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## **RETHINKING APPROACHES TO CLIMATE CHANGE POLICY**

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Climate change is a global problem, but policies to reduce greenhouse gas emissions are formulated by national and, in some cases, subnational governments. Progress in international negotiations on climate change depends on domestic political support for cooperation, but so far the world's major emitters have made little progress toward mitigating climate change. Although global warming is now widely recognized as a policy challenge among experts, ambitious measures to reduce greenhouse gas emissions are generally not a top priority for governments in domestic politics.

For twenty-five years, governmental efforts to build cooperative efforts to address the climate problem have focused on achieving an international agreement that is comprehensive both in terms of national participation

and emissions sector coverage. The objectives embodied in the Berlin Mandate and the resulting Kyoto Protocol produced both a high-water mark for these aspirations and a poison pill. The devolution of the agenda aimed at such a centralized agreement was revealed most clearly at Copenhagen, where the basic principle of binding, enforceable commitments was abandoned. If the agreements envisioned before Copenhagen were a first-best approach in a hypothetical world, they clearly were ill-suited to the world as it exists today—a world in which power is much more diffused than it was in 1991 and in which the interests of states, as their leaders and publics perceive them, vary greatly. In a variety of issue-areas, international institutions founded by or dominated by wealthy western countries are being challenged either from within—leading often to deadlock—or from without, by the emergence of new institutions with different practices and different leading states (Morse and Keohane 2014).

The dilemmas facing policymakers, scholars, and institutions on climate change are not necessarily unique. In other issue-areas, ranging from energy to non-proliferation to health, institutional arrangements have run into difficulties, or even failed—prompting changes in the actors and institutions that take the leading role in the issue-area. Some of these experiences are highly relevant to the climate area. We therefore hope that the study of climate change institutions and policies, as supported by the Social Science Research Council (SSRC), will benefit from the experiences of scholars who have worked in these areas.

Rather than view the outcome as leaving us grappling haplessly for a distant second-best solution, we should view the current situation as an opportunity to expand (and then utilize) our understanding of what might motivate countries to deal with a problem as complex as climate change. The complex landscape involves trade-offs between short and long term objectives, domestic and international priorities, multiple and interacting

environmental goals embedded in a matrix of fast-changing economic and technological relationships, objectives, and priorities. Political scientists have yet to examine many of the questions arising from the combination of the latter features with the persistent and increasing urgency of solving the climate problem. At its highest level, we address this question:

*What broad strategies that would lead to specific policy initiatives can be intentionally designed, which are smaller than comprehensive but sufficiently ambitious when taken together, to make a meaningful dent in the rate of increase in emissions of greenhouse gasses?*

We focus in this memo on *strategies* for two reasons. First, a focus on strategies is analytically clear, since strategies need to be based on and responsive to interests and to take into account structures of power and values. Second, strategies are policy-relevant, since each strategy suggests a variety of specific measures that could help to achieve the relevant strategic objectives. And, as we emphasize below, each strategy has some degree of uncertainty about the consequences of policies designed to achieve the goal of reducing anthropogenic climate change—uncertainties that could be reduced by social scientific research.

Our time frame for this memo is the next ten to twenty years. The ultimate goal can be viewed as reducing absolute emissions of greenhouse gases to near-zero over a century scale or negotiating or beginning to implement a more comprehensive agreement within a decade or two. But, keeping our eyes on what we can do during this time period to move us toward a position in which a serious comprehensive agreement is feasible is more promising than obsessing over the challenge of achieving the ultimate objective.

The principal focus of activity, and of research, on climate change involves reduction of emissions of greenhouse gases, and the following thematic

suggestions for research on climate change by social scientists emphasize this area, known as “mitigation.” But mitigation is not the only relevant activity. Insofar as climate change continues, with impacts on the human environment, adaptation will be an important issue. Furthermore, if climate change impacts become severe, and efforts to reduce emissions seem to be falling short, there is likely to be pressure to geoengineer the planet—that is, intentionally modify the climate. At the end of this memo, we outline research opportunities generated by adaptation and geoengineering.

## MITIGATION OF CLIMATE CHANGE

Action on climate change is inhibited by the fact that reducing emissions of greenhouse gases is costly and produces a global public good over a long period of time. That is, benefits of present costly action are deferred into the future, and are generalized to everyone then living on the globe, so that those who contribute are unlikely to be able to point to commensurate benefits accruing to themselves. Both theory and experimental research (Barrett and Dannenberg 2012, 2014) strongly suggest that even with ten actors, each seeking individual benefits, failure to cooperate is the likely outcome. Prospects for successful cooperation in the interstate system are worse. There are almost 200 states involved in negotiations, dozens of which are relevant to solving the problem, but all of which have the potential to block consensus. Their leaders cannot simply act on the basis of long-term state self-interest but have to seek short- or medium-term approval from relevant elites and publics with many other demands for resources. That is, the structure of the problem is malign from the standpoint of securing voluntary agreement on a general cooperative solution. As we will note below, the structure of the problem is less malign for geoengineering and adaptation, but mitigation involves a classic public goods problem that makes cooperation difficult.

In this working paper, we first provide seven general criteria against which strategies can be evaluated, in order to provide a framework for analyzing strategies that are more or less promising with respect to expanding international cooperation and coordination. Research could proceed by applying the criteria below both to generic problems, such as technology coordination, and to specific situations—for example, a technology standard or coordination agreement on renewable energy or a carbon-tax club with specific carrots and sticks.

An evaluation of strategies based on these criteria would in turn generate further research questions on the degree to which potential sub-strategies align with the criteria. Further exploration of strategies would also have to focus on the politics of specific policies to implement these strategies. In this section on the mitigation of climate change, we simply specify and defend our seven criteria, then discuss five strategies that in a more systematic analysis should be evaluated against these criteria. Research could proceed by applying the proposed criteria in specific situations (a technology standard, coordination agreement on renewable energy, or a carbon-tax club with specific carrots and sticks). But, there is also room for consideration of how the generic nature of particular strategies, like technology coordination, measure up.

### *SEVEN CRITERIA FOR THE EVALUATION OF STRATEGIES*

Our seven criteria are listed with the most aggregate and apolitical criteria firsts, followed by political issues within the climate area, then to linkages to other issues, sustainability, and whether new institutions would hinder or help effective cooperation.

1) *To what extent is this strategy capable of solving the climate problem?*  
The first-order question for any climate strategy is: how much will it reduce greenhouse gases (GHGs) emissions? We can regard this as the

strategy's *potential*. Answering this question requires precise quantitative measurement, over time, of emissions and implies the existence of a business-as-usual baseline against which to measure additional reductions. There is a long history of efforts to compare emissions with such a baseline, revolving around the scenario development process of the Intergovernmental Panel on Climate Change (IPCC) and also implementation of the Clean Development Mechanism. Neither experience is especially encouraging. More recently, the Greenhouse Gas Protocol has devised tools for evaluating the mitigation potential of a variety of different policies (Green 2016). Nonetheless, this criterion suggests that a research agenda should be developed to reconceive this question, so that well-founded judgments could be made *ex ante* about the potential efficacy of various strategies as well as *ex post* about their actual impacts.

2) *What is the political feasibility of a given strategy, given the domestic politics of key nation? And, how would their engagement contribute to a broader climate solution?* Since states' policies are crucial, an important question to raise about any strategy is how governments will react to it. The UNFCCC/Kyoto strategy did not meet the test of domestic politics in the United States and several other important countries. That is, in retrospect the comprehensive approach of Kyoto was too demanding, requiring too much commitment too soon. This result was expected by some political scientists (Victor 2001). We need, therefore, to ask whether more limited, targeted agreements could have a positive impact on the domestic politics of climate change rather than leading to resistance and deadlock.

