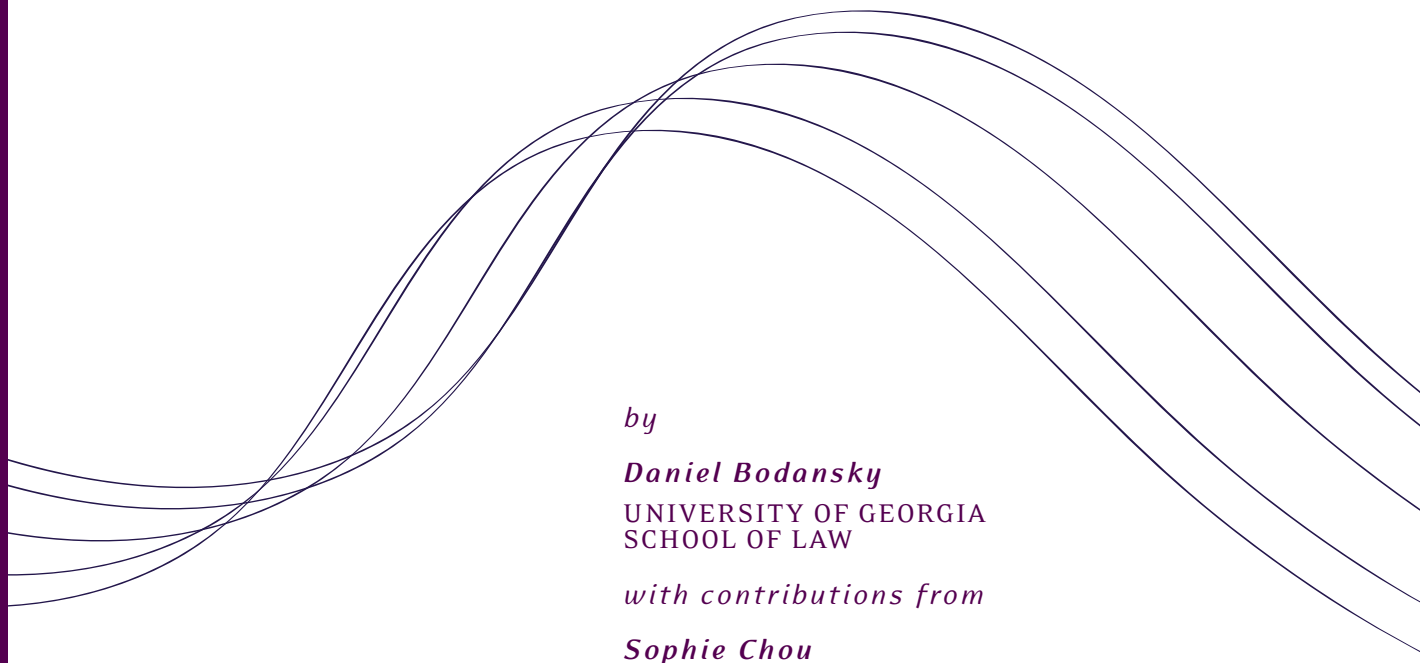
ADVANCING THE INTERNATIONAL EFFORT AGAINST CLIMATE CHANGE

INTERNATIONAL CLIMATE EFFORTS BEYOND 2012: A SURVEY OF APPROACHES



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Contents

Introduction

With the prospect of new climate negotiations starting in 2005, experts, stakeholders, and governments have begun to assess a range of options for advancing the international climate change effort beyond 2012. This paper offers a broad survey of alternative approaches proposed thus far.

While not fully comprehensive, this survey encompasses more than 40 proposals either published or publicly presented in recent years. Section I provides an overview of core issues in designing and negotiating future international climate efforts. Section II suggests criteria that could be used in assessing alternative approaches. Section III describes how the different proposals seek to address the core issues identified earlier. Section IV provides summaries of each proposal, in alphabetical order. (In some cases, titles are the proponent's original. Others have been assigned for ease of description.)

Any proposal for advancing the international climate effort comes against the backdrop of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The 1992 Framework Convention, ratified by 189 nations, establishes the basic structure of the existing climate change regime. This includes: the ultimate objective of stabilizing greenhouse gas (GHG) concentrations at safe levels; general principles such as precaution, cost-effectiveness, and common but differentiated responsibilities; obligations to report on GHG emissions and national measures to combat climate change; and commitments for assistance and technology transfer to developing countries. The Kyoto Protocol sets forth quantitative commitments by developed countries to reduce their GHG emissions. These commitments take the form of absolute emissions targets, applicable to a basket of six greenhouse gases for a five-year commitment period. The Protocol employs market mechanisms such as emissions trading and the Clean Development Mechanism (CDM), and allows parties to achieve their target in part through sinks activities such as reforestation and forest management.

Some of the proposals considered here build on the basic architecture of Kyoto—for example, by extending the CDM or by articulating a pathway towards broader participation. Others depart by varying degrees from the existing architecture—for example, by articulating a different type of commitment (policies and measures rather than quantitative emissions targets); a different negotiating process (national pledges rather than internationally-negotiated commitments); or a different forum (a smaller group of countries rather than a global process).

The proposals differ widely in their scope. Some are comprehensive in nature, setting forth a complete picture of a possible future regime. Others address a particular issue in the negotiations—for example, the type of emissions target that should be used or the criteria for differentiating commitments. Although this paper does not explore ways in which different proposals might be combined, it is important to recognize that, to the extent different proposals address different issues, they could be complementary rather than mutually exclusive.

Readers should also note that:

- While Section II presents a set of criteria that can be used in assessing alternative approaches, this paper does not attempt a systematic evaluation of the proposals presented. Its aim rather is to describe the range of options that have been identified.

- Section IV (Summaries of Proposals) is meant primarily as a resource for readers seeking additional detail on particular approaches.

I. Overview Of Key Issues

In considering the design and negotiation of future international climate efforts, a number of general issues present themselves.[1]

Form and Forum of Negotiations

Should international efforts continue to focus on the development of a single, comprehensive global regime and, if so, does the UNFCCC provide the most appropriate forum? Or should negotiations proceed in a more flexible, decentralized manner, involving multiple agreements and/or smaller groups of countries or private-sector parties (for example, like-minded states or companies)? If this more variable geometry is pursued, should it be in addition, or as an alternative, to the UNFCCC process?

Time Frame

What is the appropriate time frame—the Kyoto Protocol's second commitment period, a somewhat longer medium-term time frame, or the long-term evolution and development of the regime?

Mitigation Commitments

Approaches to defining commitments—Should the climate regime continue to operate in a top-town manner, involving the multilateral negotiation of commitments? Or should it proceed in a bottom-up fashion, seeking to encourage countries to make (and implement) pledges of domestic measures to mitigate climate change? Can the two be combined?

Type of commitments—What types of mitigation commitments should be included? Should the climate regime continue to emphasize quantitative emission targets and, if so, should they be fixed, national, Kyoto-like targets, or some alternative form of target (dynamic, dual, sectoral, no lose, etc.)? Or are non-target-based approaches preferable—for example, harmonized domestic policies and measures, development-focused approaches, financial transfers, or technology standards?

Stringency of commitments—How should the stringency of commitments be determined? Is it better to begin with relatively weak commitments, to encourage broad participation, or more stringent commitments?

Differentiation and burden sharing—How should the burden of commitments be shared among countries? For example, if a target-based approach is adopted, how should targets be allocated (for example, on the basis of population, historical responsibility, basic human needs)? What is the pathway, if any, towards global coverage? Should the differentiation in the UNFCCC and the Kyoto Protocol between developed and developing countries continue, or should additional categories of countries be defined and, if so, on what basis (e.g., per capita GDP, per capita emissions, total emissions)? Should criteria be developed for graduation of countries from one category to another?

Adaptation

What approach should be taken to the issue of adaptation? Can existing approaches under the UNFCCC be improved or expanded? Should a liability or insurance scheme be established to provide compensation to countries adversely affected by climate change?

Implementation and Compliance

Are new institutions or approaches needed to assure that international climate commitments are implemented and enforced?

II. Assessment Criteria[2]

Although this paper does not evaluate the proposals presented here, it may help to bear in mind general criteria that would apply. Alternative approaches can be evaluated from both a policy and a political perspective. It is important to note that while some assessment criteria may be complementary (for instance, a cost-effective policy may in the long run be more environmentally effective), there also may be tension between criteria (for instance, certainty on the cost of mitigation may come at the expense of certainty on environmental benefit).

Policy Criteria

Environmental Effectiveness—In addition to stringency, important factors that help determine environmental effectiveness include: controlling *leakage*, or the movement of emissions-generating activities from one country to another with weaker or no controls; stimulating long-term *technological change*; and ensuring adequate *enforcement*.

Cost-Effectiveness—A more cost-effective approach would reduce emissions at lower cost.

Equity—Agreement is more likely to be reached, and to be implemented, if it is perceived by all parties to be sufficiently equitable—or, at the least, not demonstrably unfair.

Dynamic Flexibility—Commitments that can be scaled up or down, or otherwise modified, will allow easier reassessment and revision in light of new scientific and economic information.

Complementarity—In the event of multiple regimes or approaches, complementarity of designs would facilitate linkages among them.

Political Criteria

What Commitments Can Be Negotiated?—Several general considerations are likely to affect the negotiability of future climate efforts:

> **Continuity with the UNFCCC and Kyoto Protocol**—Many parties favor remaining within the UNFCCC and building as much as possible on the Kyoto architecture. In the United States, however, Kyoto is likely to remain a non-starter.

Economic Predictability—Some countries may favor approaches offering greater economic predictability over those whose implementation costs depend on unpredictable variables such as economic and population growth, and the rate of technological change.

Compatibility with Development Goals—Particularly for developing countries, future climate efforts are more likely to win support if they help advance, rather than compete with, development priorities such as economic growth and poverty reduction.

What Commitments Can Be Implemented?—An approach must be compatible with the capabilities and limitations of the institutions on which implementation and compliance will depend. Important factors include ease of *monitoring* and predictability of *compliance*.

III. Review of Proposals

Form and Forum of Negotiations

The majority of proposals reviewed here do not explicitly address the "form and forum" issue, but appear to presume that international climate negotiations should continue to be conducted among governments on a global basis, with the goal of developing a single, comprehensive regime. Most proposals appear to presume that the negotiations will continue to be conducted under the auspices of the UNFCCC, and many focus on elaborating and further developing the Kyoto Protocol.

A few proposals, however, contemplate alternative approaches:

Orchestra of Treaties—This proposal envisions a variety of activities undertaken outside the UNFCCC by like-minded states, including:

- an Emissions Market Group (EMG), consisting of countries with domestic cap-and-trade systems, to coordinate domestic emissions trading markets (this is similar to the *Converging Markets* approach described below);
- a Zero Emissions Technology Treaty (ZETT) to foster long-term technological change through a pledge-and-review system, including commitments to R & D; and
- a Climate-Wise Development Treaty between like-minded developing and developed states to modify flows of financial assistance by embedding climate issues into development policy.

Portfolio Approach—This proposal, noting that only 21 countries account for 80 percent of global emissions, advocates breaking out of the "mega-conference mold" of the UNFCCC and instead pursuing a variety of approaches among differing constellations of like-minded states. For example, auto-manufacturing states could agree on vehicle fuel-economy standards, or a small harmonized carbon tax could be adopted to fund greater research and development (R & D).

Converging Markets—This proposal envisages a multistage regime, beginning with bottom-up, bilateral negotiations to integrate national emission trading schemes, and then developing into a broader regime as other countries seek to join the trading club. New entrants would progress through three stages, beginning as hosts for emission reduction projects; then assuming "candidate" status, with emission

caps on selected sectors or installations and partial voting rights; and finally joining the core group with a broad emissions cap and full voting rights.

Parallel Climate Policy—This proposal suggests that the United States engage China and other major developing-country emitters in a new regime parallel to Kyoto. Elements of the parallel regime would include gradual emission reduction pathways, involving modest targets initially, and full use of international emissions trading.

Time Frame

The proposals differ widely in terms of their time frame, ranging from the short-term (for example, the Kyoto Protocol's second commitment period) to the very long-term.

Short-term approaches include:

Broad but Shallow Beginning—This proposal seeks a modest, politically salable international architecture to encourage domestic measures that could be undertaken now and would reduce the costs of reducing emissions later. Like the UNFCCC, the proposal focuses on questions of institutional design rather than emission reduction targets. Its goal is to establish, in the near term, robust and flexible institutions and frameworks, capable of responding to new circumstances and information over time.

Extension of mechanisms—Proposals to extend or modify the Kyoto mechanisms—for example, by allowing policy-based CDM or creating a safety valve—represent incremental changes that could be implemented in the near term.

Growth Baselines and Dual Intensity Targets—Several proposals seek to identify types of commitments that might be attractive to developing countries in the comparatively near term. Their aim is to draw developing countries into the process and put the regime on a road towards universality.

A middle-term approach is reflected in proposals that outline a pathway for the evolution of the regime over the next several rounds of negotiations—for example, the *Multistage* approach envisions developing countries graduating through four, successively stronger stages of commitments. The *Converging Markets* approach, similarly, describes a multistage regime, beginning with a small group of core countries that have domestic emissions trading schemes and evolving outward as other states seek to join the trading group.

Finally, several proposals take a comprehensive long-term view. Some seek to identify the overarching principle that should guide the development of the climate change regime—for example, common per capita emissions *(Contraction and Convergence)*, historical responsibility for temperature change *(Brazilian Proposal)*, or equal economic burdens. Others set forth a long-term target—for example, a long-term technology target *(Technology Backstop Protocol)* or a cumulative emissions target *(Long-Term Permit Program)*.

Mitigation Commitments

Approaches to Defining Commitments

The proposals articulate a variety of ways that emission reduction commitments could be developed for states:

Top-down multilateral negotiations—Most of the proposals would continue the approach taken in the climate negotiations to date, namely, to define commitments through multilateral negotiations. As described below, these multilaterally agreed commitments could be of many kinds: emission reduction targets, coordinated policies and measures, financial commitments, and so forth. The approaches to defining commitments fall into the following general categories:

Ad hoc—Some proposals continue the approach of the Kyoto Protocol, namely to define commitments, on an ad hoc basis, in terms of incremental changes from the status quo.

Rational design of commitments—Other proposals attempt to articulate commitments in a more comprehensive, long-term manner—for example, by starting with a long-term stabilization objective, then defining an emissions trajectory, and then allocating emissions along that trajectory among countries based on criteria such as ability to pay and historical responsibility. This is the approach taken by the *Multistage* proposal and *Contraction and Convergence*.

Menu approaches—A few proposals would define a menu of commitments from which states could choose. For example, the *Dual Track* proposal would allow states to choose between assuming a binding emission target or submitting a list of policies and measures aimed at achieving a non-binding target.

Bottom-up, pledge-based approaches—Several proposals would give states even more flexibility than the menu approach, allowing them not merely to pick among various multilaterally defined alternatives, but to define their commitments themselves. The *Bottom-Up* approach would allow states to put forward whatever climate commitments they are willing and able to implement, based on their national circumstances. The commitments could take virtually any form—domestic emissions targets, efficiency standards, carbon taxes, financial transfers, investments in R & D, or adaptation measures. As in

trade negotiations, states would then engage in a series of bilateral and multilateral bargains, putting together packages of domestic and international actions that they agree to undertake. In contrast, the *Sustainable Development Policies and Measures* approach is directed specifically at developing countries. It proposes that developing country "commitments" initially take the form of pledges to implement national sustainable development policies, which would be listed in a registry. The basic function of a pledge-based approach is transparency. By making a pledge, a state opens itself up to international scrutiny of the pledge's adequacy and implementation.

