1. INTRODUCTION:
An Architecture for Climate Protection

Kevin A. Baumert and Nancy Kete

Walls, windows, floors, and doors are some of the elements used in designing a house. Not just any mix of architectural elements will create a functional home. Although there are many possible designs, making a home functional means assembling walls, windows, and other elements into a compatible whole that meets the needs of its inhabitants. So too, a climate protection treaty has its own set of "architectural elements" that must meet the needs of its stakeholders. Elements of a climate protection treaty include provisions for controlling greenhouse gas emissions, managing economic costs, and promoting accountability, among other things. While the options for designing a home may seem limitless, the diversity of potentially effective climate agreements is not nearly as constrained as current international negotiations might lead us to believe. As with homes, innovation and creativity are needed in treaty design.

Since 1997, the debate over global climate change has focused narrowly on the Kyoto Protocol—an international treaty to control greenhouse gas emissions that are trapping heat in the Earth's atmosphere. The Protocol calls on industrialized countries to reduce their emissions of greenhouse gases by about 5 percent below 1990 levels between 2008 and 2012. Over the past 5 years, government officials, observers, and experts have been absorbed in the arcane details of the Protocol, arguing at great length about the treaty's merits and demerits. As the Kyoto Protocol comes to life, this debate will shift to include new ideas for future commitments to protect the global climate system.

This volume explores a set of options for designing an international framework for climate protection "beyond Kyoto," that is, beyond the Kyoto Protocol's first commitment period.[1] We pay special attention to achieving international cooperation across the so-called North-South divide. Each approach examined in this volume could embrace both industrialized and developing countries—an eventual necessity for addressing the

problem of climate change. In conducting this study, we hope to promote a better understanding of a wide range of future climate protection options and provide building blocks for further consideration of these ideas and other alternatives not yet considered. An improved understanding of future options, we think, will lead to more environmentally effective and fair outcomes under the international climate change negotiations.

We believe now is a particularly opportune time to think expansively, creatively, and critically about different approaches to protecting the global climate system. With every year that passes, we are wagering the future, betting (or simply hoping) that global warming will not manifest itself through the worst possible outcomes before humanity finds a collective and effective long-term solution. We need intellectual and creative resources from across the globe to produce and test ideas. Just as shooting more arrows at a target provides a better sense of how to hit the bull's-eye, the more ideas we consider now, the more likely we are to find the right ones.[2]

This chapter offers a guide to the rest of this volume. Section I describes the problem of global climate change and the challenges of addressing this complex phenomenon in an economically uneven and politically divided world. The section gives particular attention to the tensions between industrialized and developing countries in the climate change negotiations. Section II probes the key architectural elements that could collectively constitute an international climate protection architecture. These elements include, among others, the legal character of commitments (binding or non-binding), the type of greenhouse gas limitation commitment (emission target or tax), the scope of the action (sectoral, national, or global), and the use of market mechanisms. The chapter concludes with Section III, which offers short summaries of the different approaches to climate protection examined in this volume.

Following this chapter are comprehensive examinations of the different approaches. Chapter 2 examines the Kyoto Protocol itself, which is particularly important because this agreement provides the starting point for discussion of future climate protection options. Given its procedural features, the Kyoto treaty can be adapted to accommodate a variety of approaches, including those examined in subsequent chapters of this volume. In its current form, the Kyoto Protocol establishes fixed "caps" on the emissions of industrialized countries but does not include formal emission-limitation commitments for developing countries. Chapter 2 explores the viability of extending Kyoto's system of emission caps to developing countries.

Chapters 3 and 4 examine two new approaches for structuring participation in greenhouse gas emission reductions by developing countries—Sustainable Development Policies and Measures (SD-PAMs) and a Sector-Based Clean Development Mechanism (Sector-CDM), respectively. Chapter 5 examines "dual-intensity targets," an alternative method of designing emission limitations, while Chapter 6 recounts Argentina's unsuccessful attempt to design and implement a voluntary greenhouse gas target. Chapter 7 looks at the Brazilian Proposal, which calls for emission reductions to be shared among countries on the basis of their relative responsibilities for global warming. Chapter 8 examines a system for distributing emission entitlements to countries on an equal per capita basis. It is important to note that these chapters are not a comprehensive cataloging of approaches: there are others not examined here,[3] and indeed others that have yet to be conceived. However, the approaches that are examined collectively encompass a thought-provoking and wide spectrum of future possibilities.

Each of these chapters assesses both the advantages and disadvantages of a particular approach. The authors pay special attention to the international appeal of the respective approaches because any successful climate protection system must be able to garner international consensus. Thus, the analyses presented in this volume explore the underlying factors—such as economic cost, fairness, and development benefits—that ultimately shape whether approaches are politically acceptable. No single approach can be designated as most desirable, and, in fact, some of them are mutually compatible, as several chapters illustrate.

Chapter 9 offers a quantitative comparison of three different approaches to differentiating greenhouse gas limitation commitments across countries. It illustrates how different approaches can deliver widely varying economic results for a given country. In other words, the disparities among countries ensure that no single strategy examined in this study (or even beyond this study) will be in the best interest of all countries. This analysis reinforces the need to examine the political viability of a variety of approaches, as is done in Chapters 2 through 8. The volume concludes with Chapter 10, which summarizes the advantages and challenges of the different approaches, explores some cross-cutting themes, and outlines some lessons that emerge from this study. Chapter 10 also sets out a way forward for the climate negotiations, incorporating many of the advantages of the approaches examined in this volume.

Box 1.1. The Scope of the Global Climate Change Problem

According to the Intergovernmental Panel on Climate Change (IPCC 2001c), climate change is a vastly different problem than other environmental and public policy issues. Below are six characteristics of the problem that help explain why this is so and militate against easy solutions.

The problem is global. Climate change is related to the concentration of greenhouse gases (GHGs) in the Earth's atmosphere. Emissions from all sources from all countries determine the concentration of these gases. Some countries are very large emitters, and others are very small emitters. Acting alone, individuals and countries that reduce emissions will have a small overall effect.

The problem is long-term. Emissions of carbon dioxide (CO_2), on average, remain in the atmosphere for about 100 years (some other gases persist for thousands of years). Thus, GHG concentrations are related to the net accumulation of gases over long periods of time, not to a single year's emissions. This raises complicated ethical questions because the future generations that will be most affected by climate change are not present to participate in today's decisions.

Associated human activities are pervasive. GHG emissions are linked to a broad array of human activities, including those related to energy use, industrial activities, and land use decisions. In addition, the wide range of policies affecting technological innovation, economic growth, and population size further shape emissions.

I. Confronting Climate Change

Addressing global climate change is a paramount challenge of the 21st Century (Box 1.1). Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide (CO_2), the chief heat-trapping greenhouse gas, have risen 35 percent—from about 275 parts per million by volume (ppmv) then to 370 ppmv today. This increase is due to human activities, primarily from the burning of fossil fuels and from deforestation. Carbon that has been sequestered in the Earth's crust (in the form of oil, coal, and other fossil fuels) over millions of years has been extracted, burned, and released into the atmosphere in large quantities within the past 200 years. Atmospheric concentrations of methane, the second leading greenhouse gas, have more than doubled over the past two

Box 1.1. *continued*

Uncertainty is pervasive. Many uncertainties exist regarding the magnitude of future climate change and its consequences, as well as the costs, benefits, and barriers to implementation of possible solutions.

