1 A "Greenprint" for International Cooperation on Climate Change

The difficulty lies not so much in developing new ideas as in escaping from old ones.
—John Maynard Keynes, *The General Theory of Employment Interest and Money*

International negotiations on climate change have been dogged by mutual recriminations between rich and poor countries, constricted by the zero-sum arithmetic of a shrinking global carbon budget, and overtaken by shifts in economic and hence bargaining power between industrialized and developing countries. We call these three factors, respectively, the "narrative," "adding-up," and "new world" problems. Given these factors, the wonder is not the current impasse. It is rather the idea that progress might be possible at all.

But there is a way forward. It requires a radical change in the approach to cooperation on climate change. We propose a "Greenprint for cooperation" that calls for a major role reversal between the developed and developing countries, a shift in emphasis from emissions reduction to technology generation, and a radical reconfiguring of contributions by individual countries.

First, instead of waiting for the industrial countries to lead, the large "dynamic emerging economies"—China, India, Brazil, and Indonesia, hereafter referred to as DEEs—must assume that mantle, offering contributions of their own and prodding the reluctant West, especially the United States, into action. This role reversal would be consistent with the fact that the stakes in the near to medium term are much greater for the DEEs than for today's rich countries.

Second, instead of focusing exclusively on emissions cuts by all, which would imply either unacceptable cuts in consumption in rich countries or poor countries' having to forgo the rudiments of modernity, the emphasis must be on technology generation. This would allow greater consumption and production possibilities for all countries while respecting the global emissions budget, about 750 gigatons of carbon dioxide over the next forty years, that is dictated by the climate change goal of keeping average temperature rise below 2 degrees centigrade.

Third, instead of basing cooperation on the old "cash-for-cuts" approach—not feasible today because the economically enfeebled rich are in no position to offer meaningful compensation to poorer countries in return for cuts in their carbon emissions—all major emitters, the rich and the dynamic poor alike, must make contributions, calibrated in magnitude and form to development levels and prospects. "From each, according to its ability, and to each, the common good of planetary survival" might be a characterization of contribution and reward in this new approach.

In this chapter we spell out how our proposed Greenprint would work, but first we explore the three major problems and why so little progress has taken place to date. We end with thoughts on the plausibility that this Greenprint can provide a basis for progress.

The Cancun, Copenhagen, and Durban "Deals"

These seem unusually inauspicious times to discuss, let alone yearn for, international cooperation to address the problem of climate change. After all, the three most recent summits held under the UN Framework Convention on Climate Change (UNFCCC)—Copenhagen in 2009, Cancun in 2010, and Durban in 2011—have come and gone. They, especially Durban, have offered only a thin reed of hope based on nothing more than promises to make more meaningful promises later, rather than on concrete commitments to act now.

To the glass-half-fullers, the Copenhagen summit had notable successes:

—It moved climate change up to the top of the political agenda.

—It took several significant steps, including spelling out the goal of limiting global warming to 2 degrees centigrade.

—It called for arrangements to mobilize $100 billion a year by 2020 to help developing countries adapt to climate change, that is, to adjust to the warming that does occur despite mitigation efforts.

—It established an advisory group to look at financing options.

But to the glass-half-emptyers, the meeting was notable for what did not happen:

—There was no agreement on binding emissions cuts and only promises of best efforts at the national level; indeed, no aggregate emissions target was set, not even for 2050.

—There was no commitment to provide public resources to the poorest countries, only broad statements of intent to provide international assistance.

—There was no agreement on international monitoring, reporting, and verification, but some willingness to countenance international consultation.