Mixed approaches—Finally, some proposals, such as the *Broad but Shallow Beginning*, combine elements of the top-down and the bottom-up approaches. They provide for both the multilateral negotiation of national emission reduction targets, as well as pledges by each state of national policies and measures (PAMs) to implement the targets. Under these approaches, compliance would be assessed not in terms of achieving the target reductions—in that sense the target would not be binding—but rather in terms of whether the PAMs pledged by a state are projected to achieve their target.

Type of Commitment

Emission Targets

Many proposals would retain the target-setting focus of the Kyoto Protocol, but propose alternative types of targets (either for all countries or only for developing countries). Examples include:

Fixed targets with a different baseline—Instead of using an historical baseline, the *Graduation and Deepening* proposal suggests linking emissions targets to projections of business-as-usual emissions during the commitment period. This would help address one of the problems of historical baselines, namely that the target may prove too easy (creating "hot air") or too hard.

Indexed targets—To address the issue of cost uncertainty, targets could be indexed to some other variable, such as GDP, rather than set absolutely.

Intensity targets—A number of proposals suggest that greenhouse gas intensity targets would be particularly appropriate for developing countries, since they could be set to adjust upward as the economy grows, imposing less of a constraint on economic growth than an absolute cap. An intensity target could cover CO_2 emissions from fossil fuels only, or other GHGs as well.

Performance targets—Performance targets define an amount of allowed emissions relative to a unit of production (for example, tons of steel produced, or kilowatts of electricity). In essence, they are carbon intensity targets defined for a particular sector or product, rather than for the economy as a whole.

No lose targets[3]—"No lose" targets are another type of target that some have suggested for less developed countries (or possibly for all developing countries). No lose targets are non-binding and, if exceeded, do not have any compliance consequence. But if a state's emissions are below the no lose target, it would be allowed to sell the surplus emissions to other countries and thereby receive a benefit.

Dual intensity targets—Dual intensity targets combine dynamic and no lose targets in a further effort to address the problem of economic uncertainty. Under this approach, developing countries would receive two targets: a relatively weak "compliance" target and a more stringent "selling" target. Both targets would be carbon intensity targets, indexed to the country's GDP. The compliance target would be legally binding; if a country exceeded the target, it would suffer compliance consequences. In contrast, the selling target would be no lose: if a country exceeded its target, it would not suffer any compliance consequence but, if it bettered the target, then it could sell its excess allowances internationally. Because different targets would be established for compliance and emissions trading purposes, developing countries could be given a comparatively easy compliance target that does not unduly constrain economic growth or create the danger of hot air, since a more stringent target would be defined for emissions trading purposes.

Conditional targets—The *Human Development Goals* proposal suggests that, to the extent that a developing country target goes beyond projected business-as-usual improvements in carbon intensity, it should be made conditional on the receipt of financial assistance or technology from developed countries.

Sectoral targets—Although most target-based proposals set a target for a country's national emissions, a target could apply to a limited number of sectors—for example, energy production. The *Growth Baselines* and the *Converging Markets* proposals, for example, envision the possibility of sector-based targets. The *Technology Backstop Protocol* would, in effect, define long-term zero emission targets for particular sectors: fossil fuel electric power generation, synthetic fuels, and fossil fuel refining.

Safety valve—Several target-based proposals, including the *Hybrid International Emissions Trading* and the *Dual Track* approaches, include a safety valve mechanism. A safety valve allows states (and possibly individual companies or other entities) to buy additional allowances at a predetermined "safety valve" price. This makes an emissions target conditional: if the marginal cost of abatement rises above the safety valve level, then the target is relaxed through the sale of additional allowances. If the price

is set above the projected marginal cost of compliance, the safety valve serves as insurance against unexpectedly high costs. Setting a low price can effectively turn the emissions target into a tax. A safety valve could be implemented by individual countries or internationally. One design issue in either case is how the proceeds, if any, would be spent.

Long-term cumulative targets—The *Long-Term Permit Program* would, in effect, define a long-term cumulative emissions target, but would not define any shorter-term targets, thereby allowing complete flexibility as to the timing of emission reductions.

Harmonized Domestic Policies and Measures

Since the international climate change negotiations first began in the early 1990s, commitments relating to PAMs have been seen as the principal alternative to emission targets. PAMs commitments could supplement or serve as an alternative to emission targets. PAMs proposals include:

Coordinated carbon tax—A harmonized or coordinated carbon tax could provide greater cost certainty than a fixed emission target.

Harmonized domestic emissions trading scheme—The *Domestic Hybrid Trading Schemes* and the *Long-Term Permit Program* proposals envision harmonized domestic emissions trading programs, the former involving a safety valve at an internationally agreed price, the latter involving long-term emission permits that could be used any time during a sixty-year commitment period.

Energy efficiency standards—A proposal for *International Agreements on Energy Efficiency* envisions efficiency standards at the production process level in major emitting industries.

Technology approaches—Given the difficulties in negotiating and enforcing emissions targets, the *Technology-Centered Approach* proposes the negotiation of protocols to finance collaborative research and development, develop common technology standards, and support deployment of existing and new technologies.

Financial Commitments

Several proposals focus on financial commitments for industrialized countries as a supplement or an alternative to emissions targets.

A proposal for *Two-Part Commitments for Industrialized Countries* would give those countries the option of achieving part of their commitments by making financial and technology transfers to developing countries rather than by reducing their emissions.

The *Purchase of a Global Public Good* proposal articulates another approach to financing. Countries would make financial payments to an international authority, which would use these funds to purchase (and retire) emission allowances, thereby reducing permissible emissions.

A proposal for a *Climate Marshall Plan* suggests ad hoc agreements between donor and recipient countries about how to spend large grants of assistance.

Stringency of Commitment

Comparatively few proposals explicitly address the issue of stringency. Among those that do, the proposals that take a short-term perspective tend to argue for relatively weak targets, as a means of encouraging broad participation. Several proposals focus in particular on the need for developing country commitments to be set at a modest level initially, in order to make them politically acceptable. Two proposals (*Broad but Shallow Beginning, Three-Part Policy Architecture*) apply this same reasoning more generally, suggesting that targets for all countries should be set at a low level initially, in order to keep costs low and encourage broad participation.

The *Multistage* approach addresses the stringency issue systematically, beginning with a concentration objective (e.g., 550 ppm), then calculating a global emissions level for each five-year commitment period, and then allocating that global target among four groups of countries. The *Long-Term Permit Program* proposal also begins with an agreed concentration objective and then calculates the maximum level of cumulative emissions consistent with reaching that objective.

Differentiation and Burden-Sharing

A large number of proposals focus on the related issues of developing country commitments and burden sharing. In general, these proposals do not suggest assigning the same commitments to all countries. Instead, they accept that different types of countries should have different types and/or levels of commitments. They therefore raise the questions: What are the criteria for participating in the commitments regime and for distributing burdens? And what are different ways in which commitments could be differentiated?

Criteria for Differentiating Commitments

The proposals advance a wide variety of possible differentiation criteria, including:

- Per capita GDP
- Per capita emissions
- Emissions per unit GDP
- Population
- Historical emissions
- Total current emissions
- Membership in particular international organizations, such as the OECD or IEA.

Some proposals focus on a single criterion (most commonly wealth, as measured by per capita GDP), while others use a multi-factor approach. For example, the *Graduation and Deepening* proposal defines a "graduation index," calculated as a function of two equally-weighted factors: per capita GDP and per capita emissions. The *Further Differentiation* approach, in contrast, focuses on per capita GDP and emissions per unit GDP (as a measure of efficiency). Meanwhile, the *Global Triptych/Extended Global Triptych* approach defines targets at the sectoral level, looking at a wide variety of country-specific circumstances to determine each particular target.

The *Human Development Goals* proposal suggests distinguishing between emissions necessary for the satisfaction of basic human needs and "luxury" emissions. According to this approach, each country should be permitted to emit at the level necessary for the satisfaction of basic human needs. Countries whose emissions are below that level should not have any obligatory emission targets. The proposal suggests defining "necessary" emissions as the current level of global per capita emissions (or 120 percent of that level).

Methods of Differentiation

The proposals reflect a variety of ways in which commitments could be differentiated:

Differentiation in form of commitment—Some proposals suggest assigning different types of commitments to different types of countries. For example, the *Further Differentiation* proposal suggests using dynamic targets for middle-income developing countries, to help ensure that emissions targets do not become an economic straightjacket, and non-binding targets for less developed countries (reserving fixed targets for developed countries).

Differentiation in stringency of commitments—Other proposals differentiate targets in terms of stringency, the approach used in the Kyoto Protocol. For example, under the *Three-Part Policy Architecture* proposal, target stringency would be a function of per capita GDP. As a country's income increases, its commitments would gradually become more stringent. The *Global Triptych/Extended Global Triptych* approach would set the stringency of a country's target on a sector-by-sector basis, looking at a range of factors including historical emissions and population. The *Graduation and Deepening* proposal and the *Soft Landing in Emissions Growth* proposal take a more categorical approach, assigning countries to different categories and proposing specific reduction targets for each category. The *Multistage* proposals combine differentiation in the stringency of commitments with differentiation in the type of commitments, identifying four stages through which developing countries pass: (1) no targets, (2) a GHG intensity target, (3) a target to stabilize absolute emissions, and (4) a target to reduce absolute emissions.

Differentiation in timing of commitments—The *Global Framework* and the *Multi-Sector Convergence* proposals both include elements similar to the Montreal Ozone Protocol's approach to differentiation, namely to give developing countries more time to achieve their commitments. The *Global Framework* approach gives developing countries that graduate into the "Kyoto track" a grace period of 5 or 10 years before they must move from a stabilization to a reduction target. Similarly, the *Multi-Sector Convergence* proposal gives low-emissions countries that exceed the graduation threshold a pre-set adjustment period before they must assume emission targets. In contrast, the other differentiation proposals presume that developing country commitments should depend not merely on the passage of time, but on satisfying substantive criteria (for example, a particular level of per capita income or per capita emissions).

Graduation / Pathway to Global Participation

Implicit in the concept of differentiation is that of graduation: as a country develops, it should graduate from one category of countries to another, based on whatever differentiation criteria are being used (e.g., per capita income, per capita emissions, emissions per unit GDP).

Some of the proposals explicitly reflect this temporal dimension, setting forth a pathway for developing countries first to participate in the commitments regime and then to assume progressively more stringent commitments, as they develop economically and pass the defined differentiation/graduation thresholds. Both the *Multistage* approach and the *Graduation and Deepening* proposal define four stages through which countries would pass. The former differentiates among categories by type of target, the latter by stringency. Other proposals address only a particular period of time—for example, the Kyoto Protocol's second commitment period—and do not specify what should happen subsequently.

Allocation of Burden

Finally, several proposals suggest more comprehensive, long-term principles of distributive justice to determine the appropriate allocation of burdens among countries. These can be separated into three general categories:[4]

Allocation-based approaches—These share burdens among countries according to a general principle for the distribution of emissions, such as common levels of per capita emissions (*Contraction and Convergence*), historical responsibility (*Brazilian Proposal*), or ability to pay.

Outcome-based approaches—In contrast, outcome-based approaches focus on the expected outcomes of different arrangements. For example, the *Equal Mitigation Costs* approach would set targets so as to equalize the expected marginal abatement costs among countries. Outcome-based approaches rely on models (which may be highly contested) to project the costs or other relevant outcomes of different burden-sharing arrangements.

Process-based approaches—Finally, proposals such as the *Global Preference Score* are process-based: they define a procedure for deciding how to share burdens, for example, by a particular voting rule.

Adaptation

Only a few proposals address the issue of adaptation:

UNFCCC Impact Response Instrument—This proposal calls for a new UNFCCC Disaster Relief Fund, financed by contributions from industrialized countries (apparently based on their historical responsibility for climate change and their ability to pay).

Global Framework—This proposal includes adaptation as one of three parallel tracks (together with Kyoto and "decarbonization"), but appears to rely primarily on existing approaches to adaptation, including the Adaptation and LDC Funds created under the Marrakech Accords.

Insurance for Adaptation—This proposal would establish an insurance pool to pay for adaptation costs in developing countries, financed by a levy on emissions trading.

South-North Dialogue—This proposal addresses the adaptation issue in a comprehensive manner, including through research and development; capacity building; the provision of adequate and predictable revenue streams based on the polluter pays principle; and insurance schemes, possibly through public-private partnerships.

Implementation and Compliance

Few proposals address issues of implementation and compliance. One exception is the *Safety Valve with Buyer Liability* approach, which proposes a system of buyer liability as a way of creating stronger incentives for compliance. On the one hand, countries that buy allowances through emissions trading would have an incentive to ensure that these allowances represent real emission reductions; on the other hand, countries that sell allowances would have an incentive to develop internal safeguards that assure their compliance, so that the value of their allowances does not go down. The *Long-Term Permit Program* proposal also attempts to create incentives for compliance by creating a valuable financial asset (long-term permits) whose value would depend on the integrity of the compliance system, and whose owners would therefore constitute a strong lobby for effective compliance measures. Several proposals suggest the possibility of trade measures against non-complying or non-participating states, including the *Hybrid International Emissions Trading*, the *Dual Track*, and the *Harmonized Carbon Taxes* proposals. The *Technology-Centered Approach* seeks to address compliance through technology agreements that are self-enforcing.

IV. Summaries of Proposals[5]

Ability to Pay

SUMMARY / RATIONALE: Modification of the current Kyoto architecture to address the problem of burden sharing over time. Proposes three new policy elements: (1) imposition of a long-term emissions constraint to connect near-term emission reductions to the regime's long-term objective; (2) ability to pay (as measured by per capita GDP) serves as the graduation criterion for assumption of targets by developing countries and the burden-sharing formula for allocating national targets; and (3) rolling baselines for emission targets.

FORUM: UNFCCC.

TIME FRAME: Seeks to modify the Kyoto Framework to achieve a viable long-term policy architecture.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets, with international emissions trading. For developed countries, absolute, binding near-term emissions reduction targets with rolling baselines. For developing countries, initial targets aimed at reducing rate of emissions increase.
- **Technology:** R & D effort among wealthy developed states to produce new technologies to make deep emission reductions.

Differentiation: Based on ability to pay, as measured by GDP per capita.

Allocation / Burden-Sharing Approach: Targets allocated based on GDP per capita.

Graduation criteria: Developing countries graduate to binding emission targets when they reach a pre-determined per capita GDP threshold.

PROPOSED BY: Jacoby et al.

SOURCES:

(1) Jacoby, H., R. Schmalensee, and I. Wing. "Toward a Useful Architecture for Climate Change Negotiations," Report No. 49, MIT Joint Program on the Science and Policy of Global Change, May 1999.

(2) Jacoby, H.D., R. Prinn, and R. Schmalensee. "Kyoto's Unfinished Business," *Foreign Affairs* 77 (July-August 1998): 54-66.

