C2G
Carnegie Climate Governance Initiative

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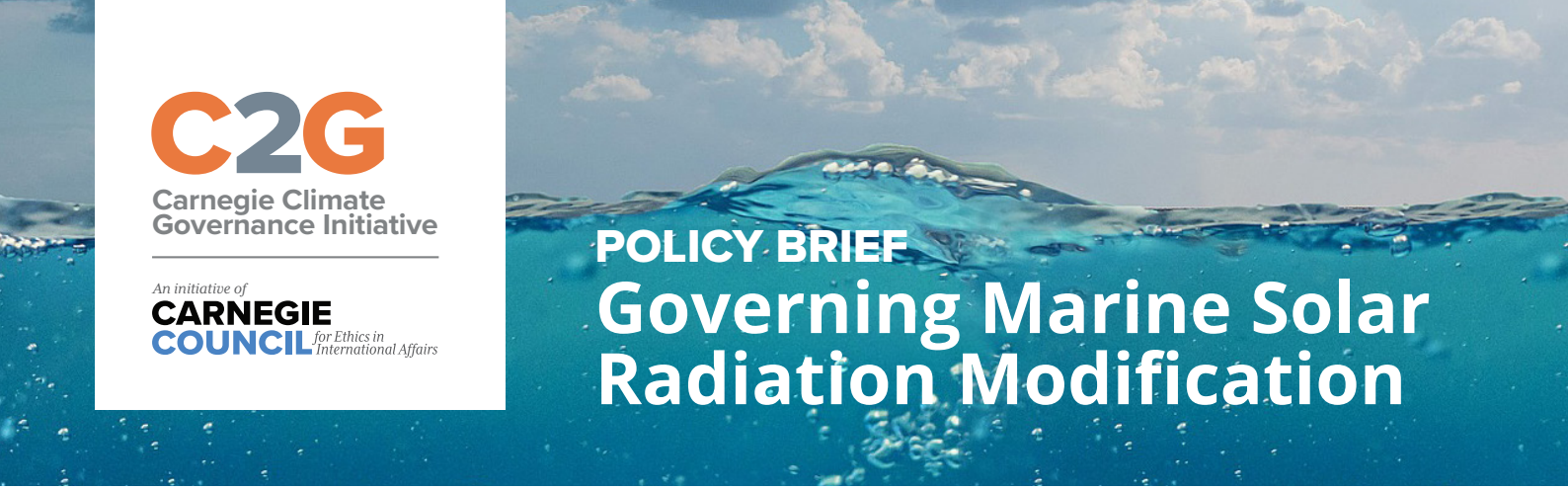

POLICY BRIEF

Governing Marine Solar Radiation Modification

Current commitments made under the 2015 Paris Agreement on climate change are insufficient to keep global warming to 'well below' 2°C, and according to the Intergovernmental Panel on Climate Change (IPCC), much greater ambition is necessary.

In response to the risks posed by climate change, some are considering the viability of Solar Radiation Modification (SRM) techniques, which aim to reflect solar radiation back into space or allow more heat to escape Earth's atmosphere. With more than two thirds of Earth covered by water, numerous potential SRM techniques might be considered for deployment in the marine environment in the future.

Marine SRM techniques are for the most part theoretical, but if ever deployed, some could create large and potentially long-term risks and governance challenges. We do not yet know enough about the risks, costs and potential benefits, or governance requirements, to understand if marine SRM techniques could be viable, or – if so – whether, when or how to deploy them.

How to Govern Marine SRM

Marine SRM could occur within recognised exclusive economic zones, territorial seas or the global commons of the oceans. Each raises different sets of governance issues. Some techniques would have transboundary impacts, requiring a level of international governance. Relevant fora, processes and communities which do or could contribute to this include

- Government at all levels
- Convention on Biological Diversity (CBD)
- London Protocol to the London Convention on the Prevention of Marine Pollution (LC/LP)
- UN Convention on the Law of the Sea (UNCLOS)
- UN Framework Convention on Climate Change (UNFCCC)
- UN General Assembly (UNGA)
- Civil Society Organizations (CSOs) and the commercial sector
- Research communities
- Regional bodies like the Arctic Council
- Other interested and affected publics

Effective governance would likely include regulation, broad participation in decision-making, transparency and access to information at the international, national, and subnational levels. This would apply to research, testing, deployment and monitoring. Key governance issues that require discussion, and which may drive amendments of current Conventions and Protocols, include

- Ensuring appropriate codes for conduct, safeguards and policy direction for research
- How to include interested and effected parties in meaningful discussion about the techniques
- Understanding the balance between the potential for harm, loss and benefits of deployment
- Resolving who decides when/if/under what conditions to move from research to deployment
- Issues around intellectual property and commercialisation
- Monitoring and attribution of impacts
- Assessing wider impacts, including on the Sustainable Development Goals
- How to align governance frameworks

Marine SRM Techniques, Readiness and Governance Challenges

Different marine SRM techniques are at different states of readiness and while some present governance challenges specific to the methods they involve (see table), all face common governance challenges including

- Responsibility for implementation, financing and compensation
- Public interests including concern and informed consent
- Commercialisation and patenting issues
- Monitoring and addressing climate impacts

Proposed Technique	Technological Readiness	Specific Governance Challenges
 **Surface albedo modification** Making surfaces brighter to reflect solar radiation. Some of the potential techniques include • reflective floating silica spheres • micro bubbles • reflective foam • creating Arctic sea ice • creating bright calcifying phytoplankton blooms	• Small scale trials of silica spheres, bubbles, sea ice and foams are underway. • Technical limitations to scale, scope and longevity of materials in situ.	• Regulatory and legal measures include customary international law, the LP and CBD decisions, but may not be comprehensive. • Regional variation in impacts (e.g. temperature and hydrological) expected. • Uncertainty about environmental impacts and ocean mechanics.
 **Marine cloud brightening** Seeding and whitening clouds above ocean surfaces, most likely using sea salt spray, to reflect solar radiation back into space.	• Technology theoretical, based on natural analogues and computer models. • Some potential for small scale outdoor experiments by 2020.	• Regulation would likely be covered by customary international law. The proposal to use sea salt may in due course be interpreted as a pollutant, and the technique would then be subject to the LP. • Regional variation in impacts (e.g. temperature and hydrological).