The consequences are potentially irreversible and are distributed unevenly. Sea level rise and other potential consequences of a global temperature increase can take more than one thousand years to play out. Likewise, societies differ in their vulnerability to climate change impacts, with poorer societies less able to adapt to the consequences of climate change.

The global institutions needed to address the issue are only partially formed. The 1992 Climate Convention has nearly universal membership (including the United States). This agreement establishes an objective of stabilizing atmospheric GHG concentrations at a level that would avoid "dangerous" human interference with the climate system. The definition of "dangerous," however, is left open to broad interpretation by Parties. The 1997 Kyoto Protocol has expanded the decision-making process for climate change policy, but currently includes only short-term targets for some industrialized countries.

Source: Adapted from Toth and Mwandosya (2001: 606–609).

centuries. These changes in the composition of the Earth's atmosphere have increased the average global surface temperature by about 0.6° C (1° F) over the past 100 years. Regional climate changes due to temperature increases have already affected many physical and biological systems, and emerging evidence suggests impacts on human settlements from recent increases in floods and droughts (IPCC 2001b).

If the trends in greenhouse gas emissions growth are not altered, global temperatures are expected to rise between 1.4 and 5.8° C (2.5 to 10.4° F) by 2100, according to the latest assessment of the Intergovernmental Panel on Climate Change (IPCC 2001a). The effects of such temperature changes on agricultural production, water supply, forests, and overall human development are unknown but will likely be detrimental to a large portion of the world's population (IPCC 2001b). To prevent atmospheric CO_2 concentrations from exceeding a level of 450 ppmv, global emissions would need to decrease dramatically during this century. Over the same period, however, the global population is expected to increase by 40 to 100 percent (from today's population of six billion) and economic growth is pro-

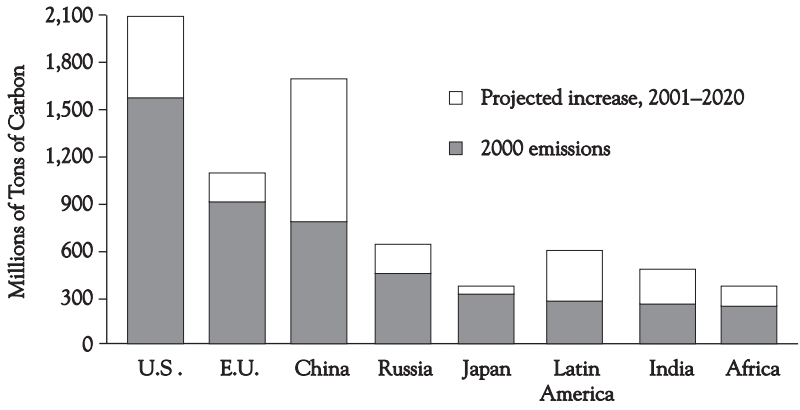
jected to climb 10- to 20-fold (IPCC 2000a). The challenge is formidable and unprecedented; meeting it will require a transition away from a global economy dependent on fossil fuels to one based on renewable and more energy-efficient technologies. Even limiting atmospheric CO_2 concentrations to a higher level, such as 550 ppmv, would entail major emission reductions from projected levels and eventual reductions far below today's emission levels.

Climate change is as much an economic and political challenge as a scientific and technological one. The nature of the problem demands a coordinated approach among the world's countries. Governments resist acting alone to rein in their emissions, given that the rising greenhouse gas output in other countries could undermine their own potentially costly efforts. Furthermore, most emissions come from sectors such as electricity generation, transportation, and agriculture, which are important to national security and economic growth. Powerful vested interests in these sectors will make the transition to a low-carbon future an uphill political climb.

International cooperation is most important—and most challenging—between rich and poor countries. Industrialized countries—primarily the United States, but also others, such as Japan and Australia—are concerned that current lack of emission control commitments for developing countries translates into a lack of environmental effectiveness. This concern is due to rising greenhouse gas emissions in poorer countries as well as the possibility that, given asymmetric emission control commitments, some energy-intensive industries might migrate to countries where emissions growth is unconstrained. Figure 1.1 shows that, although expected growth is large in industrialized countries, CO_2 emissions are expected to grow at much faster rates in China, India, Latin America, and other developing regions over the next few decades. Industrialized countries also argue that, through the 1992 United Nations Framework Convention on Climate Change (UNFCCC) and the subsequent Kyoto Protocol, they have made commitments to curb their greenhouse gas emissions *and* provide financial assistance to developing countries, all without any promise of future action from the developing world. While accepting that richer countries must take the largest steps, they argue that developing countries must take—or at least declare an intention to take—smaller steps.

For their part, many developing countries believe that the industrialized countries lack credibility on the issue of international cooperation to curb greenhouse gas emissions, having done little to address a problem largely of their own making. Figure 1.2 shows that industrialized countries are responsible for most of the buildup of atmospheric carbon dioxide over

Figure 1.1. Carbon Emissions in 2000 and Projected Growth



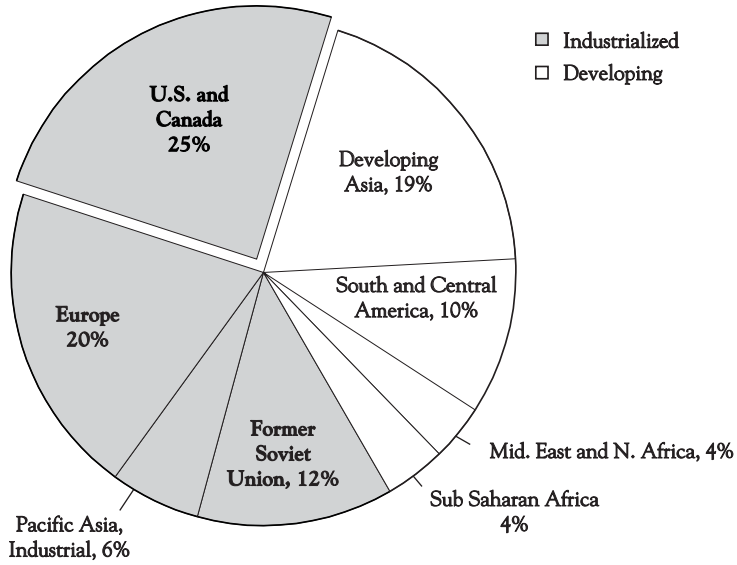
Source: World Resources Institute, compiled from data in EIA (2002a, b).
Notes: Includes carbon emissions associated with fossil fuel combustion; calculations are based on EIA *reference case* scenarios.

the past century created by fossil fuel burning and land use changes (such as deforestation).[4] Specifically, the industrialized countries are responsible for about 63 percent of human-related carbon dioxide that has accumulated in the atmosphere. The 80 percent of the world's population living in developing countries has contributed about 37 percent.