Agreed Domestic Carbon Taxes

SUMMARY / RATIONALE: Alternative type of mitigation commitment, focusing on agreed actions—in particular, an agreed domestic carbon tax—rather than on binding national emission targets.

FORUM: Not specified, but proposed as an alternative to Kyoto.

TIME FRAME: Indefinite.

MITIGATION COMMITMENTS

Types of Commitments:

- **PAMs:** Countries agree to a common tax on fossil fuels based on their carbon content (with possible exemptions for fossil fuel uses that do not emit CO_2, such as the production of some plastics). Could be extended to include methane at a later stage. Tax rate adjustable up or down at regular intervals (e.g., 5 or 10 years), as new scientific information becomes available and as the tax's effectiveness in reducing emissions is assessed. Developing countries might be given additional time to phase in the carbon tax.

Differentiation: Applicable to all countries, although developing countries might be given more time to phase in a carbon tax.

Graduation criteria: Not applicable, assuming regime is global. If developed countries decide to go ahead with a carbon tax on their own, developing countries could join in when their income and emissions increase.

ADAPTATION: Notes the need for contingency planning about how best to adapt to more serious climate change.

INSTITUTIONAL ARRANGEMENTS

New institutions: Not addressed, although implementation would be primarily at the national level.

IMPLEMENTATION

Compliance: The International Monetary Fund could help monitor compliance by examining a country's energy revenues as part of its annual consultations with countries concerning macroeconomic policies.

OTHER ELEMENTS: Some revenue from the carbon tax might go to the international community for refugee and peacekeeping operations and to developing countries for economic assistance.

PROPOSED BY: Richard Cooper

SOURCES:

(1) Cooper, R. "Toward a Real Treaty on Global Warming," *Foreign Affairs* 77: 66-79, 1998.

(2) Cooper, R. "The Kyoto Protocol: A Flawed Concept," *Environmental Law Reporter* 31: 11,484-11,492, 2001.

Bottom-Up

SUMMARY / RATIONALE: Bottom-up, country-driven approach to defining national commitments. Instead of top-down, international negotiation of national emission targets, each country would determine for itself, from the bottom-up, what might be technically, economically, socially and politically acceptable in light of its own national circumstances. In a process analogous to trade negotiations, each country would put its offer of commitments on the negotiating table and invite proposals from other countries for similar commitments. The negotiations would result in a package of commitments by each country that could include domestic or international actions of a short- or long-term nature. Components could include: a national emissions target, domestic policies and measures (PAMs), investments in emissions mitigation in other countries, technology transfer, financial contributions, adaptation measures, and so forth. Countries would seek to reach a point where the balance of commitments among all countries was generally comparable, taking into account differing national circumstances.

FORUM: UNFCCC.

TIME FRAME: Short-term. Could be utilized for the Kyoto Protocol's second commitment period (2013–2017).

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Commitments package could include a national emission target, with an illustrative package of PAMs that might reasonably be expected to meet the target.
- **PAMs:** Commitments package could include a package of PAMs, with a projection of the expected emission reductions resulting from these PAMs.
- **Financial:** Commitments package could include commitments to transfer financial or technological resources.
- **Technology:** Commitments package could include long-term commitments to promote technology development.
- **Pledge-based:** Countries would pledge a package of commitments appropriate to their national circumstances.

Differentiation: Each country's commitment would reflect its national circumstances.

Allocation / Burden-Sharing Approach: Negotiations would achieve an outcome only if all participants viewed the overall result as balanced and fair.

ADAPTATION: Commitments could be directed at adaptation.

PROPOSED BY: Robert A. Reinstein

SOURCE: Reinstein, Robert A. "A Possible Way Forward on Climate Change," in *Mitigation and Adaptation Strategies* 9: 295-309, 2004.

Brazilian Proposal

SUMMARY / RATIONALE: Burden-sharing approach based on historical responsibility for temperature change. As originally proposed during the Kyoto Protocol negotiations, the Brazilian proposal called on Annex I countries as a bloc to reduce their GHG emissions by 30 percent below 1990 levels by 2020, and set forth a methodology for allocating emission reduction burdens among countries based on their relative responsibility for global temperature increase. The proposal also included a new Clean Development Fund (CDF) (which became the CDM in the Kyoto Protocol), into which developed countries would be required to contribute if they did not meet their emission target (at a rate of $10/ton), and which would be used primarily to fund clean development projects in developing countries (with a small share for adaptation projects). Since Kyoto, the "Brazilian proposal" has come to refer to burden sharing based on historical responsibility for temperature change.

FORUM: UNFCCC.

TIME FRAME: Long-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Emission reduction targets based on historical responsibility for existing temperature change. Not compatible with growth targets, since burden-sharing methodology yields absolute emissions reduction targets.

Differentiation: Although the Brazilian proposal originally focused only on developed country mitigation commitments, its burden-sharing methodology could potentially be applied to determine the emission reduction commitments of all countries.

Allocation / Burden-Sharing Approach: Emission allowances allocated based on historical responsibility for human-induced temperature change. Parties mutually agree to apply a particular climate model to estimate each country's historical contribution to temperature change.

ADAPTATION: Original pre-Kyoto proposal provided that up to 10 percent of the Clean Development Fund could be used to finance adaptation projects in developing countries

INSTITUTIONAL ARRANGEMENTS

New institutions: Original proposal would have created a Clean Development Fund within the Global Environment Facility to fund emission mitigation activities by developing countries.

IMPLEMENTATION

Compliance: Original proposal involved financial penalty of US$10 for each ton of CO_2 emissions exceeding the target, to be paid into the Clean Development Fund.

PROPOSED BY: Luiz Gylvan Meira Filho and José Domingos Gonzalez Miguez with Luiz Pinguelli-Rosa

SOURCES:

(1) Brazilian Ministry of Science and Technology. "Technical Note on the Time-Dependent Relationship Between Emissions of Greenhouse Gases and Climate Change," January 2000.

(2) Proposed Elements of a Protocol to the United Nations Framework Convention on Climate Change. Presented by Brazil in response to the Berlin Mandate.

Broad but Shallow Beginning

SUMMARY / RATIONALE: The climate regime should start with a broad but shallow approach, focusing on policies that are inexpensive and poli
countrie
to estab
inevitably, change."

FORUM: Not specified. Could be undertaken under the UNFCCC or as a new regime.

TIME FRAME: Focuses on short-term goal of getting a system up and running now, which can effectively address the climate change problem over the longer term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets, with international emissions trading. Targets not burdensome initially, in order to encourage maximum participation. Compliance with targets is evaluated *ex ante* in terms of whether domestic climate policies are likely to meet the target, rather than *ex post* by looking at actual emissions.
- **PAMs:** Participating states have flexibility in their choice of domestic emissions control policies, but need to demonstrate *ex ante* that their policies will likely meet their target.
- **Pledge-based:** In essence, countries pledge a set of domestic climate policies aimed at meeting their national emission target (for example, an emissions trading scheme or a carbon tax), with international review.

Differentiation: Same regime applicable to all countries.

IMPLEMENTATION

Compliance: Governments held accountable for current policies rather than for past emissions. International public opinion the main enforcement agent for the foreseeable future, so public opinion should be informed by audits of national emissions forecasts.

PROPOSED BY: Richard Schmalensee

SOURCE: Schmalensee, Richard. "Greenhouse Policy Architecture and Institutions," MIT Joint Program on the Science and Policy of Climate Change, Cambridge, MA, 1996. See http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt13.pdf.

Climate Marshall Plan

SUMMARY / RATIONALE: Alternative approach to mitigation, focusing on the inputs of climate policy (policies, programs, taxes, subsidies, regulations, investments, R & D, and so forth), rather than on the outputs (emissions). Climate Marshall Plan provides a possible model for how national policies could be coordinated and burdens shared, based on "multilateral reciprocal scrutiny" among states rather than on any formal quantitative criterion.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** None. Targets are inherently flawed, since governments cannot predict the impact of their policies on emissions.
- **PAMs:** States should commit to actions (policies and measures) rather than to results.
- **Financial:** Developed countries should make financial contributions to an institution that would help finance energy-efficient and decarbonized technologies in the developing world.
- **Technology:** Significant increase in R & D needed.
- **Pledge-based:** Compatible with pledge-based approach.

Differentiation: Not addressed, although proposal seems to suggest differentiating between "rich" and other countries.

Allocation / Burden-Sharing Approach: Rather than develop quantitative allocation criteria, the climate regime should rely on more open-ended, pragmatic modes of discourse about how to share the benefits and burdens of climate regime.

IMPLEMENTATION

Compliance: A coercive compliance system is not feasible, so the regime must concentrate on how to achieve cooperation based on reciprocal scrutiny and cross-examination among states of each other's proposals.

PROPOSED BY: Thomas Schelling

SOURCES:

(1) Schelling, T.C. "The Cost of Combating Global Warming; Facing the Tradeoffs," *Foreign Affairs* (November/December 1997).

(2) Schelling, T.C. "What Makes Greenhouse Sense? Time to Rethink the Kyoto Protocol," *Foreign Affairs* (May/June 2002).

Contraction and Convergence

SUMMARY / RATIONALE: Long-term pathway for evolution of the climate regime, reflecting principle that national GHG emissions should converge at a common per capita level. Involves two steps: (1) specification of a global emissions budget leading to an agreed long-term concentration level ("contraction"); (2) sharing of emission entitlements among countries so that per capita emissions converge by an agreed year ("convergence").

FORUM: UNFCCC. Negotiations principally between regions of the world, with further negotiations within regions.

TIME FRAME: Long-term. Countries would agree on a "safe" level of atmospheric GHG concentrations (no higher than 450 ppm CO_2 equivalent) and a "full-term" (100-year) emissions budget consistent with that goal.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Each country would receive a share of the overall full-term emissions budget, in the form of tradable "entitlements" to emit. Inter-regional, international and intra-national trading of entitlements would be encouraged.

Differentiation: Applies to all countries.

Allocation / Burden-Sharing Approach: The full-term emissions budget would be allocated among regions based on a negotiated rate of linear convergence to equal shares per capita globally by an agreed date, such as 2030 or 2040. Further negotiations would be held within regions to determine national emission budgets.

OTHER ELEMENTS: Rates of contraction and convergence to be periodically revised to reflect improved scientific and economic understanding.

PROPOSED BY: Aubrey Meyer, Global Commons Institute

SOURCE: Global Commons Institute. See "C&C text in 13 Languages" at www.gci.org.uk.

Converging Markets

SUMMARY / RATIONALE: Scenario for the emergence of a liquid international carbon market, through integration of currently fragmented national emissions trading systems. Integration would begin with bilateral negotiations, tailor-made for individual countries and sectors. Over time, states seeking to join the trading regime might first be admitted as candidate countries, with an emissions cap on selected installations or sectors and partial reporting, and eventually join the core group by assuming a broad emissions cap and national reporting.

FORUM: Bilateral negotiations among countries with domestic carbon markets as a second-tier of negotiations separate from the UNFCCC process. As more states join the international emissions trading system, it could be reintegrated into the UNFCCC process.

TIME FRAME: Short to medium-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** To gain full admission into the emissions trading group, countries would need to accept mandatory national emissions targets. The targets could be economy-wide or sectoral (if only certain sectors seek to participate in the emissions trading system) and could be either absolute or dynamic.
- **Financial:** Financial assistance might be provided to candidate countries, as part of the process by which they assume emissions targets.
- **Other:** Participating countries would need to establish reliable inventories and registries for sectors that participate in emissions trading.

Differentiation: Candidate countries and core countries. In contrast to top-down, one-size-fits-all global negotiations, negotiations among a smaller group of countries could result in significant differentiation in the rights and duties of individual countries, including different types and levels of targets, different reporting requirements, different compliance systems, and different voting rights.

Allocation / Burden-Sharing Approach: Not applicable. National emission targets would develop in ad hoc way, though bilateral and multilateral negotiations.

Graduation criteria: Countries could join the trading regime through a multistage process, beginning with candidate status. Accession agreements would contain schedules of commitments regarding GHG emissions reporting, reductions and trading, as well as specific rights and access to coordinated support measures.

INSTITUTIONAL ARRANGEMENTS

New institutions: Not specified. As countries take on stronger commitments over time they will enjoy greater voting rights.

IMPLEMENTATION

Compliance: To participate in the international emissions trading market, states need to demonstrate that they have a strong domestic compliance system.

OTHER ELEMENTS: Participation and voting rights could be differentiated based on the stake of different actors. Countries with mandatory emission targets would have greater voting rights than candidate countries.

PROPOSED BY: Kristian Tangen and Henrik Hasselknippe

SOURCE: Tangen, K. and H. Hasselknippe. "Converging Markets," Fridtjof Nansen Institute, paper published under the FNI/CRIEPI/HWWA/CASS Post-2012 Policy Scenarios Project (draft), 2003.

Domestic Hybrid Trading Schemes

SUMMARY / RATIONALE: Alternative type of mitigation commitment: instead of emissions targets and international emissions trading, states agree to establish harmonized domestic trading systems, each with a safety valve at an internationally negotiated price to provide greater cost certainty and to ensure that countries pay the same price for emitting carbon.

FORUM: UNFCCC. Could eventually merge with the Kyoto system, although likely to stay separate.

TIME FRAME: Characterized as an early action policy but also sets a long-term goal for emissions.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** No fixed national emission targets. Countries are given an initial allocation of emission endowments, which generate annual emission permits.
- **PAMs:** Domestic emissions trading system involving two tradable commodities: (1) *annual emission permits*, which are required to emit a unit of carbon annually; (2) *emission endowments*, which generate an emission permit for its owner each year.[6] Each country would receive a once-only allocation of emission endowments: Annex I countries would receive emission endowments equal to their Kyoto Protocol targets; developing countries would receive emission endowments in excess of their current emissions, reflecting their need for future emissions growth (thus ensuring that, in the short term, they have surplus emission permits and their domestic trading price is zero). Emission endowments would trade freely, at a price that reflects expectations about the future price path of emission permits. (The higher the price of emission permits in the future, the more valuable the emission endowments that generate an ongoing stream of permits over time.) In contrast, the price of emission permits would be controlled, to ensure that abatement costs at any given time are predictable and reasonable. If national emissions exceed a country's emission endowments (and hence exceed the annual emission permits generated by those endowments), the government would sell additional permits at a predetermined, internationally agreed price (as in the safety valve proposals). The UNFCCC Conference of the Parties (COP) would renegotiate the emission permit price every ten years.

Differentiation: Developed and developing countries. Developed countries would receive emissions endowments based on their
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in developing country emission trading markets could trade for no more than the safety valve price, but could trade for less).

INSTITUTIONAL ARRANGEMENTS

New institutions: No new international institutions required. All the new institutions required would be at the national level, to administer the national trading programs.

IMPLEMENTATION

Compliance: Monitoring and enforcement takes place at the domestic level. At the international level, countries report on total emissions and sales of permits.

OTHER ELEMENTS: Reducing global emissions below the initial allocation of emission endowments would require the creation of an international mechanism to buy back and retire emission endowments.

PROPOSED BY: Warwick McKibbin and Peter Wilcoxen

SOURCES:

(1) McKibbin, W. and P. Wilcoxen. "Climate Change Policy After Kyoto: Blueprint for a Realistic Approach," Brookings Institution Press, 2002.

