Science, Technology, and Public Policy Program

Gerald R. Ford School of Public Policy
UNIVERSITY OF MICHIGAN

6/17/2010 | STPP Working Paper 10-3

Geoengineering in the Arctic: Defining the Governance Dilemma

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EXECUTIVE SUMMARY

Scientists and policymakers increasingly advocate research into the deployment of solar radiation management (SRM) techniques over the Arctic ice sheet, to slow the melting that has resulted from global climate change (Keith, Parson, and Morgan 2010). This memo argues that before the US government funds further SRM research, or sanctions deployment of these technologies over the Arctic, it must sponsor deliberative democratic efforts that will engage the multiple populations across the globe who are likely to be affected. Deliberative democratic engagement has multiple benefits, and can:

1) elicit "local knowledge" that can be useful for scientists and engineers, to help them maximize the benefits and minimize the risks of a particular technology (or policy);
2) prevent, or at least mitigate, controversy over a proposed technology (or policy);
3) provide a voice to those populations who are often left out of policy discussions, providing them with an opportunity to influence the process (particularly when dealing with science and technology);
4) ultimately lead to more harmonious consensus-building among various interests who often oppose one another.

In this paper, we explain the benefits of deliberative democratic approaches and their utility for geoengineering, discuss three such approaches, and suggest best practices for incorporating deliberative democracy into discussions about the governance of geoengineering.

Scientific Environment

Deployment of SRM techniques to slow melting of the Arctic ice sheet carries significant risks and uncertainties, and thus raises multiple difficulties for its governance. One suggested technique, shooting sulfate aerosols into the stratosphere, could lead to ozone depletion (Tilmes et al. 2008). This kind of depletion "could disrupt the Asian and African summer monsoons, reducing precipitation to the food supply for millions of people" (Robock et al. 2008). Thus, the consequences of injecting sulfate aerosols could impact 700 million inhabitants in the northern hemisphere, not merely the 4 million inhabitants of the Arctic region (Maté 2002).

Scientists have also suggested injecting soot into the stratosphere, since it has comparable scattering properties to sulfate aerosols (Crutzen 2006). This, however, would result in blackening the Arctic snow and possibly, accelerated melting of the ice sheet. These technologies could also have other implications, positive or negative, that have still not been fully assessed. In order to identify these implications, these technologies will need to be deployed on a large scale.

Given these risks and uncertainties, and the large population of people who could be affected by these technologies worldwide, decisions regarding the governance of SRM technology are particularly consequential. How should SRM deployment be governed, and who should make decisions about its governance? To date, the debate about whether any action should be taken and which particles to inject has been limited to the scientific community. However, it is clear that the issue is not only a question of science, but also—and most importantly—a question of governance.

Flaws in Top-Down Governance Approaches

Scholars have suggested two options for the governance of geoengineering: 1) the existing Arctic Council; and 2) development of a new international program to oversee the process (Egede-Nissen and Venema 2009; Keith, Parson, and Morgan 2010). We conclude, however, that neither of these approaches are adequate to deal with the governance challenges raised by geoengineering.

Oran Young (2000; in Egede-Nissen and Venema, 2009) argues that the Arctic Council has significant "generative power," playing an important role in shaping the policy agenda for the region and framing the issues. The Council comprises all eight nations with territory in the Arctic as well as six permanent participants representing the major indigenous peoples of the Arctic (Arctic Council, 2010). One such example is the Saami Council, a regional NGO that represents Saami Parliaments in Norway, Sweden, and Finland (Saami Council, 2009). The parliaments comprise representatives elected by the Saami of each country; these advisory bodies review policies relevant to the Saami in each respective country (Nettheim et al, 2002).

The Arctic Council, however, faces numerous shortcomings as an institution for geoengineering governance. In addition to its lack of binding authority (Egede-Nissen and Venema, 2009), it is also ill-equipped to represent individual constituents. Indeed, any top-down governance model will struggle to represent properly a region as diverse

and complex as the Arctic. However well the Saami Parliaments may represent the people who elect them, such governance structures do not cover all the peoples of the region, and while the Arctic Council explicitly represents the six indigenous communities, smaller communities are not included. Moreover, ambassadors to the Council from the nations of the Arctic have political appointments, which cannot be said to represent a majority of the citizens of each nation. As a political entity, the Arctic Council is also vulnerable to political pressure, particularly from the United States; this could present a conflict of interest because in the short-term, geoengineering would be cheaper for the US than carbon reductions (Teller 1998).

