

Prospects for a multi-stakeholder dialogue on climate engineering

Ken Conca
American University
conca@american.edu

Introduction

This article examines prospects for a climate engineering multi-stakeholder dialogue (CEMSD). Climate engineering (CE) is a suite of theorized techniques to mitigate, via carbon removal, or mask, via solar energy reflection, effects of climate change through large-scale interventions in the physics, chemistry, and biology of Earth systems. Although development of CE remains limited to conceptual work, modeling, and some small-scale field tests, the idea of deployment generates great controversy. Calls for anticipatory governance have been voiced by proponents, opponents, and agnostics (Foley *et al.* 2015). ‘Governance’ could mean many things, from research codes of conduct and greater transparency about experimentation to standards for assessing risks and impacts, to a moratorium or ban on deployment or large-scale testing. The form governance might take is far from clear, given potentially far-reaching consequences of CE interventions and the roots of CE development in different national regulatory systems.

Several features of the governance challenge, including high stakes, wide-ranging views among stakeholders, and lack of existing institutional options, suggest the possible utility of multi-stakeholder dialogue (MSD). MSDs have been used across many socio-technical controversies, with varying success, to promote social learning, develop shared norms, and provide coherence and structure to debates about international governance.

Putative advantages notwithstanding, there may be significant pitfalls and unanticipated consequences to the MSD approach. This article distills lessons from scholarly and practitioner efforts to assess the performance of MSDs, and applies them to the domain of climate engineering. Its purpose is threefold: to encourage careful, even skeptical, thinking about the utility of a much-touted approach that, despite its obvious potential, has not always had the conditions to deliver the goods; to identify specific tensions and trade-offs that would have to be navigated in designing a CEMSD; and to suggest some preliminary steps to enhance dialogue.

The article begins with a discussion of how, at least in theory, stakeholder dialogue could play a role in constructing anticipatory CE governance. The discussion then examines specific, recurring challenges in the design and execution of MSDs. These include the sensitivity of timing and ‘ripeness’ of a controversy for dialogue; trade-offs among the range of purposes MSDs serve; questions around who participates, and how; and difficulties managing knowledge-power. Two broad lessons emerge from this review. First, it can be difficult to create the enabling environment required to launch and sustain MSDs. Second, even when such conditions exist, key design choices must be navigated, entailing difficult trade-offs and raising complex questions about interest representation, participation, power, voice, and epistemology. Good design does not guarantee success, but bad design can damage both legitimacy and efficacy. The article concludes with some steps to strengthen the prospects for legitimate, efficacious dialogue.

Anticipatory governance and multistakeholder dialogue

Effective CE governance means launching and coordinating several complex activities: promoting greater understanding and learning that is well integrated with mainstream climate research, such that possibilities and risks may be properly assessed and weighed; appropriately regulating research and testing activities, at both national and international levels, in ways that serve the public interest; creating rules of the road regarding deployment, possibly including proscription, a moratorium, or various permitting requirements; creating strong incentives against rogue or illicit deployment, with the requisite monitoring and information capabilities; and building the capacity for wise, equitable, legitimate decisions going forward, as new understandings emerge of the climate threat and the range of available responses.

Despite the strong case for starting now to build an effective governance regime for these challenging tasks (Jinnah 2018), the form such governance might take is far from clear. CE presents the unique combination of being both a disruptive new technology and a global-scale environmental perturbation. As a disruptive technology, CE creates regulatory challenges and societal stakes around R&D analogous to the rise of genetic engineering or nanotechnology. Yet, its potentially global-scale environmental impacts create a regulatory task analogous to atmospheric nuclear testing or destruction of stratospheric ozone. Institution building tends to be path-dependent, drawing incrementally on past experience and existing capabilities rather than making radical departures. The precedents and existing apparatus on each side of this regulatory duality are quite different, however. There is no clear model or historical analogy for the governance challenge.

The high stakes, heterogeneous stakeholders, lack of institutional options, and complex structure of the governance problem suggest an alternative means of jump-starting the process of building CE governance may be needed. One such means, multi-stakeholder dialogue (MSD), has been used with varying degree of success on several contentious global challenges, from Internet governance to transparency in extractive industries to construction of contentious infrastructure (Stoll-Kleeman and Welp 2006). According to Hemmatti (2002), MSDs are

‘processes which aim to bring together all major stakeholders in a new form of communication, decision-finding (and possibly decision-making) on a particular issue. They are also based on recognition of the importance of achieving equity and accountability in communications between stakeholders and their views. They are based on democratic principles of transparency and participation and aim to develop partnerships and strengthened networks among stakeholders.’

By this definition, there are important differences between MSDs and such mainstream techniques of intergovernmental consensus-building as expert panels, fact-finding bodies, or panels of eminent persons. To a far greater extent than these approaches, an MSD embraces conflict, widens the array of voices through direct stakeholder participation, de-centers the role of governments, and aspires to transformative solutions. An MSD is a fundamentally communicative process, rooted in sustained dialogue that brings together divergent, openly conflictive viewpoints. Clearly, deliberative elements may coexist with significant amounts of strategic bargaining (as when MSD participants negotiate the content of standards or the language of principles) and rule-guided behavior (as when MSDs replicate well-established techniques in facilitated dialogue). Nevertheless, deliberately placing conflicting views into sustained, transformative communication is a constitutive feature of MSDs as an institutional form.

While MSDs may operate at scales ranging from global to local, the focus here is on broadly transnational examples; Table 1 lists several. Such MSDs have tended to cluster in a few areas: transnational economic activities with contentious environmental, labor or human rights impacts; accountability and transparency initiatives in response to governmental and corporate informational secrecy; emerging technologies that require standard-setting and harmonization; and processes to set labor standards and worker protections. Common characteristics of these arenas include contentious debate, a diversity of stakeholders, activities that governments have been unwilling or unable to regulate, and no clear and consensual knowledge foundation—all characteristic of the politics of CE. Several dynamic factors in world politics account for the rise of this way of doing international politics. Globalization has intensified an array of transnational activities and innovations that have contentious consequences, while neoliberal economics and the retreat of the state have led actors to seek new governance approaches. As Busch (2014) notes, MSDs ‘are evidence of both the continuing hegemony of neoliberalism as well as various responses to it.’ At the same time, the communications revolution, with its dramatic expansion of physical and virtual mobility, enabled new forms of communicative interaction.