(2) McKibbin, W. "Moving Beyond Kyoto," The Brookings Institution Policy Brief No. 66, October 2000.

(3) McKibbin, W. and P. Wilcoxen. "Salvaging the Kyoto Climate Negotiations," Brookings Institution, Policy Brief No. 27, November 1997.

Dual Intensity Targets

SUMMARY / RATIONALE: Alternative type of target for developing countries, which would be more attractive than absolute, binding, Kyoto-style targets. Developing countries would each have two carbon intensity targets: a relatively stringent but non-legally binding "trading" target, and a relatively weak, legally binding "compliance" target.

FORUM: Not specified, but compatible with UNFCCC/Kyoto Protocol framework.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Two carbon-intensity targets for each developing country: (1) a relatively weak "compliance" target, which a country would be required to meet for compliance purposes, and (2) a more stringent "selling" target, which would not be legally binding but would enable a country that emits below the target to sell the surplus without the danger of creating tropical "hot air." The authors note the benefits of expressing GDP in terms of domestic currency.
- **Pledge-based:** Compatible with a pledge-based approach, under which countries pledge their own compliance target.

Differentiation: Developed and developing countries. Dual intensity targets are an option only for developing countries.

Allocation / Burden-Sharing Approach: Formula for setting targets is not specified. Proposal notes that it is compatible with a variety of allocation formulas.

OTHER ELEMENTS: As with all dynamic targets, the failure to define maximum permissible emissions *ex ante* creates implementation challenges for emissions trading. The authors note two ways to enable trading with dynamic targets: (1) a post-verification trading system whereby transfers take place after emissions and GDP are verified, and (2) determining a country's allowable emissions just prior to the commitment period based on GDP projections that are updated annually and reconciled at the end of the period.

PROPOSED BY: Yong-Gun Kim and Kevin A. Baumert

SOURCE: Kim, Yong-Gun and Kevin A. Baumert. "Reducing Uncertainty Through Dual-Intensity Targets," in *Building on the Kyoto Protocol: Options for Protecting the Climate*, Kevin A. Baumert with Odile Blanchard, Silvia Llosa, and James F. Perkaus (Eds.), World Resources Institute, Washington, D.C., October 2002.

Dual Track

SUMMARY / RATIONALE: Comprehensive architecture for the post-2012 period aimed at increasing incentives to participate by allowing countries to choose between target-based approach or PAMs-based approach. Incorporates a "national interest" perspective, in which each country takes action for its own sake, as well as the "global commons" perspective of the Kyoto Protocol. Gives countries a choice between two tracks: a pledge of domestic policies and measures, aimed at achieving a non-binding emissions target (Track A) (reflecting the "national interest" perspective); or a binding emissions target with full participation in international emissions trading (Track B) (reflecting the "global commons" perspective).

FORUM: Kyoto Protocol negotiations.

TIME FRAME: Short-term (post-2012 period). Duration not specified.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Participating states given a choice between two types of targets, (A) non-binding emission goals, which they would aim to achieve through a detailed list of PAMs; and (B) legally binding national emission targets, which would allow them to participate fully in international emissions trading. Under Track A, countries are allowed to sell allowances if they reduce emissions below their non-binding target. Under Track B, countries are able to purchase additional allowances at a "safety valve" price, with the proceeds going to an Emission Mitigation Fund to assist developing countries.
- **PAMs:** PAMs listed in an Annex, possibly with different levels of tax rates and standards specified for developing countries. Countries opting for a non-binding emission target under Track A must submit a list of PAMs that they would pledge to implement.
- **Financial:** Country contributions to an Adaptation Fund, based on historical responsibility for climate change.
- **Pledge-based:** Track A PAMs essentially pledge-based.

Differentiation: Developed and developing countries.

Allocation / Burden-Sharing Approach: Emission targets based on specified reductions from business-as-usual scenarios. Reduction rates higher for developed than developing countries, but no rates or allocation formula specified.

ADAPTATION: Retains the Kyoto Protocol's Adaptation Fund, financed by a share of the proceeds of the Clean Development Mechanism (CDM) as well as by country contributions based on historical responsibility, determined by the Brazilian Proposal.

IMPLEMENTATION

Compliance: Penalties would apply to Track A countries only if implementation of PAMs were determined to be "excessively" (threshold undefined) insufficient to achieve the emissions goal. Track B countries subject to financial penalties for non-compliance at a rate slightly higher than the safety valve level. Participating states may impose tariffs on imported goods from non-Parties, if such goods do not fulfill the standards and policies in the PAMs list.

OTHER ELEMENTS: Double trigger for entry into force, requiring ratification by the five largest world emitters (U.S., China, Russia, Japan, and India, or EU if considered as a single party), as well as by parties accounting for 65 percent of global emissions.

PROPOSED BY: Yasuko Kameyama

SOURCE: Kameyama, Yasuko. "Maximizing Incentives Through Dual Track Approach—A Proposal for a Comprehensive Framework for Climate Regime Beyond 2012," in Climate Regime Beyond 2012: Incentives for Global Participation, National Institute for Environmental Studies and Institute for Global Environmental Strategies Joint Research Report, December 2003.

Equal Mitigation Costs

SUMMARY / RATIONALE: This approach would allocate emission reduction obligations so that they entail the same percentage reduction in GDP for all countries. Countries agree on a single economic model to calculate the inferred costs of reduction targets *ex ante*.

TIME FRAME: Indefinite.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Form of target not specified
- **Other:** Countries need to agree on an economic model to calculate inferred costs of the targets *ex ante*.

Allocation formula: Target set so as to equalize mitigation costs between countries.

PROPOSED BY: Mustafa J. Babiker and Richard S. Eckaus

SOURCE: Babiker, M. and R. Eckaus. "Rethinking the Kyoto Targets," MIT Joint Program on the Science and Policy of Global Change, Report No. 65, August 2000.

Expanded "Common but Differentiated"

SUMMARY / RATIONALE: Allocation of national emission targets on a per capita basis with a transitional regime for Annex I countries for the period until 2025 to reduce the severity of the emission reductions required.

FORUM: Not specified. Compatible with UNFCCC / Kyoto Protocol.

TIME FRAME: Long-term allocation formula, with a transitional regime for the period until 2025.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Absolute national emission targets for all countries.

Differentiation: During transition period through 2025, differentiation between developed and developing countries. Developing country targets determined on a per capita basis, allowing increased emissions in all developing countries except South Korea, Saudi Arabia, Singapore, and United Arab Emirates. Developed countries given specific targets—for 2010, a 5 percent reduction from 1990 levels and, for 2025, a 25 percent reduction from 1990 levels, with adjustments up or down based on a country's carbon intensity. (If an Annex I country's carbon intensity is lower than the Annex I average, its target reduction would be adjusted downward; if its carbon intensity is higher than the Annex I average, its target reduction would be increased.)

Allocation / Burden-Sharing Approach: Global emissions level for each commitment period calculated based on an agreed emission trajectory to achieve a specified atmospheric concentration level (for example, 550 ppm CO_2). Global emissions allocated to countries on a per capita basis, except during transitional period. Per capita allocation would initially give most developing countries surplus allowances that they could sell to Annex I countries.

INSTITUTIONAL ARRANGEMENTS

New institutions: Global regulatory agency that can impose penalties on countries that do not achieve their emissions targets.

IMPLEMENTATION

Compliance: Heavy penalties for non-compliance with emissions targets.

PROPOSED BY: Sujata Gupta and Preety Bhandari

SOURCE: Gupta, Sujata and Preety Bhandari. "An effective allocation criterion for CO_2 emissions," Energy Policy 27 (1999): 727-736, Elsevier.

Further Differentiation

SUMMARY / RATIONALE: Comprehensive survey of mitigation options, suggesting pathway for evolution of Kyoto commitments into a global regime.

FORUM: Kyoto Protocol negotiations.

TIME FRAME: Focuses on short- to medium-term emissions targets (for second and third commitment periods), which keep future options open, rather than on a long-term concentration target.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Different types of national emission targets for different groups of countries: binding, absolute targets for developed countries; binding indexed targets for wealthier developing countries; non-binding fixed (or no targets) for the least developing countries. Dynamic targets, price caps, or deferred targets could be accommodated within the Kyoto model and are viable.
- **PAMs:** None specified. Notes that PAMs commitments would represent a substantial departure from the Kyoto Protocol framework.
- **Technology:** Notes that technology standards would represent a substantial departure from the Kyoto approach.
- **Pledge-based:** Possibility of pledge-based, voluntary targets for least developed countries.

Differentiation: Differentiation based on wealth and opportunity to reduce emissions (as measured by carbon intensity levels). Three categories of countries in the second commitment period—developed countries, wealthier developing countries, and least developed countries—and four categories in the third commitment period.

Allocation / Burden-Sharing Approach: No single approach or indicator is likely to form the basis of a future global agreement, but per capita emissions will be a key indicator in evaluating fairness and environmental effectiveness.

Graduation criteria: None specified, but implies that graduation will be based on a combination of criteria, including opportunity (as measured by energy intensity), capacity (as measured by per capita GDP) and responsibility (as measured by historical, current or future emissions).

PROPOSED BY: Swedish Environmental Protection Agency

SOURCE: Swedish Environmental Protection Agency. "Kyoto and Beyond, Issues and Options in the Global Response to Climate Change," Naturvårdsverket, November 2002.

Global Framework: Kyoto, Decarbonization, and Adaptation

SUMMARY / RATIONALE: Comprehensive institutional architecture, involving three parallel, inter-linked commitment tracks: (1) a Kyoto track, involving legally-binding absolute emission targets; (2) a decarbonization track, financed by developed countries and involving the large, developing-country emitters, to introduce clean technologies in developing countries and allow them to follow a low carbon development path; and (3) an adaptation track, to provide resources to the most vulnerable regions. As the income and emissions levels of developing countries increase, they graduate first from the decarbonization to the Kyoto track and then, within the Kyoto track, from a stabilization to a reduction target.

FORUM: UNFCCC and Kyoto Protocol.

TIME FRAME: Long-term pathway to global commitments.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Like the *Multistage* approach, three levels of national emission targets: (1) carbon intensity targets for developing countries in the decarbonization track; (2) a legally binding stabilization target for developing countries when they first graduate into the Kyoto track; and (3) legally binding absolute emissions reductions targets for Annex I countries, as well as for developing countries after they have been in the Kyoto track for an agreed period of time (for example, 5 or 10 years). For the second commitment period, only a relatively small number of wealthy developing countries would graduate into the Kyoto track. Targets should be comprehensive, including all sources (e.g., bunker fuels) and gases, and should aim to keep global temperature increases below 2°C.
- **PAMs:** Developing countries in the decarbonization track should adopt "no regrets" measures as a matter of priority—for example, sustainable development PAMs.
- **Financial:** Provision of financial and technical assistance by industrialized countries for the decarbonization and adaptation tracks (including compensation to vulnerable countries for climate change damages).
- **Pledge-based:** Sustainable development PAMs for countries in decarbonization track essentially pledge-based.

Differentiation: Three general categories of countries: (1) Kyoto track countries (including developed countries and developing countries satisfying agreed graduation criteria); (2) decarbonization track countries (including the developing countries that are big emitters); and (3) least developed countries (these countries might be in the adaptation track, but not in the Kyoto or decarbonization tracks). For the second commitment period, Kyoto track countries would include only a relatively small number of developing countries at the upper end of the income range.

Allocation / Burden-Sharing Approach: Emission reduction targets for Kyoto track countries set with "strong reference" to the need for convergence of per capita emissions. Target levels might also take account of other equity criteria, including historical responsibility and ability to pay, as well as of specific domestic circumstances.

Graduation criteria: Graduation from the decarbonization to the Kyoto track based on a combination of criteria including per capita emissions, ability or capacity to act, and historical responsibility. Within the Kyoto track, advancement from stabilization to reduction happens automatically after an agreed number of years.

ADAPTATION: Adaptation track designed to help vulnerable countries, including small island developing states, limit the unavoidable effects of climate change, including through the provision of compensation by industrialized countries. Existing elements of the UNFCCC/Kyoto Protocol system would form part of the adaptation track, including the Adaptation, Least-Developed Countries, and Special Climate Change Funds.

OTHER ELEMENTS: To keep global temperature increases below 2°C, current Annex B countries will need to reduce emissions by
60
by the 2050s.

PROPOSED BY: Climate Action Network International

SOURCE: "A Viable Global Framework for Preventing Dangerous Climate Change," CAN Discussion paper, COP9, Milan, Italy, December 2003.

Global Preference Score

SUMMARY / RATIONALE: Procedurally based approach to burden sharing. Seeks to articulate a fair and transparent procedure to determine the formula for allocating climate change mitigation efforts. All countries would rank competing proposals about how to allocate emission targets (for example, based on population, grandfathering, or ability to pay). These country preferences would be weighted by population and then aggregated arithmetically. The result would be a compromise outcome that incorporates every country's preferences, rather than choosing winners and losers.

MITIGATION COMMITMENTS

Allocation / Burden-Sharing Approach: Based on arithmetical aggregation of individual country preferences regarding fair allocations.

PROPOSED BY: Benito Müller

SOURCES:

(1) Müller, B. "A Fair Compromise in a Morally Complex World," Pew Center Conference on Equity and Global Climate Change, April 2001.

(2) Müller, B. "Justice in Global Warming Negotiations: How to Obtain a Procedurally Fair Compromise," Oxford Institute for Energy Studies, EV26, October 1999.

Global Triptych / Extended Global Triptych

SUMMARY / RATIONALE: Sectorally and technologically oriented methodology for differentiating national emission targets. Originally developed in the context of internal EU negotiations about allocation of the EU's Kyoto target among member states. Calculates bottom-up, technological opportunities to reduce emissions in various sectors, taking into account different technological starting points of countries. The title "triptych" reflects the original proposal's focus on CO_2 emissions in three broad sectors: the power sector, energy-intensive industries and the "domestic" sectors (including the residential sector and transportation). The *Extended Global Triptych* approach also includes methane, N_2O and CO_2 from forestry.

TIME FRAME: Short- to medium-term. Considers two time horizons: emission targets for 2020, and long-term sustainability targets for 2050.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Absolute national emission targets, ranging from -30 percent to +200 percent from 1995 levels by 2020. Target levels consistent with stabilizing atmospheric concentrations of GHGs at 550 ppm CO_2Eq.

Differentiation: Differentiation into thirteen world regions, including both developed and developing countries.

Allocation / Burden-Sharing Approach: Sector-based approach. National targets are determined by adding together sectoral emission allowances, which are calculated differently for each sector. For example, emissions from the domestic sector are assumed to converge at a common per capita level, based on convergence of living standards; emission targets for energy-intensive industries reflect defined levels of efficiency improvements.

IMPLEMENTATION

Compliance: Only compliance with the national target is assessed, not compliance with the sectoral targets used to calculate the national targets.

PROPOSED BY:

Global Triptych: Groenenberg et al.

Extended Global Triptych: Ecofys

SOURCES:

(1) *Global Triptych*: Groenenberg, Heleen, Kornelis Blok, and Jeroen van der Sluijs. "Global Triptych: a bottom-up approach for the differentiation of commitments under the Climate Convention," Copernicus Institute, Utrecht, The Netherlands.

