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Editor's Note: Geoengineering Governance Systems

I. INTRODUCTION

This journal's volume on geoengineering builds off of our previous environmental issue, on maritime governance, in that the topic's development grew from a concern with existing international climate mitigation efforts. While continuing to believe that active and coordinated efforts to reduce global greenhouse gas emissions are the best precaution against catastrophic climate change, the editorial staff was interested in the viability of alternative options for preventing the atmosphere from overheating. One such option discussed was geoengineering, which encompasses a wide array of efforts to actively combat climate change, either by removing greenhouse gases from the atmosphere or by directly counteracting their heating effects through other atmospheric deployments. At the time such concepts were relatively nascent, although gaining increasing attention from the climate community.

While planning for this symposium, the journal was fortunately connected with the organizers of a global conference convened at Asilomar Conference Center to discuss the science of geoengineering. This conference sought to establish a global governance agreement akin to those governing recombinant DNA research in a series of conferences at Asilomar in the 1970s. Through a series of conversations, we reached an agreement whereby the journal would contribute to this process and particularly to the post-conference dialogue by publishing submissions on a set of key governance issues, by conference attendees.

The focus of this volume is on proper governance tools, and specifically how scientific and political practicalities might inform good legal policymaking going forward. The pieces we are happy to present cover an array of topics, from the role of the United Nations in any final decision to the proper attention due to recognition of intergenerational rights. They represent the perspectives of a small number of the over 200 people who attended the conference, but they pull together many of the governance and legal questions effectively.

In the following paragraphs, we provide a brief summary of the key themes of the symposium and the accompanying articles.

II. SUMMARY OF FINDINGS

A. *At Current Emissions Projections, Severe Climate Effects Are Likely*

Unchecked global emissions could lead to catastrophic climate effects around the world, particularly affecting freshwater supplies, human health, coastal settlements, and various populations centers through increased weather events.[1] Many of these dangers could manifest even if existing mitigation plans successfully reduce slightly the extent of warming to 1-3 degrees Celsius.[2]

B. *Geoengineering Projects Present a Possible Safety Valve against Climate Impacts*

In spite of the real danger posed by climate change, there has not yet been a consensus by the leading global emitters of greenhouse gases to make the cuts that would be needed to avoid serious impacts. In the face of this reality, several academics have called for increased research into strategies for engineering the climate to preserve existing atmospheric patterns ("geoengineering").[3] There are two major types of activities that constitute geoengineering. The first set of technologies focuses on carbon dioxide removal (CDR), and seek to reduce the level of greenhouse gases in the atmosphere directly, though capture and storage in various reservoirs. The second set focuses on solar radiation management (SRM), and involves counteracting the effects of greenhouse gases (notably their warming effects) through the deployment of other atmospheric technologies.[4]

C. *Geoengineering Projects Present a Potential Danger, and Should Be Regulated*

Despite its potential promise, geoengineering is also a source of heavy controversy; multiple parties have expressed concerns that geoengineering projects could cause more damage than they avoid.[5] To resolve this controversy, research and deployment of such technologies should be carefully regulated in the international system.

In having this debate, it will be important to distinguish between different technologies, which have very different effects, costs, and uncertainties. In particular, technologies focused on SRM are generally inexpensive to deploy and could have large-scale, immediate consequences; whereas CDR technologies generally act over longer time horizons and would be more expensive.[6] Any regulatory structure established must respond to very different concerns, and remain flexible, to be truly effective.

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[1] Intergovernmental Panel on Climate Change, *Summary for Policymakers*, in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY. CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 11-12 (M.L. Parry et al. eds., 2007).

[2] *Id.* at 16.

[3] Michael McCracken, *On the Possible Use of Geoengineering to Moderate Specific Climate Change Impacts*, 4 ENVTL. RESEARCH LETTERS 4 (2009); *see also* Margaret Leinen, *International Conference on Climate Intervention Technologies: Background and Overview*, 4 STAN. J. L. SCI. & POL'Y 1 (2011), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Leinen%20Intro%20Perspective%20Final.pdf.