****TABLE 1 ABOUT HERE****

MSDs have taken many forms, with variations in scale, scope, duration, and purpose. Some are one-time exercises that go out of business on completion of their efforts. The World Commission on Dams brought together a dozen individuals representing stakeholders with highly polarized views on large dams, to conduct fact-finding and develop norms for dam-related planning and decision making. It disbanded upon the completion of its two-year investigation, urging that its dialogue process be replicated around the world at the national level. Others seek to sustain networks for ongoing dialogue. An example is the Forests Dialogue, which for two decades has brought together forest-sector leaders to work toward consensus-based outcomes on initiatives ranging from illegal logging and forest certification to the inclusion of women and the principle of Free, Prior and Informed Consent (FPIC) for forestry-affected communities. Still other MSDs create or evolve into sustained mechanisms for implementation, which in turn may mean having an organizational arm with a standing budget. This is common for MSDs promoting certification standards for corporate responsibility, financial transparency, or sustainability. Thus, the Forest Stewardship Council (FSC), which grew out of a stakeholder dialogue among environmentalists, businesses, and others, manages a formal scheme for third-party certification of sustainability practices in the forest-products industry. FSC has evolved into a membership organization with a constitution, standing budget, and General Assembly.

Despite such variations, a few recurring repertoires can be said to characterize what MSDs do. First, they promote social learning among stakeholders, in which interactive processes seek to create convergent, transformative understandings of problems and solutions. The goal is that ‘the group transforms from a collection of individuals pursuing their private interests to a “community” which defines a common purpose and is oriented towards shared interests’ (Webler *et al.* 2005, cited in Muro and Jeffrey 2008). Reviewing the literature on social learning, Muro and Jeffrey (2008) identify several process features thought to play a causal role, including an egalitarian atmosphere, repeated engagement, open communication, small-group work, diverse participation, and multiple sources of knowledge. The aim is to translate these conditions into recognition of one another’s perspectives, rendering explicit the underlying values, co-creating knowledge, and recognizing complexity.

A larger aspiration than social learning is to advance the state of norm development around controversial activities. This entails reaching beyond collective learning to create greater rule-based clarity. As Bernstein and Cashore (2007) note, the ultimate goal of non-state-based governance efforts may be to create binding rules that states will embrace, ratify, and implement. However, such rulemaking derives its authority from the participants in the norm-development process, and achieves ‘political legitimacy’ through their shared acceptance of those rules.

A third function that MSDs may perform is to help organize the political space around an issue in a way that facilitates creating instrumentalities of governance. Here they play what Glasbergen (2011) calls a ‘meta-governance’ role: bringing greater coherence by setting the terms of debate, expanding entry points for participation, boosting implementation or assessment capabilities where states lack them, and promoting networking. Most ambitiously, MSDs may not just organize the space but fill it with ‘soft-law’ governance mechanisms such as certification schemes, voluntary standards, and codes of conduct. Such efforts may come as a precursor to state-based regulation, a complement to it, or a substitute for it. Common techniques include the identification, endorsement, and diffusion of best practices; capacity building; and verification of compliance with processes or targets, typically through mechanisms such as transparency, auditing and certification.

Whether an MSD promotes social learning, advances the development of norms, or organizes the political space through meta-governance, placing rival views and interests into sustained dialogue also serves a political purpose: enhancing legitimacy for controversial choices around complex governance challenges. Participatory processes derive legitimacy from some combination of their inputs (who participates), their processes (how actors participate), and their outputs (also referred to as performance legitimacy) (Risse 2004). MSDs bid for legitimacy on all three fronts, but with particular emphasis on elements of process: broad participation, open communication, equity, and transparency. Indeed, the very existence and proliferation of MSDs speaks to a legitimation deficit in world politics: they fill gaps where governments have been unable or unwilling to govern. Some observers suggest that the MSD as an institutional form has become a requisite for developing broadly legitimate responses to ‘wicked’ problems of global governance or complex transnational political-economic undertakings (Stanley Foundation 2016). As Internet governance researchers Hintz and Milan note, ‘It is now unimaginable to discuss the governance of the Internet without some form of multistakeholder participation.’

The case for a CEMSD

There have been several efforts to promote conversations on CE governance, both internationally and within countries with research and deployment potential (notably the US and UK). A few organizations have begun to engage the topic in a sustained manner through meetings, policy briefs, and position statements, including UNESCO, the American Meteorological Society, the Institute for Advanced Sustainability Studies Potsdam (IASS), The Royal Society (Britain’s national academy of science), and the Carnegie Council for Ethics in International Affairs. Policy-oriented research programs have been launched at American University, Oxford, and UCLA. Several projects and meetings have developed governance principles or guidelines, particularly for near-term concerns such as research conduct (FCEA n.d.).

None of these combines the broad stakeholder engagement, sustained dialogue, and explicit embrace of conflict of a CEMSD. There is, however, a growing recognition of the need to move the conversation in this direction. The organizers of the 2017 Climate Engineering

Conference, a gathering of leading researchers and policy advocates, made a concerted effort to attract participants from civil society organizations and the global South, and included panels on public engagement and social-justice issues. Edward Parson (2017), a leading CE policy scholar, has called for a ‘world commission’ to promote international dialogue on CE governance challenges and needed capabilities, stressing the importance of legitimacy, breadth of perspective, and learning through dialogue. The Solar Radiation Management Governance Initiative (SRMGI), a partnership launched of the Royal Society (UK), The World Academy of Sciences, and Environmental Defense Fund, works with organizations in developing countries to conduct capacity-building workshops on SRM. The Carnegie Council initiative (C2G2 n.d.) seeks to ‘expand the debate around [CE], involving developing countries, international institutions, faith and civil society groups, businesses and journalists, of all genders, from all ethnic, geographical and socio-economic backgrounds.’ American University’s Forum for Climate Engineering Assessment (FCEA n.d.) has stressed that the growing conversation on CE governance must maintain ‘a focus on issues of justice, equity, agency, and inclusion.’

One obvious advantage of a CEMSD would be a widened range of voices. Participants in the nascent governance debate skew heavily toward the industrialized world, particularly US and UK (Rahman *et al.* 2018). They also disproportionately represent elites in scientific research and science policy, as well as the male end of the gender spectrum. The 2010 Asilomar International Conference on Climate Intervention, which proffered an oft-cited set of CE research principles, included 155 organizers and participants, only five of whom were based in the global South (AICCI 2010). The CEC14 conference, billed as ‘the first large conference of its kind on climate engineering’, drew over 350 participants, with only 26 based in developing countries and with all featured speakers from US/European institutions (IASS 2014). Three years later, at CEC17, the number of developing-country participants increased, but only two of 30 plenary speakers were from the global South (IASS 2017). Narrow, skewed participation has consequences: evidence indicates that social-structural characteristics such as age and gender shape respondents’ valuation and use of information about CE (Braun *et al.* 2017). A 2014 deliberative workshop involving 39 mid-career environmental leaders from across the Global South identified several fundamental ways in which they would reframe the debate, ranging from frameworks on moral responsibility to the wisdom of using global circulation modeling as a primary policy input (Winickoff *et al.* 2015).