(2) *Extended Global Triptych*: Höhne, Niklas, Carolina Galleguillos, Kornelis Blok, Jochen Harnisch, and Dian Phylipsen. "Evolution of commitments under the UNFCCC: Involving newly industrialized economies and developing countries," Environmental Research of the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Research Report 201 41 255, UBA-FB 000412, ECOFYS GmbH, 2003.

Graduation and Deepening

SUMMARY / RATIONALE: Ambitious scenario for the Kyoto Protocol second commitment period, involving emission targets for developing countries whose combined per capita emissions and per capita income (weighted equally) pass an agreed graduation threshold.

FORUM: Kyoto Protocol.

TIME FRAME: Focuses on second commitment period (2013–2017).

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Absolute national emission targets, with international emissions trading. Annex B countries grouped into three categories, with different reduction targets (-12 percent, -6 percent, and -3 percent).[7] Developing countries that cross defined graduation thresholds assume absolute targets (with 2012 serving as the base year), with target stringency a function of per capita emissions, per capita GDP and institutional affiliations. Developing countries that are big emitters (i.e., emit more than 50 million tons CO_2) but do not graduate into absolute national targets could choose between an *ex ante* intensity target with emissions trading, or use of countrywide, policies and measures CDM. Targets would address six Kyoto gases as well as precursors of tropospheric ozone. In addition, intensity targets would be developed for international transport (bunker fuels).
- **Financial:** Financial contributions to assist LDCs adapt to negative economic, social, and ecological impacts of climate change.
- **Pledge-based:** Developing countries without emission targets could pledge to implement PAMs.

Differentiation: Differentiation of developing countries into "four circles," with different emission targets, based on a "graduation index" (GI) equally weighted between per capita emissions (reflecting polluter pays principle) and per capita GDP (reflecting ability to pay). Initially, GI of each Annex B country is calculated. Developing country targets depend on how their GI compares to that of Annex B countries: (1) developing countries with a GI higher than the Annex B average would receive the same reduction target as the average Annex B country, i.e., minus 6 percent, with a 2012 base year; (2) developing countries with a GI below the Annex B average but above the lowest OECD (Annex II) country would receive a target equivalent to the least stringent Annex B reduction target, i.e., minus 3 percent; (3) developing countries whose GI is below the lowest OECD country but above the lowest Annex B country would receive a stabilization target; (4) developing countries with a GI below the lowest Annex B country (or that are International Development Association (IDA) or food aid recipients) would not have any binding target. Developing countries in this last category, whose emissions are greater than 50 million tons, would be listed in a special annex and could either adopt an *ex ante* intensity target or engage in countrywide CDM (in essence, a no lose target).

Allocation / Burden-Sharing Approach: Stringency of national targets is a function of per capita emissions and per capita GDP, resulting in a process of contraction and convergence.

Graduation criteria: Quantitative GI based on per capita GDP and per capita emissions, supplemented by overall emissions (for big emitters) and institutional criteria. (For example, members of the EU, OECD or IEA would automatically be classified as Annex B countries, while IDA or food aid recipients would be exempt from any targets.) Developing countries would receive targets when their GI rises above the GI of the lowest Annex B country. Graduating countries that refuse to accept a target would lose any funding under the UNFCCC.

ADAPTATION: LDCs would receive funds for adaptation to negative environmental, economic and social impacts of climate change.

INSTITUTIONAL ARRANGEMENTS

New institutions: Expert review teams would calculate BAU emissions for 2012 for Annex B countries that are currently sources of hot air.

IMPLEMENTATION

Compliance: Generally not addressed. If a country passes the graduation threshold without taking a target, it would be excluded from the mechanisms and from funding under the UNFCCC.

OTHER ELEMENTS: International agreement on an indicative concentration target of 550 ppm by the first half of the 21st century, with global emissions peaking before 2030. Second commitment period targets will include intensity targets for international transport (with the International Air Transport Association and International Maritime Organisation becoming parties to Kyoto). Global warming potentials (GWP) updated to reflect IPCC Third Assessment Report values.

PROPOSED BY: Michaelowa et al.

SOURCE: Michaelowa, Axel, Sonja Butzengeiger, and Martina Jung. "Graduation and Deepening: An ambitious post-2012 climate policy scenario," Hamburg Institute of International Economics, paper published under the FNI/CRIEPI/HWWA/CASS Post-2012 Policy Scenarios Project (draft), September 2003.

Growth Baselines

SUMMARY / RATIONALE: Alternative type of emissions target for developing countries, which might be more attractive than absolute, binding Kyoto-style targets. Rather than commit to an absolute cap on national emissions, developing countries would commit to a carbon intensity target, which would require them to reduce their greenhouse gas emissions per unit GDP.

FORUM: Not specified, but compatible with UNFCCC / Kyoto Protocol framework.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Carbon intensity targets for developing countries, specifying a required rate of improvement in emissions per unit GDP. Targets set at a level below BAU emissions but high enough so that the emission reductions could be achieved through no regrets or low cost measures. Initially, targets might be set only for emissions from industrial and utility sectors, since these are the two sectors with good emissions data and carbon intensity rates that can be strongly influenced by government policy and large capital investments emissions. Sale of unused allowances to developed countries would provide a source of revenue for developing countries.
- **Financial:** Proposal recognizes that developed countries will need to provide resources and technical support to ensure that developing countries can develop the institutions and capacity necessary to participate fully in emissions trading.

Differentiation: Different carbon intensity targets applicable to different groups of countries, based on their potential to make carbon efficiency improvements. COP would determine country groupings based on such factors as fuel mix, economic growth rate, and technology level. Proposal sets forth an illustrative listing of four categories of developing countries—those with a high, medium-high, medium and low no regrets potential. Initially, regime might apply only to the big emitters, i.e., the thirteen countries that account for over 90 percent of developing country emissions.

Allocation / Burden-Sharing Approach: Stricter targets for countries with greater potential to make carbon efficiency improvements.

Graduation criteria: If a big emitters approach is adopted, the COP would need to develop a graduation rule, requiring other countries to assume carbon intensity targets when their total emissions exceed a specified level.

IMPLEMENTATION

Compliance: Developing countries would need technical assistance from developed countries to develop the laws and institutions needed to participate fully in international emissions trading, including mechanisms to accurately quantify, monitor, verify and report on emissions.

PROPOSED BY: Hargrave et al.

SOURCE: Hargrave, Tim, Ned Helme, and Christine Vanderlan. "Growth Baselines," Center for Clean Air Policy, Washington, D.C., January 1998.

Harmonized Carbon Taxes

SUMMARY / RATIONALE: Alternative type of mitigation commitment, consisting of a harmonized carbon tax rather than an emissions target. Several rationales are advanced for harmonized carbon taxes over emission targets: a harmonized carbon tax would be more efficient and effective; it would provide certainty about marginal compliance costs (although the emissions reductions resulting from the carbon tax would be uncertain); and it would make those costs transparent.

TIME FRAME: Indefinite.

MITIGATION COMMITMENTS

Types of Commitments:

- **PAMs:** Countries agree to tax domestic carbon emissions at harmonized rates. Developing countries might receive incentives or financial transfers for adopting the harmonized tax.

Allocation / Burden-Sharing Approach: Burden sharing through financial transfers from developed to developing countries.

Graduation criteria: Countries would participate fully when they reach a per capita income threshold (e.g., $10,000).

Institutional arrangements

New institutions: Voting mechanism to set harmonized carbon price. One possible approach would be to have states vote on tax rates, weight their votes and then choose the median rate.

IMPLEMENTATION

Compliance: Modest sanctions initially for non-compliance. For example, international regime might allow states to levy countervailing duties on imports from non-complying or non-participating countries.

PROPOSED BY: William Nordhaus

SOURCES:

(1) Nordhaus, W. "After Kyoto: Alternative Mechanisms to Control Global Warming," paper prepared for a joint session of the American Economic Association and Association of Environmental and Resource Economists, 2001.

(2) Nordhaus, W. "Is the Kyoto Protocol a Dead Duck? Are There Any Live Ducks Around? Comparison of Alternative Global Tradable Emissions Regimes," revised from NBER/Yale Workshop version of August 1997, 1998.

Human Development Goals with Low Emissions

SUMMARY / RATIONALE: Aims at encouraging developing country commitments through a bottom-up, country-driven process that links climate change targets to human development goals. Sets emission targets at levels that would allow emissions to satisfy basic human needs, but would limit "luxury" or "excessive" emissions.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Three types of targets: (1) voluntary targets (set at the national or sectoral/project level), reflecting no regrets reductions that result from autonomous rate of energy efficiency improvements; (2) conditional commitments that depend on receipt of technology or financial assistance from developed countries; (3) obligatory commitments to restrict excessive and wasteful, "luxurious" emissions. Targets set through bottom-up, country-driven process, involving an assessment of a country's development goals, specification of general socio-economic and environmental targets, and identification of low carbon technology paths.
- **Financial:** Progressive taxation of "excessive" emissions: the higher the emissions, the higher the tax rate. Tax revenues would be used to finance low carbon development.
- **Pledge-based:** Bottom-up target-setting process, reflecting a country's self-assessment and self-interest.

Differentiation: Focuses on developing country participation, but the approach appears to be applicable to all countries.

Allocation / Burden-Sharing Approach: Countries can emit to meet basic human needs and meet development objectives. Emission limitations relate only to excessive/wasteful emissions.

IMPLEMENTATION

Compliance: The verification process includes *ex ante* provision of information, and *ex post* verification of voluntary, conditional, and/or obligatory emission reductions.

PROPOSED BY: Jiahua Pan

SOURCE: Pan, Jiahua. "Commitment to Human Development Goals with Low Emissions: An alternative to emissions caps for post-Kyoto from a developing country perspective," Research Centre for Sustainable Development, The Chinese Academy of Social Sciences, paper published under the FNI/CRIEPI/HWWA/CASS Post-2012 Policy Scenarios Project (draft), 2003. See http://www.fni.no/post2012/panjiahua_paper_draft.pdf.

Hybrid International Emissions Trading

SUMMARY / RATIONALE: Variant of the *Safety Valve* approach. Both national emission targets and the safety valve price would be negotiated multilaterally.

FORUM: Compatible with Kyoto Protocol framework.

TIME FRAME: Safety valve approach should be implemented in the near term. Over time, could evolve into a global carbon tax or a global emission target regime.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets, with international emissions trading. Compatible with different types of emissions targets, including fixed targets or indexed targets. Targets conditional on the price of allowances remaining below the safety valve level; if the safety valve price were reached and additional allowances issued, this would in effect relax the target. Developing country targets could be indexed or voluntary.
- **Financial:** Proceeds from the safety valve could be used for R & D or to assist developing countries.

Differentiation: Compatible with various differentiation criteria.

Allocation / Burden-Sharing Approach: Emission allowances distributed based on GDP.

INSTITUTIONAL ARRANGEMENTS

New institutions: Safety valve could be implemented by individual states or internationally. If the safety valve were implemented internationally, an international authority would be needed to issue the additional allowances and administer the proceeds.

IMPLEMENTATION

Compliance: Penalties for non-compliance could include social sanctions (e.g., boycotts), trade restrictions/sanctions, and withholding of financial assistance.

PROPOSED BY: Aldy et al.

SOURCE: Aldy, Joseph, Peter Orszag, and Joseph Stiglitz. "Climate Change: An Agenda for Global Action," Pew Timing Workshop, 2001. See http://www.pewclimate.org/docUploads/stiglitz%2Epdf.

Insurance for Adaptation Funded by Emissions Trading

SUMMARY / RATIONALE: Proposes establishment of mechanism for payments by emitting countries to countries that are adversely affected by climate change, in order to cover adaptation and damage costs.

FORUM: Unspecified.

TIME FRAME: Long-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Decentralized national or regional systems of tradable permits. Emission permits allocated to vulnerable states, which can sell the permits to emitting states in order to finance insurance pools to cover adaptation and damage costs.
- **Technology:** Initiatives to develop fuel cells and improve energy storage, possibly involving provision of matching funds and rewards for meeting specific targets.

ADAPTATION: Revenues from permit trading should be used to buy insurance for adaptation costs and damage compensation.

INSTITUTIONAL ARRANGEMENTS

New institutions: Insurance pools run by a private sector insurance company.

PROPOSED BY: Carlo Jaeger

SOURCE: Jaeger, Carlo C. "Climate Change: Combining Mitigation and Adaptation," in Michel, David (Ed.), *Climate Policy for the 21st Century: Meeting the Long-Term Challenge of Global Warming*, Washington, D.C., Center for Transatlantic Relations, 2003.

International Agreements on Energy Efficiency

SUMMARY / RATIONALE: Proposes, as part of the international climate change effort, negotiation of an international agreement on energy efficiency addressing the production process in major emitting industries. Such an agreement could complement the Kyoto Protocol and would aim at participation by the United States and major developing countries. In addition, states should develop international standards for appliance efficiency in the residential and transportation sectors.

FORUM: Not specified. Negotiations could take place under UNFCCC or separately.

MITIGATION COMMITMENTS

Types of Commitments:

- **PAMs:** Countries would develop energy efficiency standards for major appliances in the residential and transportation sectors, and would negotiate an international agreement establishing target efficiency levels for the production process in major emitting industries (iron and steel, petrochemicals, paper and pulp, non-ferrous metals, and non-metallic minerals).
- Establishment of a global research and development fund should be considered.

Differentiation: Not addressed, although the agreement would work even if only OECD countries, Russia and the three major developing countries (Brazil, China, and India) participated.

IMPLEMENTATION

Compliance: No penalties for non-compliance, but participating countries would have an incentive to improve energy efficiency in order to reduce their own costs.

OTHER ELEMENTS: To be effective, would require participation only by OECD countries, Russia, and the three major developing countries.

PROPOSED BY: Yasushi Ninomiya

SOURCE: Ninomiya, Yasushi. "Prospects for Energy Efficiency Improvement through an International Agreement," in Climate Regime Beyond 2012: Incentives for Global Participation, National Institute for Environmental Studies and the Institute for Global Environmental Strategies, December 2003.

Keep It Simple, Stupid (KISS)

SUMMARY / RATIONALE: Methodology for differentiating commitments, aimed at gradually involving developing countries in the
c
or stringency of targets, financial commitments). Only rich countries with medium and high emissions have significant obligations initially; low-income countries with emissions below a certain level have no significant obligations and instead are given priority for financial assistance.

TIME FRAME: Long-term, indefinite.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Three types of per capita emission targets—stabilization targets, reduction targets, and limitation targets (i.e., targets limiting the growth in per capita emissions)—applicable to different categories of countries.
- **PAMs:** All countries obliged to implement PAMs with respect to all non-CO_2 gases and sinks. Countries with high per capita emissions must spend a certain percentage annually (e.g., 0.01 percent) of total government expenditure on these PAMs. Countries in the middle emissions category have only a reporting obligation, while countries in the low emissions category do not have any reporting obligations.
- **Financial:** Financial obligation to provide certain percentage of GNP in assistance to lower income countries. Three levels of financial obligations, applicable to different categories of countries based on their income and emission levels.
- **Technology:** High and upper-high income countries with medium and high emission levels must transfer technology at a rate equivalent to a minimum percentage of national income.

