policy

Beyond Kyoto

Advancing the **international effort** against **climate change**

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I. Introduction

The question of commitments lies at the heart of the climate change debate. Ever since climate change first emerged as a political issue in the late 1980s, attention has focused on quantified "targets and timetables" as the principal type of commitment—the model used with great success in the 1987 Montreal Ozone Protocol. Although legally binding targets and timetables for greenhouse gas mitigation could not be agreed in the 1992 UN Framework Convention on Climate Change (due primarily to opposition by the United States), they became the centerpiece of the Kyoto Protocol—and the lightning rod for its opponents.

In considering the way forward—either under Kyoto or beyond it—a central question will be the type (or types) of mitigation commitments to employ. Should quantified emission limitation targets continue to be the principal type of climate commitment and, if so, should these targets be of the kind found in Kyoto—that is, fixed targets, pegged to historical emission levels? Or should international climate policy strike out in a different direction by adopting different types of targets, for instance, or by focusing on technology standards or commitments on research and development? The often-tortuous history of the climate change negotiations demonstrates that politics more than policy will determine the answer to these questions.

This paper examines the structure of future climate mitigation commitments—that is, the different forms future commitments might take.[1] Part II addresses the function and importance of mitigation commitments. Part III identifies the range of options with respect to three key variables: what types of commitments, when, and by whom? Part IV then proposes criteria for assessing these options. Part V evaluates some of the leading proposals for future commitments.

II. Why Commitments?

The importance of commitments may seem self-evident. However, the rejection of the Kyoto Protocol by the United States, and the reluctance of developing countries to assume binding emission limitation targets (at least until industrialized countries have taken action), make it useful to consider at the outset: What is the function of commitments? Are they essential, or could the climate change problem be addressed either through the application of pre-existing legal obligations, or through voluntary measures as the Bush Administration has proposed?

The nature of the climate change problem, as well as the history of international environmental cooperation more generally, suggest the need for commitments. The existence and implications of purported legal obligations, such as the duty to prevent transboundary pollution and the polluter pays principle, are the subject of endless debate among scholars and states. Although these principles reflect strong moral imperatives—and may even have the status of international law—in the absence of courts that could apply and enforce them, they are unlikely to be of significant use in changing states' behavior. Instead, states are likely to address climate change only if they believe it is in their interest to do so. That is why climate change negotiations have focused on "commitments," requirements that a state itself assumes, rather than on "obligations," a broader term that includes norms externally imposed.

The role of commitments derives from the "collective action" nature of the climate change problem. Like other collective action problems, climate change mitigation poses a fundamental dilemma. Because most of the benefits of climate change mitigation do not accrue to the country taking action, but are instead shared by the international community as a whole, individual countries have little incentive to do anything on their own.[2] Even when the global benefits justify the costs, the country engaging in mitigation usually receives only a fraction of the total benefits. So, from its individual perspective, the costs of mitigation are likely to exceed the benefits. Of course, if the costs of reducing emissions are sufficiently low, countries might be willing to go ahead anyway, for example, to show leadership or for public relations purposes. But significant investments to reduce greenhouse gas (GHG) emissions will be in a country's individual self-interest only if they are reciprocated by other states—only if a country's actions are part of a bargain involving significant action by others to address climate change.

International commitments serve as the glue that helps hold a cooperative regime together. Before taking potentially costly actions to address climate change, states need to be confident that others will do their part as well. International commitments are the means by which countries bind themselves to one another to take mutual action.

What does it mean to say that a country "commits" itself to undertake mitigation actions? In one sense, virtually all international commitments are voluntary. Given the absence of an international legislature that can impose obligations on states, international obligations in general depend on a state's consent. But, by making a commitment (for example, to reduce GHG emissions), a state agrees to limit its future freedom of action; it promises to behave in a certain way or to achieve a certain result. While its acceptance of a commitment is voluntary, its fulfillment of the commitment is not.

International commitments fall along a spectrum. Some are political, such as the aim in the UN Framework Convention on Climate Change (UNFCCC) to return developed country emissions to 1990 levels by the year 2000; others are legal, such as the reporting requirements in the UNFCCC and the targets and timetables in the Kyoto Protocol and the Montreal Ozone Protocol. In the absence of effective

institutions to interpret and enforce international law, the distinction between political and legal commitments can often seem illusory. Most international commitments—even "legally-binding" ones—depend on the good faith of states and on the diffuse costs of developing a reputation for breaking one's promises, which makes it more difficult to enter into mutually-advantageous deals in the future. But, in general, casting a commitment in "legal" form signals a greater level of seriousness by states, raises the costs of violation, and sets in motion domestic legal implementation mechanisms. That is why, even in the absence of any realistic prospect of being sanctioned for non-compliance, countries are usually reluctant to accept legally binding commitments and why the decision to do so in the Kyoto Protocol was so controversial and difficult.

Of course, no level of commitment can fully assure that a country will uphold its end of the bargain. Some countries may view their treaty commitments as aspirational rather than absolutely binding. But, compared to a strictly voluntary system, commitments provide states with greater confidence that other states will not simply say one thing and then do another. This not only promotes action by states, but provides a signal to the market that helps drive changes in private behavior. Moreover, if mechanisms can be agreed to impose specific sanctions for violations, this further raises the costs of non-compliance and thus provides additional assurance to states that others will comply with their commitments. Indeed, given the potentially high short-term costs of mitigating climate change, many analysts believe that both legally binding commitments (in contrast to voluntary actions), and a strong compliance system (with strict penalties to deter free riders) are essential.[3]

III. Key Variables

The problem of developing climate change commitments can be expressed by the following question: who *will have* what *commitments* when*?*

All three of these variables—who, what, and when—raise important, interdependent issues.

