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CLIMATE ENGINEERING  
ASSESSMENT

# ESTABLISHING A CLIMATE ENGINEERING RESEARCH CLEARINGHOUSE

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**July 18, 2017**

**Carnegie Endowment for International Peace  
Washington, DC**

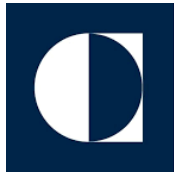
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## EXECUTIVE SUMMARY

Climate engineering (CE) is an umbrella term for a set of mostly prospective technologies that might be developed and used to counteract some of the effects of climate change. The technologies under consideration could do much good. They also, though, present myriad risks. Because of these risks, CE experts and observers have long emphasized the need for transparency in research, experimentation, and deployment.

On July 18, 2017, the Forum for Climate Engineering Assessment and the Carnegie Endowment for International Peace convened a meeting of experts in CE science and governance, transparency, and information visualization to discuss designing, implementing, and maintaining a CE clearinghouse.

A research registry, database, or clearinghouse is often cited as a necessary transparency mechanism in the governance of CE research. This workshop, building on a 2015 meeting on disclosure mechanisms for solar radiation management convened in Ottawa,<sup>1</sup> was designed to move such a clearinghouse from principle to practice.

Several key insights, and questions, from the day's dialogue emerged:

**There is consensus on the need for transparency, but there still is much disagreement over the scope and design of a disclosure mechanism.**

There are scientific and societal benefits to establishing a disclosure mechanism early in the development of a controversial technology. The conversation around CE governance and science has always included a commitment to transparency. However, as revealed in the workshop, there is significant disagreement over the scope of activities that should be disclosed and the design of the disclosure mechanism. Of particular concern is the inclusion of meetings between CE researchers, laboratory experiments, and computer models. It was also acknowledged that most geoengineering transparency and governance discussions to date have been conceived and articulated from a predominantly Western context. There is still great uncertainty over the way that these challenges are viewed in, e.g., Chinese, Indian, or Russian contexts, and whether differentiated mechanisms might be required in response to these heterogeneous contexts.

**While some contend that the CE research field is too young to need a formal clearinghouse, there is broad agreement that a clearinghouse could bridge gaps in understanding between CE researchers and the broader climate policy community.**

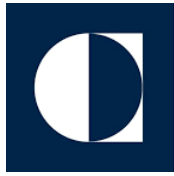
In addition to encouraging transparency as the CE field grows, establishing a clearinghouse now would advance the CE governance conversation and promote understanding of what role (if any) CE could play in the broader climate policy response. In addition, the lack of consensus on a single definition of what constitutes CE means that researchers who believe themselves to have a firm grasp of activities in their particular domain may not have complete knowledge of activities in other domains that might also be included in some definitions of CE.

**There is work to be done to determine the most efficient and effective method to collect, curate, and maintain data for a clearinghouse.**

Significant concern was raised about a time burden on scientists. The ideal process would be a balance between automated data collection, voluntary entry from researchers, funders, and journal editors, and active expert curation.

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<sup>1</sup> See "Designing Procedural Mechanisms for the Governance of Solar Radiation Management Field Experiments"



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**Next Steps:**

While the workshop highlighted several key unanswered questions, the Forum for Climate Engineering Assessment and the Carnegie Endowment for International Peace are committed to further exploring the development of a baseline clearinghouse, and documenting its development, through an iterative approach with diverse stakeholders. The purpose of developing a clearinghouse at this moment is to operationalize a commitment to transparency while the CE research field is still young and to provide accurate information about CE for policymakers.

## MEETING SUMMARY

Climate engineering (CE) researchers and those following developments in the field have fostered a strong norm of transparency. While there is broad agreement in the concept, there has, however, been little work completed on practical instruments to make transparency possible. This report summarizes a meeting on the ideal design of a CE research registry, database, or clearinghouse. The meeting was convened by the Carnegie Endowment for International Peace and the Forum for Climate Engineering Assessment. This report details the main lines of conversation, key points of agreement, and major open questions identified during the half-day meeting.