Sectoral strategies may be easier to implement, but they still need to meet the test of domestic politics. It is easy enough to imagine a US administration, for example, seeking to cooperate on sectoral policy with respect to energy, especially coal, but how far will domestic politics in the

United States allow it to go in doing so? The European Union appears to have operated from a presumed set of national/domestic mandates in pressing forward. Chinese policy takes cognizance of implications for central/provincial government power relations. How can we mobilize what we know about the domestic politics of key countries in order to be able to judge the likelihood that key states will participate and at what price? In this regard, the contribution of subgroup #1 is highly relevant. In undertaking these investigations of domestic politics, analysts should distinguish between coordination problems—in which once a focal point solution is chosen, no country has an incentive to deviate from it—and more difficult cooperation problems where there are ongoing incentives to defect.

3) *What is the potential for the strategy to change other actors' positions?*

It is worth investigating whether properly targeted agreements could provide leverage or a tipping effect on the evolution of states' positions on the climate issue by shifting incentives facing states toward stronger action to combat climate change. Conceivably, for example, China's repositioning at the international level owes something to the opportunities it has developed in renewables markets. A number of important comparative questions follow within this general rubric: Could the success of a few targeted strategies alter current national positions of countries, such as India, that currently resist a more comprehensive approach? How could specific targeted agreements reshape public and elite attitudes toward broader or deeper cooperation? Could enforcement be strengthened for specific targeted agreements, and then broadened after it had become more widely acceptable? For example, the recent Nordhaus carbon tax club proposal appears premised on the existence of a critical nucleus of willing countries. Could targeted efforts over a decade or so trigger the formation of a nucleus of states willing to take strong climate action and to enforce climate standards on others, as in the Nordhaus proposal for a climate club?

More generally, these questions point to the need for a *comparative politics of national climate policies*, with a hypothetical quasi-experimental focus. The generic question is how specifically targeted and limited climate change agreements, largely on a sectoral basis, could be expected to alter the more general climate change politics of various countries. In principle, a given targeted agreement would serve as the experimental “treatment;” the analytical problem would be to assess its likely impact on national climate policy more generally.

4) *What is the potential for the strategy to enhance feasibility through spillover to other sectors or activities?* The climate issue doesn’t operate in isolation, so the costs, benefits, and feasibility of pursuing any strategy need to be considered in the context of a much larger landscape of international issues, problems, opportunities, and threats. What are the strategy’s implications for security policy (e.g., would it make a US-China conflict more or less likely)? What are its implications for relations between wealthy and poor countries? What are its implications for the control of violent transnational conflict? Would the strategy facilitate achievement of non-climate environmental goals, which loom larger for many countries, like air pollution reduction or natural resource management?

The political feasibility of a strategy may depend in part on the degree to which implementing this strategy would facilitate other efforts to reduce GHGs, perhaps in other sectors. This question is likewise relatively unexplored, at least in the climate context. But, the Montreal Protocol experience suggests that targeted agreements can become a vehicle for actions (in this case, on hydrofluorocarbons, or HFCs) which were not anticipated when the agreement was originally designed. Are there other examples of this effect? Alternatively, can successful, targeted efforts instigate parallel efforts in related sectors (for example, an agreement to

increase efficiency by linking electricity grids across borders could encourage policies aimed at the electrification of passenger vehicle fleets)? The early literature on European integration explored what was called “spillover”—how action on one dimension of a common market could stimulate action on other sectors by creating a situation of disequilibrium, in which integration had to move forward if it was to avoid regressing (Haas 1958).

*5) Does the arrangement promise to be stable over time or, better yet, to evolve and adapt in response to circumstance as the Montreal Protocol did?* There is a large literature on “historical institutionalism” that studies “path-dependence”: processes of positive reinforcement whereas institutions can be self-reinforcing, as actors adjust their expectations to the institutions and enact difficult-to-change policies that are embedded in particular institutions (Fioretos 2017). The critical generic question is whether institutions generate more support for themselves over time, becoming entrenched, rather than cumulating opposition and resistance. Scholars of historical institutionalism have not focused their energies on climate change issues, but there may be a rich potential field here in applying their concepts to comparative analysis by institution. Why did the Montreal Protocol regime become firmly entrenched while the Kyoto regime never gained traction? An important theme of the targeted policies research agenda would be to enlist scholars from historical institutionalism to focus on climate change.

*6) Will the strategy require new institutions, and if so, how do these fit into the currently crowded field of climate, climate finance, and trade?* The basic question here is whether establishing a new institution will merely replicate (or even counteract) work currently underway and produce conflict among institutions and jostling for position and influence. Increasingly, international institutions have competing or overlapping mandates, as a result of their members having different preferences,

different patterns of representation across institutions, and the policies followed by institutional secretariats (Morse and Keohane 2014). It is important to analyze these patterns of contestation in the climate area and to explain when contestation occurs and, of these cases, when its impact is benign or detrimental to effective climate action. Researchers should also ask how the involvement of firms, subnational governments, and NGOs alters such patterns of contestation. Since the contestation of multilateralism is becoming widespread and attracting attention, it should be possible to recruit some political scientists interested in this topic to focus their analysis on issues involving climate, as well as the more-studied institutions of economic policy, such as the World Bank, International Monetary Fund (IMF), and World Trade Organization (WTO).

*7) How will the strategy affect the long-term evolution of a system in which players face great uncertainty and don't know what to do—but have to make choices?* Institutional arrangements are subject to path-dependence, but foresight is limited. For example, institutions may be initiated by weak actors and then taken over by strong ones. It is important for us, therefore, to understand the long-term effects of strategies in an evolutionary context. Another way of expressing this point is to ask whether the origin of an institution matters in terms of limiting its ultimate effectiveness. This is not necessarily a comprehensive set of criteria about strategies, and we encourage colleagues to suggest new criteria and new questions.

Furthermore, with respect to each strategy, we need to ask about its institutional context: “under what conditions” is it likely to have one set of effects or another? For example, we could ask under what conditions the United Nations Framework Convention on Climate Change (UNFCCC) could build domestic political support, change the positions of major actors, and actually help to solve the climate problem; and alternatively, under what conditions other institutional arrangements could be more

effective. From an incrementalist standpoint, we would expect the UNFCCC to be able to evolve into a more effective institution. But, it could be that instead it stands in way of a productive solution through a set of institutional practices that are dysfunctional.

Our strategies focus both on outcomes and on processes—of course, some outcomes can also be viewed as elements of a larger process. How are processes involving various pathways connecting to one another? How are institutional stability and institutional innovation connected to outcomes? We want to encourage work that connects process with outcomes.

### *FIVE STRATEGIES*

With this discussion in mind, we now discuss five broad responses to climate change, all of which depart from the Kyoto targets and timetables approach:

1) *Pledge and review*. The “pledge and review” approach is now the focus of the UNFCCC process leading up to Paris. Rather than meet a negotiated target, each country is now required to provide its own pledges of emissions reduction, using base years it chooses, and specifying implementation policies it selects. This approach relies on voluntary contributions, but these are supposed to be offered with a view to meeting a collective goal (limiting mean global temperature change to 2 °C relative to the preindustrial level). This approach thus contains “bottom-up” and “top-down” elements.

2) *Enforcement: The direct approach*. This approach begins with a direct attack on the prisoners’ dilemma or collective action problem, seeing to encourage or mandate shifts in state behavior through some system

involving changes in incentives, usually entailing some punishments for non-compliance.