Similarly, although all emissions contribute equally to global warming, large disparities in per capita emission levels reveal a social character of carbon emissions that differs widely from country to country. Figure 1.3 shows that the average American, for example, emits about 10 times more carbon than the average Chinese and 20 times more than the average Indian. Around the world, most people view CO_2 emissions from the United States as resulting largely from luxuries that are unavailable to most people in developing nations, whereas they view the emissions of poor nations as primarily for basic human needs, such as food, warmth, and shelter. Disparities in emissions also reflect an uneven distribution of energy resources throughout the world, with some countries dependent on coal (a fuel that releases relatively large amounts of carbon per unit of energy produced), whereas others rely on less carbon-intensive energy sources, such as natural gas and hydropower.[5]

Figure 1.2. Contributors to Climate Change

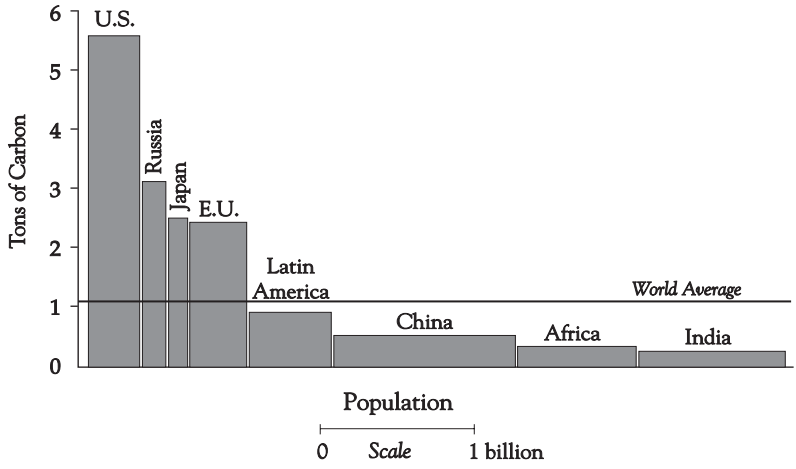
Percent of Total Accumulated Atmospheric CO_2 from Industrial Sources and Land Use Changes, 1900–2000



Source: World Resources Institute, compiled from data in Marland et al. (2000), EIA (2002b) and Houghton et al. (2000).
Notes: Data include net CO_2 emissions from fossil fuel combustion (1900–2000), cement manufacturing (1900–1979), and changes in land use (1900–1990), such as harvesting of forest products, clearing for agriculture, and vegetation re-growth.

Many in the developing world feel that some richer countries are fulfilling neither the letter nor spirit of the Climate Convention and subsequent agreements. The Convention calls on countries to "protect the climate system…on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities." More specifically, it calls on industrialized countries to "take the lead" in protecting the climate (UNFCCC 1992, Article 3.1). Mindful of these principles and the above-mentioned disparities, all countries formally agreed in 1995 that the first round of legally binding emission controls (to be adopted through a protocol) should *not* include developing countries.[6] This agreement reflects an understanding that the wealthier countries have

Figure 1.3. Carbon Emissions Per Person, 2000



Source: World Resources Institute, adapted from Grubb (1989) and compiled from data in EIA (2002b).
Note: Includes only carbon emissions associated with fossil fuel combustion.

greater financial resources and technological capability to put them on a sustainable course.

Developing countries, on the other hand, face more urgent priorities, such as poverty alleviation and public health. Even when it comes to climate change, the priority for developing countries is generally to reduce their high levels of vulnerability to the physical impacts of climate change, such as sea level rise and extreme weather events. Rather than controlling their emissions, developing countries tend to be concerned about how climate change might have an impact on food production and economic development.

Despite North-South differences in emissions, wealth, and priorities, these disparities are not the largest barrier to cooperation. Probably a more potent obstacle is the enduring and growing lack of trust. Some industrialized countries have legitimate concerns that developing countries may never come into a climate protection regime or may commit only to limit their emissions at some remote future date. For some developing countries, wealthier nations' promises on climate protection seem empty and

faithless. Furthermore, some developing countries are concerned that repeated bids on the part of the industrialized countries (principally, but not exclusively, the United States) to include emission limitation commitments for developing countries on the negotiating agenda for the Kyoto Protocol are but thinly veiled attempts to impede poorer countries' economic development prospects. After all, greenhouse gas emissions are intimately linked to essential aspects of economic development, including electric power generation, transportation, and industry. For the developing world, addressing climate change is an issue of basic economic development more than environmental protection.

Recent developments in the Kyoto process could further erode trust and reinforce the North-South stalemate. In March 2001, the United States abandoned the Kyoto Protocol, citing two main reasons: lack of developing-country participation and potentially high economic costs.[7] Yet, the absence of U.S. participation in the Protocol is likely to retard future progress on the very issue that it deemed so important—inclusion of developing countries in an emission limitation regime. In addition to abandoning the Kyoto Protocol, the United States has failed to put a strong climate policy in its place. The policy announced by President Bush in February 2002 will, by the government's own estimates, allow greenhouse gas emissions in the United States to grow by 14 percent from 2002 to 2012 (WRI 2002).

Fortunately, amid the uphill struggle for global cooperation, some grounds for optimism can be reclaimed, even in the United States. In July 2002, the state of California approved a law that will establish the first major greenhouse gas emission standards in the country. Under this law, automakers will be required by the end of the decade to limit greenhouse gas emissions from new cars and light trucks sold in California; such sales account for about 10 percent of total U.S. auto sales. Following this action, 11 additional states sent a letter to President Bush asking for federal measures to limit greenhouse gas emissions.[8]

Elsewhere in the world, most of the industrialized countries, including the members of the European Union and Japan, have ratified the Kyoto Protocol, which is poised to enter into force. With the Kyoto Protocol coming to life, discussions of what comes next gain increasing legitimacy and even urgency. Over the next few years, the pressure for a new round of negotiations will mount. There is already near-consensus that, in the long term, protecting the climate will require controlling emissions from both industrialized and developing countries. The issues are how, when, and under what conditions such emissions will be limited. What comes next?

How might the Climate Convention and Kyoto Protocol be adapted to constitute a more effective multilateral environmental regime? These questions are the subject of this volume.

II. Designing a Climate Protection Architecture

Debates on the future of the climate change treaty have focused overwhelmingly on defining emission targets or, alternatively, on how to allocate future greenhouse gas emission rights across countries. Although they are a central feature of a future climate regime, emission targets are but one part of a coherent climate protection architecture. The approaches to climate protection examined in this volume vary widely with respect to their legal character, geographic scope, use of market-based mechanisms, and other important elements of a climate protection architecture. This section explores each of these elements in greater detail. Table 1.1 summarizes the various elements and options of an international climate protection architecture.

The options discussed in this section could be combined in many ways. Indeed, there are a multitude of permutations for designing a climate protection regime, and especially for distinguishing between developed and industrialized country actions. Just as oil and water do not mix, however, some of these options are incompatible.[9] For example, the right to participate in international emissions trading is conditioned on a country's assuming an emission target with associated monitoring, reporting, and review obligations. Without a balance and coherency to rights and obligations, the environmental integrity of the framework would be sacrificed. As explained in Chapter 2, a proper balance of rights and obligations is a strength of the Kyoto Protocol—access to international emissions trading is restricted to industrialized countries that have also submitted to a battery of other treaty obligations.