Differentiation: Differentiation into 12 categories of countries, each with a different package of commitments, based on three criteria: GNP per capita (reflecting ability to pay principle), CO_2 emissions per capita (reflecting responsibility principle), and Human Development Index (HDI) (reflecting vulnerability principle). Countries classified into four categories of GNP per capita (least developed, middle income, high income, and upper-high income) and three levels of CO_2 emissions per capita (low, medium and high), yielding 12 combinations in total. In addition:

- HDI used to assess capacity of countries to adapt to climate change. Countries with high HDI deemed capable of taking adaptation action on their own, while those with low HDI require assistance.
- Countries with population over 75 million subject to some responsibilities for total emissions even if their per capita emissions are very low.
- Countries with total emissions of 80 million metric tons of industrial CO_2 monitored more closely than others.
- Countries with total emissions below 3 million metric tons addressed only in terms of assistance for adaptation.

Seven categories of mitigating factors and extenuating circumstances are identified that would allow countries to adjust the stringency of their commitments.

Allocation / Burden-Sharing Approach: Convergence on agreed per capita emissions level. Countries with current emissions above that level have an obligation to reduce emissions incrementally until agreed per capita emissions level reached, preferably within three to fo

Graduation criteria: Countries automatically graduate from one category to another as their per capita GNP or emissions per capita pass defined thresholds.

ADAPTATION: Adaptation assistance for countries with comparatively low levels of emissions and per capita income. Adaptation Fund financed by tax on all flexibility mechanisms, not just CDM.

INSTITUTIONAL ARRANGEMENTS

New institutions: An expert jury of independent technical and legal experts appointed, e.g., for five years by the UN Secretary General in collaboration with the President of the International Court of Justice, to evaluate claims by countries of mitigating factors and extenuating circumstances. Expert jury would resolve claims by countries to reduce their commitments based on objective criteria rather than bargaining power.

IMPLEMENTATION

Compliance: Countries with upper-high or high income levels and with medium or high emissions subject to fines for failure to comply with quantitative obligations. In addition, a "non-cooperation" fine on developing countries could help ensure that capacity building projects achieve results.

PROPOSED BY: Joyeeta Gupta

SOURCE: Gupta, Joyeeta. "Engaging Developing Countries in Climate Change: (KISS and Make-Up!)," in Michel, David (Ed.), *Climate Policy for the 21st Century: Meeting the Long-Term Challenge of Global Warming*, Washington, D.C., Center for Transatlantic Relations, 2003.

Long-Term Permit Program

SUMMARY / RATIONALE: Long-term approach aimed at reaching an agreed concentration target by a specified date (for example, 2070), through national emission trading programs in the major emitting countries. Participating countries would issue long-term tradable emission permits, which could be used at any time during the period up to the target date for achieving stabilization of GHG concentrations. Initially, permits could be traded only nationally—although over time national markets could be linked to create an international trading system. The permit price would likely be low initially, but would rise steadily over time, providing incentives for R & D. The long-term nature of the permits would allow emitters to decide when to time their emission reductions, providing maximum "when flexibility."

TIME FRAME: Long term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Although the proposal is framed in terms of emission permits rather than "targets" or "commitment periods," in effect, each participating country would have a long-term cumulative emissions target, consisting of its total emission permits for the agreed time period for stabilizing atmospheric concentrations of GHGs (for example, 2010–2070) (in effect, the commitment period).
- **PAMs:** Participating countries would establish national emission trading systems, involving long-term tradable permits. The long-term permits could be used to cover emissions any time during the commitment period. To reflect the fact that a ton of emissions early in the commitment period would be largely removed by sinks by the end of the commitment period, emission permits would include a depreciation factor, so that the amount of emissions they cover would steadily decline. To allow flexibility, countries would issue emission permits in tranches—for example, they might issue 20 years of permits initially, with additional issuances on a periodic basis. If permits were auctioned (rather than given out free), this would generate substantial funds for climate stabilization and adaptation efforts.

Differentiation: Initially would apply to seven largest emitting countries or regions (North America, Europe, Russia, China, Japan, India, and Brazil).

Allocation / Burden-Sharing Approach: Because international trading would not be allowed initially, allocation of emission permits should aim at achieving a comparable permit price in each participating country, in order to maximize economic efficiency. Equity concerns could be addressed through financial payments or other side payments.

ADAPTATION: Negotiations among a larger group of countries on financial support for adaptation, possibly from revenue generated from permit auctions.

IMPLEMENTATION

Compliance: Because long-term permits would be a valuable financial asset, permit owners would constitute a strong lobby for a well-policed system that ensures the integrity of the trading system.

PROPOSED BY: Stephen Peck and Thomas Teisberg

SOURCE: Peck S. and T. Teisberg. "Securitizing the Environment: A Property Rights Approach to Managing Climate Change," in J. Wesseler, J., H-P. Weikard, and R. Weaver (Eds.), Risk and Uncertainty in Environmental and Natural Resource Economics, Edward Elgar, 2003.

Multi-Dimensional Structure

SUMMARY / RATIONALE: Interim report emphasizing the need for a multi-faceted approach, involving a variety of stakeholders, forums and types of commitments. Governments—and, in particular, the major emitters—might pursue not only international agreements, but also other forms of international coordination. Industries, NGOs and individuals could build their own international agreements and measures.

FORUM: Multiple forums at the global, regional and bilateral levels.

TIME FRAME: Long-term.

MITIGATION COMMITMENTS: Multiple forms of commitments, including quantitative targets, policies and measures, technology strategies, and so forth.

Types of Commitments:

- **Technology:** Technology standards as well as international cooperation for technology dissemination.
- **Pledge-based:** Countries could pledge a variety of types of actions, including sector-specific coordinated actions, cross-border measures, voluntary industry agreements, harmonized technology standards, and coordinated research and development.

Differentiation: Major emitting countries.

IMPLEMENTATION: Implementation would occur at local, national, regional and multilateral levels.

PROPOSED BY: Ministry of Trade and Industry, Government of Japan

SOURCE: Perspectives and Actions to Construct a Future Sustainable Framework on Climate Change. Interim Report by the Global Environmental Subcommittee, Environmental Committee, Industrial Structure Council, METI, July 2003.

Multi-Sector Convergence

SUMMARY / RATIONALE: Like the *Global Triptych/Extended Global Triptych* approach, a bottom-up, sector-based approach to differentiating national emission targets, based on long-term convergence of national per capita emissions in seven sectors, with the possibility of adjustments for special circumstances.

FORUM: UNFCCC / Kyoto Protocol.

TIME FRAME: Long-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Absolute national emission targets.

Differentiation: High-per capita emission countries and low-per capita emission countries. High emission countries are those with base year emissions above the global per capita total emission standard (GTES) (see below). Low-emission countries are countries with emissions below the GTES. The former have emission mitigation commitments, the latter do not.

Allocation / Burden-Sharing Approach: Detailed methodology for calculating national emission targets:

- Initially, seven sectors are distinguished—power, households, transportation, industry, services, agriculture, and waste—which account for the vast majority of GHGs covered by the Kyoto Protocol.
- For each sector, an annual reduction rate in global per capita emissions is specified (based on a detailed examination of trends and technological potential for the given sector). For example, a reduction rate might be set for the power sector of 0.6 percent per year.
- These sectoral reduction rates are then used to calculate non-binding global sector emission standards (GSES), towards which per capita emissions in each country should converge by a particular year (the convergence year). For example, if we start in 2010 with per capita emissions in the power sector of 1036 kg CO_2Eq., then assuming per capita emissions decrease by 0.6 percent per year, per capita emissions in 2100 would be 591 kg CO_2Eq. If 2100 were chosen as the convergence year, 591 kg CO_2Eq. would become the GSES for the power sector.
- The GSES are added together to obtain the GTES, which is used to determine which countries are high-emission countries (those with per capita emissions above the GTES), and which are low-emission countries (those with per capita emissions below the GTES).
- For each country, a per capita emissions pathway is calculated for each sector, starting with actual per capita emissions in 2010 and leading to the GSES in the convergence year. The emissions pathway defines a non-binding, per capita sectoral emissions level for each year.
- The sectoral emissions levels for a country are added up and multiplied by population to determine the country's national emission target.
- National emissions mitigation targets may be adjusted upward based on "allowance factors," i.e., specific circumstances that justify higher emissions than the GSES, such as climate, population density, agriculture, problems in transitioning to a market economy, and renewable energy resource endowment.

Graduation criteria: Low emission countries take on mitigation commitments when they exceed the GTES and become high-emission countries. (An alternative graduation criterion could also be chosen through negotiation.) The target would apply after a defined adjustment period (for example, five years).

OTHER ELEMENTS: Excludes emissions due to land use change and emissions of HFCs, SF_6, and PFCs because of lack of available, reliable data at the sector and/or national level for many countries.

PROPOSED BY: Energy research Centre of the Netherlands (ECN) and Center for International Climate and Energy Research (CICERO)

SOURCES:

(1) Sijm, J., Jaap Jansen, and Asbjørn Torvanger. "Differentiation of mitigation commitments: the multi-sector convergence approach," Climate Policy 1 (2001): 481-497, Elsevier Science.

(2) Jansen, J.C., Battjes, J., Sijm, J.P.M., Volkers, C.H., and J.R. Ybema. "The Multi-Sector Convergence Approach: A flexible framework for negotiating global rules for national greenhouse gas emissions mitigation targets," ECN Report ECN-C-01-007, and CICERO Working Paper No. 4, CICERO, Oslo, Norway, April 2001. See http://www.cicero.uio.no/media/1313.pdf.

(3) Jansen, J.C., Battjes, J.J., Ormel, F.T., Sijm, J.P.M., Volders, C.H., Ybema, J.R., Torvanger, A., Ringius, L., and A. Underdal. Sharing the Burden of Greenhouse Gas Mitigation—Final Report of the Joint CICERO-ECN Project on the Global Differentiation of Emission Mitigation Targets Among Countries. ECN Report ECN-C-01-009, Petten, The Netherlands, and CICERO Working Paper No. 5, Oslo, Norway, 2001. See http://www.cicero.uio.no/media/1314.pdf.

Multistage / New Multistage

SUMMARY / RATIONALE: Pathway towards a global regime in which developing countries participate in a commitments regime in several stages, involving progressively more stringent commitments. *Original Multistage Approach*, proposed by RIVM, outlines four stages through which developing countries would pass: (1) no commitments (i.e., BAU pathway), (2) decarbonization (GHG intensity targets), (3) stabilization of absolute emissions, and (4) reduction of absolute emissions. *New Multistage Approach*, proposed by Ecofys, outlines four somewhat different stages: (1) no commitments; (2) pledge for sustainable development; (3) moderate absolute target (possibly involving a growth target and/or a safety valve), to which a Stage 3 country could voluntarily commit; and (4) absolute reduction targets until sustainable per capita level reached.

FORUM: Not specified. Compatible with Kyoto Protocol framework.

TIME FRAME: Long-term pathway towards stabilization of GHG concentrations.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** *Original Multistage:* Three types of national emissions targets: GHG intensity targets for countries at Stage 2 (specifying a rate of reduction in carbon emissions per unit GDP); stabilization of absolute (or per capita) emissions for countries at Stage 3; and reduction of absolute emissions for countries at Stage 4, with international emissions trading. Stringency of targets in each commitment period calculated based on long-term concentration stabilization scenario. For the 2010–2020 period, all developing countries might move to Stage 2, with a GHG intensity target of -3 percent annually. *New Multistage:* Two types of national emission targets, with international emissions trading: moderate absolute targets (allowing emissions to increase, but at a rate lower than BAU; possibly with a safety valve); absolute reduction targets, until a sustainable per capita level is reached (for example, 20 percent reduction for each 10-year commitment period from previous level). Stage 3 target is internationally defined, but must be voluntarily accepted by a developing country.
- **Financial:** *New Multistage:* Stage 4 countries might make financial contributions to support sustainable development measures by Stage 2 countries or mitigation costs of Stage 3 countries.
- **Pledge-based:** *New Multistage:* Stage 2 involves pledge for sustainable development (for example, by phasing out inefficient equipment), with international monitoring and review.

Differentiation: *Original Multistage:* Countries differentiated into four categories, based on GDP per capita (or possibly some other criterion such as emissions per capita): those with (1) no commitments, (2) a GHG intensity target; (3) a GHG stabilization target; and (4) a GHG reduction target. *New Multistage:* Countries differentiated into four categories based on per capita emissions. All Annex I countries in Stage 4 (absolute reduction targets).

Allocation / Burden-Sharing Approach: *Original Multistage:* Global emission levels allocated among countries based on ability to pay (per capita GDP) and historical responsibility (Brazilian proposal). For each five-year commitment period, a global emissions ceiling is chosen, based on long-term concentration stabilization scenario. BAU emissions for countries at Stage 1 (no commitments) are calculated and subtracted from global ceiling. Emissions allowances for countries at Stage 2 (GHG intensity targets) and Stage 3 (stabilization targets) are calculated and subtracted from the global ceiling. Remaining global emission allowances are distributed among countries at Stage 4 (reduction target), possibly based on the Brazilian proposal (contribution to temperature increase) or on contribution to total emissions. *New Multistage:* Within each stage, targets are equal (although recognizes that targets might be differentiated within each stage to reflect national circumstances).

Graduation criteria: *Original Multistage:* GDP per capita (or possibly emissions per capita). *New Multistage:* GHG emissions per capita. Graduation operates in only one direction, towards higher level of commitments, even if per capita emissions fall below the threshold for the stage a country is in.

PROPOSED BY: *Original Multistage:* RIVM.
New Multistage: Höhne et al.

SOURCES:

(1) *Original Multistage:* "Methodology—Increasing participation," RIVM website. See http://arch.rivm.nl/fair/methodology/increasing_participation.html.

(2 *New Multistage:* Höhne, Niklas, Carolina Galleguillos, Kornelis Blok, Jochen Harnisch, and Dian Phylipsen. "Evolution of commitments under the UNFCCC: Involving newly industrialized economies and developing countries," ECOFYS GmbH on behalf of the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Germany, Research Report 201 41 255, UBA-FB 000412, February 2003.

Orchestra of Treaties

SUMMARY / RATIONALE: Decentralized approach, involving four building blocks: (1) a group of emissions markets (GEM), to include countries with domestic emissions trading systems; (2) a zero emissions technology treaty (ZETT), to foster long-term technological change; (3) a climate-wise development treaty (CDT), to promote development, technology transfer, and adaptation; and (4) the UNFCCC, as a focal point and forum to address issues on which all countries can cooperate. Intended to pay attention to sovereignty concerns relating to energy and to build around national interests in technology and development.

FORUM: UNFCCC serves as one building block; the other three building blocks are negotiated outside the UNFCCC. ZETT might be negotiated under the auspices of the G8; CDT might be initiated by G8 or G20 (Group of Twenty finance ministers and central bank governors) or by a regional system, or might grow out of national reviews of ODA. Eventually, GEM, ZETT and CDT could be integrated into UNFCCC.

TIME FRAME: Not specified, but intended to address not only short-term emissions but also long-term technological change. Orchestra approach envisioned as short- to medium-term, with long-term integration into UNFCCC.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Countries participating in ZETT commit to the ultimate goal of zero energy-related CO_2 emissions.
- **PAMs:** PAMs could be one component of the ZETT.
- **Financial:** ZETT could include funding commitments for research and development, as well as subsidies for zero-emitting technologies. CDT intended to modify flows of financial assistance to developing countries in order to embed climate issues into development policy.
- **Technology:** ZETT would focus on developing zero-emitting technologies.
- **Pledge-based:** GEM, ZETT and CDT are all essentially pledge-based, at least initially.