What Types of Commitments?

Specifying the content of a commitment has both formal and substantive dimensions:

Binding vs. Non-Binding

To begin with, there is the issue of the legal form of a commitment—in particular, whether it will be legally binding or political. This is not simply an either-or choice; a range of options present themselves:

Non-binding "commitments" Although perhaps strictly speaking a misnomer, a "commitment" can be expressed in non-legally binding language, as a recommendation ("should" rather than "shall") or an aim. The emissions target for developed countries in the UNFCCC (to return emissions to 1990 levels by the year 2000) was contained in the commitments section of the treaty, but was stated as an "aim" rather than a legal requirement.

One-way ("no-lose") commitments This is a variant of the previous option. An aim, although non-binding, could have legal consequences in the sense that, if bettered, it can provide a country with certain legal benefits. For example, if a country reduced its emissions by more than its non-binding target, then it could sell the surplus emissions to other countries.[4] Project baselines established under Kyoto's Clean Development Mechanism (CDM) are, in essence, one-way "commitments," since a country (or firm) faces no penalty if its project exceeds a baseline, but receives certified emission reduction credits if the project reduces emissions below the baseline.

Legally binding commitments A commitment can also be expressed in binding language ("shall"), like the targets and timetables in the Kyoto Protocol. It is important to note that this is a separate question from whether the commitment is subject to enforcement through a compliance system (considered below). Most international commitments do not have any specific compliance mechanisms.[5] Nonetheless, they are legally binding and must be complied with by those states that accept the commitment (in much the same way that one is bound by one's solemn promises, whether or not enforcement machinery exists).

Enforceable commitments A binding commitment can be subject to a mandatory compliance system, with authority to respond to violations, such as the dispute settlement system adopted under the World Trade Organization. This would provide the greatest assurance of compliance but would also present the greatest worry for states that are on the fence about whether to undertake mitigation commitments. The Marrakech Accords, which set forth detailed rules to operationalize Kyoto, establish a compliance procedure, including consequences for non-compliance. But the binding character of these consequences remains an open question.

Choice of Policy Instrument

The substantive content of commitments can involve an equally wide variety of policy instruments:

Emission targets An emission target is an obligation of result: it requires regulated entities (for example, countries or firms) to achieve a particular level or rate of emissions, but allows them flexibility as to how they will achieve that result.[6] Emissions targets can be specified in various ways: fixed or indexed, absolute or conditional, and economy-wide or sectoral.

> *Absolute targets*—Until recently, most of the attention in the climate change regime has focused on fixed, countrywide emissions targets, pegged to an historical base-year emissions level (generally, 1990 emissions). The Kyoto Protocol, for example, requires industrialized countries to achieve predetermined, fixed levels of emissions for the 2008-2012 commitment period.[7] In this respect, the climate change regime has followed the approach used in several other international environmental regimes, including those addressing acid rain and stratospheric ozone depletion.

Indexed targets—Because emissions depend on a wide range of variables that are difficult to anticipate in advance (economic growth, weather, technological change, etc.), an emission target can be pegged to one or more of these variables, rather than defined in fixed terms, like the Kyoto targets.[8] Thus far, most of the literature has focused on tying emissions targets to a country's GDP so that the permitted level of emissions would be larger or smaller, depending on whether the economy grows or shrinks. The Bush Administration's carbon intensity target[9] and the proposed Argentine target[10] are both examples of indexed GDP-based targets.

Conditional targets—In contrast to the Kyoto targets, which apply come what may, a target could be formulated in conditional terms: if the specified conditions are not satisfied, then the target either would not apply at all or would be modified in some fashion. One option is to make commitments conditional on a state's achievement of a minimum level of wealth. (For example, per capita GDP could be used as a "graduation criterion" for the assumption of commitments by developing countries.) In addition, conditional targets—like indexed targets—could help alleviate fears that a fixed emission target might become an economic straitjacket. A conditional target that has received particular attention in this regard is the so-called "safety valve" approach.[11] In essence, a safety valve defines a conditional target in negative terms: the target applies unless the cost of compliance exceeds a specified level, in which case the target is relaxed through the issuance of additional emission allowances.[12]

Sectoral targets—A target can also be specified on a narrower basis than total national emissions. For example, targets could be specified for particular sectors or industries that are particularly important, politically easier to address, or comparatively insulated from international competition. Sectoral targets could be binding or "no lose," fixed or indexed. In essence, proposals to expand the CDM to apply to entire sectors rather than particular projects[13] would involve setting no-lose, sectoral emission targets: if a developing country failed to meet its sectoral target, it would face no consequences; but reducing emissions below its target would generate emission reduction credits that the country could sell.

Financial targets Rather than focus on emissions, a target can be specified in financial terms, as an amount to be devoted to climate change mitigation, either domestically or internationally. Both the UNFCCC and the Marrakech Accords set forth collective financial commitments that apply to Annex II countries as a whole, rather than individual targets for each state.