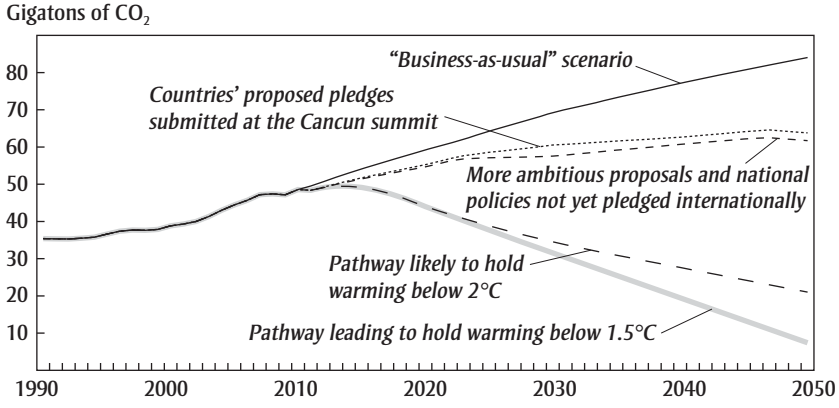
—There was no mechanism for reducing emissions from deforestation and forest degradation, although there was some recognition of the "need" for the "immediate establishment of a mechanism."

—And there was no discussion of international trade in emissions rights.

In Cancun a year later, expectations were so low that what did occur was an upside surprise. Although there was still no agreement on binding emissions reductions, the Cancun summit did lead to emissions reduction pledges from both developed and developing countries, involving all of the major economies and the largest emitters—China, the United States, the European Union, India, and Brazil. The agreements included a mechanism to track countries' progress in meeting those commitments and a review of the adequacy of the commitments in meeting long-term global emissions reduction goals. And they established a number of mechanisms and institutions to help accelerate emissions cuts and protect vulnerable countries, such as a Green Climate Fund, a global network of climate-related technology experts, an adaptation framework, and a strategy for tackling deforestation.[1]

1. Houser (2010).

FIGURE 1-1. Pledges to Reduce Emissions Are Woefully Inadequate: Projected GHG Emissions under Different Scenarios



Source: Climate Action Tracker (climateactiontracker.com), © 2009 Ecofys and Climate Analytics.

The big problem with the pledges made by the major countries to cut emissions is that they are inadequate compared to what the scientific community says is necessary to keep climate change to manageable levels. As figure 1-1 shows, a group of MIT scientists who maintain an interactive real-time scoreboard calculate that even if all countries keep their pledges, the likely temperature rise by 2050 will be 3.2 degrees centigrade (5.8 degrees Fahrenheit). Although this would be better than the predicted temperature rise of 4.8 degrees centigrade (8.6 degrees Fahrenheit) under a "business-as-usual" scenario, it would still fall far short of the need to limit temperature rise to 2 degrees centigrade (3.6 degrees Fahrenheit) and emissions to below 450 ppm (parts per million). So, even on the most generous interpretation, the insurance policy against catastrophe was weak.

One year later, in Durban, the headline outcome was the agreement to start talks on a post-2020 climate accord. A new working group was given a mandate "to develop a protocol, another legal instrument or an agreed outcome with legal force under the United Nations Framework Convention on Climate Change (1992) applicable to all Parties." The job is to be completed by the end of 2015 to enable the agreement to go into effect and be implemented in 2020. The noteworthy and new part of this wording is that all countries are supposed

to be legally bound, including the big developing-country emitters and the United States.[2]

Optimism has to be tempered by the fact that neither the magnitude nor the timing of commitments was specified, so it is not certain that the depressing emissions trajectory shown in figure 1-1 will be improved upon. Further clouding the outlook was the absence of details on the Green Climate Fund: who will contribute, how much, public funding or private, and if private, would it be via trade in emissions allocations?

Finally, the Rio+20 summit, held in June 2012, was never meant specifically to tackle or revive international cooperation on climate change. And it lived up to that expectation by producing a document of fifty-three pages of fine print described scathingly by a *New York Times* blogger as "283 paragraphs of kumbaya."[3] The final document contained some potentially useful ideas and promises. One was a commitment to devise new environmentally friendly development benchmarks in areas such as renewable energy and food security. It also gave a small boost to scrapping fossil fuel subsidies, but even here the draft agreement merely invited governments to "consider rationalising inefficient fossil fuel subsidies . . . in a manner that protects the poor and the affected communities."