### Is a Clearinghouse Needed?

In the workshop's first session, climate engineering (CE) expert participants discussed the current state of CE research and the field's history with transparency norms. While briefly reviewing the state of CE research, participants noted that carbon dioxide removal (CDR) experimentation is far more advanced than experimentation having to do with solar radiation management (SRM), although the latter receives much more media attention and stakeholder concern than the former. There are currently two known planned field experiments with implications for SRM in the United States.

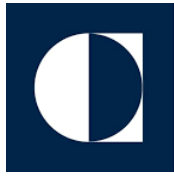
It was noted that all assessments of CE governance, such as the Oxford principles,<sup>2</sup> have called for a disclosure tool. The purpose of such a transparency mechanism is two-fold: to minimize risk (both physical and sociopolitical, i.e. moral hazard and technological lock-in) and to build public trust both in the validity of CE research and in its alignment with public goals like preventing dangerous climate change. The latter goal is generally considered more relevant in these early stages of CE research, largely because the CE research community remains at this point small and coherent enough that strong norms of scientific legitimacy and integrity have thus far been sufficient to constrain the riskiest possible behaviors of members of the research community. This is something that could well change, however, if the research field grows, spreads to less transparent environments, or if corporate actors or governments become major players in the field.

To minimize risk, there must first be a culture of transparency, a mechanism to disclose new developments, and ideally an effective set of incentives to promote its utilization. To create public trust, there first must be an accessible, accepted common source of information about CE research. A clearinghouse would help bridge the gap in understanding between CE researchers, policymakers, and the broader network of actors concerned about climate change.

While a disclosure mechanism is a widely-accepted concept in the field, some participants questioned the necessity of a robust clearinghouse at this stage of CE research. Several concerns were raised about the feasibility and desirability of such a tool. First, it was noted that the CE research community is quite small, and an information-sharing network already exists. The few (potential) CE researchers who do not share their activities are censored by their governments, such as in China and Russia, a barrier that a clearinghouse is unlikely to breach. Second, a participant noted that scientists are already burdened by excessive reporting requirements. Third, some argued that establishing a clearinghouse for CE research would stigmatize the field, potentially chilling

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<sup>2</sup> <http://www.geoengineering.ox.ac.uk/oxford-principles/principles/>



funding and further research. Fourth, there were concerns about harassment of CE researchers by those with a pre-existing antagonistic orientation, such as “chemtrailers.”<sup>3</sup>

In the discussion that followed, several key areas of disagreement emerged:

- First, there was no consensus on whether establishing a database would increase or decrease polarization over CE research. While some participants claimed CE was being unfairly singled out, others noted recent increased scrutiny on mitigation programs and made comparisons to transparency mechanisms in nanotechnology research.
- Second, concerns were raised about scientists’ willingness and ability to participate, and several incentives were suggested, which are detailed in the following section of this report.
- Third, participants questioned the ability of a clearinghouse to facilitate public understanding. Few participants thought the general public would utilize the database, and some argued such information will only be misinterpreted and mischaracterized by the extreme voices in the CE debate. Others noted that a centralized clearinghouse on CE research could reduce misunderstandings among informed stakeholders such as policymakers and ENGOS.
- Fourth, participants were uncertain if and how to design a clearinghouse that would aid anticipatory governance of CE research and deployment. It was suggested that a baseline clearinghouse would generate useful debate, and could evolve into a more robust clearinghouse linked to other governance mechanisms.

The workshop revealed important areas of debate about the ideal design of a clearinghouse. However, there was broad agreement that a well-designed transparency mechanism would provide a common, central source of current information and is necessary, if not sufficient, to ameliorate polarization and inform the climate policy conversation.

