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Time for a Government Advisory Committee on Geoengineering Research

Even talking about research on geoengineering stirs controversy. Creating an effective mechanism for such discussions will be an essential prerequisite to any scientific work.

Nobody likes geoengineering. But whether your basic response is revulsion or resignation, the idea is getting increasing attention, and we need to develop a better way of talking about it. The most prominent scheme, known as solar radiation management (SRM), would aim to reduce global warming by spraying aerosols into the stratosphere or whitening clouds, thereby reflecting more sunlight back into space. Even strong advocates of geoengineering research acknowledge the many risks involved. The physical risks include possible shifts in global precipitation patterns and increased droughts and floods in the world's most vulnerable regions. The political risks include the possibility that geoengineering technologies will provide a welcome excuse to avoid difficult measures to reduce greenhouse gas emissions. And many see geoengineering as yet another expression of the same technocratic mindset that underlies modern industrialism and global warming itself. Moreover, the mere prospect of geoengineering is a profound indictment of decades of failed efforts to reduce greenhouse gases. No wonder that discussing it has long been taboo.

And yet reasonable people disagree about what to do about it. With regard to geoengineering research, some say it shouldn't be conducted at all. Others argue that research should be limited to computer modeling and laboratory studies. Some insist that small-scale deployment is necessary to develop technologies that could be used in a climate emergency, such as melting Arctic permafrost. With regard to policy, some advocate self-regulation by scientists, others favor oversight by national governments, and others call for international treaties.

Reasonable people also disagree about the relevance of competing ethical frameworks. Should we embrace utilitarian cost/benefit analysis? Some analysts suggest that geoengineering would be far cheaper and more effective than reducing carbon-based energy production. Or should we em-

phasize basic moral principles? Some argue for cultivating a more humble relationship with nature or taking responsibility for past greenhouse gas emissions. Others say our first responsibility is to prevent catastrophic climate change by any means necessary. Or should we let "the people" decide, and if so, which people and through what mechanisms?

This vexing jumble of technical uncertainties and political disagreements is not going away any time soon. As climate change impacts become more pronounced, public pressure to adopt quick and easy remedies will grow. Indeed, government agencies in the United States and abroad have already funded geoengineering research, including modeling projects, climate strategy projects, and some climate research with applicability to geoengineering. Privately funded research is in full swing, and entrepreneurs have filed patent claims on prospective geoengineering technologies. In the coming years, poor countries with rising sea levels and growing demand for carbon-based energy may deem geoengineering an attractive option. Rich countries with powerful fossil fuel lobbies may well agree.

This situation raises a series of pressing questions for scientific governance. What kinds of geoengineering research should governments fund, if any? Who should oversee such research? What criteria should they apply? And how can we encourage international cooperation and understanding?

Many commentators focus on the immediate need for substantive standards, but this is only half the challenge: Such standards must emerge from trusted institutions and a transparent process. We believe that in the United States a standing government advisory body would provide a critical focal point for policy formation around geoengineering research. Such a body has been proposed by a task force of the Bipartisan Policy Center and others. What such a body should look like and how it should be established remain open questions. This article proposes design characteristics, membership, and key functions of a geoengineering advisory body for promoting societal discussion and governance of geoengineering research.

Nongovernmental initiatives and the UK SPICE experiment

The oversight of geoengineering research has been addressed by several recent nongovernmental initiatives. In March 2010, the Climate Response Fund organized a meeting with over 150 experts from diverse fields in Asilomar, California, to develop norms and guidelines for geoengineering research. In the same month, the Royal Society, the Environmental Defense Fund, and The World Academy of Sciences founded the Solar Radiation Management Governance Initiative (SRMGI), which has organized deliberative meetings in the United Kingdom, India, Pakistan, Senegal, Ethiopia, China, and South Africa. Nongovernmental organizations have also produced thoughtful reports on the topic (see the recommended reading). These efforts have brought analytical clarity and public attention to key issues, but they have not been integrated into governmental policymaking.

The most ambitious effort by a national government to confront the challenges of funding and governing geoengineering research has been in the United Kingdom, and the results are instructive. In 2010, three UK research councils funded the Stratospheric Particle Injection for Climate Engineering (SPICE) project, which included a small outdoor geoengineering study. The plan was to model a SRM deployment by spraying 150 liters of water from a balloon into the atmosphere through a 1-kilometer hose.