Why the Old Approach Won't Work

It is abundantly clear that the approach that has been used for climate change discussions over the past twenty years hasn't worked and won't work because of the three problems that we have labeled the "narrative" problem, the "adding-up" problem, and "new world" problem. We consider each in turn.

The Narrative Problem

Climate change talks have not taken place in a historical vacuum. They have in fact been characterized by contentious and competing ethical and moral perspectives (discussed in detail in chapter 2). Developing countries look at recent history and argue that the rich world has been

2. Jan Von der Goltz, "Durban Climate Deal: What a Great Result This Would Have Been Some Ten Years Ago!" *Global Development: Views from the Center* (blog), December 13, 2011.

3. Mark McDonald, "U.N. Report from Rio on Environment a 'Suicide Note,'" *IHT Rendezvous* (blog), June 24, 2012.

responsible for the bulk of emissions and, having "colonized" emissions space, has preempted the growth and development prospects for developing countries. Relying on a broad ethical notion that all citizens of the world have equal access to the atmosphere's capacity as a carbon sink, they contend that their development opportunities should not be constrained.

Further, they are outraged that rich countries demand that they reduce their emissions, given that the difference in per capita energy use between rich and developing nations is so vast and that rich countries, especially the United States, have yet to seriously initiate the process of emissions reductions. They invoke the fact that U.S. emissions have actually increased since the 1997 Kyoto Protocol on emissions reductions (despite reductions since 2007) and find it galling that a nation of gas guzzlers, reluctant to give up its profligate ways, should be asking them to forgo the rudiments of modernity such as access to basic energy services. They also complain that rich countries have not shown enough generosity by way of financial and technology transfers to poor countries.

This narrative of recrimination has not gone unchallenged. At one extreme, Richard Cooper argues that "optimal decisions generally require [that] bygones . . . be ignored. To focus on equity, and thus the alleged retrospective wrongs of the remote past, is to assure inaction."[4] Vijay Joshi (2009), too, argues that the notion of historic responsibility is "a persuasive claim but it runs up against some powerful moral intuitions. The advanced countries did not expropriate knowingly. They acted in the belief, universally held until quite recently, that the atmosphere was an infinite resource. Moreover, the expropriators are mostly dead and gone. Their descendants, even if they could be identified, cannot be held responsible for actions they did not themselves commit."[5] For example, if only individuals can be responsible, then calculations from the Climate Analysis Indicator Tool (CAIT) suggest that just 8 percent of the 2000 emissions stock can be traced to the flow of emissions from individuals who are still alive and might be held responsible.[6]

4. Cooper (2008, p. 20).
5. Joshi (2009, pp. 130–31).
6. Posner and Weisbach (2010, table 5.1).

The rich countries have their own narrative of recalcitrance. They blame the major developing-country emitters such as China and India for not cooperating adequately and for being unwilling even to consider emissions cuts. Furthermore, claim some in the rich world, if we are responsible for pollution, then the developing world should be responsible for its large population. And if we are to be blamed for the "bads" such as emissions, then we should get credit for the "goods" that we have provided in the form of technology and research (such as those that led to the green revolution).

The Adding-Up Problem

The adding-up problem is the brutal arithmetic that for the planet to survive in some habitable form, the world has to live within a fixed carbon budget of about 750 gigatons of CO_2 emissions between now and 2050. More allocations for one country mean less for another. The cold, hard fact is that a drastic reduction in aggregate emissions is required if we are to achieve a reasonable probability of keeping temperatures at livable levels. But the exercise is even more difficult than allocating a fixed carbon budget. Any attempt at allocation is a moving target because the carbon budget is actually shrinking relative to the growing needs of developing countries.