3) *Strategic coordination: The indirect approach.* This approach involves negotiation of a number of agreements addressing individual pieces of the puzzle—that is, separate agreements for different gases and sectors—the aim being to exploit opportunities for leverage that vary with the gas and sector (Barrett 2003).

4) *Building Blocks.* The “Building Block” approach (Stewart, Oppenheimer, and Rudyk 2013) is a multifaceted and “bottom-up,” in which many actors, including non-state actors, implement mitigation policies, utilizing different modes of governance and providing direct benefits to participants. This approach relies on three distinct strategies: clubs, institutional linkages, and dominant actor initiatives.

5) *Carbon pricing.* Carbon pricing instruments, primarily in the form of emissions trading schemes and taxes, are being created all over the world (World Bank 2014).

Optimists suggest that linking these various pricing mechanisms together could create a global price on carbon, and ultimately drive emissions reductions.

These approaches are not alternatives. Some can be used in combination; some can serve as a stepping-stone to another. There are complementarities as well as possible tensions among them. In this way, they can be considered potential additions to the “transnational regime complex for climate change,” which includes both state-based and non-state-based non-hierarchical and overlapping initiatives to promote mitigation (Abbott 2012; see also Keohane and Victor 2011). Importantly, whether used alone or in combination, these mitigation strategies cannot

be relied upon to “solve” the problem of climate change, which requires reducing global (net) emissions of greenhouse gases to zero. For this last reason, we maintain that it is important to set forth a research agenda related to adaptation and geoengineering—strategies that imperfectly substitute emission reductions.

As we suggested at the outset of the memo, each strategy has some degree of uncertainty associated with it. For social scientists, a key point is that these uncertainties could be reduced by social scientific research. This research agenda memo is designed to point out research directions that could reduce some of these uncertainties, making it less likely that action will lead to undesired consequences and providing more evidence for decision-making.

#### *STRATEGY #1: PLEDGE AND REVIEW*

One research approach uses what is currently happening in climate change negotiations as a “window” into fundamental questions of understanding state preferences and how state strategies interact: what is called “pledge and review.” Pledge and review is related to a longer history of governments’ efforts to set targets and timetables for climate action, but it is the current manifestation of it. But pledge and review focuses on state preferences, and the consequences of strategic interaction, on the basis of actual negotiating experience. As a general rule, to explain state behavior, it is crucial to understand state preferences, or interests: preferences that are of course generated through domestic political processes. Indeed, any bargain struck on climate change policy will be based on the preferences of the participants in the process, as well as on structures of power and interdependence in the climate area.

*Pledges as a window into state preferences.* Governments often have incentives to avoid making their real preferences clear—either to maintain domestic political coalitions or to gain bargaining advantages with other states. In the climate arena, the process specified by the UNFCCC has exacerbated this problem, since it has given incentives to countries to hold back on commitments to maintain bargaining chips and to avoid offending domestic audiences if no agreement will be forthcoming anyway.

Yet, the new negotiating process countries are using in preparation for the Paris Conference of the Parties in December 2015 has made it easier to observe what countries seek. This process is based on countries submitting pledges—“Intended Nationally Determined Contributions,” or INDCs—specifying the policy measures they propose to take over the next several years. These INDCs will become simply “Nationally Intended Contributions” (NDCs) after Paris. The Paris Pledge and Review Process therefore makes more specific the set of questions that we can ask about national policy. We still need to ask the same generic question: how do states respond to a bargaining situation in which they have incentives to under-promise and to conceal their true preferences?” But, we now have some specific evidence with respect to this generic question since we can ask: “How serious, in terms of contribution to reducing climate change, is each state’s Paris proposal?” Pledge and Review generates opportunities to make proposals, then gives diplomats the task of stitching together these national pledges into new international agreements.

For political scientists these pledges—and new pledges surely to be called for after Paris—may be an opportunity for understanding what countries actually care about and how different sets of countries may have different preferences. That is, we can make inferences about underlying state interests, or preferences, from the NDCs, which should help us to understand both their likely future policies and their potential responsiveness to different policy initiatives in the future. But, to evaluate

the depth of these pledges, we need to sharpen our measurement tools to analyze these pledges, as well as to understand the policies embedded in agreements about the measurements actually used—an issue discussed more in the “Review” section below.

Policy analysts now are mostly focused on the level of ambition of the pledges, measured by their potential contribution to reducing global warming or the cost to the state of the measures proposed. This is of course an important issue, crucial for determining whether the pledges will add up to effective global action. But, from the standpoint of social science, it is also important to understand the different combinations of policies that different states adopt in their climate pledges. Indeed, this is an important issue also of policy and institutional design. The identification of different *types* of policy combinations, reflecting different preferences, could help policy analysts design different packages of emissions-reduction policies to fit different state preferences.

What we suggest is that an investigation of the NDC’s—the national pledges—could provide analysts with clues about state preferences, or interests, which could in turn be used both to anticipate future state policies and to design policy responses. One possible typology of interests, beginning with material interests, is as follows:

1) *Contribute to supplying the global public good.* It is sometimes assumed the incentive to “free ride” is so overwhelming that countries will fail to supply *any* amount of a public good. This will not be true for limiting climate change. Economists calculate the “social cost of carbon” as a value placed on reducing one ton of emissions against the background of a long-term scenario for action. This value has even entered into policymaking, including within the US federal government. Although this value is “global,” it can be disaggregated and will be strictly positive for almost any country. By contrast, relative to a “business as usual” scenario

of “doing nothing,” the cost of reducing the first ton of emissions will be very close to zero. Hence, countries have some incentive unilaterally to reduce emissions. The problem is that this incentive isn’t strong enough.

2) *Create local or national public goods for which climate change credit could be gained.* An example is provided by measures to reduce emissions of soot, or black carbon, which both cause local health problems and contribute to global warming. There may be sufficient self-interested local and national motivation to reduce such emissions that the global public benefit is essentially a free good to the country involved. At the same time, reductions in other pollutants, such as sulfates, could amplify “global warming.” The self-interests of a state and the collective interests of all states will sometimes—but not always—be consonant.

3) *Generate competitive economic benefits.* An example of this could be the creation of new industries, such as solar, wind, or batteries. Insofar as governments believe that they have a competitive advantage, real or potential, in such industries, and that there could be growing demand for their products, they have interests in taking the lead to promote action that creates such demand. China, for example, has taken a leading position in manufacturing solar panels, which gives the Chinese government an economic interest in promoting climate change policies that would encourage more solar use. At the same time, other industrial and related policies may work against global efforts to limit greenhouse gas emissions. The emergence of hydraulic fracturing is both beneficial and potentially harmful to such efforts.

4) *Bargain for side-payments.* An example is requests for money to help pay the cost of controlling emissions and adapting to climate change. This motivation is likely to be especially strong for relatively poor developing countries, particularly those countries likely to bear significant costs as a result of increasing global temperatures and rising sea levels.

5) *Generate domestic public support by contributing to the provision of global public goods.* Only countries that are democratic or semi-democratic, where public support matters, and in which there are significant constituencies concerned about climate change are likely to have this motivation.

6) *Create reputational benefits.* Great powers have stakes in a wide variety of issues and may find it advantageous to be seen as leaders in providing global public goods. In Joseph S. Nye's phrase, doing so may enhance their "soft power" (Nye 2004). For other states, as climate pledges become the norm, it could be important not to be stigmatized as a non-cooperator, which could hurt the state with respect to issues on which it has clear interests.

Future work in social science, under the aegis of the SSRC, could sharpen this list of motivations and assess it empirically. We expect that multiple interests are likely to drive the behavior of any individual state, but that the emphasis will be different for different states—and that the specific mix of interests of any state is likely to help us understand, and perhaps predict, state policy.