Policies and measures In contrast to a target-based approach, a commitment regarding policies and measures (PAMs) is an obligation of conduct rather than an obligation of result: it requires

countries to act in certain ways, but does not require them to achieve any particular level of emissions or financial contribution. During the negotiation of the Kyoto Protocol, the European Union pushed for the inclusion of commitments related to policies and measures, but due to strong resistance from the United States, the Protocol includes only an illustrative list of possible PAMs, without requiring states to adopt them.[14] Examples of PAMs include:

Technology and performance standards—An international commitment can address the use of emission-reduction technologies. For example, it could specify mandatory standards relating to appliance efficiency, residential insulation, or the use of renewable or other non-emitting energy sources.[15] The international commitment can either require the use of particular technologies (which would tend to lock in those technologies) or set forth a performance standard (for example, relating to energy efficiency) that allows private entities flexibility as to the choice of particular technologies. Among the relatively few examples of international technology standards are the construction, design, and equipment standards for oil tankers set forth in the Marine Convention (MARPOL) including, for example, segregated ballast tanks.[16]

Taxes—An international commitment can provide for a common or harmonized tax on GHG emissions. So long as a country had the required tax in place, it would satisfy its international commitment, regardless of the actual level of emissions reduction achieved.[17]

Subsidy removal—An international commitment can require countries to remove specified subsidies, for example, on energy production or consumption. The Kyoto Protocol includes in its illustrative list of PAMs for developed countries "the progressive reduction and phasing out of subsidies."[18] Subsidies are a problem not only in industrialized countries: the International Energy Agency estimates that removing energy subsidies in just eight developing and transition countries would reduce their CO_2 emissions by 17 percent and global emissions by 4.6 percent.[19]

Emissions trading—An emissions commitment can be coupled with a PAM requiring countries to implement a domestic emissions trading program with specified features (including possible linkages with other national programs and with an international emissions trading system, or a safety-valve device).[20] The European Union directive on emissions trading represents an effort of this kind: it sets forth the parameters of a required emissions trading system for EU member states.

Technology R & D and incentives—To address the low rates of investment in research and development concerning emission-reducing technologies,[21] a commitment might require states to devote additional resources for R & D, as well as for deployment of existing and new technologies.[22] For example, countries could commit to various forms of participation in an international hydrogen initiative. The agreement on the international space station is one illustration of an international agreement focusing on cooperative research, development, and deployment.

Since a targets-based approach and a PAM-based approach are often seen as competitors, it is worth emphasizing that they could complement one another: a target could be used to specify the overall result to be achieved, while PAMs could specify the means for reaching that result. Indeed, in some cases the relationship could be even stronger. As some commentators have noted,[23] an international target-and-trading approach would be most cost-effective if combined with national PAMs ensuring that domestic trading systems are complementary.

When Will Commitments Apply?

Another critical question is the timing of commitments. The international negotiations thus far envision a dynamic process beginning with the relatively modest but important reporting requirements in the UNFCCC, to be followed by specific mitigation commitments in subsequent protocols. A future agreement could set forth a more detailed road map for the evolution of commitments over time.

There are two important elements to timing: first, when will a commitment take effect, and second, how long will it last?

When Does the Commitment Begin?

In contrast to most treaties, which set forth commitments that take effect immediately upon the agreement's entry into force, the Kyoto Protocol establishes a commitment period beginning more than ten years after its adoption. The intent was to avoid economic disruption by giving countries and firms time to adjust to the Kyoto targets. Even so, many economists argue that, if the United States had stayed in the Kyoto system, the Kyoto targets would have cost more than necessary by requiring premature capital retirement.[24] According to this view, an even longer-term target, timed to coincide with ordinary patterns of capital turnover, would have been more economically efficient. If a commitment is too far off in the future, however, it may lack credibility; it may raise concerns that, given the lack of stability in international politics, the commitment is likely to be changed before it ever takes effect. An intermediate approach is suggested by the Montreal Ozone Protocol, which provides for the gradual phasing-in of commitments, so that the commitments start relatively soon, but do not reach their full stringency until later, in order to give individuals and industry time to adjust.

What is the Duration of a Commitment?

In most international environmental regimes, commitments have an indefinite duration; they continue in effect until the parties modify or terminate them. The Kyoto Protocol, in contrast, defines an emission target for only a five-year period, ending in 2012. This is sometimes justified as providing necessary flexibility. The rationale is that, given the significant uncertainties relating to climate change, the international regime should consist of a series of rolling commitment periods, which allow commitments to be continually redefined to take account of improved scientific and economic understanding. But indefinite commitments also could build in flexibility (for example, a carbon intensity target that increases in stringency over time) or could provide for periodical review with a view to possible adjustments. Most international environmental agreements have flexible amendment procedures, so that commitments can be periodically updated in response to new problems and new information. Similarly, the international trade rules and tariff rates set forth in the GATT/WTO regime are not time-limited. But this has not meant that they are carved in stone; instead, the trade regime has undergone major changes through periodic negotiating rounds. The real effect of making commitments with a limited duration is to reverse the ordinary presumption of continuity. In other regimes, commitments continue until they are changed; in the Kyoto Protocol, they lapse unless they are renewed. This allows states to preserve much more freedom, but at the cost of making the regime less predictable, and necessitating repeated negotiations, each of which could prove politically difficult.

Who Will Be Subject to Commitments?

Individuals/Private Entities

Although the climate change regime has, thus far, sought to establish obligations only for states—for example, relating to emissions targets, financial contributions, and reporting—an international commitment could conceivably apply directly to individuals, private entities, or sub-national entities such as cities. International criminal law, for example, establishes basic duties on individuals (for example, not to commit torture or genocide), the violation of which results in international criminal liability.[25] Although individual criminal responsibility seems clearly inappropriate for climate-related activities, other forms of individual liability are possible. For example, an international emissions tax could apply directly to producers or consumers of fossil fuels. Similarly, some have suggested that, given the withdrawal of key countries such as the United States from the Kyoto Protocol, the international climate regime should establish emission reduction obligations for multinational corporations.

