

## *Book Review*



Jesse L. Reynolds, *The Governance of Solar Geoengineering: Managing Climate Change in the Anthropocene*, Cambridge, UK: Cambridge University Press, 2019. ISBN: 978-1316614136 (pbk), 278 pp., \$47.00.

As the adverse impacts of climate change increase, so does the “emissions gap.”<sup>1</sup> It remains uncertain whether more-ambitious mitigation action will be taken by states. Against this background, solar geoengineering has been described as “a more drastic category of responses to climate change” which has the potential to reduce global warming quickly and cheaply (Reynolds, *The Governance of Solar Geoengineering*, p. 1). The possibility of solar geoengineering has raised controversy because of the social, ethical, legal, and political challenges it entails, as well as the risk of harm it would pose to the atmosphere, climate system, and marine environment.

The book under review addresses the governance of solar geoengineering in three ways. It is descriptive, setting out the law and policy applicable to solar geoengineering; it is analytical in regard to the opportunities and challenges brought about by solar geoengineering; and it is prescriptive, being a proposal of the future governance of solar geoengineering. Reynolds’ book delivers two central messages. First, do not underestimate the potential of solar geoengineering to reduce climate change, but do consider its possible substantial negative impacts on people and the environment. Second, solar geoengineering’s governance poses genuine challenges, which warrant careful thought. Reynolds provides a panoramic view of all key governance issues in the literature, from the disciplines of law, political science, and economics, and writes about all topics in a style that is friendly to both experts and laypersons.

Following an introduction to climate change and solar geoengineering in Chapter 2, Chapter 3 tackles the common concern that solar geoengineering will

---

1 UNEP, *Emissions Gap Report 2019*, <[www.unenvironment.org/resources/emissions-gap-report-2019](http://www.unenvironment.org/resources/emissions-gap-report-2019)>.

undermine the states' already insufficient climate-mitigation efforts. Chapter 4 is the first in a set of chapters dealing with the role of states in the governance of solar geoengineering (another set—Chapters 10 and 11—cover non-state governance). It investigates questions such as state conduct and decision-making mechanisms from the perspective of international relations. Chapters 5–8 address international law as it applies to solar geoengineering. Chapter 9 uses US environmental law to demonstrate how domestic law can respond to solar geoengineering. The next two chapters after that are concerned, as noted, with non-state actors' contributions to the governance of solar geoengineering. In Chapter 12, a proposal for compensation for transboundary harm arising from research on, or deployment of, solar geoengineering is elaborated. In Chapter 13, Reynolds proposes a governance framework for solar geoengineering in three stages: small-scale research, large-scale research, and implementation.

In essence, Reynolds is sceptical about the “emissions abatement displacement concern”, and devotes one whole chapter (Chapter 3) to respond to the arguments in support of it. He highlights the shift from resistance to, to acceptance of, climate adaptation, as well as a similar shift regarding negative-emission technologies (NETs). So it is not surprising to witness a similar resistance to solar geoengineering at this early stage. He further argues that a reduced effort to mitigate greenhouse gas emissions because of the operationalization of solar geoengineering is logically plausible but not necessarily true. He reviews fifteen studies of public opinion on solar geoengineering, and concludes that none of them indicates that there will be any reduction in the incentive to mitigate. He points out that, even if solar geoengineering reduces investment in emission abatement, this might not be a significant problem, because such a displacement of emission abatement needs to be weighed against the reduction in climate risk due to the implementation of solar geoengineering (p. 41). That is, social welfare might increase despite the reduction in emission mitigation.

Chapter 5 addresses contemporary international conventions and treaties, customary international law, and general principles of international law applicable to large-scale outdoor activities or implementation of solar geoengineering. Reynolds takes a balanced approach in discussing both the prevention of transboundary harm arising from solar geoengineering activities and undertaking solar geoengineering as a measure to prevent environmental harm from dangerous climate change. Regarding the obligation to prevent transboundary harm, Reynolds explains that this obligation could be interpreted in such a way that states, especially those with unusually high emissions, are obliged to prevent transboundary harm from climate change through undertaking research in, and even implementation of, solar geoengineering (p. 87). In relation to the

customary law of state responsibility for internationally wrongful acts, when a state fails to comply with its obligation to take adequate mitigation measures in accordance with the international climate law regime (e.g. the Paris Agreement), Reynolds suggests that solar geoengineering could be used as a measure by the responsible state to fulfill its obligation to make reparations to injured states (p. 89). He also discusses whether solar geoengineering could be used by the injured state that has suffered from the adverse impacts of climate change as a “countermeasure” vis-à-vis the states that fail to mitigate emissions. However, given that countermeasures are subject to several limitations, it would be difficult to make a case that research on and implementation of solar geoengineering is consistent with the regime of countermeasures.