In a recent *Nature* article, Keith, Parson, and Morgan advocated another approach: the creation of a loosely-coordinated international program to govern Arctic geoengineering (2010). Loose coordination allows flexibility and innovation, avoiding "lock-in" to a particular technology while the uncertainties are still high. They suggest that the informality and transparency of such a program will draw in experts and stakeholders, enhancing its legitimacy from the bottom up.

While the KPM approach represents one of the most thoughtful approaches to date, we identify three broad critiques of this system of international governance based on moral, political, and knowledge-based arguments. The moral critique rests on the idea of informed consent: geoengineering is essentially an enormous experiment conducted on the people of the Arctic—or the world—and modern scientific ethics require such experiments to proceed only with the informed consent of the subjects of the experiment (Belmont Report 1979; Morrow, Kopp, and Oppenheimer 2009). The KPM governance model does not come close to reaching this level of consent from affected communities, and the voluntary participation of stakeholders and experts is not appropriately representative of everyone in the Arctic.

The emergence of a global anti-geoengineering movement underscores the importance of broadly accepted political legitimacy in geoengineering governance (e.g "Hands Off Mother Earth") (Hands Off Mother Earth 2010). Politically, the KPM model offers no safeguard or alternative in the event that it does not successfully attract international stakeholder and expert support. They expect the informality of their approach to attract such support, but the informality also means there is no binding arbitration if disagreements arise or stakeholders fail to uphold commitments. The lack of a broadly accepted authority therefore increases the risk of failure of the entire project.

Finally, KPM does not consider the sorts of knowledge to be included in their governance model, even though scholars have noted that international programs tend to ignore local and indigenous knowledge unless specific care is taken to include them (Martello 2004). This knowledge provides an important complement to traditional scientific inquiry; for example, indigenous knowledge has been vital to coastal sea ice monitoring and understanding the effects of climate change on indigenous species such as caribou (Krupnik and Jolly 2002).

The Benefits of Bottom-Up Governance

Governance approaches that involve local communities directly in decision-making can more appropriately deal with the ethical dilemmas posed by geoengineering. A variety of these "bottom-up" approaches have proven successful in achieving informed

consent from indigenous communities. These systems rely on the participation of community members who contribute their local knowledge in a deliberative manner at the grassroots level; this then influences binding policy (Birner and Mappatoba 2002). Fung and Wright (2001) describe these "empowered deliberative democracies" as radically democratic in their reliance on the participation and capacities of ordinary people, deliberative through their emphasis on reason-based decision making, and empowered since they attempt to tie action to discussion (qtd. in Birner and Mappatoba 2002).

Bottom-up approaches like these provide a solution to the moral, political, and knowledge-based problems detailed above. Such systems offer local communities a way to participate in decision-making that has a direct impact on them, their homes, and their livelihoods, thereby addressing the moral dilemma. To address the political critique, bottom-up approaches are a form of direct democracy and therefore have all the legitimacy of democratic governance. Finally, bottom-up governance offers a way for decision-makers to make direct use of indigenous knowledge, which provides one of the best measures of the changes taking place in the Arctic reason (Krupnik and Jolly 2002). By studying common themes across various bottom-up governance approaches, we can identify the beneficial aspects of such approaches (See Table 1). Three broad categories of bottom-up models are described below.

Indonesia and Thailand: Collaboration Between Local Leaders and NGOs

Two similar cases involving bottom-up forest management in Thailand and Indonesia demonstrate the strengths of collaboration between nongovernmental organizations and local community leaders.

The conflicts between government agencies and indigenous communities

In Indonesia, several tribal communities clashed with managers of the Lore Lindu National Park System because their villages were within the boundaries of the park. Members of these communities depended on activities such as logging and hunting endangered animals for their livelihood, but once the park designated their homes as protected forests, villagers could no longer engage in these activities (Birner and Mappatoba 2002). Similarly in Thailand, several different tribal communities clashed with officials from the Royal Forestry Department over the rights to control the forests in which they lived. The Royal Forestry Department designated these forests as conservation zones without acknowledging the interests that their inhabitants had to the use of these resources (Zurcher 2005). At the time, the Thai Parliament was considering a piece of legislation known as the Community Forestry Bill, but several forest communities, activists, and NGOs found the bill unacceptable because it maintained the discussion of forest management as purely state led (Johnson and Forsyth 2002).