It should be emphasized, however, that attempting to impose obligations directly on individuals or private entities would pose very difficult issues of implementation and enforcement—particularly with respect to individuals and firms located in countries that do not participate in the international regime

and that therefore could not be enlisted for enforcement purposes.[26] There are, at present, no examples of international environmental regimes that apply directly to individuals.

States

Given the difficulties of imposing obligations directly on individuals, most international regimes define commitments for states and rely on them to translate these into obligations for individuals and firms under their jurisdiction.

Because of the global nature of the climate change problem, the natural tendency is to include all countries in an international climate change regime. All countries have a duty to participate because of their contribution to climate change, and they all have a right to participate because they will all be affected by it. The UNFCCC takes this approach: it is open to any state and defines at least minimal obligations for all participants. At the same time, it recognizes that the same level of commitment is not appropriate for all states. It therefore sets forth differentiated obligations, based on the principle of common but differentiated responsibilities and respective capabilities.[27]

In establishing new commitments, a key question will be whether they apply equally to all states, or whether differentiation is appropriate. Kyoto's mitigation commitments all take the same form, for instance, but apply only to developed countries and vary in stringency among them. Commitments could also be differentiated by form (some countries have absolute or binding targets, while others have indexed or no-lose targets); by timeframe (as in the Montreal Protocol, which gave developing countries an additional 10 years to phase out ozone-depleting substances);[28] or by conditionality (applying when a country has met a criterion such as a specific level of per capita GDP or emissions).

The criteria that might be used to determine who should participate in a climate regime, or to differentiate commitments among the participants, include the following:

Big current emitters Relatively few countries contribute significantly to climate change—15 countries, for example, account for 75 percent of global CO_2 emissions.[29] Mitigation commitments by these big emitters could largely address the climate change problem. Moreover, limiting membership in the regime to countries with mitigation commitments could simplify the negotiating dynamic significantly.

Big historical emitters Alternatively, commitments might vary depending on a country's historical contribution to the climate change problem. Here, the rationale for differentiation would be the idea that countries with high historical emissions are responsible for the current problem and have a duty to fix it—including through reductions in their current emissions. This is the essence of the so-called "Brazilian proposal" for allocating the burdens of addressing climate change.[30]

Rich countries Commitments could vary depending on a country's wealth and therefore its capacity to respond to the climate change problem.

Like-minded states A future climate regime could be limited to like-minded states, which are willing to undertake a certain level of commitments and have shared views about international implementation mechanisms such as emissions trading. Again, the idea would be to create a more favorable negotiating dynamic by conducting negotiations initially among countries with shared goals, bringing other countries in later.

IV. Assessment Criteria

Potential commitments need to be evaluated from both a policy and a political perspective. In some cases, synergies may exist between different assessment criteria: a climate policy that is equitable or cost-effective may in the long run be more environmentally effective. But, often, different assessment criteria will be in tension. Ensuring predictability in the costs of mitigation measures, for example, comes at the expense of predictability concerning environmental effects. More broadly, there are strong tensions between the basic goals of policy optimization and political feasibility. Formulating a sound climate change policy is not so difficult; nor is formulating a politically acceptable one. The challenge is to devise a policy that is both sound and acceptable.

Policy Criteria

What commitments are optimal from a policy perspective? There are five key criteria: environmental effectiveness, cost-effectiveness, equity, dynamic flexibility, and complementarity.

Environmental Effectiveness

Ultimately, the purpose of mitigation commitments is to reduce dangerous climate change. The bottom-line test of commitments is their effectiveness, over the long run, in preventing (or at least limiting) climate change.

An important contributor to environmental effectiveness is, of course, stringency—all other things being equal, a stronger commitment should produce a greater environmental result than a weaker one. But all other things are rarely equal and, as a result, environmental effectiveness is not solely a function of stringency. Other important factors include:

Leakage To the extent that the climate change regime is not global, private entities can avoid the impacts of commitments by shifting their operations to a non-party state. As a result, more stringent targets could actually be counterproductive, both by discouraging countries from joining and by causing emitting activities to shift to states without commitments.[31]

Stimulating technological change Some types of commitments may be more effective, over the long run, in inducing technological change. For example, many policy analysts argue that market-based approaches, such as "cap-and-trade" or taxes, are more effective in promoting ongoing technological change than technology standards, which lock in a particular technology and fail to provide incentives for further change.[32]

Changes in public attitudes, awareness, and learning Over the long run, addressing climate change will likely require changes in public attitudes and behaviors. To the extent a commitment can help do so—for example, by raising public awareness—this would be an extra benefit.