[4] ROYAL SOC'Y, GEOENGINEERING THE CLIMATE: SCIENCE, GOVERNANCE AND UNCERTAINTY 9-36 (2009).

[5] *Leinen*, *supra* note 3; *see, e.g.*, Alan Robock, *20 Reasons Why Geoengineering May Be a Bad Idea*, 64:2 BULL. ATOMIC SCIENTISTS 14, 14-18 (May 2008)

[6] Jason J. Blackstock & Jane C. S. Long, *The Politics of Geoengineering*, 327 SCIENCE 527 (2010).

D. *The 2010 Asilomar Principles Provide a Useful Structure for Thinking About Geoengineering Governance*

One major result of the 2010 conference at Asilomar was the promulgation of five major principles needed to guide international debates over geoengineering governance. These principles, broadly, are that: 1) any research or implementation must have as its primary objective the collective benefit of human kind; 2) governments and other bodies must establish liability mechanisms associated with such research; 3) research should be undertaken in an open and interdisciplinary manner, and subject to risk assessment reviews; 4) research should be subject to independent technical assessments; and 5) the public should be involved, and approaches should particularly consider international and intergenerational effects.[7]

Of particular concern in this debate is the focus on intergenerational equity. As Wil Burns explains, intergenerational equity considerations are important in the context of geoengineering because they pull policy in different directions. On the one hand, successful projects could reduce damage to the planet and thereby help future generations as much as they help current ones. On the other, the availability of such options may undermine mitigation efforts; in the case of CDR, by providing an excuse for avoiding desperately needed mitigation activities, which is particularly troubling for SRM, which would not address other atmospheric impacts of greenhouse gas emissions such as ocean acidification.[8] Meanwhile, SRM could create its own climate problems, and potentially be irreversible. In this piece, the author highlights a potentially undervalued asset for future generations: that of choice. Particularly with SRM technologies, geoengineering could be done in the future; and so any implementation of ideas without due diligence could take away from future generations the right and ability to determine their own futures.[9]

Another issue that merits more attention than has thus far been given is the question of which harms merit consideration in the geoengineering debate. Not all victims of geoengineering may have the same moral rights to prevent implementation. Specifically, parties who stand to gain from global warming (particularly farmers in cold regions who may gain longer growing periods) would as a result be harmed by geoengineering; but a moral analysis reveals that their harms should not be considered on the same scale as those who face damages from global climate change. Also, within the geoengineering-harmed communities they should also have fewer rights than those who stand to be directly harmed by geoengineering projects' side effects (particularly in regions that may become more arid with the application of certain SRM technologies).

E. *Several Possible Mechanisms of Enforcement Bring Advantages and Disadvantages*

Although most scholars in the field agree that there should be some governance, the nature and extent of that coverage is heavily debated. In a dialogue between diplomats, Ambassador Richard Benedick and career diplomat Robert Berg debate the merits of the United Nations (UN) system. Ambassador Benedick believes that any eventual governance scheme should not be bound by UN Frameworks, pointing out that UN bureaucracies would inevitably

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[7] *Leinen*, *supra* note 3, at 4-5.

[8] *See* Malin Pinsky & Gregory E. Wannier, *Editors Note*, 2 STAN. J. L. SCI. & POL'Y ii (2010), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Editors%20Note%20-%20Oceans.pdf.