In both the Indonesian and the Thai cases, local community leaders acted as organizers for their villages, initiating the bottom-up governance approach to address their grievances. In Indonesia, local leaders organized multiple meetings in each of their communities; in some communities, villagers elected special envoys to represent them to the park management, but in all cases, ordinary villagers participated in the deliberative

process through a series of meetings organized by community leaders (Birner and Mappatoba 2002). NGOs acted as facilitators between the village leaders and the park management to craft agreements that would be mutually agreeable. In Thailand, local communities formed grassroots protest groups; their local leaders contacted NGOs, who would bring media coverage, serve as liaisons with government officials, and assist in drafting a "people's version" of the Community Forestry Bill (Zurcher 2005; Johnson & Forsyth 2002). These NGOs formed networks with local peoples to help write and advocate for a new draft of the Community Forestry Bill that would establish communal rights of access and management of the forests (Johnson and Forsyth, 2002; Zurcher, 2005).

Strengths and applicability of these cases to Arctic geoengineering governance

These cases offer examples of successful negotiation between government agencies and the indigenous communities whose interests the government initially failed to represent. In addition to demonstrating that policymakers can create a space for public participation, the Thai and Indonesian examples show that such participation works for politically and technically complex issues. In developing the Indonesian forest management agreements, the NGOs assisted with the technically complex task of mapping resource usage using GPS and GIS systems (Birner and Mappatoba, 2002), while in Thailand, NGOs and their associated academics provided communities with information about, for example, their rights under the Constitution of Thailand. In the context of geoengineering, a similar system could serve as a channel for disseminating scientific and technical information, as well as relaying concerns about it to decision-makers.

Drawbacks of this model for Arctic geoengineering governance

Like the indigenous inhabitants of the Arctic, the communities in these cases sought control over the land on which they lived, and through it, their way of life. One group of stakeholders sought to put limits on use of the land, leading to questions of how much the local community can and should sacrifice for the greater good. While this is analogous to the problems posed in the Arctic by geoengineering, the analogy will not necessarily scale up. Negotiations over the use and protection of land are inefficient when the number of stakeholders becomes too large. The problem of geoengineering cannot be successfully handled only by individual local leaders contacting NGOs to make agreements with only their villages. Local communities will have to form a broad network of alliances to successfully address these problems. For example, regional or environment NGOs may be able to assist in the coordination of the over 4 million Arctic inhabitants belonging to different nations and tribes.

Lessons for SRM Deliberation

Cooperation between local communities and NGOs offers a model through which local communities can participate in deliberation leading to the drafting of community law, agreements with government agencies, and even national legislation. The local

community is able to transmit its concerns and relevant knowledge upward through the NGOs, while the NGOs provide necessary information and communication infrastructure.

In applying this example to solar radiation management in the Arctic, local communities and interested NGOs will need to establish connections with each other and build networks to include other communities, academics, and activists; these NGOs will need to provide the infrastructure for grassroots communities to communicate with those in power as well as to disseminate the information the communities will need to deliberate and make informed decisions. Most importantly, the bottom-up approach requires local leaders to actively engage their communities through frequent meetings, encouraging participation from as many members of the community as possible. This model should not focus on the NGOs; instead, it is the community engagement that fundamentally equips this model to address moral and ethical issues, answer questions of political legitimacy, and draw on the unique knowledge of indigenous people.

Australia and Austria: Inclusion of Relevant Local Stakeholders Enhances Knowledge-Sharing

Policymakers in Australia and Austria have developed models that ensure sustained engagement from a variety of stakeholders. Not only do stakeholder engagement models ensure representation of those peoples most affected by policy decisions regarding their land, but these models also value the expertise of these peoples. While this approach introduces a potential bias during deliberation as these stakeholders have preconceived interests, these models try to minimize this problem by integrating a period of negotiation among traditional opponents (e.g., farmers and conservationists). Additionally, the process of stakeholder engagement in decision-making requires discussion on scientific, economic, and social complexities that differ among the stakeholders involved in the deliberative process. By including a variety of stakeholders during deliberation, policymakers ensure development of policy that incorporates these differing viewpoints. Doing so not only contributes to the political legitimacy of the policymaking process, but also acknowledges the concerns and knowledge of various stakeholders thereby offering a means to gain public acceptance.