Enforceability Given the nature of the climate change problem, countries will be tempted to violate their commitments, since the near-term economic benefits of violation (reduced compliance costs) will typically outweigh the near-term environmental costs (greater climate change). For this reason, climate change commitments may be effective in changing behavior only if they can be adequately monitored and enforced.[33]

Cost-Effectiveness

Since countries have only a finite level of resources to devote to climate change and other competing needs, commitments need to get the most "bang for their buck"; they need to reduce each unit of emissions at the lowest possible cost. Most economists agree that market-based approaches—such as emissions trading and taxes—are best from this perspective.[34] The more flexibility market participants have to seek out and utilize low-cost reduction options, the greater the economic effectiveness. That is why the Kyoto Protocol provides not only "where" flexibility (countries may receive credit for emission reductions in another country where the reductions can be made more cheaply), but also "what" flexibility (countries can choose the domestic policies and measures that make most sense for them) and "when" flexibility (countries can time their reductions over a five-year commitment period, and can bank surplus reductions for use in future commitment periods). As discussed above, many economists argue that even longer commitment periods would be desirable, to give companies more flexibility in timing their emission reductions to take advantage of regular capital replacement cycles and additional R & D.[35]

Equity

Commitments should treat participants fairly. As discussed in the equity paper in this report, this is important not only in determining which commitments are politically acceptable; it is also an important end in itself. Whereas environmental and economic effectiveness can both be judged in absolute (objective) terms, equity is by its nature relational. The question is whether a commitment (or set of commitments) is sufficiently equitable to be perceived as such by all participants.[36]

Dynamic Flexibility

Given the likelihood that commitments will periodically need to be revised in light of new scientific and economic information, a commitment would ideally be formulated in a manner that allows revisions as needed. For example, both targets and taxes have a form that can be scaled up or down, becoming more stringent or lax as the circumstances warrant.

Complementarity

The withdrawal of the United States from the Kyoto Protocol opens up the possibility of a fragmented climate regime, with different country groupings adopting different types of commitments. In that case, an important factor in assessing possible commitments would be the feedbacks, complementarities, and potential linkages between commitments in different regimes. For example, if one group of countries adopted commitments involving policies and measures and another group adopted binding emissions targets, it could be difficult for the two regimes to interact. Similarly, if the two groups both adopted "cap and trade" regimes—one based on absolute, fixed targets and the other on indexed targets—trades between the regimes, although possible, might be difficult, and need to wait until emission reductions had been achieved and verified.[37]

Political Criteria

From a political perspective, there are two key criteria: whether a particular type of commitment can be negotiated, and whether it can be implemented.

What Commitments Can Be Negotiated?

In considering future commitments, the question is not simply which commitments are optimal, but which are negotiable. Most of the options for mitigation commitments discussed above have been proposed at one time or another. But none has been able to command a stable consensus.

In some cases, an option may not be negotiable due to domestic political factors in particular countries. For example, carbon taxes are likely to be unacceptable to the United States in the foreseeable future, regardless of which party is in power.

But several more general considerations also affect the negotiability of mitigation commitments, including the following:

Continuity with Kyoto A commitment's continuity with Kyoto could cut both ways in terms of political acceptability. On the one hand, most countries now have a substantial investment in the Kyoto process, so a commitment's continuity with that process would be a point in its favor.

At the same, Kyoto has become a negative icon for many in the United States, and is likely to remain a non-starter even once a new administration takes office. In terms of this particular criterion, indexed or conditional targets could conceivably square the circle: they are compatible with the architecture established by Kyoto, including the emissions trading mechanism;[38] but they are more flexible than the fixed, absolute targets in Kyoto, and thus could credibly be characterized as a different approach from Kyoto.

Economic predictability For countries as widely different as the United States and China, a primary concern with Kyoto-style commitments has been the possibility of high compliance costs. Although some economists estimate that the costs of compliance would be low—and that an emissions target for China could even be economically advantageous, given its potential to reduce emissions cheaply and to sell surplus credits to countries with higher mitigation costs—compliance costs depend on many unpredictable variables such as rates of economic and population growth and of technological change, which make economic estimates highly uncertain.[39] From a political standpoint, economic predictability may be as or more important than economic efficiency. Countries want to know in advance what they are undertaking and whether it makes political and economic sense.

Compatibility with sustainable development priorities Most developing countries perceive climate change mitigation and economic development to be in competition with one another: money invested in mitigation is money diverted from economic development. In the long run, developing countries will undertake climate change mitigation only if they see synergies with sustainable development goals, for example, through the promotion of energy efficiency, renewable energy, and sustainable land use.[40] So, to the extent that they can be crafted in a manner that advances a country's development goals, climate change commitments will be more attractive.[41]

What Commitments Can Be Implemented?

To be effective over the long run, commitments need to take into account the capabilities and limitations of the institutions on which implementation and compliance will depend. The importance of institutional capacity is by now well understood in the context of technology transfer: the "best" available technology is not necessarily best for a country lacking the capacity required to use the technology effectively. Instead, technologies that better fit a country's capacities may be more appropriate.
At the international level, where institutions are notoriously weak, the issues of implementation and enforcement deserve particular attention. A commitment may make perfect policy sense in the abstract, but, unless it takes account of the practical realities of implementation, a gap is likely to emerge between promise and performance.

Factors relevant to implementation include the following:

Ease of monitoring Different types of commitments vary widely in terms of the ease with which they can be monitored and verified. Some analysts attribute the success of the international oil pollution regime to its reliance on construction and design commitments that are easy to verify (by direct inspection of ships when they are in port),[42] rather than on discharge standards. In the climate change context, national emissions of carbon dioxide can be estimated with a high degree of confidence, but emissions of other gases and removals by sinks are considerably more uncertain. Indexed targets introduce additional complexities, since they require monitoring not only of emission levels but also the variable to which emission allowances are pegged.[43]

Predictability of compliance Most implementation of international commitments takes place at the national level, through national law, so commitments adopted internationally need to be capable of domestic legal application. One criticism of obligations of result, such as targets and timetables, is that, because compliance depends on changes in behavior by firms and individuals (as is the case with climate change), it is difficult for a country to predict accurately whether it will achieve the required result. By contrast, obligations of conduct, such as equipment standards, tend to be easier to implement at the national level: if a country engages in the required conduct (for example, by requiring firms to install the specified equipment), then it is in compliance.