Legal Nature of Commitments

Among observers and analysts, confusion often exists over whether a promised action is voluntary or mandatory in international agreements. Generally, all international treaty commitments are made voluntarily, in the sense that sovereign states themselves decide whether to participate in the agreement.[10] Once the treaty comes into force, specific commitments may or may not be considered legally binding.[11] In actuality, the legal nature of a given commitment will probably fall somewhere along a continuum between legally binding and non-binding, depending on the speci-

Table 1.1. Designing a Climate Protection Architecture: Possible Elements and Options

Element of Architecture	Options
Legal Nature of Commitment	1. Legally binding 2. Non-binding
Type of GHG Limitation Commitment	1. International carbon tax (e.g., $10 per ton) 2. Internationally harmonized policies and measures 3. Fixed emission target: cap on emissions (Kyoto-style targets) 4. Dynamic emission target: limit of emissions in relation to GDP growth 5. Dual emission targets: "safe zone" between a high and a low target 6. Emission target with cost cap: target expands if emission reduction costs reach a certain threshold (e.g., $100 per ton) 7. Sustainable development policies and measures (not harmonized)
Coverage and Scope of Actions	1. Gases (e.g., CO_2 only or all six principal greenhouse gases) 2. Geographic (e.g., project, sector, national, regional, global)
Timing and Triggers	1. Determined by existing Annex (e.g., Annex I of Climate Convention) 2. New thresholds for participation: A certain level of income or emissions per capita, for example, determines when a country should take an action
Approach to Differentiating GHG Commitments	1. Pledge-based: Kyoto-style negotiations 2. Principle-based: Agree first on principles and then derive subsequent allocation rules from those principles

ficity of the promised action, the consequences of non-compliance, and the intentions of governments making the agreement. It is worth bearing this continuum in mind throughout this volume.

The climate regime, as explained by Depledge in Chapter 2, currently employs both non-binding and binding commitments. Some provisions, such as the greenhouse gas commitments under the 1992 Climate Convention, are widely considered non-binding pledges.[12] This is due to the general phrasing of the requirements and the lack of an accompanying system of enforcement. The 1997 Kyoto Protocol, however, establishes legally binding requirements for emission limits in industrialized countries. These emission limits are precisely spelled out in the agreement and backed by procedures and mechanisms (adopted in 2001) aimed at remedying cases of non-compliance, such as when a country exceeds its emission limit.

Table 1.1. *continued*

Element of Architecture	Options
Market-Based Mechanisms	1. Project- or sector-based trading (e.g., Clean Development Mechanism) 2. International emissions trading (e.g., Kyoto-style allowance trading)
Financial and Technology Commitments	1. Funding for adaptation, renewable energy investment, sustainable development policies and measures, technology transfer, etc. 2. Compensation for climate impacts
Accountability Commitments	1. Non-compliance consequences 2. Measurement, reporting, review
Environmental Objective	1. Climate Convention objective 2. Agreement to keep a certain stabilization option open in the future 3. A quantitative objective, such as a limit on global emissions, concentrations, or temperature change that is consistent with the Climate Convention objective

Note: Other potential elements of an international climate-protection architecture exist, but are not examined here. Likewise, there are other non-treaty-based strategies, such as technology-driven approaches, which are not examined here.
Abbreviations: GHG (greenhouse gas), GDP (gross domestic product).

Like other environmental agreements, the climate change regime might successfully incorporate non-binding approaches (beyond those already stipulated in the Convention) into its architecture.[13] Several approaches discussed in this volume—SD-PAMs (Chapter 3), Sector-CDM (Chapter 4), and dynamic targets (Chapter 5)—might be quite effective in a non-binding form. Past experience with the Climate Convention, however, suggests that a *purely* non-binding system is unlikely to prevent dangerous climate change.[14] In the future, the climate regime could adopt mandatory requirements for all countries or, instead, for a subset of countries, such as those with greater responsibility for the problem of climate change or those with greater capabilities to reduce emissions.

Type of Greenhouse Gas Limitation Commitments

Greenhouse gas limitation commitments will form a central element of a future climate protection architecture. Here, policymakers have a variety of options. Some commitments would entail *harmonized* policies and mea-

sures across countries, such as the removal of fossil fuel subsidies or promotion of renewable energy. Countries could likewise promote climate protection through an international carbon tax. Although theoretically appealing, these kinds of internationally harmonized approaches have had limited traction in climate negotiations over the past decade. Such proposals suffer from monitoring and enforcement problems and, perhaps most important, tend to intrude into the domestic policymaking sphere in a way that has proven politically unacceptable.

Emission targets offer several benefits relative to harmonized actions. First, by their very nature, targets can be differentiated across countries. The Kyoto Protocol targets, for example, range from a 10 percent increase above 1990 levels (Iceland) to an 8 percent reduction below 1990 levels (European Union and others). The concept of differentiation, rather than harmonization, better reflects the Climate Convention's promise to give "full consideration" to the "specific needs and circumstances" of Parties (UNFCCC 1992, Article 3.2). Second, decisions on *how* to achieve emission targets are left to the sovereign discretion of countries, without the intrusion of international rules.[15] Generally, the preference for emission targets (and trading, discussed below) is due to the legal framework underpinning international agreements, which is based on sovereignty and therefore voluntary assent (Wiener 1999). In effect, voluntary assent makes harmonized approaches—such as a global carbon tax or internationally coordinated policies—less politically workable than targets. Through a structured negotiating process, countries commit to a target they find politically acceptable with respect to environmental stringency and economic costs. Third, emission targets are compatible with market mechanisms (see below) such as international emissions trading, which can help reduce overall costs.

One kind of target is a *fixed* (or, absolute) *target*, which establishes a maximum level of emissions a country can emit during a specified period. For example, targets taken by industrialized countries under the Kyoto Protocol entail fixed emission ceilings during the 2008 to 2012 time frame (Chapter 2). Fixed targets have the advantage of ensuring a particular environmental outcome (via a "cap" on emissions)[16] and can promote cost-effectiveness when coupled with emissions trading.

The difficulty with negotiating fixed targets stems from uncertainties over future emission levels and the costs of achieving any future emission target (Baumert et al. 1999, Pizer 1999,Victor 2001). The further into the future targets are set, the greater the uncertainties. These uncertainties carry two opposing risks: (1) a target set too stringently can potentially

constrain economic development, an unacceptable consequence for many developing countries and (2) a target set too loosely, in contrast, can result in a weakening of other countries' targets. This second risk is due to the influence of international emissions trading: for instance, country A's excess emission allowances (due to weak targets) might be traded to country B, which would, as a consequence, be able to increase its own emissions. (This phenomenon is often referred to as "hot air" trading.)

At least three ways of designing emission targets could potentially reduce economic uncertainties and environmental risks. The first is a *dynamic target*. Under this kind of target, a country's allowable level of emissions is adjusted according to some other variable, such as gross domestic product (GDP) (CCAP 1998, Baumert et al. 1999, Philibert and Pershing 2001). A dynamic target of this sort was proposed by Argentina in 1999 (Chapter 6). Dynamic targets can reduce economic uncertainty in the target-setting process and promote environmental integrity (i.e., less unintentional "hot air"), particularly with respect to developing countries. Yet, dynamic targets pose certain challenges relative to fixed targets, including added complexity and data requirements. These challenges are explored in greater depth in Chapter 5.