Australia's Landcare Program

The state of Victoria established a multi-disciplinary, community-based, highly-autonomous soil conservation program that was later replicated nationwide (Youl, Marriott, & Nabben 2006). By prioritizing the program's autonomy and reliance on community participation, policymakers ensure involvement of relevant stakeholders by relying on local and indigenous persons for implementation of sustainable farming practices. When Australian local and indigenous landowners hear about funding opportunities announced by the Australian national government or supporting national organizations, they work with community-based groups not only to plan and implement landcare projects, but also to deliberate with farmers and community volunteers to achieve consensus on projects (Youl et al. 2006). Community-based groups hold information sessions to provide technical education to its members and also facilitate

sharing of ideas with other landcare groups across the country (Youl et al., 2006). Community groups are clustered into networks according to region and shared interests. These networks communicate with local governments and industry for financial support and technical information. Community coordinators and regional organizations manage networks. Community coordinators develop regional strategies and also share technical assistance in a two-way communication process between networks and regional-level groups. These regional representatives communicate with state associations and governments, who then communicate with the national government and supporting organizations. With multiple levels of communication, stakeholders at all levels communicate on technical aspects and strategies for implementation. This infrastructure showcases policymakers valuing the knowledge of local stakeholders, inclusion of indigenous persons, and offers a tiered approach to deliberation and decision-making.

Austria's Neusiedler See-Seewinkel National Park

The deliberative process for establishing the Neusiedler See-Seewinkel National Park involved the cooperation of two national governments and required consensus among conflicting viewpoints (e.g., park use for agriculture versus tourism, hunting and fishing, and environmental protection) (Stringer et al. 2006). When a top-down approach proved unsuccessful, policymakers adapted a more bottom-up approach to deliberation by allowing landowners (including indigenous people), community groups, and private businesses to communicate directly with policymakers through a park planning committee (Stringer et al., 2006). The park planning committee gave local persons an opportunity to share their unique and profound expertise of the environment, and soil and climate change effects on the land under debate. This committee also encouraged negotiation of the various scientific, economic, and social complexities among traditional opponents (Stringer et al., 2006). Furthermore, small-scale landowners were encouraged to form shared interests groups and choose representatives for direct involvement in the negotiation process (Stringer et al., 2006). These representatives ensured high-level stakeholders (Austrian and Hungarian national governments and environmental NGOs) considered the positions of local stakeholders in the final decision-making process. Thus, a process that began as a top-down approach with national governments telling community members how the project affects them evolved to include bottom-up approaches that achieved consensus and developed a park reflecting local priorities.

Lessons for SRM Deliberation

Implementation of a deliberative democratic approach that includes stakeholder engagement in the Arctic would provide an infrastructure that recognizes the unique expertise of local and indigenous people and values them as legitimate stakeholders. Knowledge sharing between local stakeholders and those implementing geoengineering technologies potentially educates local communities about the risks and benefits they are most likely to endure while providing a process through which consensus or consent can be reached. Given the expansive environment in the Arctic, the structural levels of stakeholder engagement presented in this paper offer a means through which many indigenous persons could be reached during the deliberative process. With the proposal to

launch SRM technologies in the Arctic, integrating local stakeholders into a decision making process is necessary to deal with the complex and diverse population and ecosystem, acquire political legitimacy, and achieve consensus on SRM technology implementation and governance. These approaches provide evidence of successful negotiation between government authorities and local and indigenous communities over scientifically, economically, and socially complex issues. The unique expertise of indigenous persons in the Arctic on how climate change truly affects their environment and utilization of this knowledge through stakeholder engagement can improve the comprehensive nature of drafting policies on SRM technology deployment and governance.

China and Brazil: Deliberative Public Opinion

Policymakers who seek to interpret and integrate public opinion confront a dilemma. If the assumption is correct that most people know little about policy choices, direct consultation will only evoke primarily uninformed opinion (Fishkin 2010). Conversely, if policymakers only consult policy elites, they may be more knowledgeable, but the consultations would fail to yield a public voice. The choice, it appears, is between "representative but uninformed mass opinion and informed but unrepresentative elite opinion" (Fishkin 2010). Deliberative public opinion, understood here as an approach that generates reasoned public opinion across a large randomized sample of the population, offers a way out of this dilemma.