V. Options for Future Commitments

The following represent some of the most frequently discussed options for future climate change mitigation commitments. Three caveats are in order. First, these options are, of course, not the only possibilities. Instead, they represent a range of approaches chosen to illustrate many of the general issues regarding mitigation commitments. Second, the assessments of the various options identify the most prominent advantages and disadvantages of each approach, rather than applying the assessment criteria discussed above in a systematic manner. Finally, these options could be combined in various ways; they are not mutually exclusive. For example, an agreement might commit states not only to an emissions target, but also to efficiency standards and funding for research and development. Or it might set forth different types of commitments for different categories of countries—a binding emissions target, say, for industrialized countries, and a non-binding one for developing countries. Or it might set forth an evolutionary pathway, with different types of commitments kicking in at different times.[44]

Absolute, Sequentially-Negotiated National Emissions Targets

The Kyoto Protocol sets forth fixed national emission targets for the 2008-2012 period. The idea is that the first five-year commitment period will be followed by other commitment periods, to be negotiated on a rolling basis. Kyoto-style targets, if applied to all significant emitters, would have several benefits:

- *Environmental effectiveness* Fixed targets, if complied with, provide the greatest environmental certainty.

- *Cost-effectiveness* Fixed targets can be cost-effective if combined with emissions trading (as in the Kyoto Protocol) and with "when flexibility" (either through a longer commitment period or through provisions for banking and borrowing).

- *Equity* Fixed targets (like targets generally) can be differentiated among countries to meet equity concerns.

- *Dynamic flexibility/scalability* Fixed targets (like targets generally) can be adjusted up or down to take account of new information.

- *Continuity with Kyoto* For countries that support Kyoto, fixed targets would provide the greatest continuity.

At the same time, absolute targets also have several significant drawbacks:

- *Difficulties of negotiating* The costs of achieving a fixed national emissions target are uncertain, and depend on many factors (such as rates of economic growth and technology change) that are difficult to predict. Although absolute targets can allow considerable flexibility in implementation (as illustrated by the Kyoto mechanisms), they represent a legal straitjacket in the sense that, once agreed, they do not provide for changing circumstances. This rigidity could make iterative negotiation of fixed short-term targets difficult.

- *Perceived incompatibility with development priorities* Absolute targets are particularly problematic for developing countries and countries with rapidly growing economies, since they are seen as representing a potential constraint on economic growth. Of course, targets could build in "headroom" to allow developing country emissions to grow. Unless economic and emissions growth can be predicted reliably, however, setting fixed targets for developing countries involves a difficult balance between targets that are too loose (and possibly create surplus allowances, above business-as-usual emissions, often referred to as "hot air"), and targets that are too strict and inhibit development.

Indexed National Targets

Indexed targets have some of the same advantages and disadvantages as fixed targets. On the positive side, they are cost-effective if coupled with trading, which appears difficult but not impossible; they can be differentiated between countries[45] and made more or less stringent as the circumstances warrant; and they could provide continuity with Kyoto. In addition, they provide greater flexibility than fixed targets by allowing emissions to vary depending on whether the economy (or whatever variable emissions are pegged to) grows or shrinks. This can prevent the creation of "hot air" due to an economic downturn, but comes at the expense of environmental certainty. Indeed, if economic growth is sufficiently high, permitted emissions may even go up rather than down. And although the increased flexibility of indexed targets mitigates the problem of economic uncertainty, it does not eliminate it altogether.

Sectoral Targets

Sectoral targets (either fixed or indexed) have the benefit over economy-wide targets of allowing states to proceed incrementally. Rather than attempt to develop a target that makes sense for the entire economy, states can address emissions in a step-by-step manner, starting with a more limited set of activities in sectors such as energy or transportation. That is why many national strategies for addressing GHG emissions take a sectoral approach. Moreover, in some cases, more is known about emissions in one sector than another, so sectoral targets may help ease monitoring concerns. Finally, sectoral targets would make it more difficult for countries to give preferential treatment to particular sectors and, in that respect, could help ease competitiveness concerns.

But addressing emissions on a sectoral basis comes at a price. If states are restricted as to which types of emission reductions "count" internationally, they may be unable to take advantage of the most cost-effective options. Even if targets are developed for all sectors with significant GHG emissions, separate sectoral targets prevent countries and firms from making tradeoffs across sectors, doing more in a sector where emissions can be reduced more cheaply and less in another sector where reductions are more expensive.[46] Allowing such tradeoffs not only makes economic sense; it may also make targets more negotiable by giving countries flexibility to focus on those sectors where they can reduce emissions with the least economic and political pain. Sectoral targets also could distort competitiveness and give rise to complex equity issues if different circumstances prevail in the same sector in different countries.

Hybrid Targets (Safety Valve)

Hybrid targets, advocated primarily by economists,[47] were put on the table informally by Brazil in 2000, during the negotiations that culminated in the Bonn/Marrakech Accords. Hybrid targets have a number of desirable features:

- *Economic predictability and negotiability* By ensuring that the costs of mitigation commitments cannot rise above a predetermined level, hybrid targets remove one of the principal obstacles to the negotiation and acceptance of emission reduction targets.[48]

- *Equity* Although the safety valve level would need to be the same globally (otherwise the country with the lowest safety valve price could continue selling permits until the global trading price equilibrated at its safety valve level), commitments could still be differentiated through the emission reductions targets. (With a hybrid target, a country's costs are a function of both the safety valve price and the stringency of its emission target.) Thus, the safety valve, like fixed targets, is compatible with the application of equity criteria.