ADAPTATION: CDT could address adaptation issues.

INSTITUTIONAL ARRANGEMENTS

New institutions: Institutional issues not specifically addressed.

IMPLEMENTATION

Compliance: Not specifically addressed. In general, new treaties are among like-minded states and are aimed at being facilitative rather than to create stringent obligations.

OTHER ELEMENTS: New Information Exchange Protocol under the UNFCCC, to take stock of progress under each treaty, as well as Emission Monitoring Protocol to monitor how GHG emissions are controlled.

PROPOSED BY: Sugiyama et al.

SOURCE: Sugiyama, Taishi and Jonathan Sinton with Osamu Kimura and Takahiro Ueno. "Orchestra of Treaties," CRIEPI, paper published under the FNI/CRIEPI/HWWA/CASS Post-2012 Policy Scenarios Project (draft), 2003

Parallel Climate Policy

SUMMARY / RATIONALE: Pathway for development of a regime parallel to Kyoto, involving big emitters not currently participating in the Kyoto Protocol emission targets (including the United States and China). Bottom-up approach, beginning with development of U.S. domestic cap-and-trade program and then building out to engage China, and possibly India, Brazil, Mexico, Australia, and Canada at a later date.

FORUM: Parallel regime to Kyoto, involving the United States and major developing-country emitters. Could eventually merge with Kyoto.

TIME FRAME: Short to medium-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emissions targets, with international emissions trading. Developing countries would cap only selected sectors and would receive headroom allowances that are gradually tightened over time. Schedule of updatable emissions pathways and longer-term commitment periods. Developing countries could receive revenue from sales of surplus allowances.
- **Financial:** Countries make contributions to a capacity building fund or existing mitigation initiatives.

Differentiation: Developing countries take on emissions targets for selected sectors with headroom allowance assignments. Targets for all countries tighten over time.

Graduation criteria: Per capita income threshold.

IMPLEMENTATION

Compliance: Countries negotiate and agree on rules for implementation and compliance at the time of target setting. Financial penalties to be enforced by UNFCCC/Kyoto Protocol-like compliance committee.

PROPOSED BY: Richard B. Stewart and Jonathan Wiener

SOURCE: Stewart, R. and J. Wiener. "Reconstructing Climate Policy Beyond Kyoto," American Enterprise Institute Press, 2003.

Per Capita Allocation

SUMMARY / RATIONALE: Elaboration of several possible burden-sharing approaches, all based on the principle of equal per capita emissions entitlements.

FORUM: UNFCCC / Kyoto Protocol.

TIME FRAME: Long-term, through 21st century.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Absolute national emission targets.

Differentiation: Two categories of countries: developed and developing.

Allocation / Burden-Sharing Approach: Under the *Sinks approach*, the oceanic sink is divided up among countries on a per capita basis; for example, the 1990 sink of 2.0 Gt would be divided by the 1990 world population of 5.3 billion to yield per capita sink availability of 0.38 tC. The *Budget approach* first sets a long-term concentration target, e.g., 450 ppm by 2100, and an emissions pathway, and then calculates the allowable level of per capita emissions for each commitment period. The *Moving Entitlements* approach involves setting a moving per capita emissions entitlement (e.g., 2.0 or 2.5 tC) that would be subject to periodic review to incorporate new scientific information.

OTHER ELEMENTS: Emissions trading restricted to projects that promote a zero carbon energy system, not the perpetuation of the current fossil fuel system. Resources from emissions trading should be used in the first commitment period to help bring the cost of renewable energy technologies to a level that is competitive with fossil fuel technologies.

PROPOSED BY: Centre for Science and Environment (CSE)

SOURCE: Agarwal, Anil. "Making the Kyoto Protocol Work," CSE Statement. See http://www.cseindia.org/html/eyou/climate/pdf/cse_stat.pdf.

Portfolio Approach

SUMMARY / RATIONALE: Multifaceted approach to technology research, development and diffusion, aimed at promoting a technological revolution in energy production and consumption. Similar to *Technology-Centered Approach*.

FORUM: Parallel negotiations among differing constellations of like-minded states.

TIME FRAME: Short to medium-term.

MITIGATION COMMITMENTS

Types of Commitments:

- **PAMs:** Suggests two possible PAMs: fuel-efficiency standards for automobiles, negotiated among the small number of auto producing countries; and technology targets for power generation and fuel refining (for example, new power plants and refiners could be required to use renewable energy or to capture and sequester carbon byproducts).
- **Financial:** Carbon tax to finance public sector energy R & D. Financial assistance to developing countries to finance incremental costs of mitigation measures.
- **Technology:** Program to promote technology transfer to developing countries.
- **Pledge-based:** Compatible with pledge-based approach.
- **Other:** Developing country commitments could be made conditional on technology transfer and financial assistance by industrialized countries.

Differentiation: Although technology agreements could include any like-minded states, discussion of financial and technology transfers suggests differentiation between developed and developing states.

OTHER ELEMENTS: CDM should focus on energy sector rather than land use change.

PROPOSED BY: Richard Benedick

SOURCE: Benedick, R. "Striking a New Deal on Climate Change," *Issues in Science and Technology Online*, Fall 2001.

Purchase of a Global Public Good

SUMMARY / RATIONALE: Alternative approach to mitigation—essentially international emissions trading without a cap—involving the purchase by a new international institution of emission reductions, financed by contributions from participating states. Proposal intended primarily as a thought experiment, applying public goods theory to the climate change problem. Normally, public goods are purchased by governments, with the burden of financing this collective purchase determined separately using the tax system. In this proposal, reductions in greenhouse gas emissions are treated as a public good. A newly created international bank would, in effect, purchase emission reductions by buying and retiring emission allowances. Countries would be required to make financial contributions to the new bank to finance these purchases.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Each country would receive emissions allowances based on its BAU emissions trajectory, plus headroom (for example, an additional 20 percent, to protect against the possibility that emissions are unexpectedly high). Because national emission targets would be above BAU emissions, all countries would be sellers in the emissions trading market (with the newly created international bank as the buyer).
- **Financial:** Participating countries would be required to make financial contributions to the International Bank for Emissions Allowance Acquisition to buy and retire emission allowances.

Differentiation: All states would participate.

Allocation / Burden-Sharing Approach: National emission targets based on BAU trajectory, plus headroom. Method for allocating financial contributions not specified, but could be based on per capita income, consumption levels or expected benefits from climate change mitigation.

INSTITUTIONAL ARRANGEMENTS

New institutions: COP determines emission allowances for each country and number of emission allowances to buy and retire. International Bank for Emissions Allowance Acquisition created to buy and retire emission allowances.

IMPLEMENTATION: International bank receives funds to purchase emission allowances.

Compliance: Bank monitors emissions and buys emission allowances only if country has achieved reductions.

PROPOSED BY: David F. Bradford

SOURCE: Bradford, D. "Improving on Kyoto: Greenhouse Gas Control as the Purchase of a Global Good," CEPS Working Paper No. 96, January 2004.

Safety Valve

SUMMARY / RATIONALE: Hybrid approach to form of commitment, combining emission targets with a "safety valve." Safety valve addresses the problem of uncertainty about costs of complying with fixed emissions targets by allowing the issuance of additional emission allowances (either by individual governments or an international authority) at a predetermined price. The safety valve price would provide an upper bound on the marginal cost of compliance.

FORUM: Not specified, but could be undertaken as part of second commitment period Kyoto negotiations.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets, with international emissions trading. Compatible with fixed Kyoto-like targets or indexed targets. Targets not absolute, since additional allowances could be sold at the safety valve price. Proceeds from the sale of safety valve allowances could be used for mitigation activities in developing countries.

Differentiation: Not addressed. Differentiation could relate to the safety valve price (with certain limitations on emissions trading) as well as to the emission target levels.

INSTITUTIONAL ARRANGEMENTS

New institutions: Not addressed. Safety valve could be administered either by individual countries or by an international authority.

OTHER ELEMENTS: Proposal leaves open how the quantity target and the "trigger price" should evolve over time. Two possibilities: (1) raise the trigger price over time to guarantee that the quantity target is reached, and (2) choose trigger prices in line with willingness to pay to limit climate change. If used in conjunction with international emissions trading, either the trigger price must be harmonized across countries or restrictions on permit sales from countries with low trigger prices would be necessary. Alternatively, the trigger price could be set low enough to avoid the need for international trading. If the trigger price were raised rapidly, limits to banking would be necessary.

PROPOSED BY: William Pizer

SOURCE: Pizer, William. "Choosing Price or Quantity Controls for Greenhouse Gases," Climate Issues Brief No. 17, Resources for the Future, July 1999.

Safety Valve with Buyer Liability

SUMMARY / RATIONALE: Comprehensive architecture, including a target-based regime with a safety valve to provide greater economic predictability, and buyer liability to promote compliance.

FORUM: Multiple tracks, including the UNFCCC.

TIME FRAME: Not specified, but aims at building a long-term, robust architecture.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets, with international emissions trading. Targets not absolute, since additional allowances could be issued under the safety valve. Compatible with different types of targets, although data needed to support growth or indexed targets is currently too soft to be used in an emissions trading system where underlying assets are worth trillions and cross-border transactions could amount to tens of billions of dollars.
- **PAMs:** As a first step in development of international cooperation, states might pledge PAMs.
- **Technology:** Technology strategy in parallel with UNFCCC process to promote more active international collaboration on technology development. Technology strategy should include non-binding, flexible memoranda of understanding to promote more active international collaboration on technology development, but not technology targets and timetables.
- **Pledge-based:** Pledges possibly useful as a first step, to allow governments to experiment with alternative policy instruments. Useful only if countries agreed on performance benchmarks and strong institutional review mechanisms to assess the effectiveness of national measures.

Differentiation: Primary differentiation between developed and developing countries, with secondary differentiation among developing countries based on income level.

Allocation / Burden-Sharing Approach: For developing countries, stringency of commitments depends on income level.

Graduation criteria: Although no binding emission targets for developing countries initially, developing countries would need to assume binding targets in the longer term. One or more threshold income levels could be set, beyond which emission controls would be required on an increasingly stringent basis.

IMPLEMENTATION

Compliance: Emphasis on domestic enforcement in advanced industrialized countries. Buyer liability will give buyers—who will generally be located in advanced industrial democracies with strong domestic enforcement—an incentive to purchase allowances only from sellers that comply with their emission targets.

OTHER ELEMENTS: Safety valve permits issued by national governments rather than an international institution.

PROPOSED BY: David Victor

SOURCE: Victor, David. "International Agreements and the Struggle to Tame Carbon," *Global Climate Change:* 204-229, 2001.

Soft Landing in Emissions Growth

SUMMARY / RATIONALE: Staged approach for integrating developing countries into the emission reduction process after 2010. Aims to stabilize global CO_2 emissions by 2030 and atmospheric concentrations at 550 ppm.

FORUM: Kyoto Protocol negotiations.

TIME FRAME: 2010–2030.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Fixed, binding national emissions targets, with international emissions trading. Developed countries have reduction targets; developing countries must stabilize emissions by different dates, depending on their ability to pay (as measured by their per capita income) and their causal responsibility (as reflected by their per capita emissions).

Differentiation: Primary differentiation between developed and developing countries. Secondary differentiation among three categories of developing countries: (1) high income or high emissions countries, which must stabilize emissions starting in 2015; (2) intermediate income or intermediate emissions countries, which must stabilize from 2030; and (3) low income or low emissions countries, which must stabilize from 2045.

Allocation / Burden-Sharing Approach: Developing country stabilization targets based on per capita income and per capita emissions. Emission reductions by developed countries must offset emissions growth in developing countries.

PROPOSED BY: Blanchard et al.

SOURCE: Blanchard, Odile, Patrick Criqui, Michel Trommetter, and Laurent Viguier. "Equity and efficiency in climate change negotiations: a scenario for world emission entitlements by 2030," Cahier de recherche No. 26, Institut d'Economie et de Politique de l'Energie, July 2001.

South-North Dialogue

SUMMARY / RATIONALE: Global and comprehensive approach, aimed at keeping temperature increase below 2ºC compared to pre-industrial times. Addresses both mitigation and adaptation, and covers all countries, both developed and developing. Countries would be differentiated into six groups, each with a different package of mitigation, adaptation and financial commitments.

FORUM: UNFCCC.

TIME FRAME: Not specified, potentially long-term. Envisions a series of commitment periods but duration is not defined.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Annex I countries would continue to have Kyoto-like targets—i.e., targets that are legally-binding, quantified and absolute. Targets for Annex II countries would be more stringent than Kyoto. Newly Industrialized Countries (NICs) and Recently Industrialized Developing Countries (RIDCs) would also have quantified targets, but their targets would be conditional on all major Annex I countries (including the U.S.) taking on quantified targets. NICs would have absolute limitation or reduction targets, while RIDCs would have absolute limitation targets that would be conditional on receipt of significant financial and technological assistance from Annex II countries. Other developing countries and least developed countries (LDCs) would not have quantified emission commitments.
- **PAMs:** NICs, RIDCs, other developing countries (DCs) and LDCs would be required to adopt sustainable development PAMs (SD-PAMs). SD-PAMs by RIDCs, other DCs and LDCs would be co-funded by Annex II financial transfers. Other qualitative actions by NICs, RIDCs, other DCs, and LDCs include sectoral CDM and non-binding renewable energy and energy efficiency targets.
- **Financial:** Annex II countries would be required to transfer financial and technological resources to those non-Annex I countries with low to medium capability to mitigate.

Differentiation: Differentiation into six groups: (1) Annex II countries; (2) other Annex I countries; (3) NICs; (4) RIDCs; (5) other DCs, and (6) LDCs. Each group of countries would have a different package of mitigation, adaptation and financial commitments.

Allocation / Burden-Sharing Approach: Differentiation into groups based on three criteria: (1) historical responsibility (as measured by cumulative emissions for the 1990–2000 period), (2) capability (as measured by per capita GDP and the human development index), and (3) potential to mitigate (as measured by emissions intensity, per capita emissions and emissions growth rate).

Graduation criteria: Composition of groups would change over time. Countries would automatically graduate into a group when their indicators cross the pre-determined thresholds for that group.

ADAPTATION: Adequate and predictable revenue streams for adaptation, based on the polluter pays principle. Modification of Global Environment Facility rules to allow funding of adaptation projects with local benefits. Insurance schemes should be explored, possibly through public-private partnerships.

OTHER ELEMENTS: A 2ºC increase in global temperature is set out as the desired upper limit.

PROPOSED BY: Ott et al.

SOURCES: Ott, H., H. Winkler, B. Brouns, S. Kartha, M.J. Mace, S. Huq, A. Sari, J. Pan, Y. Sokona, P. Bhandari, A. Kassenberg, E. La Rovere, and A. Rahman. "South-North Dialogue on Equity in the Greenhouse: A proposal for an adequate and equitable global climate agreement," Eschborn, 2004.