A second advantage of the MSD approach would be to engage CE skeptics or opponents such as environmental advocacy organizations, indigenous peoples’ groups, and human rights activists. To date, governance conversations have emanated mainly from the research community itself, joined by interested science-policy groups, while opponents tend to line up behind blunt opposition to the enterprise. Only four percent of attendees at the CEC14 conference were from non-governmental organizations (NGOs). Civil society groups also played little or no role in prominent attempts to define CE research or deployment norms, such as the Oxford Principles. Such exercises often avoid the sternest voices of opposition, for fear of inhibiting progress or fragmenting a tenuous consensus. Skeptics may also be reluctant to engage—particularly if they see participation as providing premature legitimization, or if they feel a given problem frame places them at a disadvantage.

Beyond broadened participation, a CEMSD might enhance social learning within the CE debate. Rather than sustained dialogue, the conversational repertoire on CE governance consists mostly of one-off positional statements and task-force reporting that pools the voices of knowledge elites (or their critics). MSDs, in contrast, are premised on communicative practices

that embrace conflict, work through it, and commit to sustained engagement. Communicative gains are clearly needed: the CEC17 meeting's summary report noted the paucity of CE scientists attending the panel on social justice, the tendency of academics and activists to talk past one another when exchanges did occur, and the tendency of critics to frame their concerns in ways that researchers and policy practitioners could not operationalize (IASS 2017).

A CEMSD might also advance the development of governance norms. In an analysis of 49 sets of standards developed during the period 1998-2006, Fransen and Kolk (2007) found that MSDs typically produced 'more specific and well-elaborated' standards than those developed by NGOs, intergovernmental organizations (IGOs), or business associations working independently. Prior efforts to promulgate CE governance norms have usefully flagged key challenges, such as impact assessment or responsible conduct of research. But they have skewed toward nearer-term considerations and emphasized the specific interests of the research community. Efforts to develop a research code of conduct, for example, begin significantly downstream from ethical questions about large-scale interventions in the climate system, and fail to engage the complex political consequences of advancing research, however responsibly conducted (Preston 2013). Bellamy (2016) argues that CE governance proposals have failed to reflect key insights about uncertainty and adaptation from the 'reflexive governance' movement in Science and Technology Studies.

Another potential benefit of a CEMSD is the ability to think creatively and non-incrementally about governance arrangements. To date, there has been a tendency to rely on the existing institutional apparatus: promoting better coordination among tangential treaty bodies such as UNFCCC, CBD and the London Convention, or pushing for the Intergovernmental Panel on Climate Change (IPCC) to play a stronger knowledge-framing role. These may be useful steps, but the conditioned preference for existing institutions fragments rather than integrates CE's dual problem structure as disruptive technology and global environmental consequence. Institutional incrementalism may also discourage relevant stakeholders—specifically, environmental and human rights organizations, affected communities, risk and impact experts, and parts of the climate-science research and policy communities—unless they are already engaged with a given institution. An MSD approach might avoid premature lock-in on institutional frameworks that could result from treaty negotiations. As Olson (2011) argues, 'At this point, the important task is to organize informal but focused international dialogues about needed downstream governance arrangements.'

Behind each of these putative advantages of a CEMSD is the promise of broader legitimacy for whatever new understandings, norms, or instrumentalities of governance might emerge. The narrow governance dialogue to date has sought legitimacy primarily from experts' credentials rather than the breadth and representativeness of participants or the quality of processes.

Whether any of these gains can be realized, however, is far from clear. A review of the literature on the origins, dynamics, and efficacy of MSDs suggests two key considerations: whether a sufficient enabling environment exists for a dialogue to form, and how the process of dialogue navigates several tricky trade-offs in design considerations.

Do the conditions exist to launch and sustain a CEMSD?

Historically, many global-scale MSDs have emerged when transnational regulatory controversies settled into a hurting stalemate. Opponents may succeed in highlighting problems, raising

concerns, and branding perpetrators, yet fail to stimulate what they consider acceptable governmental or societal responses. For their part, the actors whose behavior is the target of regulation may fail to persuade key audiences through self-regulation or voluntary codes, and come to see value in credible norms or rules to guide investment planning, protect institutional reputations, and reduce uncertainty. MSDs emerge when a minimally sufficient coalition of actors across such a stalemate perceive benefits to dialogue and negotiation, even as others prefer to continue with the politics of confrontation. The World Commission on Dams was formed when activist pressures had crippled the World Bank's ability to fund new dam projects. (Some) activists came to the table despite that success, perceiving an opportunity to consolidate their gains and define rules that would shape the wider dam-building arena beyond the Bank (Conca 2006).

As the MSD concept has been emulated and institutionalized through repetition, a second common pathway to formation has emerged, marked not by stalemated conflict but the entrepreneurship of a promotional coalition—for example, alliances between corporations and environmentalists. Such partnerships may coalesce around emergent technologies, as seen in the Internet Governance Forum, or may promote responsible practices around controversial activities, as in the effort to incentivize 'sustainable' palm oil and soy production through voluntary codes of conduct. Here, the strategy is not simply to create dialogue among parties in conflict, but rather to collaborate in establishing a new developmental trajectory for the activity in question.

Are conditions ripe for a broadly international CEMSD? As we have seen in the past few years—from pre-Paris gloom, to a burst of optimism in the wake of the Paris Accord, to the blow of US departure from the agreement—'ripeness' in climate politics is subject to unanticipated shifts. Still, it seems questionable whether either a hurting stalemate or a plausible promotional coalition exist. Several prominent CE researchers have come to the table for governance-conversation initiatives, and the 2014 CEC conference featured rival efforts to define a code of responsible practice (IASS 2014). Indeed, CE researchers have probably been the strongest voice for bringing predictability to the space. It is less clear that other key stakeholders are ready to talk. A few environmental advocacy organizations have gotten involved in efforts to promote governance dialogue. The initiative led by the Carnegie Council for Ethics in International Affairs includes ETC and WWF International in its Advisory Group. The Environmental Defense Fund co-founded the SRMGI, which counts the Dutch chapter of Greenpeace and WWF-UK among its partners. Most of the major international environmental NGOs have remained outside the nascent CE governance debate, however, with several on record opposing deliberate climate interventions (e.g., EDF n.d.).