*What is the impact of "review"?* A crucial aspect of the Paris accords is likely to be "review": provisions for interpreting pledges so they are comparable and for monitoring pledge implementation, since the credibility *ex ante* and the efficacy *ex post* of monitoring will fundamentally affect state strategies, which will be based on the principle of reciprocity. No states will want the "sucker's payoff"—taking expensive actions while others are managing to conceal their avoidance of such actions. One significant contribution of social science to the post-Paris process will be to analyze the review and monitoring process and how it affects the dynamics of subsequent negotiations. Our SSRC committee

could usefully take the lead in this enterprise by sharpening measurement tools and applying them to the post-Paris process.

As always in politics and policy making, comparisons will also be useful. The basic idea behind “pledge and review” is to create the conditions for “naming and shaming”—an indirect and perhaps weak form of enforcement, but one that may possibly be useful nonetheless. The approach has been used before to address other issues, such as human rights (Hafner-Burton 2008), but there has not, to our knowledge, been any systematic analysis of this approach in global politics. More ambitiously, pledge and review could create the conditions for joint *learning* about others’ preferences, enabling states to adapt their own strategies in a situation of interdependence. We therefore propose to investigate the conditions under which review of commitments can produce meaningful changes in strategic behavior.

One problem with empirics is that we lack a “counterfactual.” We don’t know what would have happened in the absence of a process or framework for facilitating “naming and shaming.” We can compare emissions today with emissions in the future, but as noted previously, countries have many motivations for undertaking policies that will affect emissions and, in any event, the background (technological change, economic activity, migration, natural and man-made disasters, etc.) is always changing. Isolating the effect of one institutional change from all of these other considerations will always be difficult. However, we can create a “counterfactual” in the laboratory, and by this means see whether and how a process for review affects behavior. A recent experimental analysis of the Paris review process, for example, suggests that the review process may increase the level of “ambition”—that is, the collective target and individual pledges—but it is unlikely to increase actual “contributions” significantly (Barrett and Dannenberg 2015).

## *STRATEGY #2: ENFORCEMENT: THE DIRECT APPROACH*

For the past quarter of a century, negotiators have been trying to steer the world clear of “dangerous” climate change by asking countries to limit their emissions. This approach is “direct,” because it limits the thing that causes the climate to change—increases in the atmospheric concentration of greenhouse gases. Limiting emissions directly supplies the global public good of reducing climate change, and is vulnerable to free riding. One reason for this is greed: players may hold back on reducing their own emissions, hoping that others will take up the slack. Another reason is fear: players may be reluctant to contribute if they fear that others won’t contribute. As noted before, no country wants to get the “sucker’s payoff.”

Traditional non-cooperative game theory emphasizes the first motive, suggesting that, whether or not others contribute, each country will be better off not contributing. The second motive is more in keeping with behavior uncovered by experimental game theory—“conditional cooperation.” Conditional cooperators are willing to contribute, provided they believe that others will contribute. The problem is that, for any randomly chosen pool of players, there will be both kinds of player—free riders and conditional cooperators—and the presence of the free riders tends to erode the willingness of the conditional cooperators to contribute. This is the main reason that, in public goods experiments, contributions tend to start high but decline over time.

Incentive problems like these can be overcome by the use of punishments targeted at countries that don’t contribute or that contribute too little. Reciprocity is effective at sustaining cooperation in prisoners’ dilemma games played by two players. For this same reason, strategies of reciprocity are effective in sustaining cooperation in trade agreements (though an agreement like the WTO is multilateral, trade is always

bilateral). However, reciprocity is less effective in addressing a problem like climate change, which involves supplying a global public good. Reciprocity would imply that, if one country failed to limit its emissions, then the other countries should reciprocate by failing to limit their emissions. The problem is that, by doing this, these countries would hurt themselves in the bargain. It is unlikely that this punishment would be credible. If an agreement to limit emissions is to be enforced, it will probably have to be designed differently.

Greed and fear are not the only considerations. Another issue is the legitimacy of the use of punishments to enforce a particular standard. Returning to the earlier example, which countries get to decide the amount by which any one country should reduce its emissions? Suppose that this is decided by a vote. Then, a country that finds itself in a minority may feel the obligations imposed upon it are unfair. Of course, states are entitled to exercise their sovereignty by not participating in such an agreement. But, suppose the other states decide to impose sanctions on this country anyway. One consequence might be that the target states would agree to change their behavior. Another consequence might be that the target states would retaliate. These possibilities have not yet been explored carefully in the literature.

*Clubs and climate change.* William Nordhaus (2015) has recently proposed a “climate club,” in which the members impose a specified price on club members’ carbon emissions, and these members impose trade sanctions to induce reluctant states to join. Because the agreement limits total national emissions, it is comprehensive in scope. Because it does so by means of a carbon price, it also ensures that abatement by the club members will be cost-effective. These two features are very much in keeping with the approach taken by the Kyoto Protocol. What is different is the application of a punishment mechanism.

The punishment mechanism is not a “border tax adjustment,” but a blunt trade restriction—a tariff imposed on all imports. Nordhaus considers different carbon tax levels and different tariff levels and looks for the ability of such an agreement to sustain cooperation. Note that the WTO has over time negotiated reductions in tariffs among its members. Nordhaus’s approach involves a select number of such members taking away from the others something they were given before—tariff reductions. Normally, provision of a club good benefits the club’s members only, without affecting non-members. Nordhaus’s concept is different. His club hurts non-members, by taking away a benefit (liberalized trade) they currently enjoy. For this reason, his approach is more appropriately labeled a “coercive club.”

To highlight the difference, it might help to consider an example of a non-coercive club—the agreement to fund nuclear fusion research (The ITER International Fusion Energy Organization). This project is being funded by the European Union, Japan, China, India, South Korea, Russia, and the United States. These countries formed the club because it didn’t pay any of these countries to do this “big science” research on their own, and yet they each will gain from the knowledge produced by the collaborative effort. Non-members are not “punished” for not joining; they simply derive less overall benefit (their scientists are not participating in the effort, and so are not learning directly from the enterprise). Membership is flexible. Canada withdrew in 2003, without suffering any consequences. India joined in 2005, but only because it wanted to join and not because it was coerced into joining.

The idea of a club approach, like most ideas in climate change policy, has been around a long time. More than twenty years ago, Carraro and Siniscalco (1994) proposed linking a cooperative R&D agreement, like ITER, to participation in a climate change agreement. A country would not be hurt for failing to participate in the climate change agreement, but if it

did not participate, it would be denied access to the fruits of the R&D generated by the club agreement. Rather than use a stick, this approach uses a carrot—join the climate agreement and you can also join the R&D agreement. However, this approach also has problems. For example, it assumes that the knowledge produced by the club agreement does not “leak” out. It also assumes that it is credible for the club members to deny third parties access to this knowledge. Given that their club produces knowledge that lowers the costs of reducing emissions, denying access to the knowledge may not be credible.

Probably the most successful international environmental agreement ever is the Montreal Protocol on protecting the stratospheric ozone layer. This agreement requires that parties limit their consumption and production of CFCs. It also requires that they ban trade in CFCs and products containing CFCs between parties and non-parties. As Barrett (2003, Chapter 12) has shown, this approach transforms the prisoners’ dilemma into a coordination game. Provided a critical mass of countries participates, it pays all countries to participate. In equilibrium, the global public good is provided fully, and trade is not restricted.