Although the SPICE project sailed through university research oversight procedures, UK funding bodies required a "stage gate": an extra review by an independent panel of scientists, social scientists, and a member of a civil society organization. As part of this process, the panel worked with SPICE scientists to bring the work into accordance with norms for "responsible innovation." Social scientific research on public dialogue and engagement attempted to assess societal views on the experiment and geoengineering more generally. The experiment carried no significant physical risks, and yet it provoked a flood of criticism by civil society actors and significant debate in the United Kingdom and abroad.

Political controversy over SPICE hinged on a number of issues. First, a coalition of international environmental groups and other nongovernmental organizations (NGOs) claimed that the experiment circumvented international policy discussions that were ongoing. Second, the choice to investigate a deployment gadget, and not the physics of underlying natural systems, led many to see this as the wrong experiment at the wrong time. Third, after the project was approved, it was discovered that an investigator and others involved in the project had submitted a patent application on the experimental mechanism. This raised concerns that profit motives might be driving the research and that commercial interests might control the development and use of a potentially world-changing technology. As debate sharpened, UK funders postponed the project on the recommendation of the stage-gate panel in September 2011. Eight months later, the principal investigator pulled the plug on the balloon experiment, while continuing other aspects of the project.

SPICE has so far turned out to be less a physical experiment

than an experiment in governance. The way the balloon experiment was born, debated, and died illuminated key questions concerning the control of research and the substantive standards that should apply to it. The stage gate had a messy, ad hoc character that scientists saw as a difficult moving target. On the other hand, it opened an important space for public dialogue, norm formation, and social learning.

Many in the United Kingdom and elsewhere agree that a trusted oversight framework should be established before further outdoor geoengineering research. But how can this be achieved in a way that is acceptable to stakeholders and the public? New institutions are necessary for creating a platform for oversight and learning in an evolving field, and for providing practical advice as public funders, such as the National Science Foundation, contemplate geoengineering research programs.

The development of a national advisory committee is a promising idea in this context, and there are useful models. The U.S. President's Council on Bioethics, established by George W. Bush, is one instructive precedent. Many liberal bioethicists criticized the council for its conservative orientation, often neglecting its important procedural innovations. Whereas most government bioethics councils in the United States have focused on providing specific policy recommendations, the President's Council explicitly sought to foster public deliberation. The council's charter gave it a diverse set of tasks: "advise the President," "undertake fundamental inquiry," "explore specific ethical and policy questions," and "provide a forum for a national discussion." In its work on stem cells, for example, the council did not insist on consensus but laid out different positions on the moral status of embryos and how that could affect stem cell research and policy. President Bush's stem cell policy didn't satisfy many scientists, but his council promoted public discussion of moral disagreements that arguably laid the groundwork for compromise down the road.

Necessary characteristics of a geoengineering advisory committee

The overarching goal of an advisory body on geoengineering should be to recommend principles, policies, and practices that help make research more safe, ethical, and publicly legitimate. But the procedures of such a body will be just as important as the content of its recommendations, and both will receive intense public scrutiny. An advisory committee on geoengineering will be more effective and legitimate to the extent that it is independent, transparent, deliberative, publicly engaged, and broadly framed. We discuss each of these qualities in turn.

- ***Independent***. The authority of expert advice depends on the public perception that it has not been unduly influenced by professional, economic, or political interests, including the interests of researchers, public officials, or the sponsoring agency itself. An advisory body that is seen as merely echoing the views of its sponsors would have little public credibility. In particular, an institution charged with monitoring and assessing research on geoengineering must not become, or be seen as becoming, an advocate for the deployment of geoengineering technologies. This requires including people with no direct involvement in geoengineering research.

Of course, expert advisory bodies cannot remain entirely insulated from the controversial issues they address, and it would be impractical to exclude everyone with a perceived interest in either promoting or opposing geoengineering research or deployment. Many of those most knowledgeable about geoengineering also have personal, professional, or political stakes in the issue. Committee independence should be understood, therefore, not with respect to individual committee members but rather as an institutional feature of the committee as a whole. An advisory body is independent when diverse perspectives and interests balance each other out, so that no particular view is able to dominate the others. This approach is echoed in the advisory committee guidelines of the National Academy of Sciences, which allow a fairly high degree of potential bias among committee members, as long as they are not entirely committed to a certain position. The best way to ensure independence is by appointing a balance of perspectives representing diverse disciplinary, experiential, geographic, and political orientations.