In both the hurting-stalemate and promotional-coalition scenarios, a non-incremental shift in contextual conditions can be an important ripening agent if it causes a critical mass of potential participants to see new opportunities for positive-sum dialogue. Reichow argues that the key to placing the dialogue on nanotechnology development in Europe onto a 'learning trajectory', in contrast to conflictive stalemate on genetic engineering, was a set of European Union employer regulations that mandated a meaningful process of risk assessment. Efforts for greater transparency in transnational extractive industries gained momentum when the global commodities boom increased both investment opportunities and the problems of extractivism; this in turn created incentives for key parties on different sides to enter dialogue.

Whether the Paris agreement constitutes such a ripening agent for CE governance remains to be seen. If the 2°C goal yields triggers greater depth and specificity in IPCC's

analysis of negative emissions, or if individual nations begin to factor negative emissions into Nationally Determined Contributions, the environmental community's sense of urgency around CE would likely increase. How IPCC handles CE in its Sixth Assessment and its forthcoming special report on 1.5°C will also be a bellwether of the issue's ripeness for the mainstream climate science community, shaping both the allocation of climate research funding and the ability to proceed to larger-scale field testing. IPCC and Paris are also likely to cleave SRM and CDR into separate policy bins. While such a move would be consistent with much of the emerging conversation on anticipatory CE governance, it may also make it harder to bring key stakeholders such as the assessment community and environmental activists to the table on SRM, given the closer bridge from CDR to extant policy debates on REDD+ and carbon capture and storage.

Another lesson from the literature is that ripeness to launch must be matched with an enabling environment sufficient to sustain the initiative. The literature on networked governance flags processes important for the development of trust, including sustained engagement, intensified relationships, growing reliance among collaborators, the achievement of common goals, and the effective resolution of disagreements (Reichow 2016). Nurturing such processes requires leadership, sustained institutional support, and adequate funding; without these ingredients, the risk of failure is substantial. Many civil society groups involved with Internet governance, one of the most robust domains of MSD practice today, express growing disillusionment with the processes they helped to create (Milan and Hintz 2014).

Departure of key participants can be profoundly destabilizing to fledgling MSDs. Global Witness, an environmental and human rights NGO, was instrumental in documenting the role of illicit natural resource extraction in civil wars; the organization subsequently helped create the Kimberley Process, an MSD-based chain-of-custody scheme for conflict-free diamonds. Kimberley suffered a serious setback when Global Witness later quit over what it saw as persistent failure to close loopholes and develop a comprehensive, auditable chain-of-custody system. It is too early to tell whether the Paris Agreement will stabilize both climate politics and the space for CE to the point that credible CEMSD participants from civil society prefer dialogue to playing a spoiler's role—or whether they will decide that the climate, too, is broken. Moreover, that challenge is two-tailed: it applies equally to CE proponents armed with the ability to breach voluntary research norms or moratorium provisions.

Keeping fractious coalition partners involved and engaged requires leadership with credibility on all sides. The chair of the World Commission on Dams, Kader Asmal, led effectively not by claiming arms-length neutrality or expert knowledge, but rather precisely because he enjoyed a measure of trust and credibility on all sides. His status as a lead member of South Africa's anti-apartheid movement gave him deep credibility with anti-dam activists, while his experience as water minister of a dam-building government resonated with dam proponents. At the moment, the most plausible candidates for leadership on CE dialogue may be the handful of university centers on CE governance that have emerged in recent years. In terms of legitimacy, however, academics trade in a combination of neutrality and expertise; it is far from clear that these are the relevant currencies of leadership and convening power in cases of epistemologically pluralistic, value-conflicted dialogue.

How should challenges and trade-offs in MSD design be navigated?

Even if conditions are propitious for launching and sustaining a MSD, another key message of the literature is that there are difficult trade-offs to navigate around participation and process. Some derive from the fact that, as noted previously, MSDs find their legitimacy in a complex mix of representativeness, procedures, and outputs. Other trade-offs are rooted in the range of purposes MSDs may pursue. Social learning, norm articulation, and meta-governance are not inherently contradictory, and may tap synergies (either in the sense of being mutually reinforcing, or in the strategic sense of allowing a broader range of stakeholders with different purposes to come to the table). Evidence suggests that pursuing multiple purposes, and attaining different levels of success across them, need not inhibit an MSD's growth or institutionalization (Rustad *et al.* 2017). However, specific design features—who participates, how dialogue is fostered, or how consensual knowledge is developed—may be very different for an MSD premised on legitimizing prescriptive and proscriptive norms than for one promoting social learning and consensus-building about expert knowledge and uncertainty. In a review of transparency and accountability initiatives, Gaventa and McGee (2013) found that ‘many initiatives are not underpinned by a clear articulation of exactly what outcome or impact is sought, or of how the actions and inputs contemplated are expected to generate that outcome or impact. That is, the assumptions underlying the causal chain, from inputs to outcomes and impact, are absent, vague or only implicit.’ As discussed below, some of the most difficult design trade-offs surround questions of participation and knowledge-power.

Who should participate, and how?

Both legitimacy and efficacy of MSDs are shaped by who participates and how they do so. Challenging questions about interest representation are the norm in MSD processes, and CE would not be exempt. Are scientists with an interest in conducting CE research fully representative of climate science? Are participants with origins in developing countries, but who live, train, and make their careers in the US and Europe, authentic voices of developing-world views? Can experts in risk assessment and impact assessment speak authoritatively about risk and impact, given the controversies surrounding methods and techniques in those fields?

A lesson from the MSD literature, however, is that even if such questions of representation can be navigated, choices about who participates and how will still entail challenging trade-offs. One reason for this is that there is no simple mapping between who participates and the resulting perceptions of legitimacy of the process, given the multiple dimensions of legitimacy discussed previously. Schouten and Glasbergen, assessing the performance of the RSPO, note that the choice to promote broad participation strengthened its ‘rule-based’ or process legitimacy. But that same choice forced it into a pragmatic, incrementalist stance that, while minimizing conflict among participants, undercut elements of its ‘moral’ legitimacy and inhibited buy-in from key stakeholders (primarily non-participating environmental organizations) (Schouten and Glasbergen 2011).