Nordhaus also finds that there are situations in which the threat to impose trade restrictions causes all countries to participate in an agreement to impose a common carbon tax. In other situations, however, participation in the agreement is less than full, meaning that trade is actually restricted.

The trade restrictions in the Montreal Protocol satisfy the legitimacy criterion in that they were agreed multilaterally and used to enforce an agreement that addressed the concerns some parties had about the distribution of the gains from cooperation. In a 1990 amendment, the parties to this agreement agreed that the industrialized countries should pay the full costs of compliance by developing countries. Nordhaus’s

analysis ignores this bargaining problem, but could clearly be extended in this direction.

Nordhaus's trade restrictions are credible, because the "optimal tariff" of the members of the climate club is positive. However, one of the main reasons for establishing the WTO in the first place was to overcome the terms of trade externality involved when countries choose their tariffs independently (Bagwell and Staiger 2004). The WTO requires that countries make mutual concessions. Each country loses by having to reduce its tariff, but each country gains when all countries reduce their tariffs. The reason members gain by imposing tariffs in the Nordhaus analysis is that he assumes the non-members of the coercive club do not retaliate, either independently or as part of a countervailing coalition. In other words, key political processes are missing from his analysis. It seems at least plausible that non-members will want to retaliate.

Actually, it is possible the use of tariffs by a subset of WTO members could trigger a trade war.

Another important point is that, even with Nordhaus's assumptions, full cooperation by the coercive club can only be sustained for a carbon tax no greater than about \$50/tCO<sub>2</sub>. The social cost of carbon could easily be greater than this value today, but it will certainly be greater than this value in the near future. In other words, even if we accept all of Nordhaus's assumptions, his approach is unable to achieve all that the world would like to achieve. Clearly, more social science research is needed on the ways in which international cooperation in limiting climate change can be enforced.

### *STRATEGY #3: COORDINATION: THE INDIRECT APPROACH*

Sometimes the best way to supply a global public good is to approach it indirectly. An example of an indirect approach to addressing climate change would be to ask the players to adopt a technology standard, *the use of which would cause the players to reduce their emissions*. This approach may not be as cost-effective as limiting emissions directly, but it may have another advantage—it may be easier to enforce.

For example, the International Convention for the Prevention of Pollution from Ships (MARPOL) agreement (Mitchell, 1994a and 1994b), which established a technology standard for reducing pollution of the oceans by oil tankers, worked better than previous efforts to limit these emission directly. For fifty years states had sought to limit oil pollution at sea directly, by limiting discharges from tankers located within a certain distance of the shore. This approach failed. Monitoring and verification was essentially impossible, and few port states built reception facilities for taking the oil that tankers didn't release into the sea. Previous efforts were never enforced. MARPOL changed these incentives, by requiring that tankers be designed to segregate ballast tanks from the cargo holds. Under MARPOL, monitoring and verification was simple—only an occasional on-board inspection was required. Reception facilities were unnecessary. MARPOL also made enforcement easy. Port states only had to deny access to ships that did not meet the standard. Most importantly, MARPOL changed incentives. Provided port states enforced the standard, tanker operators wanted to meet the standard. In turn, as more tankers met the standard, more port states wanted to enforce the standard. In MARPOL, mutually beneficial behavior was reinforcing.

Notice that the technology standard entails an implicit trade restriction—a ban on oil imports transported by noncompliant tankers. In equilibrium, every country complies with the standard, and so trade is never restricted.

But, if it were not for the implicit trade restriction—if port states did not limit access to tankers meeting the MARPOL standard—then the oceans would not be protected.

This arrangement is similar to the use of trade restrictions in the Montreal Protocol. In both cases, the design of the agreement transforms a prisoners' dilemma into a coordination game (Barrett 2003). In both cases, there is a tipping point in participation. If participation in the agreement falls below the tipping point, no country wants to be a party to the agreement. If participation in the agreement rises above the tipping point, every country wants to be a party to the agreement.

Technology adoption is a coordination game so long as use of the technology entails significant network externalities (meaning that the net benefit to adopting the technology increases in the number of other players who adopt the technology); see Barrett (2006). If network externalities are strong, all countries will want to do the same thing—either keep to the old standard or adopt the new one. No country or small group of countries will want to act differently from the greater mass of countries. It will thus make sense for the agreement to mandate the new standard provided that all countries together are better off when all countries adopt the new standard.

The trade restrictions in the Montreal Protocol also make this agreement a coordination game. The gains from trade increase in the number of other countries with which any country trades. When a trade restriction is imposed, there is a big penalty to being a party to the agreement when participation is low—for then the party can't trade with the larger mass of the world. When participation is high, however, the penalty switches; the countries that lose are the nonparties.

Based on these two examples, two suggestions for addressing climate change seem almost obvious. One is to amend the Montreal Protocol to limit HFCs. The other is for the International Maritime Organization to adopt an agreement establishing standards for ocean shipping. These, however, are only two examples. Many more agreements would be needed, covering other gases and especially other sectors. The essential commonality of desirable agreements is that they should create a coordination game among participants, in which, once a critical number of players adhere to the agreement, all others have incentives to do so as well.

*The two approaches compared.* The coordination approach is very different from the one taken so far by the climate negotiations. The direct approach has strived for a single comprehensive agreement. The indirect approach is more piecemeal. The direct approach has put the emphasis on cost-effectiveness. The indirect approach emphasizes incentives and the need for coordination, even though cost-effectiveness may need to be sacrificed. The direct approach is more vertical in orientation, emphasizing what each country should do for the greater good (such as limiting emissions to meet the 2 °C temperature change goal). The indirect approach is more horizontal in orientation, focusing on the incentives for countries to behave in a way that is mutually beneficial.

Generating situations of coordination is essential but may not be sufficient. We therefore turn to quite a different approach, the “bottom-up” approach of “Building Blocks.”

#### *STRATEGY #4: BUILDING BLOCKS*

The Building Blocks framework has its roots in two realizations. First, the landscape of climate-related activities at the international level has already fragmented into a regime complex with multiple institutions

assessing the effect of their actions on GHG emissions even when this is not their central objective. In particular, many agreements and activities already exist which bear implications for GHG emissions even though their primary objective is not GHG reduction (for example, Multilateral Development Bank (MDB) power sector funding, regional air pollution agreements, or the incipient agreement on trade in environmental goods and services). Second, collaborative and synergistic efforts involving a wide range of actors that have been largely excluded from the “first-best” approach heretofore will be needed to effectively implement any program or set of programs that produce significant GHG reductions. These include firms, NGOs, subnational governments, and various elements of civil society whose interests, capabilities, and intentions align wholly or in part with the larger emissions goal. The objective of the Building Blocks approach is to restructure or tune existing arrangements (or develop new ones), which take advantage of the interest of some of the involved parties in GHG emissions reduction as a concomitant goal to enhance the latter.

The Building Blocks has some affinities with strategic coordination, but the Building Blocks approach explicitly emphasizes the involvement of non-state actors, and sometimes includes arrangements that do not include states at all. Furthermore, Building Blocks arrangements are often directed toward reorienting the missions of existing organizations or agreements—for instance, reorienting multilateral development banks toward actions focused on climate change. Some Building Blocks arrangements depend on the presence of one or a small number of dominant actors—including states, firms, and international organizations.

Building Blocks is conceived as a set of largely independent institutional arrangements that either exist already (such as the Montreal Protocol) or are hypothetical but plausibly could be developed (such as an agreement between solar panel manufacturers to develop and diffuse an industry standard that results in greater product penetration and reduced sectoral

GHG emissions). Each building block institution may engage only governments, only intergovernmental organizations such as MDBs, or only firms; or can be built from a mixed membership. At this juncture, Building Blocks initiatives are seen as complements to the current UNFCCC approach or are neutral with respect to it; but they do not in any way seek to drain effort from the UNFCCC “pledge and review” strategy or in any other way compete with it. Of course, in some sense, this is impossible since political and diplomatic resources are limited and new or old institutions will likely act in ways which protect or enhance their own power.

