue to governments, international organizations, civil society**
- **Highlight urgency and risks**

LEARN
- **Understand better the risks and potential benefits**
- **Develop governance and monitoring frameworks**

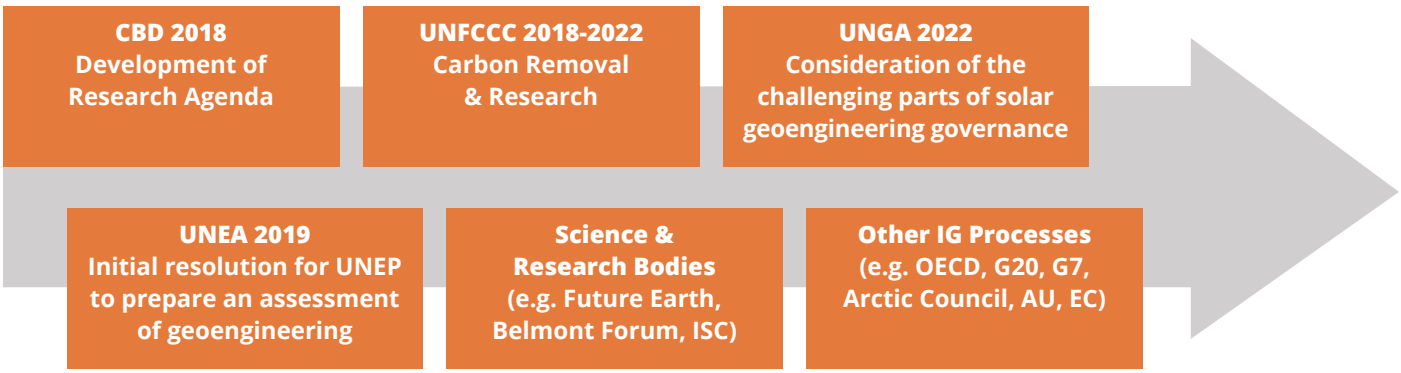
DECIDE
- **National, international fora agree to rules and guardrails to prevent hasty, unilateral, ungoverned deployment**
- **Decide whether to deploy or not**

Key governance challenges include:

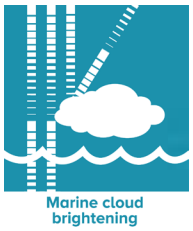
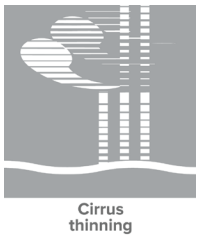
- codes of conduct, safeguards and policy direction for research,
- developing a globally agreed risk-risk decision-making framework,
- analyzing risks and potential trade-offs between different response scenarios including non-action in a warming world,
- who decides when/if/under what conditions to move from research to deployment,
- issues around intellectual property and commercial development,
- monitoring and attribution of climate impacts resulting from Solar Radiation Modification,
- assessing impacts on the Sustainable Development Goals, or what may come after them after 2030,
- long-term institutional guarantees against premature termination,
- issues around liability and compensation in case of unequal outcomes.

How to govern Solar Geoengineering?

Due to the potential transboundary impact of Solar Radiation Modification, some level of international governance will be essential. Fora and processes which could contribute include the UN Environment Assembly (UNEA), the Convention on Biological Diversity (CBD), the UN General Assembly (UNGA), the UN Security Council, research groups such as Future Earth, and regional bodies such as the Arctic Council.



Solar Radiation Modification Technologies, Maturity, Governance and Challenges

Proposed Method		Maturity/Governance	Governance/Technical Challenges include:
	Injecting reflective aerosol into the lower stratosphere to increase planetary albedo (reflectivity) and thereby reduce temperatures.	• Technology theoretical, based on natural analogues and computer models; • Outdoor experiments possible as early as 2019; • Governance covered by customary international law and CBD but not yet comprehensive.	• Regional variation in impacts (e.g. temperature and hydrological); • Risk of ozone depletion; • Impact on vegetation and crop growth; • Risks of premature termination; • Risk to implementation of many SDGs; • Responsibility for implementation, financing and compensation; • Public concern, informed consent; • Privatization and patenting issues; • Intergenerational ethics.
	Seeding clouds above ocean surfaces (e.g. with self-steering, autonomous ships), or whitening clouds above land to reflect sunlight back into space.	• Technology still theoretical based on observations and simulations; • Governance covered by customary international law, CBD and LC/LP, but not yet comprehensive.	• Technical limitations to scope and delivery ; • Regional variation in impacts (e.g. temperature and hydrological) expected; • Depends on weather conditions; • High levels of uncertainty about aerosol and cloud behavior; • Risk to implementation of many SDGs.
	Thinning of cirrus clouds to allow more infrared radiation from Earth to escape.	• Technology still theoretical, based on simulations; • Governance covered by customary international law and CBD decisions, but not comprehensive.	• Technical limitations to scope; • Regional variation in impacts (e.g. temperature and hydrological) expected; • High levels of uncertainty about aerosol and cloud behaviour; • Risk to implementation of many SDGs.
	Making surfaces (urban areas, roads, agricultural land, grasslands, deserts, polar ice-caps, oceans) brighter to reflect solar radiation.	• Mechanism confirmed by simulations and demonstrations, but not yet at scale; • Governance covered by customary international law and CBD but not comprehensive.	• Small on global scale (up to 1-3°C on regional scale); • Land-use and deployment costs; • Impacts on hydrological cycles, plant growth and aquatic systems.