Miller-Dawkins (2014) distinguishes among three participatory models commonly seen in MSDs, which she labels representative, deliberative, and collaborative. The *representative* model provides a designated voice for key constituencies. This may include those who invest in, produce, or otherwise benefit from the activity in question; the people, groups, or communities most directly affected or placed at risk; entities with regulatory or other governance and oversight responsibilities, at various levels; and those who speak for voiceless interests such as the environment or future generations. An increasingly institutionalized practice for MSDs using

this model is to organize different types of stakeholders into chambers that aggregate their input and then represent those views at higher levels of dialogue.

Deliberative processes, in contrast, seek to promote greater understanding, convergence, or harmonization among divergent worldviews. They may be conceived as exercises in social learning (Muro and Jeffrey 2008) which seek to create shared knowledge through interaction and dialogue, grounded in ideas about communicative rationality. The concept of social learning emerged with emphasis on the social, as a counterpoint to rationalistic planning approaches to complex problems, and has been widely cultivated in the field of natural resources management. MSDs taking this tack often engage in joint fact-finding initiatives and/or the collection of testimony and perspectives from a wide range of sources.

The *collaborative* model starts with a ‘coalition of the willing’, bringing together actors who share a vision for promoting change and desirable outcomes. For example, a subset of firms in an industry that are committed to socially responsible practices might link up with a subset of NGOs willing to compromise and work with industry partners, as in the efforts to create best-practice codes around the production of soy and palm oil. Here, participation typically works according to an opt-in approach.

Importantly, these three broad models of participation differ in how they align with the various potential benefits of a CEMSD, framed above in terms of social learning, norm development, and meta-governance. The deliberative model aligns most closely with the aim of promoting open-ended social learning. The representative model has advantages of lending legitimacy through the more systematic representation of interests, which gives more credibility to the effort to generate and authorize convergent norms. The collaborative model is often deployed when the goal is to implement instrumentalities of (soft-law) governance, typically by building a coalition around best practices and voluntary compliance mechanisms. It can also be useful for building coalitions that straddle previously delinked domains (such as CE modeling and environmental impact assessment). Thus, choosing any of these models is a de facto ranking of which benefits a CEMSD would be positioned to attain.

Beyond aligning with goals, another important trade-off across these three models is the role of the state. In a deliberative model that stresses social learning, the convening and framing role of national governments would be deliberately circumscribed and limited; they are themselves agents of learning about CE, and not a privileged group in that regard. If instead the primary goal is authoritative negotiation of governance norms, suggesting a representative model, the role of states comes more toward the front. For norms to have teeth, they must at some point be mapped onto prevailing practices of sovereignty, existing institutions, and the governance capabilities of states. The role of states also expands appreciably if the purpose is meta-governance (the collaborative model), as they become key actors in building coalitions, creating legitimacy, and suppressing turf battles among existing institutions.

If the role of states is too weak and emerges too late, then there is a significant danger of venue-shopping, fragmentation of the tasks of governance, and exploitation of soft mechanisms to escape control from harder ones (Schäferhoff *et al.* 2009). If instead the role of states is too strong, too early, there are significant dangers of losing what MSDs do best: bringing stakeholder voices to the front. One danger is a form of capture, as DiNardis and Mark (2103) identify in multi-stakeholderism around the Internet: ‘Governments with repressive information policies can advocate for top-down and formalized multi-stakeholderism to gain additional power in areas in which they have traditionally not had jurisdiction. These types of efforts can result in multilateral rather than multi-stakeholder approaches with non-governmental actors limited from

participating in formal deliberations and lacking any meaningful voting power.’ Another danger is that heterogeneous national practices of science regulation yield a least-common-denominator effect in international dialogue, before social learning has fully fleshed out the regulatory needs around CE. Sovacool and Andrews, reviewing the effectiveness of EITI, found that its implementation improved informational transparency, its core instrumental purpose. They also found perverse incentives for corrupt governments to join for reputational reasons, and that voluntary transparency commitments were insufficient to address corruption.

Participatory trade-offs revolve around ‘how’ as well as ‘whom’. Research shows that the efficacy of participatory mechanisms in public policy may be constrained by participants’ asymmetrical access to information, how the tension between broader inclusiveness and deliberative feasibility is managed, and the cost burdens (in time, money, and personnel) of sustaining participation (Wampler 2013). A study of stakeholder involvement in global environmental assessments raised several concerns directly applicable to CE dialogue. Interviews conducted with 99 participants in assessments conducted by IPCC or the UN Environment Programme revealed widely shared concerns around unclear or inappropriate meeting goals, unbalanced representation of different groups, improper handling of contested issues and control, and sub-optimal outputs from engagement (Garrard and Kowarsch 2010).

Sustaining participation across stakeholders with varying resources and capabilities creates difficult challenges. One non-trivial problem is that, as the MSD form has proliferated, civil society groups may be besieged with requests to participate, taxing their resources against the uncertain promise of effectiveness. A recent blog post offering cautionary advice from one experienced MSD practitioner was titled ‘How can you tell whether a Multi-Stakeholder Initiative is a total waste of time?’ (Miller-Dawkins 2014). On CE governance, a few major environmental NGOs have dipped their toes into the water, but most remain outside the debate. They would have to be persuaded the issue is ripe enough and important enough to warrant deploying some of their scarce climate-governance resources—alongside the efforts to keep a shaky climate-governance regime afloat, to battle climate skepticism, to fight for renewable energy, and so on—and that doing so outweighs the risk of prematurely legitimizing CE. A similar calculus applies to indigenous groups and human rights organizations, already entangled in controversies around REDD+ and the problem of physical violence against environmental defenders (Global Witness 2014).

It may be that ramped-up CE experimentation, or controversy around a proposed experiment, is a necessary condition for the significant engagement of poorly funded and overtaxed civil-society groups. These organizational barriers problematize the prospects for the level of civil-society engagement necessary to legitimize a CEMSD.

How is knowledge-power to be managed?