- *Scalability* A hybrid target could be scalable through its safety valve price as well as its emission reduction targets. To facilitate planning by business (which is currently difficult due to uncertainty about the stringency of targets after Kyoto's first commitment period), the safety valve price could have an automatic escalator, which would apply unless the parties decided otherwise.

Of course, the economic predictability of hybrid targets comes at the expense of environmental predictability—the principal strength of fixed emission reduction targets. This has an obvious downside: if mitigation costs prove high and the safety valve kicks in, then the level of actual emission reductions would be less than under a fixed target. But there are risks either way. Just as we have no assurance what level of reductions a given price will buy, we have no assurance how much a particular emissions reduction will cost. The difference is, the economic risks of excessive costs are near-term, while the environmental risks of insufficient reductions in emissions are longer-term and may be correctable through stronger measures later. Moreover, economic predictability could even provide an environmental benefit: with a guaranteed ceiling on costs, countries might be willing to accept more ambitious targets, leading to greater emissions reductions if costs prove low.

In addition to environmental uncertainty, a hybrid target would be likely to face issues of political acceptability in countries opposed to the introduction of new taxes, since the safety valve would operate, in effect, like a tax. Agreement could also prove difficult on a safety valve price as well as on what to do with any money raised from the sale of additional permits. (Would the money go to an international fund and, if so, who would control the fund, or would it be spent domestically?) In addition, if the safety valve price were set relatively low, it could limit incentives for technological research and innovation, by giving companies an easy way out if costs prove high.

Non-Binding ("No-Lose") Targets For Developing Countries With Graduation Criteria

No-lose targets have been proposed primarily as a means of providing incentives for developing countries to accept emission targets.[49] Over the long run, developing countries may need to accept binding targets as their economies develop. No-lose targets could serve as a useful transitional device, possibly in conjunction with criteria that define when a developing country would graduate from a non-binding to a binding target. During the transitional period, no-lose targets could be combined with legally binding commitments in various ways. For example, under a "dual commitment" approach, a relatively weak but legally binding commitment could be combined with a stricter one-way commitment that, if surpassed, would allow a country to engage in emissions trading.[50] Given the high variability of economic growth rates in developing countries, an indexed rather than fixed target could be used to prevent the target from becoming too easy or too hard.

Efficiency/Technology Standards

The difficulties involved in negotiating, monitoring, and enforcing emission targets have made technology standards more attractive, even to some economists who, as a rule, criticize such standards as inefficient.[51] Technology standards—for example, relating to energy efficiency—could be negotiated by governments or through public-private partnerships. One advantage is that they could have a significant environmental impact, even in the absence of universal acceptance, through tipping effects. As Scott Barrett explains: "If enough countries adopt a [technology] standard, it may become irresistible for others to follow, whether because of network effects, cost considerations...or lock-in."[52] If so, technology standards would be essentially self-enforcing, and would not involve the compliance issues raised by emission targets. Moreover, trade rules may allow countries that accept a technology standard to exclude from their markets products that fail to meet the standard, putting additional pressure on non-participants to join the technology regime.[53] Finally, technology standards are comparatively easy to monitor, since in most cases they simply require inspection to make sure that the proper equipment is being used.

At the same time, technology standards have a number of significant drawbacks that have limited their appeal in the climate change negotiations thus far. They depend on governments being able and willing to pick technologies based on sound technical considerations (rather than on the basis of which technologies are produced domestically or are backed by a politically powerful lobby). They lock in technologies and do not provide an incentive for further innovation. They limit flexibility by prescribing not just a result, but how countries must achieve it. For these reasons, among others, over the last decade, environmental policy has tended to move away from command-and-control regulation towards market-based approaches.

R & D Commitments

If emission reduction technologies such as hydrogen fuel cells or carbon capture and storage became practicable and economic, this could go a long way towards overcoming the existing barriers to climate change mitigation. But recent studies indicate that, despite the high profile of the climate change issue, investments are going down overall in mitigation-related research and development.[54]

International commitments by states to provide funding for research and development are not unprecedented. For example, the international space station is the product of an agreement providing for multilateral cooperation and funding.[55] Voluntary approaches have also sometimes proven successful. Twenty-one countries including the United States currently contribute to the Consultative Group on International Agricultural Research, which funds research centers around the world.[56] So, while some countries such as the United States may be wary of any new financial obligations, financing of R & D might prove attractive, either as an alternative to more stringent types of mitigation commitments or, at a minimum, as an add-on.

VI. Conclusions

In developing new mitigation commitments, the toolbox available to policymakers contains a wide range of options. In this respect, the climate change debate has grown considerably more sophisticated over the past decade.

In moving forward, it is unlikely that one size will fit all: different mitigation commitments will prove more or less attractive to different countries. The question will be whether to undertake the extremely difficult political task of negotiating a unitary system or to accept—at least for the short- to medium-term—a more variegated set of commitments, under either a single regime based in the UNFCCC or multiple regimes at the bilateral, regional, and global levels.

In general, the various types of possible commitments are complementary to one another rather than mutually exclusive, both within and between countries. National and international climate policy could consist of a mix of different types of emission targets for different countries and sectors, as well as technology standards and R & D commitments.