Deliberative polling: Success in China's Zeguo township

Policymakers in China's Zeguo township introduced deliberative polling as a way to democratize local policy-making in the process of prioritizing infrastructure projects for the coming year. The projects, designed by local officials, included new bridges, roads, a school and city gardens. The process was a more formalized version of their tradition of holding *kentan* or 'sincere heart-to-heart' discussions where similar kinds of local issues were debated and discussed (Fishkin 2010). Deliberative polling asks participants to prioritize approximately a dozen infrastructure projects among the roughly 30 possible. The town's leadership makes an explicit commitment to abide by the decisions of the polling, thus ensuring the implementation of those projects with the most votes (Fishkin 2010). Zeguo's deliberative polling process has several additional features that distinguish it from its largely informal predecessor:

- Random sampling ensures the results are more likely to be representative of the population, and eschews party influence and interest group pressure (Fishkin 2010);
- Trained moderators ensure equal opportunities for to allow citizens to hear different points of view and become informed of the trade-offs to any given policy before expressing their preferences in confidential questionnaires (Fishkin 2010);
- Government buy-in is achieved, demonstrated by the binding nature of the polling and implementation of the results of the deliberative poll.

The Zeguo example provides a compelling example of how policymakers can ascertain informed, representative, opinion. In the case of geoengineering in the Arctic, a region inhabited by roughly 4 million, clearly there is no way to obtain the opinion or consent of such a large number of people. But by using a deliberative poll, it is possible to gain a sense of the temperature of opinion on an issue, while also ensuring that the opinion is informed and that the public has had a chance to consult, ask questions, and deliberate among themselves.

Participatory budgeting: lessons from Porto Alegre

Porto Alegre, Brazil has developed a deliberative democratic process known as participatory budgeting, in which municipal governments allow citizens to participate in budgetary processes. The process emerged from direct negotiations between government officials and civil society leaders, who sought solutions to address the various health and welfare concerns affecting citizens (Torres et al. 2003). Public budgeting programs are year-long decision-making processes through which citizens negotiate among themselves and with government officials in organized meetings over the allocation of capital investment on public works projects, i.e. health care clinics, and schools. Citizens attend meetings during which they vote for public policies and elect delegates to represent the community to the local government.

The Brazil example is particularly interesting because it includes, and creates leadership from within, a low-income population (Torres et al. 2003). This provides a useful analog to SRM deployment in the Arctic, where communities may lack access to education, and lack a history of political mobilization or issue articulation. Yet in the case of Porto Alegre, the technical complexity of various budget options was not a barrier to participation and leadership for people who lacked access.

The Porto Alegre public budgeting approach also secured government buy-in. By instituting a system dependent on civic engagement and informed participation, it shifted the power dynamic between the local government and the public, with the result that the public could hold the government accountable for its actions.

The World Bank commissioned the Porto Alegre case study to determine the effectiveness of the participatory budgeting process (Torres et al. 2003). It found that among cities that implemented participatory budgeting, there was a noticeable improvement in the accessibility and quality of various public welfare amenities. The participatory budgeting process was also popular; the number of participants rose from 1,000 in 1990 to 40,000 less than 10 years later (Torres et al. 2003). Such a huge increase in public participation suggests that bottom-up governance is politically viable and practically feasible, even among low-income and/or uneducated populations. Technical complexity of the issues, lack of access, and low-income status are not inherent barriers to participation and understanding of the issues that directly affect their communities.

Lessons for SRM Deliberation

The decision to implement bottom-up governance fundamentally depends upon political legitimacy, and the Zeguo and Porto Alegre approaches are proven methods for building up that political legitimacy by allowing citizens to have input on issues that

directly affect them. These case studies demonstrate that exclusive reliance on technical expertise is neither necessary nor likely to create the kind of sustained trust with the population that geoengineering would require, were scientists and policymakers to pursue SRM deployment in the Arctic region.