In gathering a pluralistic set of stakeholders, MSDs tend to loosen the moorings of policy debates from the positivist end of the knowledge spectrum. They do this in several ways: introducing broadened ‘ways of knowing’ that transcend narrowly technical forms of expertise; incorporating elements of strategic bargaining that go beyond technocratic processes of optimization-via-assessment; and valuing path-dependent institutional knowledge over the ‘rational design’ approach to institution building. Any serious attempt to bring civil society, potentially affected communities, or broader publics into the CE governance conversation will face significant challenges and difficult choices around how to manage knowledge-power. Tensions are already

apparent: according to the organizers of a panel on the prospects for radical emissions reductions at the 2017 CEC conference, the discussion ‘demonstrated that academics and civil society representatives sometimes find it difficult to understand each other due to the different terminologies and narratives used in the academic and climate justice civil society communities’ (IASS 2017, p. 17). Research on science-based MSD processes indicates that there is no single stable destination once one pushes off from the positivist dock (Welp *et al.* 2016).

Epistemological tensions and trade-offs may be lessened when MSDs limit their goals to dialogue, social learning, and building trust, as opposed to generating norm convergence or the operationalization of governance. Reichow defines learning within networks as a ‘sustainable increase in shared knowledge and methods between the collaborators.’ MSD ‘how-to-do-it’ guides, which have proliferated as the form has become more established, tend to stress the strengthening of shared purpose through the growth of shared beliefs. For example, Collective Leadership Institute’s ‘dialogic change’ model is based on sequential stages of exploration/engagement, building/formalizing, implementing/evaluating, and replication/institutionalization. However, the scholarly literature cautions that learning as a collective, networked enterprise has several components: substantive learning (about causality, problem definition, consequences, and potential responses), strategic learning (a growing understanding of how to collaborate), and institutional learning (convergent understandings of acceptable rules for behavior and practice) (Koppenjan and Klijn 2004 cited in Reichow 2016). As Reichow notes, these different forms of learning are mediated quite differently: substantive learning is mediated by expertise, strategic learning hinges on trust, and institutional learning turns on the ability to create informal agreements that may harden over time.

Taking all of these challenges together, it is an open question whether a coherent epistemological stance can be found for a CEMSD. Climate scientists, including both those who wish to promote CE research and those who fear association with it, are important stakeholders in CE governance; integrating CE better into climate science, environmental risk assessment, and other technical fields is one of the most important challenges. Yet, such integration is problematic from an MSD perspective if it requires the emulation of IPCC-style practices of knowledge stabilization. Most climate science sits at the positivist, experimentalist, fact-telling end of the epistemological spectrum. Attaching confidence intervals to declarative statements of fact may be necessary to bridge the CE/climate science gap. But, as we have seen in other social controversies around climate, such as the land-use/REDD+ debate, it is not likely to be a viable way to draw in the diverse ‘ways of knowing’ about risks and benefits that different stakeholders bring to the table.

Signs of such tensions are already evident within the IPCC as it continues to broaden its focus beyond climate modeling to engage the ‘human dimensions’. IPCC’s Fifth Assessment included a chapter on human security—a contested concept around which much useful learning has occurred, but which struggles to fit IPCC’s prevailing standards of peer review and replicability (Adger *et al.* 2014). Such tensions can be productive, and may bode well in the long run for a more robust societal dialogue with science. But if validity in the climate-science sphere struggles with the ‘soft’ social science of human security, it remains an open question whether a CEMSD could find a viable epistemological range that reconciled the pull of mainstream climate science with the pushback from activists and affected communities. Organizers of CEC 17 concluded from a panel on social movements and climate justice that ‘the difference between even relatively applied-oriented academics and activists on these issues is still fairly wide. These

individuals did not share the same concerns, theories of social change, or vocabularies’ (IASS 2017, p. 36).

Finally, even if a CEMSD could find a sufficiently stable epistemological range within which to work, it must also navigate the broader terrain of declining societal faith in science and lessened trust in knowledge elites. As Ulrich Beck noted, in the contemporary ‘risk society,’ ‘solidarity from anxiety arises and becomes a political force’ (Stapleton 2016). Disruptive new technologies may have a limited time window to persuade that promised benefits outweigh risks, or else face mounting political challenges and popular skepticism. Contrasting the public debates around genetically modified organisms and nanotechnology in Europe, Reichow (2016) notes that the former failed to comprehensively engage the question of risk, meaning that a negative image was anchored in the public mind by the time industry and civil society groups entered sustained dialogue on the terms of deployment. Nanotechnology, in contrast, was marked (according to Reichow) by serious investigations of potential harm from the start, the results and credibility of which lessened any such negative anchoring.

Conclusion: Preliminary steps

If this review suggests significant barriers to successfully launching and designing a CEMSD, it also points to preliminary steps that might enhance the likelihood of success, in terms of legitimacy and efficacy. A first step is to think more carefully about the underlying purpose of dialogue. Table 2 summarizes the key ripeness considerations discussed above, applied to three ideal-type CEMSD dialogues: a problem-finding, social learning-centered approach; a norm-development approach seeking to define ‘responsible progress’; and a meta-governance approach focused on framing the specific regulatory challenges, building governance capabilities, and creating policy networks. At this stage, a focus on social learning, while facing clear challenges, might bypass some of the limitations around weak articulation of the issue within the climate regime and the absence of governance-champion states, which become more inhibiting if the purpose is norm development or meta-governance. This in turn suggests an emphasis on building knowledge cooperatively, embracing a ‘reflexive’ approach that emphasizes decision making under uncertainty, and deliberately juxtaposing different ways of knowing. This approach has the additional virtue of expecting no particular role from governments other than that they engage as learning agents alongside other stakeholders.

A second, related step forward would be to engage more systematically with wider forms of expertise. One of these is the non-CE climate science community. It is clearly problematic for scientists with an interest in CE, and trained in one specific mode of climate-science analysis (climate modeling) to speak disproportionately for ‘science’ in workshops and initiatives around the issue. Particularly important will be to hear from adaptation science and expertise on marine and land-based ecosystems. Widening out the voice of science in stakeholder dialogues would create a more pluralistic space for the discussion of knowledge and uncertainty (aided by the significant epistemological differences between atmospheric physics and, say, ecology). This might help to level dichotomies of knowledge-power that polarize debate on the issue, and may make it easier for actors who are not technical experts to come to the table. Social scientists with expertise on the social construction of risk also have a role to play in this regard. Moreover, in all of these arenas, developing-country scientists are much better established than in CE.