A second way to design emission targets is to use *dual targets*. Here, a country has two emission targets, rather than one. The purpose of the lower (more stringent) target is to provide an incentive to reduce emissions, since reductions below this target would enable the country to sell emission reduction allowances. The higher (less stringent) target would have a punitive function: Exceeding this target puts the country out of compliance. Thus, the lower target would be a selling target and the higher one a compliance target. No penalty would be assessed if emissions fell between the selling and the compliance targets. That area would be the safe zone, in which the country is neither out of compliance nor able to sell allowances through international emissions trading. This dual target concept, as explored in Chapter 5, could be combined with a dynamic target approach.

The third way addresses cost uncertainties by coupling a fixed target with a *cost cap*, sometimes referred to as a "safety valve" or "price cap" (Pizer 1999, Victor 2001).[17] A cost cap places an upward limit on the costs of emission reductions, thereby providing greater up-front certainty about the potential magnitude of implementation costs for a given target. If abatement costs exceed the cap (e.g., $100 per ton of CO_2), the government may issue additional emission allowances (or purchase them from a central authority), rather than require more costly emission reductions. In

such an instance, using the cost cap would allow greenhouse gases to exceed the target level, effectively transforming a fixed target into a dynamic one. Although not explored in any of the chapters, a price cap could work in tandem with several of the proposals examined in this volume.

It should be noted that quantitative emission targets—fixed or dynamic—are not a necessary condition for climate protection, especially for countries whose emissions are relatively small. The 49 countries classified as "least developed" by the United Nations contribute approximately 0.5 percent of yearly global CO_2 emissions.[18] These countries and perhaps others need not necessarily adopt quantitative emission targets or other commitments, even over the next few decades, because their current and future contributions to global greenhouse gas emissions are small.

Moreover, larger developing countries have demonstrated that they can take climate-friendly actions in the absence of firm targets. A wide range of energy efficiency and renewable energy measures are already helping to limit the growth of greenhouse gas emissions in developing countries, even though these measures are being taken for reasons other than climate change (Reid and Goldemberg 1999, Biagini 2000). Thus, *qualitative approaches* that advance country-specific sustainable development policies and measures (SD-PAMs, Chapter 3) could play an important role in developing countries' future climate protection efforts.

Coverage and Scope of Actions

Future commitments could vary with respect to their coverage and scope. Kyoto-style targets, for example, are nearly comprehensive in their emission coverage. They encompass all emission sources and certain sinks (i.e., emission absorption activities) within a country and also address all six main greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). In the future, emission limits for some countries could be narrower in coverage, especially in developing countries where some gases are difficult to measure or monitor and may constitute only a small share of countrywide emissions.

A treaty could promote action at the project, sector, or countrywide levels. Project-based emission reductions (which also have sustainable development benefits in developing countries) are already authorized through the Kyoto Protocol's Clean Development Mechanism (CDM). Sector-based commitments might encompass those parts of national economies where greenhouse gas emissions are most prominent, such as heavy

industry, land use change and forestry, or electric power production. The approaches examined in Chapters 3 and 4 of this volume—Sector-CDM and SD-PAMs—could be channels for such strategies. Other kinds of international cooperation at the sector level might help address competitiveness concerns, particularly in sectors—such as steel or aluminum—where international competition is often intense.

Internationally, future agreements might entail commitments from a particular region or limited set of countries, such as those that are the largest greenhouse gas emitters. The Kyoto Protocol embodies this approach, in that 38 countries are captured (37, counting the U.S. withdrawal) under the emission control system. It further allows regions, such as the European Union, to achieve their targets jointly through their own internal agreement on commitments. This same strategy could be employed in the future, including in developing countries (see Chapter 2).[19] Finally, a *global* commitment could cover all countries under the same emission control system. Proposals such as those calling for per capita-based emission entitlements fall under this category (Chapter 8).

In general, a regime that is broader in scope and coverage will afford greater opportunity for participants to undertake emission reductions where they are least costly (see market mechanisms below). At the same time, however, the broader the scope, the higher a regime's monitoring and evaluation costs will be.

Timing and Triggers

Future actions could also vary with respect to *timing*: Some countries could take action sooner than others. This kind of differentiation is clearly visible in the Kyoto Protocol, as industrialized countries committed to emission controls from 2008 to 2012, with the prospect of additional countries making commitments in a later period. Since the 1992 adoption of the Climate Convention, action has been differentiated primarily on the basis of countries' designation as "Annex I" or "non-Annex I" Parties, categories that correspond roughly to traditional North-South groupings. Some treaty provisions apply to other categories, including "Annex II" Parties (wealthy countries with a special obligation to provide developing countries with financial and technological assistance on climate change), "economies in transition," "developing" countries, and "least developed" countries (see Chapter 2).

For the future, a challenging issue is determining what should trigger an emission limitation commitment for a particular country. A least developed country might be exempt from greenhouse gas commitments of any

kind for several decades, yet a rapidly growing one might not. This issue of when countries should graduate to steeper commitments arises in several of the approaches examined in this volume. Whereas traditional distinctions (i.e., Annex I/non-Annex I) will be useful and necessary in the future, new categorizations may be needed to differentiate the timing of actions across countries. For example, the 1987 Montreal Protocol includes different schedules for phasing out ozone-depleting substances based on a country's per capita consumption of certain controlled substances (0.3 kilograms per person) (Montreal Protocol 2000).

Approach to Differentiating Commitments

As noted above, greenhouse gas emission targets can be differentiated across countries, with some countries required to reduce emissions more than others. It is useful to consider two different procedural approaches to negotiating emission targets, be they fixed, dynamic, or qualitative. The different approaches examined in this volume, as well as others outside the scope of this study, can be categorized as either pledge-based or principle-based. This distinction is important because it determines a starting point for negotiations and, more fundamentally, reflects differing and perhaps conflicting ways of viewing the challenge of climate protection.

Generally, the international negotiating process is best characterized as pledge-based; countries formulate their national positions and negotiate in their interests, voluntarily making commitments (alone or with other countries) at their sovereign discretion. Because the international legal order lacks the ability to require a country to participate, the tradition has been for countries to "pledge" particular actions in a bottom-up style. These commitments typically represent (and always purport to make) some divergence from the status quo. (See Box 1.2.) In the Kyoto Protocol negotiations, for example, industrialized countries pledged various emission limitation or reduction targets relative to their 1990 emission levels. This pledge-based approach reflects the voluntary assent rule and the *realpolitik* of international negotiations.

Bottom-up negotiation processes like the Kyoto Protocol have been criticized as ad hoc, with negotiated results shaped mainly by political power and economic might rather than by objective criteria. Thus, many have called for negotiation on overarching principles or rules that, once agreed, would guide the subsequent emission reduction efforts among nations in an orderly fashion. The Brazilian Proposal (Chapter 7) and per capita allocations (Chapter 8) are two examples of principle-based proposals. The Brazilian Proposal would apportion emission reduction requirements based

Box 1.2. Business As Usual: The Challenge of Setting Targets

In determining emission targets, governments will primarily be concerned with their business-as-usual (BAU, or "baseline") scenario, which represents the most plausible projection of future emissions.[1] BAU embodies the notion of what would happen, hypothetically, if climate-friendly actions were not taken. BAU emission estimates can help governments gauge the stringency and economic acceptability of a particular emission target. The difficulty of estimating BAU patterns stems from trying to forecast the future, a challenge that may be greater in developing and transition countries, which have fewer consistent historical patterns and for which development is more affected by external conditions. Even in mature economies of the industrialized countries, however, accurately predicting future economic and emission trends is difficult.