- ***Transparent***. One way to help establish the independence and legitimacy of advisory committees is to make their proceedings publicly accessible and transparent. As Jane Long and Dane Scott have argued in these pages, sunshine is a good disinfectant for lurking vested interests. Further, citizens are more likely to trust advisory processes that remain open to public scrutiny. To be sure, transparency alone is never enough: Providing public access to information on geoengineering research will do nothing unless those who are concerned and affected actually have the means to make use of such information. Additionally, in some cases, excessive transparency requirements may make it difficult for committee members to openly discuss controversial issues. Generally speaking, however, secrecy breeds distrust, and advisory committee procedures should be as transparent as possible.
- ***Deliberative***. The authority of expert advice depends not primarily on the credentials of advisory committee members but on the reasons and arguments with which

they defend their views. Indeed, given that advisory committees have no decisionmaking power, whatever authority they have rests primarily on their persuasive capacity. Advisory bodies are thus deliberative in a double sense; ideally, the members deliberate among themselves, and they inform and promote deliberation among policymakers and the general public. Although advisory committee members may have strong views on matters of either fact or value, they should remain open to alternative views and seek consensus.

Of course, when it comes to controversial issues such as geoengineering, characterized by both moral disagreement and scientific uncertainty, a reasonably diverse advisory body is unlikely to reach consensus on many issues. Moreover, excessive pressure to reach consensus may result in the suppression of minority views. It is important, therefore, that advisory committees balance the deliberative goal of consensus against the political need to represent diverse perspectives. This can be done in part by preparing reports that outline a range of policy options, accompanied by the best reasons for each option, rather than insisting on a single consensus recommendation. Similarly, an advisory committee on geoengineering should take care to clearly and publicly explain the technical and political uncertainties associated with different possible courses of action.

The President's Council on Bioethics pursued its deliberative mandate through a variety of means: It solicited extensive public input, included majority and minority perspectives in its reports, outlined a range of policy options on various issues, and produced publications intended for a broad audience.

- ***Publicly engaged***. Most advisory committees address themselves primarily to policymakers, but controversial public issues such as geoengineering require a different approach. Geoengineering, especially solar radiation management, involves a wide range of moral disagreements and scientific uncertainties, and it potentially affects people around the world. In addition, the relevant technical, political, and environmental conditions are in considerable flux. Given this context, efforts to restrict the participants in decisionmaking to a narrow group of elites are bound to fail. SPICE was a case in point.

Potential avenues for public engagement include holding public hearings at diverse locations, publishing accessible reports and educational materials, and fostering contacts with mass media outlets. An advisory committee cannot be expected to generate societal consensus on a complex issue such as geoengineering, but it may be able to promote well-informed debate and compromise.

- ***Broadly framed***. Technologies for SRM raise numerous safety concerns, especially with regard to the potential impact on global precipitation patterns, which could have disastrous consequences for vulnerable populations. Such concerns also apply to research that could lead to deployment, as well as research occurring on a scale large enough to qualify as deployment. Although commentators often call for balancing the efficacy of geoengineering technologies against risks to public safety, it would be a mistake to limit public discussion to questions of safety and efficacy. Much of the public concern about geoengineering rests on more fundamental questions about global inequality and the human relationship to nature. If global warming is the result of humans treating nature as a mere resource to be manipulated at will, does geoengineering represent more of the same? Will it offer a way for rich countries to avoid their historical responsibility for the problem? An expert advisory body cannot provide definitive answers to such questions, but it can facilitate constructive public engagement with them.

III. Who should sit on a national advisory committee?

Given the many controversies involved, the membership of an advisory committee on geoengineering is likely to receive considerable public scrutiny. Membership balance will be crucial for both scientific and political reasons. Scientifically, addressing complex issues such as geoengineering depends on multiple disciplines. Researchers with different disciplinary training and commitments can address different aspects of the issue and identify each other's blind spots. Politically, including diverse perspectives promises to enhance legitimacy, insofar as it reassures outsiders that no single perspective or interest has dominance. Of course, exactly which perspectives to include often becomes controversial. Indeed, interest groups have occasionally filed legal suit to be represented on federal advisory committees, which under the U.S. Federal Advisory Committee Act must be "fairly balanced" in terms of the points of view represented and the functions performed.

A geoengineering advisory body should include members representing a few key categories:

- ***Experts from the natural sciences, social sciences, and humanities.*** As noted previously, a geoengineering advisory body should include members with diverse views and interests, including both proponents and critics of geoengineering research. And even if we set aside the interests of individual researchers, every scientific subfield has biases associated with its particular theories and methods. Therefore, illuminating all sides of a complex issue such as geoengineering requires balanced participation across a range of

scientific subfields. Moreover, governance discussions draw on not only the technical possibilities and effects of research and possible deployment, but also social and moral questions regarding the purpose and effects of experiments and the motives and goals of researchers. What norms are most likely to produce cooperation and effective compliance within the United States and across the globe? Will geoengineering undermine public support for climate mitigation and adaptation efforts? Addressing such questions depends in part on the social sciences and humanities.