Many of Reynolds’ suggestions in Chapter 13 concerning future governance bring added value to the discussion on the governance of solar geoengineering. Regarding the governance of small-scale research, he sees the limits of state-centric governance with international law as the centerpiece, and thus draws attention to non-state governance, which can offer “adaptiveness, expertise and an ability to operate across borders” (pp. 200 and 203). Regarding the governance of large-scale research, he proposes the establishment of an intergovernmental institution/solar geoengineering organization (SGO), which would have five core functions: facilitating research, ensuring responsible research, preventing premature escalation, fostering international trust and perceptions of fairness, and minimizing emission-abatement displacement (p. 209). He concedes at the same time that such an SGO might be politically costly and technically difficult to establish. Regarding the deployment of solar geoengineering, one option he sees is to establish or empower an intergovernmental decision-making institution, made up for the most part by states having the capacity, political clout, and willingness to implement (or counter) solar geoengineering, while the roles of other states are limited for the sake of efficient decision-making. In other words, unanimity or a supermajority of all states would not be required. He recognizes that an intergovernmental institution with decision-making authority might not be necessary or feasible, and suggests that, alternatively, an intergovernmental institution with the functions and mandates of the SGO might suffice (pp. 218–19).

Reynolds emphasizes throughout the book that he proposes the future governance of solar geoengineering on the basis of welfarism, aiming to maximize the welfare of current and future human beings in ways that are sustainable, consistent with widely shared norms, and seemingly feasible (pp. 5, 55, 184, and 196). In Chapter 12, he adopts a welfarist approach to frame his proposal for the liability and compensation for harm arising from solar geoengineering. In his proposal, the welfarist approach seeks to maximize welfare by offering

incentives for the injurer in, and victim of, solar geoengineering activities in order to find their optimal choice in the balancing between the climatic benefits of solar geoengineering and the cost of accidents, precautionary measures, and administrative costs. This approach can also be found, for instance, in rules regarding the obligation to prevent transboundary harm. Where, for example, despite the exercise of due diligence, transboundary harm is unavoidable and an hydraulic engineering project causes significant transboundary harm, this could still be lawful in the absence of an agreement with the affected state, if the harm arising from the project is far less than the socioeconomic benefits that the affected state could derive from the activity, such as a share of hydroelectric power and flood control.<sup>2</sup>

Although the welfarist approach is in general coherent throughout this book, the contents relating to the participation of developing countries, in particular the most vulnerable populations, in the decision-making and deployment of solar geoengineering seem inconsistent with this approach (p. 47). On the one hand, Reynolds emphasizes that “equity weighting” and special attention to the vulnerable groups are significant for increasing people’s well-being (p. 5), but on the other hand there is his proposal of the model of an intergovernmental decision-making institution that merely counts one or two dozen states as key participants and possibly excludes the vulnerable populations—this seems to go against the goal of maximizing the welfare of human beings. Furthermore, his assumption that people from industrialized countries are more resistant to solar geoengineering, while developing countries will take the lead in deploying solar geoengineering (pp. 65, 69, and 223), lacks empirical evidence. Such an unfounded judgment is neither helpful for improving the collaboration between industrialized and developing countries nor beneficial for maximizing the welfare of human beings and ecosystems.

In conclusion, Reynolds advocates for solar geoengineering by responding to many of the criticisms leveled against it. He calls for rational assessment of all possible solutions in response to climate change, while especially taking into account the benefit of future generations. Given the likely inadequacy of merely applying mitigation, adaptation, and NET methods to preventing dangerous climate change, he argues that solar geoengineering should be

2 1997 Convention on the Law of Non-navigational Uses of International Watercourses, Art. 7.2; and International Law Commission, ‘Draft Articles on the Law of the Non-Navigational Uses of International Watercourses and Commentaries Thereto and Resolution on Transboundary Confined Groundwater’, *Yearbook of the International Law Commission*, vol. 11, part 2, 1994, commentary on Article 7.

considered seriously, including through governance that facilitates its responsible research, development, and implementation. In Reynolds' eyes it is quite plausible to govern large-scale research and implementation of solar geoengineering in a way that could maximize humans' welfare. His comprehensive and in-depth analysis is a valuable "toolbox" for policymakers, and it unveils multiple routes for further research for scholars.

*Haomiao Du*

Faculty of Law, Economics and Governance, Utrecht University, Utrecht,  
The Netherlands

*h.du@uu.nl*