### **Designing a Clearinghouse:**

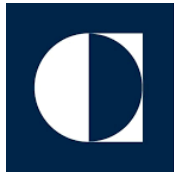
In a session facilitated by data transparency experts, best practices were identified from other research clearinghouses, including:

- Utilizing an iterative approach with early and consistent engagement with stakeholders
- Creating a culture that celebrates transparency as an end in and of itself
- Forging partnerships with front-end users to encourage consistent participation
- Contextualizing data through expert curation and commentary to aid back-end user understanding
- Designing separate visualizations for different audiences

Participants broke into small groups to define success and failure of a potential clearinghouse, as well as to discuss the data collection process and design elements in detail. The discussion is summarized here:

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<sup>3</sup> CE researchers have received threats from individuals who confuse proposed CE technologies with “chemtrails,” a long-standing conspiracy about airplane contrails containing chemical agents for nefarious purposes.



### **What does success for a global, voluntary climate engineering clearinghouse look like?**

- The clearinghouse would have significant, sustained participation from stakeholders on the front and back ends, especially from moderate or previously unengaged stakeholders.
- The information provided through the clearinghouse will help guide evidence-based decision making about CE research specifically and climate response options more broadly.
- A central clearinghouse will encourage cooperation among the CE research community and will lower an information barrier to entry for new researchers, especially from the developing world.
- The clearinghouse will build public trust and decrease stigmatization around CE research, potentially opening more funding opportunities.

The group was not in consensus about the feasibility or desirability of each of these four outcomes, especially the third and fourth outcomes around scientific cooperation and public trust.

### **Who are the ideal contributors to the clearinghouse?**

While most participants identified scientific researchers as the ideal contributors to the database, concern was raised about time burdens for researchers. Funders - including private companies, journals, regulators, civil society organizations, and citizen scientists were also identified as potential contributors to the clearinghouse.

### **Who would the end users of the clearinghouse be?**

The group was in general consensus that policymakers and environmental NGOs are ideal end users for the clearinghouse, with the idea that these groups would use the clearinghouse to learn more about the state of CE research. There was disagreement over the likelihood of the public and the scientific community using the clearinghouse. Most believed only highly enthusiastic or polarized members of the public will access the clearinghouse, and it was argued that the CE research community is, as of now, so small that there is no lack of information sharing. Some disagreed with this assertion, as even comprehensive knowledge in one domain or sub-domain of CE does not preclude a lesser knowledge of other domains that could still be considered as CE. Other potential end users identified were journalists, academics in orthogonal fields, funders of CE research and experimentation, and students.

### **What would motivate CE researchers/practitioners to contribute information about their work to the clearinghouse?**

The most commonly-cited motivations for CE researchers to contribute to the clearinghouse were a commitment to transparency and the desire to have CE be a fuller part of the conversation about forms of climate change response. Similar, though perhaps less aspirational, motivations include fear over losing a “social license to operate”, or the anticipation of future transparency-related conditionalities on the part of funders. Additional suggested motivations included compliance with future funder or regulatory requirements, desire to share data with other researchers, and the opportunity to attract attention to one’s own research.

### **What scope of activities should be included?**

There was significant debate over the scope of CE activities to include in the clearinghouse. While there was general consensus that both SRM research and CDR research should be included, participants disagreed over the types of methodologies that should trigger inclusion in the clearinghouse. There was broad agreement that outdoor experimentation, including planned experiments, should be included in any registry, especially those that have measurable environmental impact. Some argued that all scientific studies of CE, including computer modeling, should be included, while others claimed that level of inclusion would impinge upon the scientific process. Some noted that the potential scalability of the technology being studied should be considered. Another area of the debate was the inclusion of content outside the scope of physical science, such as social science research and governance developments. Several participants proposed changing the standards for inclusion over time, starting with only outdoor (“outside the lab”) experiments and expanding the scope following stakeholder buy-in.

### **What content, at what level of detail, should be collected?**

Most participants agreed that each entry should include a summary of the study, its objective or expected contribution to the field, any environmental impact assessment, the funder(s), the research institution(s), and a link to any published article. There was disagreement over the inclusion of raw data, stemming from disagreement about the feasibility of scientific cooperation and concerns about intellectual property.