Another important form of expertise to engage is that of communities of practice in risk assessment and environmental impact assessment. These techniques are often invoked as best

practices for responsible field-testing and eventual deployment of CE. Yet, figuring out what it means, specifically, to assess CE impacts and evaluate CE risks has barely begun. As Williamson (2016) notes, ‘the non-climatic impacts ... on ecosystems and biodiversity’ are key determinant of cost, feasibility and acceptability of those techniques, yet have barely been studied. ‘For all such schemes, modelling the theoretical potential of a proposed approach can give a completely different picture from that obtained when environmental impacts — not to mention practicalities, governance and acceptability — are considered.’ Exploring risks and impacts can also be a useful exercise in building trust, through the cooperative creation of new knowledge. Comparative risk assessment could play a similar role, particularly if contrasted CE deployment scenarios with other speculative options such as hyper-aggressive expansion of energy conservation and renewable technologies—something that is rarely done by either CE proponents or skeptics.

A third preliminary step would be to promote experimentation with techniques of public engagement and deliberative learning. Burns and Flegal (2015) outline several options for facilitating public deliberation on CE: collaborative forums, citizen juries, deliberative mapping (which brings together experts and citizens to conduct multi-criteria participatory appraisals), and World Wide Views (which involves simultaneous, linked citizen dialogues on a chosen topic at multiple sites around the world). Bellamy *et al.* (2013 and 2017) conducted deliberative workshops that experiment with majoritarian, individualistic, and consensual forms of deliberation to gauge citizen preferences on CE, revealing in the process concerns about containment, uncertainty, and reversibility distinct from themes privileged in expert dialogues on CE governance. Workshops conducted by Winickoff *et al.* (2015) to engage the voice of global South scientists demonstrate an interesting method for engaging various communities of expertise (in this case, mid-career environmental professionals).

Use of these techniques, which acknowledge the limits of NGOs as stand-ins for civil society, serves purposes beyond just soliciting opinions from a public that has been disengaged on this issue, valuable though that may be (Merk *et al.* 2015). They may also be useful in enabling key stakeholders in the environmental, human rights, and indigenous communities to engage, by helping actors new to the arena build understanding, capabilities for engagement, and communication strategies that are grounded in their own interests and ways of knowing. Again, this is likely to be easier (though hardly easy) for a learning-centered MSD based on a deliberative model of participation and a minimal, de-centered role for governments.

Launching a multi-stakeholder dialogue is a gamble. Global Development Incubator (2015), a consultancy that specializes in catalyzing creative, non-traditional partnerships around challenging development issues, summarized in sobering terms its findings from interviews with key actors across 17 multi-stakeholder initiatives:

‘Of all the lessons learned from our interviews, one was the most salient: setting up [a multi-stakeholder initiative] is a high-risk venture, and those considering doing so should proceed with caution. In addition to requiring significant time and financial investments, MSIs’ achievements often fall short of expectations. Our interviewees gave their MSIs on average a C grade ranking on performance against founding objectives.’

For CE, multiple approaches are surely called for, and experimentation with different forms of dialogue can only be healthy. But the dangers of an unsuccessful dialogue are also significant.

They include unrealistically elevated expectations about consensus, the danger of capture, the risk of dismissiveness from policy makers, and the possible departure of key constituencies from the table. Fortunately, the pace at which both CE knowledge and CE governance debates are developing allow time for some preliminary measures that could enhance the prospects for successful dialogue.

Table 1: Examples of international MSDs

Extractive industries:	Kimberley Process (KP) Mining, Minerals and Sustainable Development (MMSD)
Controversial infrastructure:	World Commission on Dams (WCD) Construction Sector Transparency Initiative (CSTI)
Natural resource dialogue:	The Forests Dialogue The Water Dialogues
Commodity chain certification:	Forest Stewardship Council (FSC) Marine Stewardship Council (MSC) Common Code for the Coffee Community Roundtable on Sustainable Palm Oil (RSPO) Roundtable on Responsible Soy (RTRS) International Federation of Organic Agricultural Movements (IFOAM)
Accountability and transparency:	Open Government Partnership (OGP) Global Initiative for Fiscal Transparency (GIFT) Open Contracting Partnership (OCP) Extractive Industries Transparency Initiative (EITI) Global Reporting Initiative
Emerging technologies:	Internet Governance Forum (IGF)
Labor standards:	Fair Labor Association Worker Rights Consortium
Sustainability practices:	ISEAL Alliance The Partnering Initiative

Source: Compiled by author.

Table 2: Key ‘ripeness’ and sustainability considerations for 3 ideal-types of CEMSD

MSD Purpose:	Social learning	Norm development	Meta-governance
Ripeness and sustainability considerations:	--reluctance of key constituencies to come to the table --disengagement of important forms of expertise --low public engagement or policy salience	--reluctance of key constituencies to come to the table --disengagement of important forms of expertise --low public engagement or policy salience --weak articulation within the climate-governance regime	--reluctance of key constituencies to come to the table --disengagement of important forms of expertise --low public engagement or policy salience --weak articulation within the climate-governance regime --need for specific governments prepared to lead

Source: Compiled by author

References

Adger, W. et al. 2014. Human Security. In C.B. Field *et al.* eds., *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*, pp.755-791. Cambridge: Cambridge University Press.

Asilomar International Conference on Climate Intervention. 2010. Participant list. Available at <http://climate.org/archive/resources/climate-archives/conferences/asilomar/participant-list.html>

Bellamy, R. 2016. A Sociotechnical Framework for Governing Climate Engineering. *Science, Technology, & Human Values*, 41(2), 135-162.

Bellamy, R. et al. 2017. Public Perceptions of Geoengineering Research Governance: An Experimental Deliberative Approach. *Global Environmental Change*, 45, 194–202.

Bellamy, R. et al. 2013. ‘Opening Up’ Geoengineering Appraisal: Multi-Criteria Mapping of Options for Tackling Climate Change. *Global Environmental Change*, 23, 926–937.

Bernstein, S. and B. Cashore. 2007. Can Non-state Global Governance Be Legitimate? An Analytical Framework. *Regulation & Governance*, 1, 347–371.

Braun, C., C. Merk, G. Pönitzsch, K. Rehdanz and U. Schmidt. 2017. Public Perception of Climate Engineering and Carbon Capture and Storage in Germany: Survey Evidence. *Climate Policy*, 18(4), 471-484.

Burns, W. and J. Flegal. 2015. Climate Geoengineering and the Role of Public Deliberation: A Comment on the US National Academy of Sciences’ Recommendations on Public Participation. *Climate Law*, 5, 252-294.

Busch, L. 2014. Governance in the Age of Global Markets: Challenges, Limits, and Consequences. *Agriculture and Human Values*, 31(3), 513-523.

C2G2. No date. Governing Geoengineering Overview. <https://www.c2g2.net/governing-geoengineering/>

Conca, K. 2006. *Governing Water*. Cambridge, MA: MIT Press.