Dynamic targets (Chapter 5) represent an attempt to lessen some of the problems associated with postulating a BAU reference case by introducing targets that are subject to adjustment according to shifting economic conditions. This was the main appeal of a dynamic target for Argentina (Argentine Republic 1999), which used nine different future scenarios to determine the magnitude and mechanics of the target it ultimately announced. Chapter 5 introduces the concept of "dual targets"—an innovative way to further reduce (but not eliminate) economic uncertainty in establishing emission limitations.

continued on next page

on each country's relative responsibility for the global temperature increase. The per capita approach would distribute allowances according to the size of a country's population. There are other allocation-based approaches—not examined here—that operate similarly.[20]

Principle-based approaches often are advanced under the mantle of *equity*, a stated principle of the Climate Convention. (See Box 1.3.) The most recent IPCC assessment catalogs 13 equity principles and their associated allocation rules (Toth and Mwandyosa 2001), illustrating a diversity of views on what constitutes an equitable allocation of emission allowances across countries. Similarly, many believe that, given North-South disparities in negotiating capacity and power, a principle-based approach to negotiating commitments is fairer *procedurally*. Some developing countries question whether they can ever get a "fair deal" if emission commitments are determined on the basis of raw bargaining power.

Box 1.2. *continued*

The concept of BAU is also relevant to other approaches examined in this volume. The concept of Sustainable Development Policies and Measures (SD-PAMs, Chapter 3) is predicated on taking actions that diverge from a "conventional development path." Emission credits under the Clean Development Mechanism (CDM) or Sector-CDM (Chapter 4) must be "additional" to those that would have occurred otherwise. Both of these approaches involve the same slippery concept of business as usual.

Two of the approaches examined in this volume attempt to sidestep the difficult issue of business as usual, as they are not concerned with the status quo. An allocation based on equal per capita entitlements, or an approach based on relative responsibility for global temperature increase (i.e., the Brazilian Proposal), operates according to predetermined principles that do not involve BAU forecasting. Nevertheless, these approaches do not entirely avoid the morass of BAU. Countries will still be concerned about assessing the reduction efforts required by a given target, and such assessments typically involve forecasts of future emission levels. The political acceptability of a particular target is strongly influenced by the magnitude of emission reductions required, as well as the associated costs or benefits.

[1] Even though Kyoto targets are expressed relative to a base year (e.g., 8 percent *below 1990*), the difficulty of meeting them typically involves assessing current emission levels relative to future emission projections (e.g., a 2010 target might amount to a 20 percent reduction compared to projected levels).

To be sure, however, the issue of equity should not be associated solely with the differentiation of emission commitments achieved through principle- or pledge-based negotiations. Equity is relevant to all elements of the architecture. For example, the Montreal Protocol on Substances that Deplete the Ozone Layer is widely perceived as fair not only because country commitments were differentiated but also because industrialized countries ultimately compensated developing countries for phasing out ozone-depleting substances (Banuri et al. 1996). Developing countries agreed to phase-out schedules only after industrialized countries provided the necessary financing through a multilateral fund. Similarly, the level of acceptable climate change (see "Global Environmental Objective" below) will have a major bearing on equity because the impacts of climate change will be unevenly distributed. As suggested by the definition in Box 1.3,

Box 1.3. Equity and Climate Protection

The Climate Convention stipulates that countries should protect the climate system "on the basis of *equity*, and in accordance with their common but differentiated responsibilities and respective capabilities" (emphasis added). In general terms, the Intergovernmental Panel on Climate Change (following on Flexner 1997) defines equity as "the quality of being fair or impartial" or "something that is fair or just." In the narrower context of international environmental issues, Harris defines equity as "a fair and just distribution among countries of benefits, burdens, and decision-making authority associated with international environmental relations." Several equity considerations are embedded in these definitions, including the following:

Procedural equity concerns the fairness of the negotiating process. Albin states that during negotiations all Parties should have the opportunity for fair hearing, fair input, fair play, and fair procedures. More specifically, all Parties should be given full and equal opportunity in the debates and all Parties should negotiate in good faith, reciprocate, and adhere to agreed rules. In addition, decision-making should be transparent and votes representative.

Consequentialist equity refers to the fairness of outcomes or distributive justice, that is, the distribution of greenhouse gas emission limitations and their associated costs and benefits, as well as the burdens associated with adapting to or bearing the physical impacts of climate change. Consequentialist equity also has a temporal dimension: *Intergenerational* equity suggests that actions to protect the climate system are called for in the near term so that future generations do not suffer from unacceptable climatic changes.

Sources: Banuri et al. 1996 (IPCC, above), Albin 2002, Harris 2000.

the totality of the climate protection architecture, not just one element, ultimately will influence whether governments perceive an agreement as fair. Likewise, achieving an internationally acceptable differentiation of greenhouse gas commitments is not just a matter of agreeing on equity principles. Countries may hold fundamentally different worldviews on climate change encompassing very different notions about the urgency of climate protection and the nature of appropriate management strategies (Rayner 1994, cited in Banuri et al. 1996).

Market Mechanisms

Market mechanisms, such as international emissions trading, are increasingly embraced by the international community in efforts to address climate change.[21] The primary attraction of market mechanisms is *cost-effectiveness*, a principle enshrined in the Climate Convention (Article 3.3). Emissions trading supports this principle by providing incentives for emission reductions to be undertaken where they are the least costly. The merits of emissions trading with respect to cost-effectiveness are extensively documented in the literature.[22]

The basic mechanics of international emissions trading are relatively simple. First, governments must commit to emission limitation targets (discussed above). Second, such targets are divided into discrete, tradable units. These tradable units are often referred to as *allowances*, because they "allow" the holder to emit a specified amount of greenhouse gases, say, one ton of carbon dioxide or the equivalent amount of another greenhouse gas. Governments may choose whether to distribute these allowances to domestic emitting sources. Third, allowances could then change hands in several ways—in trades between governments, between a governmental and a private entity, and between private entities. The party purchasing allowances is entitled to emit more; the party selling those allowances is required to emit less.

As explained in Chapter 2, the Kyoto Protocol incorporates an international emissions trading system, as well as two project-based market mechanisms—joint implementation and the CDM. In addition to lessening the cost of greenhouse gas emission cuts, the CDM aims to promote sustainable development in the developing world. Several other approaches discussed in this volume could also use market mechanisms. SD-PAMs (Chapter 3) could entail access to the CDM. Sector-CDM (Chapter 4) suggests expanding the scope of the CDM to encompass entire sectors or geographic regions. Dynamic targets (Chapters 5 and 6), variants of the Brazilian Proposal (Chapter 7), and a system of per capita–based entitlements (Chapter 8) could each use an international emissions trading system. Chapter 9 illustrates the cost-effectiveness benefits that could be realized under a well-functioning trading system.