To put the current situation in perspective, keep in mind that the UNFCCC arrangement is itself unusual in terms of access afforded observing parties like NGOs from the environmental advocacy sector, research NGOs, and business NGOs. To this day, the conferences of the parties have a component resembling a bazaar more than a diplomatic negotiation. This circumstance may have arisen because the entire negotiation was essentially foisted on stronger governments by much weaker ones in collaboration with a handful of international intergovernmental organizations and various scientist/policy entrepreneurs. Creating a media focus on reluctant governments, facilitated by the multiple observing parties, was a key aspect of this strategy. This activity somewhat resembles, at a much larger scale, what transpired under the Vienna Convention and Montreal Protocol. In the climate case, a large number of states and others, characterized by highly divergent interests, were needed to give the problem legitimacy and generate public attention in order to initiate action. Once that goal was achieved, the process stalled in reaching and effectively implementing a comprehensive, binding agreement on specific, near term objectives.

In this context, the Building Blocks can be viewed as a means to circumvent the resulting sprawling nature of the UNFCCC by creating

additional, smaller-scale venues where the interests of states and other parties can be aligned toward emissions-reducing actions.

Building Blocks would utilize a range of incentives to achieve their goals. In some cases, binding commitments and credible enforcement would occur; the lack of binding commitments within the UNFCCC would not prevent some building blocks from obtaining such commitments from participants. For example, the International Civil Aviation organization (ICAO) has a goal of setting CO<sub>2</sub> emissions standards for aviation. Putting aside the question of how ambitious these standards would be, they would likely be treated as enforceable and the parent Chicago Convention has ample means for doing so. Likewise, the Montreal Protocol has strong enforcement provisions, which could be applied to the pending agreement on hydrofluorocarbon emissions (a non-ozone-depleting category of chemicals that replaced ozone-depleters and are potent GHGs).

The original Building Blocks formulation (Stewart et al, 2013) envisioned three types of strategies, which could be used for identifying existing arrangements to be exploited or new ones to be developed to reduce GHG emissions. These are Club Strategy, Linkage Strategy, and Dominant Market Actor Strategy.

*Club Strategy.* Clubs of various kinds—more or less coercive—are discussed in Section 2 above. Club membership entails excludable, non-rival, economic benefits as well as obligations, as in the case of ITER, discussed above. Those who fail to meet their obligations are denied the benefits of membership, but these benefits do not come at a significant cost to other members. Clubs, as we have argued, can be valuable for climate change policy, but they are not a panacea. Non-coercive clubs may not provide sufficient excludable benefits to attract large numbers of adherents, and coercive clubs may face dangers of retaliation, if their rules are not regarded as legitimate by powerful states.

Other arrangements may be considered “pseudo-clubs,” since they resemble clubs, but they do not explicitly provide significant non-rival benefits to members. For example, firms in the aluminum industry formed a pseudo-club to develop an industry standard for reduction of emissions of perfluorocarbons, the strongest GHGs. Such a private arrangement is only likely to work in industries dominated by a handful of actors, who do not receive direct benefits from the club but who obtain the indirect benefit of excluding new, noncomplying competitors. Along similar lines, states or firms could form a club to rationalize inconsistent national technical standards applicable to solar panels.

*Linkage Strategy.* The linkage strategy takes advantage of either existing institutions or institutional relations with objectives other than mitigation but where there may be pockets of support for GHG reduction within the institution. The clearest example is the attempt to include HFCs under the Montreal Protocol. Potential arrangements could include adding GHG-related conditionality to existing arrangements for development assistance by multilateral development banks, or enlarging the scope of regional air pollution agreements to include GHG reductions.

*Dominant Market Actor Strategy.* This approach envisions firms in markets with one or a few dominant actors or states with firms having a dominant position in a market relevant to GHG emissions deciding to exercise leverage (for reasons of self-interest or in the case of states, policy-related reasons) over that market in the direction of emissions constraints. For example, DuPont eventually saw an advantage in supporting (or at least not opposing) a strong US position in Montreal Protocol negotiations, partly to reap first-mover advantage on substitutes and partly because US regulation under the Clean Air Act had become inevitable. The European Union has attempted to use the central position of landings at European airports as leverage to push ICAO into developing

CO<sub>2</sub> emissions regulations. Large aviation engine manufacturers could join in such efforts if they saw first mover advantage. A similar dynamic could play out within the International Maritime Organization (IMO) with respect to the emissions from ships. Potential extension of the cooperation noted above in the aluminum industry in the direction of greater efficiency or similar agreements occurring outside a political venue provide a purely private-actor example.

These three categories do not exhaust the possibilities. In addition, some approaches mix or cut across this categorization: the Montreal example has characteristics of both linkage and dominant actor strategies.

#### *STRATEGY #5: CARBON PRICING*

Carbon pricing instruments have been popping up around the globe, from the local to the global levels. These include emissions trading schemes, often referred to as “cap-and-trade,” carbon taxes, and in some cases, efforts at carbon neutrality. The world’s two largest emitters—the United States and China—both have emissions trading schemes in place at the subnational level. In some cases, such as in Vancouver, BC, these have successfully reduced emissions without negative economic effects.<sup>1</sup> There is also a booming “voluntary market,” in which firms and other actors are purchasing offsets without being required to do so by law.

Like other strategies in this memo, carbon pricing need not be universal to be effective at achieving mitigation. Individual countries or jurisdictions below the national level can implement pricing instruments unilaterally. Generally, carbon taxes are implemented less frequently than cap-and-trade systems (Green 2016). The popularity of cap-and-trade systems can be attributed to the neoliberal turn in environmental policymaking, which privileges market-based approaches (Bernstein 2001). International organizations like the OECD have also found that market-based

approaches are likely to be more effective than other types of mitigation policies (OECD 2013).

The general enthusiasm for carbon markets has given rise to two challenges. First, markets are only as good as the rules that govern them. If carbon-pricing schemes are created with weak rules, then little (if any) mitigation will result. Second, the proliferation of carbon pricing policies creates a complex landscape. This is not *a priori* a negative outcome, since national and subnational policies may produce domestic mitigation irrespective of other states' activities, as the Vancouver, BC, example demonstrates. But, this complexity could present a number of regulatory challenges, if different jurisdictions choose to link their markets together.

The economic logic of pollution pricing goes back to Pigou. If environmental costs of production are included in the price, rather than externalized, behavioral change should follow. Thus, the efficacy of the policy is premised on getting the price right. However, there are many political pressures to keep the price of carbon as low as possible. In the area of carbon markets, this can be achieved through a number of different policies. Regulators can create too many allowances. In principle, the creation of a "cap" or allowances puts restrictions on emissions, but in practice, the large number of allowances may mean that companies do not have to change their behavior in order to meet new regulatory targets. Regulators can give away allowances for free, instead of selling them, as economists would recommend. This was one of the main compromises of the proposed US federal trading scheme (known as the Waxman-Markey bill). According to one analysis, the bill would have freely distributed over 75% of the allowances in the first decade.<sup>2</sup> Finally, lawmakers can allow regulated entities to purchase offsets, which allows them to continue emitting without reduction, so long as reductions are taken elsewhere. Some have criticized this as immoral. In his recent encyclical, Pope Francis argues that carbon credits "seem to provide a quick and easy

solution under the guise of a certain commitment to the environment, but in no way does it allow for the radical change which present circumstances require.”<sup>3</sup>

Carbon offsets, which are generally part of cap-and-trade schemes, have been criticized on a number of fronts. First, they may produce perverse incentives. For example, rules governing the Clean Development Mechanism and the Joint Implementation program of the Kyoto Protocol have unintentionally incentivized the creation of emissions in order to create offset credits. Manufacturers of refrigerant gases have increased their production in order to capture HFC-23, one of the by-products of the production process, which is a potent greenhouse gas (Wara 2008). Second, many have questioned whether carbon offsets actually produce the promised reductions. To the extent that offsets are the work of creative accounting (“double counting”) rather than actual emissions abatement, they could have a negative effect on mitigation efforts (Schneider, Kollmuss and Lazarus 2015). Concerns about the incentives of firms in charge of monitoring and verifying carbon offsets has also raised questions about the amount of actual abatement (Green 2014, Lund 2010).