DeNardis, L. and R. Mark. 2013. Thinking Clearly about Multistakeholder Internet Governance. GigaNet Annual Symposium, 14 November 2013.

Environmental Defense Fund. No date. Our Position on Geoengineering. Available at <https://www.edf.org/climate/our-position-geoengineering>

Foley, R. D. Guston and D. Sarewitz. 2015. Toward the Anticipatory Governance of Climate Engineering. Available at <https://geoengineeringourclimate.com/2015/02/24/toward-the-anticipatory-governance-of-geoengineering-working-paper/>

Forum of Climate Engineering Assessment. No date. Who We Are. <http://ceassessment.org/who-we-are/>

Forum for Climate Engineering Assessment. No date. Climate Engineering and Conservation Timeline. Available at <http://ceassessment.org/climate-engineering-and-conservation-timeline/>

Fransen, L. and A. Kolk. 2007. Global Rule-setting for Business: A Critical Analysis of Multistakeholder Standards. *Organization*, 14(5), 667–684.

Garrard, J. and M. Kowarsch. 2010. If at First You Don't Succeed: Evaluating Stakeholder Engagement in Global Environmental Assessments. *Environmental Science and Policy*, 77, 235–243.

Gaventa, G. and R. McGee. 2013. The Impact of Transparency and Accountability Initiatives. *Development Policy Review*, 31(s1), s3–s28.

Glasbergen, P. 2011. Mechanisms of Private Meta-Governance: An Analysis of Global Private Governance for Sustainable Development. *International Journal of Strategic Business Alliances*, 2(3), 189–206.

Global Development Incubator. 2015. *More Than the Sum of Its Parts: Making Multi-Stakeholder Initiatives Work*.

Global Witness. 2014. *Deadly Environment: The Dramatic Rise in Killings of Environmental and Land Defenders*. London: Global Witness.

Hemmati, M. 2002. *Multi-stakeholder Processes for Governance and Sustainability: Beyond Deadlock and Conflict*. London: EarthScan.

IASS. 2017. *Climate Engineering Conference 2017*. Potsdam: IASS.

IASS. 2014. *Climate Engineering Conference 2014*. Potsdam: IASS.

Jinnah, S. 2018. Why Govern Climate Engineering? A Preliminary Framework for Demand-Based Governance. *International Studies Review*, 20(2), 272–282.

Koppenjan, J. and E. Klijn. 2004. *Managing Uncertainties in Networks*. London: Routledge.

Merk, C. et al. 2015. Exploring Public Perceptions of Stratospheric Sulfate Injection. *Climatic Change*, 130(2), 299–312.

Milan, S. and A. Hintz. 2014. In Multi-stakeholderism We Trust: On the Limits of the Multistakeholder Debate. Blog post to *CGCS Media Wire*, September 19. Available at <http://www.global.asc.upenn.edu/in-multistakeholderism-we-trust-on-the-limits-of-the-multistakeholder-debate/>

Miller-Dawkins, M. 2014. How Can You Tell Whether a Multi-Stakeholder Initiative Is a Total Waste of Time? Blog post to *From Poverty to Power*, 10 March 2014. Available at <https://oxfamblogs.org/fp2p/how-can-you-tell-whether-a-multi-stakeholder-initiative-is-a-total-waste-of-time/>

Muro, M. and P. Jeffrey. 2008. A Critical Review of the Theory and Application of Social Learning in Participatory Natural Resource Management Processes. *Journal of Environmental Planning and Management*, 51(3): 325-344.

Olson, R. 2011. *Geoengineering for Decision Makers*. Washington: Woodrow Wilson Center.

Parson, E. 2017. *Starting the Dialogue on Climate Engineering Governance: A World Commission*. Waterloo, Ontario. Retrieved from Policy Brief: Fixing Climate Governance Series.

Preston, C. 2013. Ethics and Geoengineering: Reviewing the Moral Issues Raised by Solar Radiation Management and Carbon Dioxide Removal. *WIREs Climate Change*, 4, 23–37.

Rahman, A. 2018. Comment: Developing Countries Must Lead on Solar Geoengineering Research. *Nature*, 556, 22-24.

Reichow, A. 2016. Risk, Uncertainty, and Learning in Nanomaterials Regulation: An Analytical Framework. *The European Journal of Risk Regulation*, 7(3), 502-516.

Risse, T. 2004. Transnational Governance and Legitimacy. Paper presented at the ECPR Standing Group on International Relations Conference, The Hague, September 9-12.

Rustad, S. et al. 2017. Has the Extractive Industries Transparency Initiative Been a Success? Identifying and Evaluating EITI Goals. *Resources Policy*, 51, 151-162.

Schäferhoff, M. et al. 2009. Transnational Public-private Partnerships in International Relations: Making Sense of Concepts, Research Frameworks, and Results. *International Studies Review*, 11 (3), 451–474.

Schouten, G. and P. Glasbergen. 2011. Creating Legitimacy in Global Private Governance: The Case of the Roundtable on Sustainable Palm Oil. *Ecological Economics*, 70, 1891-1899.

Stanley Foundation. 2016. A Multistakeholder Governance Agenda: What Are the Opportunities? Report of the 57th Strategy for Peace Conference, Warrenton, VA, October 26-28.

Stapleton, P. 2016. From Mad Cows to GMOs: The Side Effects of Modernization. *European Journal of Risk Regulation*, 7(3), 517-531.

Stoll-Kleemann, S. and M. Welp, eds. 2006. *Stakeholder Dialogues in Natural Resources Management*. Berlin: Springer.

Schäferhoff, M. et al. 2009. Transnational Public-Private Partnerships in International Relations. *International Studies Review*, 11, 451-474.

Wampler, B. 2013. *Participation, Transparency and Accountability: Innovations in South Korea, Brazil, and the Philippines*. Report for the Global Initiative for Fiscal Transparency (GIFT).

Webler, T. et al. 1995. Public Participation in Impact Assessment: A Social Learning Perspective. *Environmental Impact Assessment Review*, 1(5), 443-46.

Welp, M. et al. 2016. Science-based Stakeholder Dialogues: Theories and Tools. *Global Environmental Change*, 16, 170-181.

Williamson, P. 2016. Emissions Reduction: Scrutinize CO2 Removal Methods. *Nature* 530(7589), 153-155.

Winickoff, D. et al. 2015. Engaging the Global South on Climate Engineering Research. *Nature Climate Change*, 5, 627-634.