Financial and Technology Commitments

Financial provisions—such as those for capacity building, adaptation assistance, and technology transfer—are essential to crafting North-South compromises. For example, the final package adopted as the 2001

Marrakesh Accords comprises technical provisions for making the Kyoto Protocol operational *and* a financial component, however limited, aimed at helping developing countries address climate change and adapt to its physical impacts. This financial package includes an adaptation fund and a least developed country fund for which industrialized countries have pledged a relatively small amount of money.[23] Currently, the climate change regime has designated the Global Environmental Facility (GEF) as its financial mechanism. In addition to managing several funds for the Climate Convention, the GEF finances activities supporting the Convention's implementation in developing countries, including capacity building, preparation of national communications and greenhouse gas inventories, and vulnerability and adaptation assessments.

To the extent that developing countries are asked to take on new greenhouse gas commitments, the design and funding of financial mechanisms will be critical. According to the Climate Convention, the degree to which developing countries will effectively implement their commitments depends on the degree to which they receive assistance from the industrialized countries (UNFCCC 1992, Article 4.7). The IPCC further states, "Most analysts…suggest that both equity and efficiency considerations create a case for large international financial transfers as part of any regime for substantial reductions in greenhouse gas emissions" (Banuri et al. 1996).

Accountability Provisions

Any effective climate protection architecture will require provisions for determining whether countries are adhering to their promises. These provisions include national monitoring and reporting as well as the review of information (such as emissions data) submitted by Parties in order to ensure accuracy and completeness. These requirements are essential conditions for implementing some options for greenhouse gas limitation commitments as discussed above, since a government cannot manage what it cannot or does not measure. Equally important are the procedures and consequences to which countries are subject if they fail to comply with their obligations (or are suspected of non-compliance). Such credibility mechanisms are already enshrined in the Kyoto Protocol and the subsequent 2001 Marrakesh Accords and will undoubtedly form important building blocks for future climate agreements.

Global Environmental Objective

To what end is the above-discussed climate protection architecture directed? What constitutes "climate protection"? The Climate Convention (and by association the Kyoto Protocol) establishes, as an ultimate objective, the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The Convention also stipulates that, "Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

There is currently no agreement on what constitutes a dangerous level of greenhouse gas concentrations. The IPCC's most recent assessment report states that, "Given the large uncertainties that characterize each component of the climate protection problem, it is impossible to establish a globally acceptable level of GHG concentrations today" (Toth and Mwandyosa 2001). Yet, an important step to building an environmentally effective climate regime would be to achieve greater clarity on a long-term goal (Berk et al. 2001, Corfee-Morlot 2002). A long-term perspective casts the climate protection challenge into sobering relief: Even limiting atmospheric greenhouse gas concentrations to a *doubling* of pre-industrial levels would likely require a wholesale transition in the world's energy economy. A more formal long-term objective might help shape more effective near-term actions in a way that is consistent with a variety of future atmospheric stabilization options. One promising approach explored by the COOL Global Dialogue Project is to ensure that global commitments keep future climate protection options open to a stabilization of CO_2 concentrations at 450 ppmv (550 ppmv including all gases) (Berk et al. 2001).

III. Seven Approaches to Climate Protection

Rigid divisions between industrialized and developing countries have been a main feature of the international climate debate (and indeed other debates) over the past decade. To protect the atmosphere from dangerous climate change, the coming decade must witness the bridging of this divide between richer and poorer nations. Accomplishing this will require, first and foremost, industrialized country leadership, as called for under the Climate Convention. New ways of designing international coopera-

tion, such as those examined here, will also need to be considered, if not adopted.

When examining the different approaches, here and in subsequent chapters, it is important to avoid false comparisons. The approaches presented differ in scope, application, and purpose; they represent different elements of a climate protection architecture. Some of them are mutually compatible, and none of them represents the best or most appropriate approach for all countries. Chapter 10 explains the elements of a climate protection architecture that are prominent in each approach.

The Kyoto Protocol

In Chapter 2, Joanna Depledge describes the salient features of the climate protection architecture that currently exist in the 1997 Kyoto Protocol. As the focal point of international negotiations from 1995 to the present, the Kyoto treaty is clearly the architecture with which the international community is most familiar and comfortable. No doubt, some elements of the Protocol will persist for decades to come, and other approaches, such as those described in this volume, may even be absorbed into the Kyoto Protocol framework in the future. Depledge assesses the viability of continuing Kyoto—preserving the existing architecture (e.g., fixed targets) but widening its scope to include developing countries. The author also examines the processes through which the Kyoto Protocol can expand and embrace some of the other approaches presented in this volume. In the process of articulating the Kyoto Protocol's architecture and its procedures, Depledge illuminates the historical context of the current tensions between industrialized and developing countries.

Sustainable Development Policies and Measures

In Chapter 3, Harald Winkler and his colleagues examine Sustainable Development Policies and Measures, an innovative approach for developing countries to contribute to climate protection. For most developing countries, climate change is not an immediate priority, and sustainable development could be a more robust objective around which to organize action. The SD-PAMs approach harnesses this reality by beginning with the development objectives and needs of developing countries. If countries act early to move to greater sustainability in their development path, they will start bending the curve of their greenhouse gas emissions downward. The approach's logic is derived directly from the Climate Convention, which states that countries should promote "sustainable develop-

ment" through "policies and measures to protect the climate system" (Article 3.4). As the authors point out, the emphasis in the climate negotiations has been to focus on emission reductions rather than sustainable development. The approach is illustrated through a case study of South Africa.

Sector-Based Clean Development Mechanism

Chapter 4, by Joséluis Samaniego and Christiana Figueres, examines a *sector*-based Clean Development Mechanism and considers its potential application in Mexico City. This approach builds on the already operational *project*-based CDM. Currently, CDM rules and institutions are designed primarily to encompass projects that are relatively narrow in scope, such as electric power or energy efficiency projects. The Sector-CDM represents an expansion of the scope of the CDM to cover entire national sectors (such as cement or power production) or geographic areas (such as a municipality). This approach could support emission reductions and sustainable development benefits—the two expected by-products of the CDM—across a wider array of activities. This approach could also bring financial resources to fund the kind of SD-PAMs discussed in Chapter 3. It is important to note that this approach differs from others in this volume in that a Sector-CDM is not necessarily a post-Kyoto one. Because the definition of a CDM project is currently indeterminate, new rules conceivably could make this approach operational in the relatively near future.

Dual-Intensity Targets

In Chapter 5, Yong-Gun Kim and Kevin Baumert explore two distinct ideas—dynamic targets and dual targets—and how, individually and in combination, they can be used to reduce the uncertainties inherent in committing to greenhouse gas emission limitations. Establishing greenhouse gas targets is a contentious process. Future emission levels are highly uncertain (especially in developing countries), and countries are wary of any commitment that could turn out to be excessively stringent. Yet, weak targets might not deliver any environmental benefits. Dynamic targets, as alluded to in Section II of this chapter, could help address these challenges. Dynamic targets differ in two important respects from the fixed targets adopted in the Kyoto Protocol. First, dynamic targets adjust according to a variable (such as GDP) that typically has a strong influence on emission levels. The adjustments could be made by using *intensity* or

indexed targets—the two main kinds of dynamic targets. Second, more than one target can be used. In this regard, Kim and Baumert explore the viability of using high- and low-intensity targets (i.e., dual targets), between which a country would occupy a "safe zone" where it would neither be out of compliance nor able to sell emission allowances.