Sustainable Development Policies and Measures (SD-PAMs)

SUMMARY / RATIONALE: Bottom-up pledge-based approach to developing country participation. Focuses on implementing nationally determined policies for sustainable development rather than setting emission targets through multilateral negotiations. Two general rationales: (1) Each developing country is unique, so top-down, one-size-fits-all approaches are inadequate. Instead, climate policies should develop from the bottom-up. (2) Developing countries, as a political reality, are much more concerned with economic development than climate change.

FORUM: UNFCCC.

TIME FRAME: Proposed as a useful interim step towards deeper developing country participation.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** None for developing countries.
- **PAMs:** Developing countries would commit to implementing and accelerating national sustainable development plans. Developing countries would begin by identifying policies and measures that further their development objectives. They would then quantify the effects of these policies and measures on GHG emissions, in order to determine which create synergies between development and climate objectives and which create conflicts. Initially, SD-PAMs would be voluntary and would simply be listed in an international registry. Over time, SD-PAMs might be made mandatory for a group of middle-income developing countries.
- **Financial:** SD-PAMs that reduce GHG emissions could be funded under the existing UNFCCC and Kyoto provisions, including the CDM (expanded to include sectoral CDM) and the GEF.
- **Pledge-based:** Developing countries would pledge SD-PAMs.
- **Other:** Developing countries would report on SD-PAMs for international review.

Differentiation: Implicit differentiation between developed countries (with mandatory emission targets) and developing countries (with SD-PAMs). Suggests identifying group of countries for which SD-PAMs might be particularly appropriate, based on their emissions intensity (emissions per unit GDP) and income (GDP per capita).

Graduation criteria: Developing countries that become "middle-income" might transition from voluntary to mandatory SD-PAMs.

ADAPTATION: Not addressed, although SD-PAMs might relate to adaptation rather than mitigation.

INSTITUTIONAL ARRANGEMENTS

New institutions: A special SD-PAMs reporting registry would be created within the UNFCCC.

IMPLEMENTATION: Developing countries would formulate, implement and report on SD-PAMs.

Compliance: Initially, implementation of SD-PAMs would be voluntary, so no compliance or enforcement mechanism is specified. Countries would report quantified changes in GHG emissions resulting from particular SD-PAMs. Suggests the possibility of international review of SD-PAMs.

PROPOSED BY: Winkler et al.

SOURCE: Winkler, Harald, Randal Spalding-Fecher, Stanford Mwakasonda, and Ogunlade Davidson. "Sustainable Development Policies and Measures: Starting From Development to Tackle Climate Change," in *Building on the Kyoto Protocol: Options for Protecting the Climate*, Kevin A. Baumert with Odile Blanchard, Silvia Llosa, and James F. Perkans (Eds.), World Resources Institute, 2002.

Technology Backstop Protocol

SUMMARY / RATIONALE: Alternative technology-based protocol that could serve as a "backstop" in case of failure of the first-best option (efficient policy instruments such as taxes or tradable permits). A technology-based protocol would set forth medium- to long-term technology targets—for example, capture and sequestration of all carbon from new power plants by 2020—in order to stimulate technology development and reduce emissions.

FORUM: Not specified. Could be undertaken under the UNFCCC or as a new regime.

TIME FRAME: The protocol focuses on medium-term technology goals.

MITIGATION COMMITMENTS

Types of Commitments:

- **Technology:** International agreement on specific technology-based targets. New fossil fuel power plants installed in Annex I countries after 2020 and new synthetic fuels capacity in Annex I countries would be required to capture and store all carbon from their waste streams. In addition, if countries agreed to stabilize atmospheric concentrations of GHGs, they would need to adopt a second stage of targets, requiring new fossil fuel refining capacity after 2050 to capture and sequester carbon from fuels. These targets would not apply to non-Annex I countries until their per capita income reached the average level of Annex I countries.

Differentiation: Differentiation in timing of commitments between developed and developing countries, based on per capita income level using Purchasing Power Parity (PPP).

Allocation / Burden-Sharing Approach: The same technology targets would apply to all countries, but developing countries would not be required to achieve these targets until their income level reached that of the Annex I average.

Graduation criteria: Non-Annex I countries would be subject to the technology targets when their per capita income (in PPP terms) equaled the average for Annex I countries in 2020 (for the first stage targets) or 2050 (for the second stage targets).

PROPOSED BY: Jae Edmonds and Marshall Wise

SOURCE: Edmonds, J. and M. Wise. "Building Backstop Technologies and Policies to Implement the Framework Convention on Climate Change," Pacific Northwest National Laboratory, Washington, D.C., May 1998.

Technology-Centered Approach

SUMMARY / RATIONALE: Multifaceted approach aimed at promoting a technology transition in the electricity generation and transportation sectors. Five main components: (1) an R & D protocol to "push" the development of new technologies; (2) protocols establishing technology standards to provide a "pull" incentive to commercialize new, low-emitting technologies; (3) a multilateral fund to help spread new technologies to developing countries; (4) a short-term system of pledge and review; and (5) a protocol for adaptation assistance. Similar to *Portfolio Approach*.

TIME FRAME: Intended to promote a long-term technology transition, but also includes short-term measures such as pledge and review.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** None. Target-based approaches cannot enforce participation or compliance.
- **PAMs:** Negotiation of protocols mandating open technology standards. These protocols would not require global participation since, if enough countries adopt a standard, others are likely to follow due to tipping and network effects. Both government and industry representatives would participate in picking standards.
- **Financial:** Financial contributions by developed countries for (1) collaborative research and development; (2) a multilateral fund to finance technology change in developing countries, and (3) adaptation assistance for developing countries.
- **Technology:** Collaborative research on new technologies, together with agreements on technology standards.
- **Pledge-based:** Short-term protocol pursuant to which states would pledge national PAMs, with international review.

Differentiation: Protocols involving financial transfers for technology diffusion and adaptation differentiate between developed donor countries and developing recipient countries.

Allocation / Burden-Sharing Approach: Financial contributions for R & D could be allocated based on UN scale of assessments, historical responsibility for climate change, or current emissions.

ADAPTATION: Adaptation Fund financed by contributions from industrialized countries.

IMPLEMENTATION

Compliance: Critique of target-based approach focuses on the compliance/participation problem. In contrast, technology-oriented protocols build in incentives to cooperate and are mainly self-enforcing.

PROPOSED BY: Scott Barrett

SOURCE: Barrett, Scott. *Environment and Statecraft: The Strategy of Environmental Treaty-Making*, Oxford University Press, 2003.

Three-Part Policy Architecture

SUMMARY / RATIONALE: Modification of Kyoto architecture, consisting of three parts: (1) global participation in emission targets, (2) long-term targets, and (3) market-based instruments.

FORUM: UNFCCC. Proposed as a follow-up to or as a substitute for the Kyoto Protocol.

TIME FRAME: Addresses both the short and long term.

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** National emission targets for all countries, with international emissions trading. For developing countries, individual national targets could be indexed, and could begin with a BAU target, gradually becoming more stringent as a country's wealth grows. In general, short-term targets should be firm but moderate, to keep costs low and avoid rendering large parts of capital stock prematurely obsolete. Long-term targets should be flexible but more stringent, in order to motivate technological change and bring down costs over time.
- **PAMs:** Countries should use market-based instruments as the chief means of reducing emissions. Options include domestic carbon taxes, a system of tradable permits, or a hybrid approach involving tradable permits and a safety valve. If there is an international trading system, its design should facilitate integration with domestic policies.
- **Technology:** Agreement on long-term target to motivate technological change.

Differentiation: Primary differentiation between developed and developing countries. Secondary differentiation among developing countries based on per capita GDP.

Allocation / Burden-Sharing Approach: Stringency of developing country targets based on per capita GDP.

Graduation criteria: Developing countries could voluntarily accede to binding emission targets. Developing countries would be required to take on binding emission targets once their per capita GDP reached agreed levels.

PROPOSED BY: Robert N. Stavins

SOURCE: Stavins, Robert. "Can An Effective Global Climate Treaty Be Based on Sound Science, Rational Economics, and Pragmatic Politics?" Faculty Research Working Paper Series, Kennedy School of Government, Harvard University, RWP 04-020, and Resources for the Future, May 2004. See http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP04-020/$File/rwp04_020_stavins_rev2.pdf; and http://ssrn.com/abstract=538943.

Two-Part Commitments for Industrialized Countries

SUMMARY / RATIONALE: Modification of Kyoto regime to give developed countries greater flexibility in how they achieve their commitments. Developed countries could comply either by achieving their emission reduction target or by making financial and technological transfers.

FORUM: Not specified, but implicitly under the UNFCCC/Kyoto Protocol regime.

TIME FRAME: Not specified, but implicitly aimed at the near-term (for example, the Kyoto Protocol second commitment period).

MITIGATION COMMITMENTS

Types of Commitments:

- **Targets:** Form of targets not specified.
- **Financial:** Developed countries could achieve their commitments through financial and technology transfers, rather than through emission reductions.

Differentiation: Developed and developing countries. Emission targets and financial/technology transfer commitments applicable only to developed countries.

Allocation / Burden-Sharing Approach: Not addressed. Each developed country able to determine its own mix of emission reductions and financial/technology transfers.

IMPLEMENTATION

Compliance: Developed countries could comply through either emission reductions or financial/technology transfers to developing countries.

PROPOSED BY: Chandrashekhar Dasgupta (The Energy and Resources Institute)

SOURCE: Not published in the literature, information is based on presentations in his personal capacity at COP-9.

UNFCCC Impact Response Instrument

SUMMARY / RATIONALE: Proposes an impact response instrument and creation of a new UNFCCC Disaster Relief Fund to cover the costs of international relief efforts for climate-related disasters, financed by contributions from industrialized countries based on their historical responsibilities and ability to pay. Argues that a balanced climate regime needs to focus not only on mitigation but also on the inevitable "post-disaster phase," including disaster relief, rehabilitation and reconstruction.

FORUM: UNFCCC.

Types of Commitments:

- **Financial:** Mandatory contributions by industrialized countries to the UNFCCC Disaster Relief Fund. Suggests that only modest additional contributions would be necessary.

Allocation / Burden-Sharing Approach: Financial contributions would be proportionate to countries' "differentiated responsibilities and ability to pay."

ADAPTATION: Emphasizes the need for disaster response measures, including relief, rehabilitation and reconstruction. Focuses in particular on disaster relief.

INSTITUTIONAL ARRANGEMENTS

New institutions: New UNFCCC Disaster Relief Fund, administered by UN Office for the Coordination of Humanitarian Affairs, under the guidance of the UNFCCC COP.

PROPOSED BY: Benito Müller

SOURCE: Müller, B. "An FCCC Impact Response Instrument as part of a Balanced Global Climate Change Regime," June 2002. See http://www.wolfson.ox.ac.uk/~mueller/iri.pdf.

Endnotes

1. For a fuller description of variables in designing mitigation commitments, see Bodansky, Daniel. "Climate Commitments: Assessing the Options," in *Beyond Kyoto: Advancing the International Effort Against Climate Change*, Pew Center on Global Climate Change, December 2003.

2. For a fuller description of these criteria, see Bodansky, Daniel in *Beyond Kyoto: Advancing the International Effort Against Climate Change*.

3. The notion of no lose targets was originally articulated by Cédric Philibert of the International Energy Agency. See Philibert, Cédric. "How could emissions trading benefit developing countries," *Energy Policy Vol. 28*, n°13, November 2000.

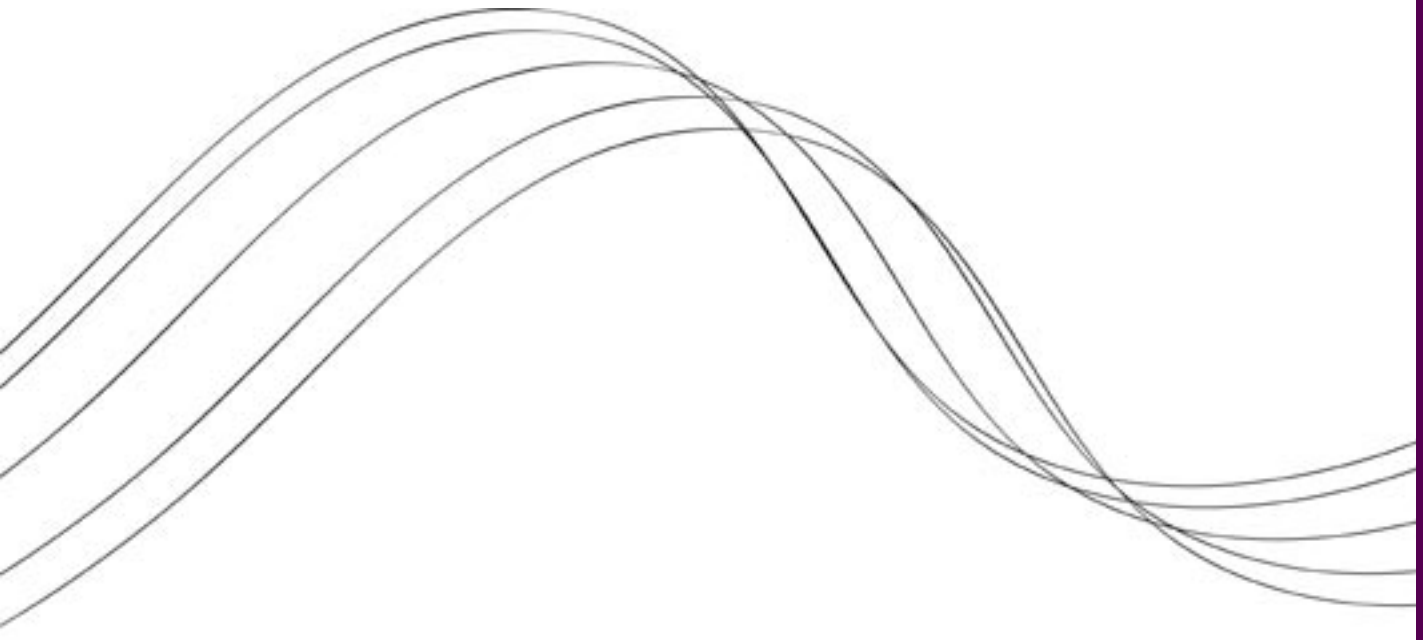
4. Jansen et al., *Multi-Sector Convergence Approach* (Energy research Centre of the Netherlands / CICERO, 2001).

5. Titles for the proposals summarized in this section are in some cases the proponents' originals and in some cases have been assigned for ease of description. The summaries are intended to represent as best as possible the thinking and intent of the proposals' original authors. In each summary, a category of issues is listed only if the proposal in some manner addresses it, so not all categories appear.

6. Domestic trading systems would cover only CO_2, initially, on the grounds that including other gases would add enormous complexity.

7. In general, the Kyoto Protocol first commitment period targets would serve as the baseline for these reduction targets (except for countries with hot air, whose baseline would be an estimate of BAU emissions in 2012).

This paper surveys and synthesizes more than 40 proposed approaches for strengthening international climate efforts beyond 2012. It is part of a Pew Center series on *Advancing the International Effort Against Climate Change*. The Pew Center was established by The Pew Charitable Trusts to bring a new cooperative approach and critical scientific, economic, and technological expertise to the global climate change debate. We inform this debate through wide-ranging analyses in four areas: policy (domestic and international), economics, environment, and solutions.



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