Until recently, the high-income countries, with one-sixth of the world's population, were responsible for the bulk of the greenhouse gases (GHGs) in the atmosphere. But China, India, and other developing-country emitters such as Brazil, Mexico, South Korea, Indonesia, South Africa, and Iran will progressively account for a larger share of total GHG emissions, meaning that without significant cuts from them, global targets cannot be met by actions by industrial countries alone.[7] In fact, the flows of CO_2 emissions by developing countries (the global South) have already exceeded those of the industrial countries (the global North). Even on a cumulative basis, developing-country emissions will exceed those of the industrial countries by around 2030.[8] Not much later, developing-country CO_2 emissions in a business-as-usual scenario (if no reductions are made and everyone continues on the current trajectory)

7. Joshi (2009).
8. Wheeler and Ummel (2007).

will greatly exceed the level of those consistent with keeping temperatures at reasonably safe levels (see figures 1-2a and 1-2b).

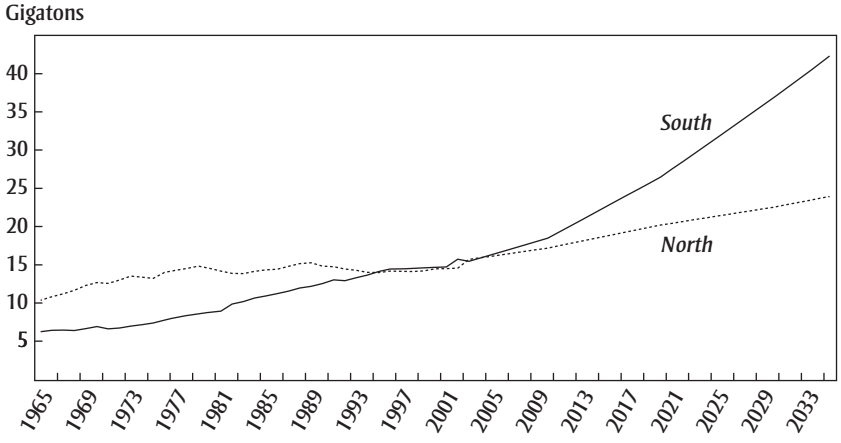
Moreover, given current rates of technological progress, the available carbon capacity is not even adequate to sustain business-as-usual growth rates for developing countries, let alone for the world as a whole (discussed in chapter 3). One striking calculation is that if the pace of technological change does not accelerate and if poorer countries preserve their development opportunities, rich countries will have to reduce their emissions by 270 percent! This means that they need to significantly *add* to the capacity of the atmosphere as a carbon sink—for example, by financing reforestation—for the overall carbon budget constraint to be met.

But could developing countries contribute to the atmosphere's carbon-sink capacity by cutting back emissions and ensuring safe global levels of CO_2? Unfortunately, emissions reductions for the foreseeable future would entail significant economic costs, given these countries' need for massive expansions in energy, transport, urban systems, and agricultural production for development. Current emissions are inequitably distributed across the world, with per capita emissions of developing countries a fraction of those of high-income countries (see figure 1-3). The implication is that any emissions cuts will reduce energy use and income even further beyond already low levels. Moreover, many of the large developing-country emitters are those with the better prospects for growing faster in the future, and emissions cuts would jeopardize these prospects. In short, given current technologies, growth and climate change goals are irreconcilable.[9]

Any commitments by developing countries to reduce emissions will lead to an increase in the price of energy and hence implicitly in the price of carbon, which is embodied in energy products. This price rise will affect not just the overall economy but also the composition of production and the distribution of consumption (see chapter 4). On the production side, manufacturing tends to be far more energy- and carbon-intensive than agriculture and services, so any increase in the carbon price is likely to lead to a contraction of manufacturing. In India, for example, the carbon intensity of manufacturing was about 518 tons per million U.S. dollars in 2004, much more than the 301 tons