Argentine Voluntary Commitment

In Chapter 6, Daniel Bouille and Osvaldo Girardin offer a specific and unique example of a country that sought, and failed, to implement a voluntary commitment based on a dynamic target. In 1998, Argentina declared its intentions to be bound by an emission limitation target and further elaborated on the specifics of that target the following year. The authors illuminate the political context under which Argentina made its commitment, emphasizing Argentina's desire to align its foreign policy objectives with those of the United States. The chapter likewise demonstrates that target setting is a technically complex exercise, in part because of the uncertainty of future emissions and the treatment of gases other than CO_2, such as methane from agriculture. The chapter articulates several lessons learned from the Argentine experience—both in deciding to commit to a voluntary target and in specifying the target's nature and level—that could be useful to other countries contemplating similar actions.

Brazilian Proposal

In Chapter 7, Emilio La Rovere, Laura Valente, and Kevin Baumert explore the Brazilian Proposal. The most salient feature of this Proposal is its call for sharing emission reduction burdens on the basis of each country's relative responsibility for the global temperature increase. This idea is derived from the "polluter pays" principle and builds squarely on the Climate Convention language calling for all countries to protect the climate system according to their "common but differentiated *responsibilities* and respective capabilities" (Article 3.1, emphasis added). The Brazilian Proposal is the only approach examined in this volume that has been officially proposed to the UNFCCC Parties. The proposal was originally submitted in July 1997, before the adoption of the Kyoto Protocol, and revised in 1999. Although the Proposal played an important role in the Kyoto negotiations, it did not garner a consensus. It may yet play an important part in future debates on shaping a global climate protection sys-

tem. Chapter 7 explores various ways that the Proposal could be expanded to include developing countries and adapted to increase its workability.

Per Capita Entitlements

In Chapter 8, Malik Amin Aslam explores per capita-based emission entitlements, the approach that has gained perhaps the most attention of any examined in this volume. The per capita entitlements idea is based on the notion of "equitable" resource sharing and elaborates on the proposition that each person has the right to emit an equal amount of greenhouse gases. Although there are many variants of this approach, most begin by suggesting that overall global emissions must contract to a level that prevents dangerous climate change. Moreover, emissions *per person* must converge from today's levels to one that is equal across all countries. The analysis addresses key issues likely to shape the acceptability and effectiveness of an equal per capita entitlements approach, including issues of equity and the application of various fairness criteria, the importance of international emissions trading, and the ability to account for diverse national circumstances. The author proposes an alternative that might increase the political appeal of a per capita-based solution.

Notes

1. The Kyoto Protocol's first commitment period runs from 2008 to 2012. Although this may sound far away, negotiations for the second commitment period must be concluded by the end of 2007, according to the Protocol's own provisions. Negotiations could begin between 2003 and 2005.
2. See Menand (2001, 431) for a metaphor of probabilistic thinking.
3. Indeed, some strategies to protect the global climate system do not even involve an international treaty. This volume does not address such strategies.
4. If non-CO_2 gases could be included in this figure, the responsibility would shift somewhat toward developing countries because many developing countries have a higher share of non-CO_2 gases than industrialized countries.
5. Some hydropower installations can result in significant emissions of greenhouse gases, particularly dams in tropical countries. See WCD (2000).
6. This agreement, known as the Berlin Mandate, establishes that the protocol or other legal instrument to be negotiated should not include new commitments for developing countries.
7. For treatment of this subject, see Baumert and Kete (2001).
8. For more information, see the Natural Resources Defense Council webpage at http://www.nrdc.org/media/pressreleases/020722.asp.

9. Some of the elements of a climate protection architecture address the rights or privileges of governments (or their private entities) under the treaty. These include the right to participate in international emissions trading and the CDM. Other elements of differentiation address the obligations of countries—what they should or must do. Access to particular treaty rights typically comes part and parcel with the assumption of parallel obligations.
10. "Voluntary" is an ambiguous term. For this reason, we use the term "non-binding" instead. See Werksman (1999) for a discussion on this point.
11. The case of Argentina exemplifies this distinction (Chapter 6). Although its commitment was dubbed "voluntary," Argentina's communication to the UNFCCC stated that "the present commitment shall constitute a binding international commitment once the Conference of the Parties to the UNFCCC implements a new option that may enable non-Annex I Parties" to assume a target and participate in the mechanisms (Argentine Republic 1999). If the COP had taken such action, Argentina's target would be considered voluntary and binding.
12. Experts disagree on this point. Literally speaking, treaty commitments are binding on Parties. However, the loose phrasing of commitments in the UNFCCC, according to many, renders them aspirational rather than mandatory commitments. Article 4.2b, for example, requires industrialized countries to "communicate… detailed information on its policies and measures… with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases." This differs from Kyoto's clear emission reduction requirements and non-compliance procedures.
13. For example, see Levy et al. (1992). When viewed as legally binding regulatory rules, many agreements will appear as ineffective (e.g., Convention on Long-Range Transboundary Air Pollution, or LRTAP). Yet, multilateral environmental agreements can establish important norms and principles, increase governmental concern for environmental problems, and catalyze processes that enhance the capacity of governments to address environmental problems.
14. Many industrialized countries have not achieved the emission limitation pledges made in the Climate Convention.
15. Another reason for the preference for trading over taxes (i.e., quantity over price instruments) identified by Pizer (1999) is the hope that emission allowances might be distributed free, whereas a carbon tax would require a transfer of revenue to governments.
16. Of course, this assumes that countries comply with the target.
17. Like a carbon tax, the level of a cost cap would need to be harmonized across countries.
18. Authors' calculations, based on EIA (2001a).
19. The European Union, however, is still a special case because both the member states and the European Union are Parties to the Protocol. The European Union has strong institutions that can exercise jurisdiction over its members in important policy areas. Thus, the joint fulfillment of commitments among a regional grouping will be harder in other cases.

20. For other principle-based proposals, see, specifically, Blanchard et al. (2001), Groenenberg et al. (2001), Gupta and Bhandari (1999), and Müller (2001b), and, generally, Banuri et al. (1996) and Toth and Mwandosya (2001).
21. Taxes, of course, are also a kind of market-based mechanism. As discussed above, however, greenhouse gas taxes are more likely to be implemented at the domestic than international level.
22. See Baumol and Oates (1988) and Tietenberg (1985). For experiences with U.S. domestic programs, see Carlson and Burtraw (2000), Stavins (2001), and US EPA (1985). At the international level, however, emissions trading is relatively untested. Achieving the positive results that have been demonstrated in domestic contexts will require competitive markets and other conditions that may prove elusive, especially within the confines of international treaty law where participation and compliance cannot be assured (Baumert et al. 2002). The Kyoto Protocol constitutes the first major experiment in international emissions trading.
23. UNFCCC 2002, Decisions 5/CP.7 and 7/CP.7.