[9] Wil Burns, *Climate Geoengineering, the Termination Problem, and Our Responsibilities to Future Generations*, 4 STAN. J. L. SCI. & POL'Y 37 (2011), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Burns%20Final.pdf.

mire geoengineering efforts in a morass of bureaucratic requirements. Instead, he draws on his experience negotiating the Montreal Protocol and calls for a leading consortium of countries to collaborate and share research, establishing guidelines for research and implementation along the way.[10] In response, Robert Berg applauds the bureaucratic restraints in the UN as necessary to preserving a wide variety of interests in a very complex set of proposed activities, and restraining individual parties from acting rashly. In addition, judgments affecting different communities' livelihoods that need to be made will inevitably be controversial; and so he particularly extols the UN's role as a leading institution that could provide diplomatic cover for any geoengineering activities that are eventually undertaken.[11]

However, not all parties even believe that such governance is necessary, in any form. Joshua Horton in particular questions this, arguing that the "logic of multilateralism" itself will prevent any country from stepping forward (or authorizing its private citizens to step forward) without international consensus. Diplomatically, there is little reason to do so; the instigator would get the blame for anything that went wrong (and potentially owe damages), and would be relied on to continue any successful activities without having received support from the rest of the world. Instead, Horton believes that focus should be placed on promoting cooperation among researchers, to help encourage what he sees as a critical body of work.[12]

A possible middle ground is recommended by Bidisha Banerjee, who argues that while full international treaties would be burdensome, the overwhelming uncertainty in the science could lead to radically different interpretations (even on the same data), and so scientists' (or countries') voluntary codes of conduct may not provide a sufficient check on individual action. This middle ground comes in the form of environmental assurance bonding, a relatively recent concept in environmental law. Under this theory, any scientists or countries seeking to implement geoengineering technologies would be required to issue a bond equal to the worst possible damages such technologies could cause, and then receive a full refund to the extent that such harms are avoided. This could allow optimistic parties to move forward without unfairly imposing the risks of their actions on other entities. The program would almost certainly stifle some level of implementation, and could be a complicated system to implement, particularly in calculating the appropriate bond level and the bond-issuing agency. However, if done correctly it could provide a potential structure for all parties to act based on their perception of risk.[13]

III. CONCLUSION: LOOKING FORWARD

If there is one unifying dialogue that emerged from the Asilomar Conference and our discussions with various policymakers and academics, it was that the current system is inadequate. More cautious voices have urged that a fully-fledged regulatory regime is required to prevent "rogue actors" from engaging in foolish scientific experimentation that irreversibly harms the planet. More optimistic voices argue that current paranoia is getting in the way of

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[10] Richard Benedick, *Considerations on Governance for Climate Intervention Technologies: Lessons from the "Ozone Hole"*, 4 STAN. J. L. SCI. & POL'Y 6 (2011), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Benedick%20Final.pdf.

[11] Robert Berg, *Can the UN be a Better Leader on Climate Change?*, 4 STAN. J. L. SCI. & POL'Y 10 (2011), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Berg%20Final.pdf.

[12] Joshua Horton, *Geoengineering and the Myth of Unilateralism: Pressures and Prospects for International Cooperation*, 4 STAN. J. L. SCI. & POL'Y 56 (2011).

[13] Bidisha Banerjee, *The Limitations of Geoengineering Governance In A World of Uncertainty*, 4 STAN. J. L. SCI. & POL'Y 15 (2011), http://www.stanford.edu/group/sjlsp/cgi-bin/users_images/pdfs/61_Banerjee%20FInal.pdf.

scientific work that could save mankind from our own greenhouse gas emissions. The journal itself declines to advocate any one side of the debate; but whatever the final solution is, it must be tailored to individual technologies. The concerns around rogue action are much more reasonable in the context of aerosol releases into the atmosphere, than they are when protesting efforts to store carbon dioxide in underground facilities. To resolve the inevitable conflation of these two distinct issues, one solution going forward could be to separate discussions around the two technologies into different forums. Not only would this avoid public confusion, but it might also enable more pointed and productive dialogue at future such meetings going forward.

However, regardless of whether such dialogues are separated, all types of geoengineering technologies should be vigorously monitored. The Asilomar Conference was a useful first step in thinking about global governance regimes for different technologies, and the Journal is honored to be part of this process. Hopefully, the suggestions listed herein contribute to several more global meetings to come.

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