Table 1. Common Themes in Models of Bottom-Up Governance

	Government Buy-In	**Technical Complexity of Issue**	**Represent Population**	**Using Local Knowledge**	**Presence of Existing Interests**
Local Leaders and NGOs	Yes; NGOs provide information on legal rights, which governments are then bound to support	Political, scientific, and economic	Dependent on local leaders, who may designate appointees or attempt to engage entire town	Local leaders work with supportive NGOs to share their unique perspective	Dependent on NGO; some are able to act as neutral advisors, while others may be politically divisive
Stakeholder Engagement	Yes; Concession of implementation to local stakeholders	Scientific, economic, and social	Inclusion of relevant local stakeholders	Valuing expertise of local and indigenous people	Potential for bias from stakeholders during deliberation; negotiation among opponents minimizes effects
Deliberative Public Opinion	Yes; Held accountable for execution of policies determined by public's priorities	Political and economic	Inclusion of large sample sizes of lower-income, "lay person" populations	Discussions and random sampling require attention to lay-person viewpoints	None, as the process is not connected to or controlled by political parties

Best Practices

The deliberate modification of the earth's climate through SRM technologies inevitably raises questions about the scientific integrity of the proposed processes. While scientists can easily imagine the potential problems that could arise scaling up laboratory experiments to large scale that encompasses our entire complex ecosystem, less attention has been given to governance of these technologies. However, given the impact SRM will have on the citizens of the Northern Hemisphere, and the Arctic Circle in particular, examination of proper deliberation methods is essential. Over 700 million inhabitants in the Northern Hemisphere are the people most likely to incur the greatest risks, and the greatest gains, from launching SRM technologies. Therefore, it is imperative to institute processes of deliberation that maximize the consideration of the knowledge and concerns of these citizens. By doing so, those who launch SRM technologies not only stand to gain support of the citizens who are involved in deliberation, but also gain the unique insights of the people who live in the Arctic.

Based on our assessment, we developed the following best practices for SRM deployment:

1. Research into the ideal deliberative process for SRM in the Arctic should be funded by the same governments and institutions that currently fund soot and aerosol research. Funding for this research successfully occurred before (i.e. National Nanotechnology Initiative, 2004) and could easily occur in this case.
2. Ensure the greatest diversity of participating populations to properly represent the Arctic residents and achieve legitimacy among the indigenous persons.
3. Take advantage of existing social structures in the areas where deliberation occurs to maximize the efficacy of the process.
4. Institute a deliberative process that involves an open, two-way communication flow of knowledge without imposition of values on participants by high level stakeholders.

USING DELIBERATIVE DEMOCRACY FOR SRM DEPLOYMENT: THE EXAMPLE OF SOOT VS. SULFATE AEROSOLS

As mentioned at the outset of this paper, scientists are currently debating what kind of particulate matter should be used for SRM deployment. We contend that this debate should not occur within the scientific community alone: it provides the perfect opportunity for deliberative democratic engagement.

If this decision is made by scientific or political elites, for example from the eight Arctic nations, it will flagrantly violate the principles we have identified. Morally, a single panel cannot adequately represent all the diverse communities and subcommunities in the Arctic, so the experiment would proceed without the informed consent of all the participants. Politically, we have argued that top-down approaches are generally seen as less legitimate than bottom-up approaches, but this is particularly salient for an issue like soot, since images of black snow coupled with Arctic protesters claiming to be excluded from the process could be expected to turn global opinion against geoengineering very quickly. This political danger is exacerbated by the likely exclusion of indigenous knowledge from a top-down panel, since indigenous knowledge provides a useful complement to traditional scientific knowledge and can be extremely helpful in identifying potential unintended consequences of geoengineering in the Arctic. Its exclusion makes a negative unintended consequence much likelier, which would make the political problem worse. In sum, local peoples are likely to have specialized knowledge regarding the potential impact of using soot vs. sulfate aerosols that would be extremely useful to decisionmakers.

While it would require additional investigation of the culture, structure, and daily lives of the affected populations to recommend a specific deliberative democratic approach for resolving this question, the best practices that we have identified from analogous cases provide us with a basic structure to proceed. The deliberative process must be as diverse as possible. This helps to mitigate the moral critique and ensures as much as possible that indigenous knowledge is included in the decision. Furthermore, the communication channels between elite decisionmakers and laypersons must not only be open, but elites must make clear that the participants have power in the process; i.e., the participants actually must have the power to shape the decision between sulfate aerosols and soot. Finally, as governments and scientists fund research to compare the scientific and environmental viability of soots and sulfate aerosols, they must also fund deliberative democratic efforts that will: 1) assess the social and political viability of these initiatives and 2) generate local environmental knowledge that could be useful in determining the viability of these options.

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