- ***Experienced-based experts***. Not all expertise involves disciplinary credentials. Experts associated with environmental groups, business interests, or community organizations, for example, may have valuable knowledge that rests primarily on practical experience. Such experts are essential for effectively addressing the complex political challenges associated with geoengineering research.
- ***Representatives of potentially affected communities.*** Many government advisory committees include representatives of constituencies with a potential stake in the issue before the committee. Such representatives may be experts of one kind or another, but their expected contribution to committee deliberation rests in part on their familiarity with a potentially affected constituency. The potential impact of geoengineering on global precipitation patterns is likely to affect different populations in very different ways. A geoengineering advisory body should thus include people with knowledge and experience of diverse regions around the globe. Although the members of a U.S. government advisory committee are likely to reside in the United States, at least some members should have personal familiarity with other parts of the world, especially the poor countries most vulnerable to climate change.
- ***Representatives of diverse political viewpoints***. The standard view of expert advisory committees as insulated from politics makes it difficult to explicitly consider the political views of committee members. Most people would rather insist that committee members leave their politics at the door, and of course committee members should not be partisan advocates. Geoengineering is not currently a partisan issue, and it would be valuable for an advisory body to maintain a nonpartisan status. But with regard to controversial issues such as geoengineering, the political views of committee members are bound to receive public scrutiny. Therefore, rather than avoiding consideration of the committee members' political views, it makes sense to seek a balance of political orientations. An advisory committee is likely to enjoy greater public legitimacy to the extent that it includes members with diverse political orientations.

TABLE 1

Membership: Specific member recommendations

Natural scientists
- Researchers currently involved in geoengineering projects
- Other climate scientists
- Ecologists and environmental scientists

Social scientists and humanists
- Environmental and regulatory law experts
- International legal scholars
- Political scientists, international relations scholars, and policy analysts
- Science and technology studies scholars
- Science policy experts
- Philosophy and ethics scholars

Academic research administrators with expertise in emerging technologies

Business and military leaders

Environmental NGOs
- Environmental NGOs with climate change focus
- Environmental justice and equity organizations

Former government officials with experience in diplomacy and administration

What should a national advisory committee do?

Such a national advisory committee would not regulate directly but provide detailed advice to the Executive Branch and government agencies on an oversight framework before the conception and funding of geoengineering research. Guidelines could be implemented either as a voluntary code or through formal regulations. Granger Morgan, Robert Nordhaus, and Paul Gottlieb, –in the previous issue of this journal, –outlined a set of policies that should be in place before the development of an SRM research agenda. Here we build on their suggestions and also outline longer-term functions.

- ***Scope of application***. Part of the challenge of producing a clear and credible governance framework is determining the scope of application; that is, defining what kinds of experiments are even subject to review as a geoengineering experiment. The Royal Society defines geoengineering as "the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change." But this does not sufficiently clarify the issue. Does this definition apply to

the activities' effects, intentions, or both? Also, does it include research on familiar measures intended to affect climate, such as painting roofs white or reforestation?

- ***Experiment categories for triaging oversight***. As others have frequently argued, a pressing governance priority should be to demarcate a first-tier category of research that poses little or no concern, perhaps including computer modeling, laboratory experiments, and/or very small outdoor experiments that pose no significant risks and require no government oversight. An advisory committee would be well positioned to make such recommendations and also to articulate a tier of clearly prohibited research, such as for outdoor SRM research of a given size. The process of setting these tiers of concern and developing a corresponding oversight approach should be informed by public outreach and engagement activities.
- ***Values***. There will be a temptation to divorce these line-drawing activities from the explicit definition of values, principles, and priorities that necessarily underwrite them. But one of the most important functions of the advisory committee should be to promote public deliberation and debate about values and goals. A good place to start is the Oxford Principles, a code of ethics for geoengineering governance developed in 2011 by a team of Oxford academics. Another is the list of principles developed by the Bipartisan Policy Center task force. Drawing on environmental ethics, bioethics, and existing international law, this discussion of values should encourage open-ended deliberation.
- ***Intellectual property***. As part of a framework for research oversight, the advisory committee should develop recommendations on intellectual property and research transparency. Intellectual property and financial interests can shape the conduct and direction of research. As the SPICE experience shows, it can also undermine public trust. Accordingly, as part of an oversight framework, an advisory committee should develop a range of possible options for the disclosure and management of financial and other conflicts of interest, as well as for how intellectual property rights arising from federally funded research might best be allocated.
- ***Transparency***. An advisory committee should recommend requirements for public notification and transparency regarding research proposals, funding, procedures, data, publications, or all of the above. Such requirements should specify when and how the public should be notified and whether they pertain to privately funded research. The committee should also include annual or biannual reports on the science and politics of geoengineering, assessing both publicly and privately funded research activities around the world.
- ***International communication and coordination***. A final crucial activity of a national advisory committee will be to engage with the international community of political and scientific actors, many of whom have already done serious thinking about governance. Because some geoengineering technologies such as SRM would involve large-scale transboundary effects, related research activities necessarily have international implications. International coordination is especially important in light of the possibility that a single country could undertake SRM unilaterally. Many nations have already begun, or are likely to begin, programs of research, raising challenges of trust and cooperation.