The second set of challenges presented by carbon markets involves the logistical and political difficulties of linking them together. The proliferation of markets has naturally led many to propose creating links among them. Linking extant markets is a means to expand the benefits provided by a market approach and potentially produce a bottom-up global institutional architecture for climate change. Many have touted linking diverse emissions trading systems as an elegant solution to the previous flaws of the climate change regime. Indeed, even the executive secretary of the UNFCCC, Christiana Figueres, has noted: “There is...no doubt in my mind that we will progressively realize that the most cost effective way to implement that global regulation is through linking these individual [emissions trading] schemes, via common standards and rules

that provide enhanced liquidity and fungibility while avoiding double counting” (Figueres 2012).

Linking carbon markets could have several benefits. First, it would dispel the need for a top-down agreement, which has proven politically infeasible. Second, it could potentially create a global price for carbon, which some believe is the most promising approach to addressing climate change. Third, it could theoretically produce more reductions at a cheaper price than would have occurred if each country restricted cap-and-trade to the domestic context. And finally, linked markets have the advantage of lowering costs of emissions reductions for developed nations, while providing a revenue stream to developing ones.

However, there are also a number of challenges (Green, Sterner and Wagner 2014). Linking markets requires that states (or other linking jurisdictions) commit to firm caps in the medium term. Any changes (most likely increases in the supply of allowances) would undermine efficiency gains at the international level, just as it would at the national level. Moreover, linking will require close regulatory coordination among actors, which may be politically difficult to achieve. Since linked markets will, by definition, be affected by policy choices made in other jurisdictions, collective decision-making will be needed to avoid adverse outcomes. However, as the number of linked markets grows, this may approach the level of coordination required by a Kyoto-like agreement, thus shrinking the political benefits of such an approach. Nonetheless, the possibility of moving toward a global, or even semiglobal (as in the Nordhaus model), carbon price makes it a potentially powerful strategy to promote mitigation.

The voluntary market constitutes the final piece of the landscape. Since the early 2000s, firms, NGOs, individuals, and governments have spent over US\$4 billion on offsets created by private regulators (Ecosystem

Marketplace 2015: <http://www.ecosystemmarketplace.com>). These private regulators create their own rules about what constitutes an offset—from how the projects are designed to who monitors them. This voluntary market is largely separate from the compulsory taxes and trading schemes described above (see Green 2016). However, it has attracted considerable activity. Perhaps most importantly, the majority of “forest carbon”—projects that conduct afforestation, reforestation or avoided deforestation activities—are largely occurring in the voluntary market. The rules governing these types of projects are much more lenient in the voluntary market, and there is a considerable demand for them. As a result, private regulators on the voluntary market are leading the way in developing rules and practices around forest carbon.

Several conclusions and questions can be synthesized from this discussion. First, carbon markets are growing, not shrinking in number and size. Thus, they will likely be part of any set of strategies to promote mitigation. Second, there is potentially considerable variation in the effectiveness of individual markets, depending on their design, relationship to other markets and mechanisms for monitoring. Third, private actors are not only the targets of public regulation, but are also serving as rule-makers in the voluntary market.

### *RESEARCH QUESTIONS*

Specific research questions can be generated from each perspective. The following research questions are indicative, suggesting possible directions, but they are not meant to be comprehensive.

*Pledge and review and the exploration of state interests.*

1) Do pledges provide evidence for the preferences (or interests) of states, reflecting governments’ political calculations and coalitions, thereby enhancing our understanding of state policy?

2) State interests with respect to climate policy are not entirely predictable from their material situation: for instance, Norway (not one of the states most threatened by climate change) is a leader whereas India (which is threatened) is a laggard. And states' conceptions of their interests sometimes change, as recent Chinese policy illustrates. Under what conditions can we expect state interests on climate policy to change?

3) Under what political conditions can a review process be expected to be rigorous and implemented in an effective way?

4) Under what conditions is "naming and shaming" types of review effective? In contrast, under what conditions is more "managerial" review effective?

5) Under what conditions can intergovernmental review lead countries to increase their national contributions over time, or conversely, to discourage ambitious pledges?

*Enforcement: The direct approach.*

1) Nordhaus's approach is to link a climate change agreement to the WTO. Might linkages to other issues be effective?

2) Nordhaus assumes that the "targets" of trade restrictions do not retaliate in kind. Is this a plausible assumption? Under what conditions would the targets be willing to retaliate, and what would be the consequence of linkage in this case—a failure to limit emissions coupled with a trade war?

3) Would countries be as willing to participate in a "climate club" if they were required to supply a "carrot" as well as to impose a "stick"?

*Coordination.*

- 1) Are there lessons from other agreements besides MARPOL and the Montreal Protocol for how to design a coordination agreement?
- 2) Do the enforcement advantages of the coordination model outweigh the reduction in cost-effectiveness relative to direct approaches?
- 3) What other kinds of climate agreements might fit into the “coordination” mold?

*Building Blocks.*

- 1) Would many Building Blocks activities, co-existing with the UNFCCC, tend to enhance the quality of outcomes or result in lowest common denominator outcomes? What precedents exist for such arrangements?
- 2) Under what conditions might expansion of existing arrangements (such as the Montreal Protocol) to broaden their scope beyond the original objective weaken implementation of the original set of obligations?
- 3) To what extent would national antitrust laws, or related national policies, limit the scope of activities involving dominant market actors and therefore make a club approach infeasible in certain sectors?
- 4) Would the restriction of club benefits to members restrict diffusion of new technology so much that its beneficial effect on emissions would be outweighed by its inhibiting effect on innovation and emissions reductions by others?
- 5) What would be the effect of reframing the issue of coercion in a positive way, providing for climate clubs to guarantee “safe harbors” against such measures as a benefit of membership?

*Carbon pricing.*

- 1) What design features make for a robust carbon market that results in net reductions in emissions (and how do we know)?
  
- 2) Under what conditions might we expect to see such a design? That is, what are the domestic political opportunities and constraints that influence institutional design?
  
- 3) How can the voluntary market promote further mitigation, incentives for participation or other non-climate benefits?

## **NON-MITIGATION STRATEGIES**

### *STRATEGY #1: ADAPTATION ASSISTANCE*

Adaptation means taking measures to reduce vulnerability of people, infrastructure, and societies to climate change (Javeline 2014, 420). Such measures could include costly projects with long, multi-decade lead times like building storm surge barriers to protect coastal cities like New York, or raising the height of existing ones, such as the Thames barrier downstream of London, or massive projects to bring water to highly populated but arid regions, such as California. Less costly measures, which require less or no centralized planning and shorter lead times, include shifts in crop varieties to adapt to a warmer climate, broader adoption of air conditioning, and implementation of early warning and shelter systems in anticipation of increases in coastal storms, higher sea level, and more intense and frequent heat waves. Because there is great variation in the type and degree of adaptation effort that may be undertaken at different places and times, adaptation to climate change is a rich field for social science. The free-rider problem is much attenuated: communities have incentives to act, because their own actions will provide local benefits. However, many governments and individuals in the

developing world do not possess the funds required to implement the full range of potential measures.