### **How should data be collected or curated?**

There was consensus that, at least in the near future, entry into the clearinghouse should be voluntary. Due to concern about the time burden on researchers, participants offered several suggestions to expedite data collection, including utilizing tagged articles in a journal database and contacting funders. There was general agreement that the clearinghouse must be centrally curated by an expert host, aided by automated data collection processes, to ensure high-quality data.

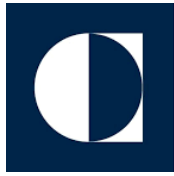
### **What are possible unintended negative consequences of a clearinghouse?**

A commonly cited potential negative consequence of a clearinghouse was harassment of researchers, likely by opponents of CE research or “chemtrailers.” Another central concern was the risk of stigmatizing CE research by creating a disclosure mechanism that does not exist for other categories of climate research. Some participants claimed such stigmatization could chill research and funding, or could push researchers who do not wish to participate to be more secretive than they would have been absent the clearinghouse. Other participants expressed concern that this disclosure mechanism may not be well-integrated into other CE governance tools, such as codes of conduct. There was also broad concern about the definitional debates about what technologies constitute “CE.” In a more immediate timeframe, some noted the risk of a lack of participation from front and back end users and the risk of not receiving adequate funding to maintain a high-quality clearinghouse.

### **Next Steps:**

The workshop generated useful debate over a CE clearinghouse’s potential effects on scientific collaboration, public trust, and evidence-based policymaking. The Forum for Climate





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Engineering Assessment and the Carnegie Endowment for International Peace are committed to establishing a prototype climate engineering clearinghouse as a way to generate further useful discussion about the optimal form of CE transparency mechanisms.

FCEA and CEIP will be guided in this effort by the best practices outlined by the data transparency experts present at the workshop. First, stakeholders will be engaged early and often in the design process, including contributors such as scientists and funders and back-end users such as policymakers and ENGOs. Second, the clearinghouse will evolve through an iterative process. The initial version will be designed to encourage transparency, leaving open the possibility that future iterations will be tied more closely to desired governance outcomes.

### **Participants:**

Tom Ackerman, University of Washington

Neil Craik, University of Waterloo

Stephen Davenport, World Bank

Deborah Gordon, Carnegie Endowment for International Peace

Tracy Hester, University of Houston Law Center

Anna-Maria Hubert, University of Calgary

Sikina Jinnah, University of California Santa Cruz

Andrew Light, World Resources Institute

David Livingston, Carnegie Endowment for International Peace

Jessica Mathews, Carnegie Endowment for International Peace

David Morrow, Forum for Climate Engineering Assessment

Simon Nicholson, Forum for Climate Engineering Assessment

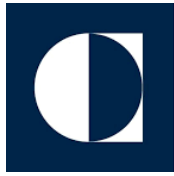
Denice Ross, New America

Chris Sula, Pratt Institute

Michael Thompson, Forum for Climate Engineering Assessment

Olaf Veerman, Development Seed





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### **Copy of Agenda:**

“Climate Engineering Research Registry: Disclosure Mechanisms and Best Practices”

July 18, 2017

Carnegie Endowment for International Peace

1779 Massachusetts Ave NW, Washington, DC 20036

9:00 AM - 9:15 AM

Breakfast and Introductions

9:15 AM – 10:15 AM

Overview of Ongoing and Proposed Climate Engineering Research, Basis for a Registry

Speakers:

Neil Craik, University of Waterloo

Tracy Hester, University of Houston

Tom Ackerman, University of Washington

Anna-Maria Hubert, University of Calgary

10:15 AM - 12:00PM:

Brief Presentations & Roundtable Discussion: Disclosure and Transparency Experts

Speakers:

Denice Ross, New America Foundation

Stephen Davenport, World Bank

12:00 PM - 12:45 PM

Lunch

12:45 PM - 1:30 PM

Scope of Project, Partners, Next Steps