A national advisory committee will be well positioned to facilitate connections, build norms, and promote cooperation across national borders. It should tap into existing international networks of nongovernment actors who have laid important groundwork, such as the SRMGI initiative mentioned previously.

Institutional options

There are a number of plausible options for establishing a government advisory body on geoengineering. Whether and how the U.S. Federal Advisory Committee Act (FACA) applies to these options will be important for understanding the regulatory restraints on the composition and activities of such a body. Choices for such a body, therefore, range from more to less formally regulated.

Creating a new committee to provide direct advice to federal officials on geoengineering research would bring the greatest degree of transparency, publicity, and formal legitimacy. It would also be subject to FACA, which applies to "any committee, board, commission, council, conference, panel, task force, or other similar group," which is established by statute, the president, or one or more agencies, and which is "utilized…in the interest of obtaining advice or recommendations for the President or one or more agencies or officers of the Federal Government" [5 U.S.C. Appendix §§ 3(2)]. As noted previously, FACA requires that advisory committee membership be fairly balanced. It also requires that committees meet only when convened by a designated officer of the federal government, and it includes various transparency requirements to facilitate public participation in the advisory committee process.

Alternatively, an existing FACA committee could be charged with providing advice on geoengineering research. Candidates for using existing committees include the President's Council of Advisors on Science and Technology, the Presidential Commission for the Study of Bioethical Issues, and the U.S. Global Change Research Program's Subcommittee on Global Change Research.

A less formal alternative would be to create a subcommittee or workgroup of an existing FACA committee. FACA committees can have advisory subcommittees and workgroups that are not subject to all the same formal procedural requirements as their parent committees. The activities of subcommittees are generally covered by the charter of the parent committee, and some agencies, such as the Centers for Disease Control, require that they adhere to the notice and open meeting provisions of FACA. If a subcommittee makes recommendations directly to a federal officer or agency, or if its recommendations will be adopted by the parent committee without further deliberations, then the subcommittee's meetings must be conducted in accordance with all openness requirements. "Workgroups" can meet to gather information, conduct research, draft recommendations, and analyze relevant matters. They are not empowered to make any decisions, and recommendations must be funneled back through, and decided on by, a parent advisory committee or subcommittee.

The most flexible choice would be to seek independent input through established advice brokers such as the Bipartisan Policy Center or the National Academy of Sciences. Committees not actually managed or controlled by the federal government are not governed by FACA, which allows greater leeway in membership and procedures. We think such an option is sensible and workable so long as the design elements discussed above are given due attention.

Conclusion

Geoengineering research is not normal science. The research is characterized by high stakes and scientific and political uncertainty. It raises many red flags, especially in light of the checkered history of efforts to apply technological fixes to complex problems. And it animates larger issues at the heart of climate change politics, engineering ethics, and the problem of democratic governance in a technically complex society.

For these reasons, a technocratic approach to defining acceptable research will not fly, even more so if it is done in an ad hoc or opaque way. For one thing, the SPICE project indicates that this will not work. SPICE is an early indication of how moving forward is not just about funding science but governing it. And governing is not simply about finding the appropriate norms for conducting research, though this is critical, but also about developing trusted institutions. Given the need for public visibility and accountability, we think a governmental advisory body is an appropriate vehicle. In the short term, a national advisory committee, if designed according to the preceding considerations, could help create an effective and legitimate oversight framework. More important, over the long term, it could help establish a trusted architecture for making sound public decisions about this controversial issue.

Recommended reading

Mark B. Brown, "Fairly Balanced: The Politics of Representation on Government Advisory Committees," *Political Research Quarterly* 61, no. 4 (2008): 547–560.

Daniel Cressey, "Cancelled Project Spurs Debate over Geoengineering Patents," *Nature* 485 (May 24, 2012): 429.

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Jane C. S. Long and Dane Scott, "Vested Interests and Geoengineering Research," *Issues in Science and Technology* (Spring 2013): 45–52.

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