Thus, on a global scale, adaptation has disturbing implications, which we describe as the “malign politics of adaptation.” For wealthy countries, funding for and implementation of adaptation strategies may be the path of least resistance, because the domestic politics of these approaches is often benign. Within a national or subnational context, adaptation perfectly fits what pluralist democracies do best: respond to directly affected concentrated and organized interests with targeted benefits and pay off other organized groups with benefits of their own. Developed countries are likely to be able to find the funds and the political support for implementation of adaptation policies, particularly in the wake of extreme weather events. Thus, in the developed world, adaptation avoids the global free-rider problem. It generates jobs and profits and, in the short term, is likely to reduce the impact of climate change on people’s lives. Nevertheless, experience in disaster risk management—accounting for the historical and current level of risk—shows that even in wealthy countries implementation of adaptation generally falls well below economically optimal levels and its benefits are unevenly distributed among population groups due to perverse incentives and the realities of the distribution of wealth and political influence.

Developing countries are largely reliant on the developed world for adaptation activities funding. Yet, beyond altruism, and perhaps fear of increasing flows of migrants driven by climate, developed nations have little incentive to contribute large sums to support adaptation in the developing world. This is perhaps most clearly seen in the lackluster activity around climate finance. Developed nations have pledged US\$100 billion in climate-related funding for the developing world by 2020. Yet thus far, pledges are much larger than actual transfers.

However, the politics of adaptation are malign in the developing world, which is likely to be *more* vulnerable to the effects of climate change. This is due to several factors. First, they are largely dependent on the developed world for funding of these policies. Second, generally speaking, developing nations have weaker governance capacity; thus, implementation of adaptation policies is more difficult. And third, poorer economies are also more dependent on outdoors industries, such as agriculture, fishing, and timbering, that are particularly vulnerable to a changing climate.

These distributional inequalities will lead to a somewhat different kind of politics: demands from disadvantaged countries for help accompanied by claims of support from the rich countries, accompanied by relatively little actual aid. Regardless of promises to establish adaptation funds to help the poor, aid is likely to be meager and to be controlled essentially by the donors. Since adaptation is often a local, and therefore, site-specific issue, it is difficult to compare strategies. Instead, we examine climate finance institutions, which are critical to funding adaptation measures in the developing world.

*Research Question: What types of funding strategies and institutions can overcome the “malign politics” of adaptation?*

### *STRATEGY #2: SOLAR RADIATION MANAGEMENT*

Another adaptation strategy is to reduce the amount of solar radiation that enters the atmosphere. This reduces vulnerability to climate change without (necessarily) taking steps to reduce emissions. Temperatures on earth could be markedly lowered as a result, as it occurs naturally when enormous volcanic explosions emit huge quantities of ash into the atmosphere. One way of cooling the planet, therefore, would be to send particles into the upper atmosphere that would reflect sunlight away from

the earth—an intervention known as “solar radiation management,” or SRM.

There are many uncertainties associated with such a strategy, and use of SRM would not affect the build-up of carbon within the atmosphere. As a result, certain processes associated with climate change, such as ocean acidification, would continue even if global mean temperature were stabilized. From an ecological standpoint, solar radiation management seems a last resort and is viewed with horror by many scientists. However, if limiting temperature change to 2 °C were in itself crucial to the fate of the planet, it seems that the option to achieve this objective by means of SRM should not be dismissed out of hand. The discussions around SRM have been relatively few and controversial.

As with adaptation, many have been unwilling to discuss the legal issues surrounding SRM for fear that it would result in reduced efforts at mitigation. The Oxford Principles on Geoengineering call for “governance before deployment.”<sup>4</sup> Others have underscored the need for more research on both the science and the governance of the issue (Parson and Keith 2013).

We do not propose to engage in this debate but rather seek to encourage social science research that may be crucial to evaluating the costs and benefits of SRM. What would the *political economy* of solar radiation management look like?

For some democratic politicians, and for authoritarian leaders bent on attaining maximum economic growth, solar radiation management may appear attractive. By crudely suppressing the temperature effects of increasing CO<sub>2</sub> levels, it could appear to solve problems of global warming in the short run—the relevant time span for democratic politicians from an electoral standpoint—and it could do so cheaply, which

could be crucial for leaders of rapidly growing but still relatively poor countries. In democracies, politicians campaigning for a cheap “solution” to global warming could out-compete those demanding an expensive solution that would be more sustainable in the long term. And despite the scientific uncertainties, the use of SRM could be rationalized as buying time for more effective long-term action.

However, only powerful states, able to withstand external pressure, could carry out these measures at relatively low cost. The notion that weak countries could use SRM unilaterally fails to consider the coercive pressures that could be imposed on such countries by more powerful states and groups of states that were opposed to SRM. These politics could quickly resemble international politics between rival states or blocs. Opponents of SRM would likely try deterrence and, if that failed, could even take military action, such as shooting down the rockets that were carrying particles into the upper atmosphere. So the politics of SRM are consistent with adaptation strategies more broadly: benign domestic politics but malign international politics.

The relevant social science questions are again about the interactions between institutional approaches to SRM and configurations of state power and preferences. Any institutions to regulate geoengineering would need to be designed with two great risks in mind: 1) geoengineering will be used when it would be better for it not to be used, or 2) geoengineering will not be used when it would be better for it to be used. Both “false positives” and “false negatives” are important.

It would therefore be worthwhile now to engage in serious social science research about the implications of solar radiation management and whether international regulation, through the United Nations Security Council or a new multilateral institution, would be an appropriate response. Such a study should also consider whether civil society should

be represented—for instance through an advisory council of civil society groups—chosen by other civil society groups through an institutionalized process that would ensure wide geographical representation. Social science has a great reservoir of expertise relevant to issues of an international regime to manage solar radiation: 60 years of work focused on arms control. And, there has been substantial thinking in social science recently about international institutional design (e.g., Koremenos 2016).

We can think about institutional design choices along a number of dimensions, including membership (state exclusively or including non-state actors; if state membership only, universal or selective); voting provisions (consensus, unanimity, majority voting, qualified majority voting with or without vetoes); degree of institutionalization (permanent secretariat or not); breadth of powers over a range of issues; depth of authority, including issues of enforcement. Productive thinking could be devoted to the task of creating an institutional design for solar radiation management that would be both politically feasible and effective (Victor 2008; Bodansky 2013; Barrett 2014).

*Research Question: Along these and other dimensions of institutional design, which design would be most likely to yield effective regulatory results, avoiding both false negatives and false positives with respect to geoengineering?*

## CONCLUSION

Table 1 summarizes our strategies.

STRATEGIES	Key Actors	Key Institutions
Pledge and Review	States	UNFCCC
Direct Approach: Enforcement	States	States' regulatory agencies (?)
Indirect Approach: Coordination	States	Other multilateral environmental agreements
Building Blocks	Firms, NGOs, international organizations	Minilateral, transnational organizations and IOs
Carbon Pricing	States, subnational jurisdictions	National and subnational governments and their regulatory agencies
Adaptation Assistance	Banks, IGOs, development organizations, NGOs	UNEP, GEF, World Bank
Solar Research Management	States, Firms	To be designed

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