But to the extent that commitments vary between countries, international climate change policy will face several important challenges: first, to ensure that the various commitments add up to a sufficient level of effort overall; second, to ensure that the mix of commitments across countries is, broadly speaking, equitable; and third, to promote linkages between different national programs and, if there are multiple international regimes, between those regimes. None of these tasks is insuperable, and careful policy analysis can help elucidate the possible solutions. But, in the end, the successful resolution of these issues will depend on mustering greater political will among states to address climate change.

Endnotes

1. For a discussion of two related issues—first, how to distribute the burden of mitigation commitments (based on wealth, historical emissions, per capita entitlements, or some other criteria), and, second, what the trajectory or end point of commitments should be—see Ashton and Wang (2003) and Pershing and Tudela (2003), respectively. This paper focuses on mitigation commitments and does not address the equally important issue of adaptation commitments.

2. In this respect, mitigation differs from adaptation. Most of the benefits of adaptation accrue directly to the country undertaking the adaptation measures. (They are, in this respect, what economists refer to as "private" rather than "public" goods.) Thus, so long as the benefits outweigh the costs, countries have an incentive to undertake adaptation measures regardless of what other states do.

3. Barrett (2002); Victor (1999).

4. Philibert and Pershing (2001).

5. The World Trade Organization dispute settlement system is one important exception.

6. Another way to say this is that approaches using emissions targets flow from outputs (i.e., emissions) to inputs (i.e., the activities that cause emissions), rather than vice versa. See Heller and Shukla (2003).

7. Although the provisions on sinks in the Marrakech Accords have modified these targets, and Kyoto's flexibility mechanisms allow countries considerable leeway in how they meet their targets.

8. The non-binding target in article 4.2(a) of the UNFCCC implicitly acknowledged a wide variety of circumstances that may cause emissions to vary.

9. U.S. Global Climate Change Policy: A New Approach, Feb. 14, 2002, available at http://www.usgcrp.gov/usgcrp/Library/gcinitiative2002/gccstorybook.htm.

10. Bouille and Girardin (2002).

11. Kopp et al. (1997); McKibben and Wilkoxen (1997).

12. The safety valve has been characterized as a "hybrid" approach because it mixes a quantity-based instrument (if the safety valve price is not exceeded, then the quantitative target must be met) with a price-based instrument (if the safety-valve price is reached, then additional emissions are allowed at that price). IEA (2002).

13. Samaniego and Figueres (2002).

14. Kyoto Protocol, art. 2.1.

15. Barrett (2002).

16. Mitchell (1994).

17. Cooper (1998); Nordhaus (2001).

18. Kyoto Protocol art. 2.1(a)(v).

19. China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa, and Venezuela.

20. McKibben and Wilkoxen (1997).

21. Margolis and Kammen (1999).

22. Barrett (2002).

23. Hahn and Stavins (1999).

24. Aldy et al. (2001). For a discussion of rates of capital turnover, see Lempert et al. (2002).

25. The Genocide and Torture Conventions—in which the United States participates—both define crimes for which individuals can be held responsible. The newly created International Criminal Court will have jurisdiction to prosecute individuals directly for commission of crimes against humanity.

26. International criminal law is generally based on the idea of universal jurisdiction: any state can proscribe and punish violations, regardless of where they occur. A similar approach could be used for climate change, although it would be sure to draw objections from non-participating states, such as the United States, which have objected to the new International Criminal Court on similar grounds.

27. UNFCCC, art. 3.1.

28. The timetable specified in the Montreal Protocol for industrialized countries to phase out their use of ozone-depleting substances applies conditionally to developing countries, if their per capita consumption of ozone-depleting substances exceeds a specified level.

29. IPCC (2001), sec. 10.1.2.1.

30. UNFCCC (2002).

31. For more on leakage, see Aldy et al. (2003).

32. Wiener (2001).

33. Barrett (2002).

34. Aldy et al. (2003).

35. Lempert et al. (2002).

36. Ashton and Wang (2003).

37. Trading between systems using absolute and relative targets might also be possible through use of a gateway as in the United Kingdom trading system or a commitment period reserve. For a discussion of the possibility of trading between systems using absolute and relative targets, see Haites (2002); IEA (2002).

38. See supra note 37.

39. Estimates of U.S. compliance costs, for example, differed by more than an order of magnitude, from about $5 billion to over $400 billion per year. See Weyant and Hill (1999); EIA (1998).

40. Heller and Shukla (2003).

41. Winkler et al. (2002).

42. Mitchell (1994).

43. IEA (2002), at 139 (GDP measurement is relatively inaccurate in many developing countries).

44. For example, as the text discusses, developing countries might start with non-binding emissions targets and more towards more binding targets over time, as they satisfy specified graduation criteria.

45. Differentiation would be possible on the basis of not only the stringency of the target, as with fixed targets, but also the variable to which targets are indexed.

46. Although trading across sectors could mitigate this concern, if trading were fully allowed, then the sectoral targets would, together, amount to an overall national target.

47. Kopp, Morgenstern, and Pizer (1997); McKibbin and Wilkoxen (1997).

48. In rejecting the Kyoto Protocol, for example, the Bush Administration identified potential harm to the U.S. economy as one of Kyoto's two fatal flaws.

49. Philibert and Pershing (2001).

50. Kim and Baumert (2002); Philibert and Pershing (2001).

51. Barrett (2002), at 398.

52. Id., at 395.

53. Charnovitz (2003).

54. Margolis and Kammen (1999).

55. Barrett (2002), at 394.

56. See http://www.cgiar.org/index.html.

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