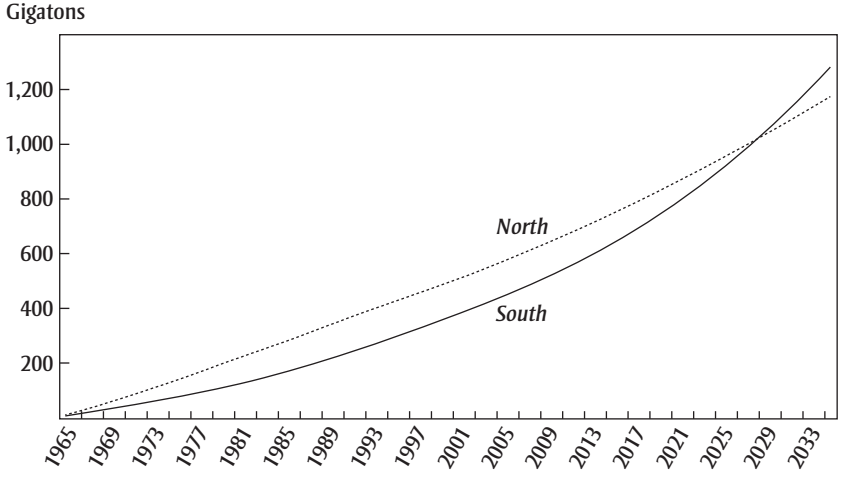
9. Birdsall and others (2009).

FIGURE 1-2a. Poorer Country Emissions Are Overtaking Those of the Rich on an Annual Basis: Annual CO_2 Emissions, 1965–2035



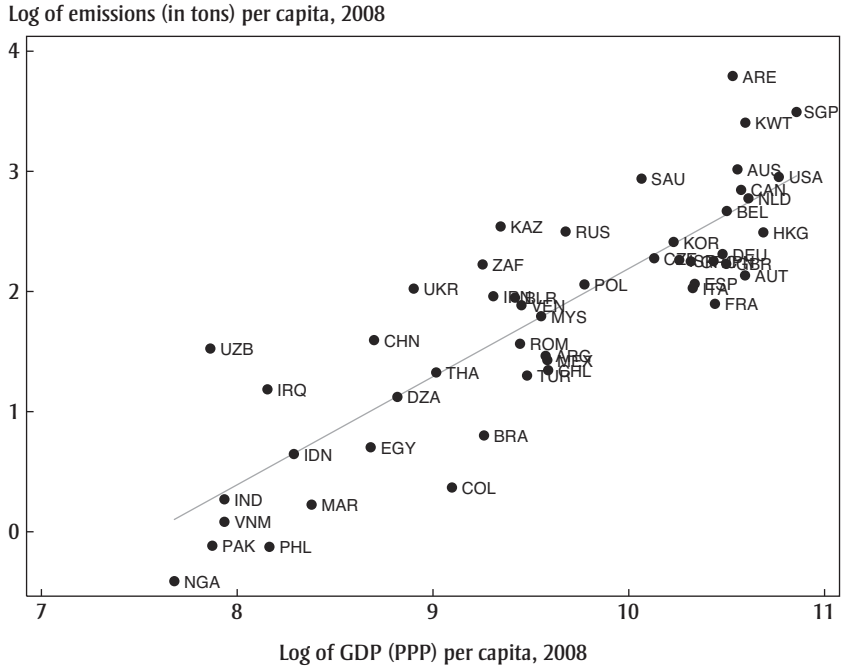
Source: Wheeler and Ummel (2007, p. 17).

FIGURE 1-2b. . . . and Will Eventually Dominate Even on a Cumulative Basis: Cumulative CO_2 Emissions, 1965–2035



Source: Wheeler and Ummel (2007, p. 17).

FIGURE 1-3. Richer Countries (to the right) Emit Far More per Capita Than Poorer Ones (to the left): International Distribution of Emissions, 2008



Source: Authors' calculations, based on data from the World Bank's World Development Indicators.

in agriculture and 231 tons in services. Of course, there are big differences within manufacturing, with certain energy-intensive manufacturing sectors emitting more than twice as much carbon as others.

In an international system of trading emissions rights, developing countries might have to cope with even higher carbon prices than if emission rights were not tradable. The reason is that if industrial countries undertake greater emissions cuts than developing countries and rights are not tradable, there will be international differences in carbon prices, with lower prices in developing countries than in industrial countries. But tradability—which is likely to involve producers in industrial countries' purchasing emission rights to discharge CO_2 in poorer countries—will lead to an international equalization of carbon prices, with prices in poorer countries rising by more than that entailed by their emissions cuts

alone. Higher carbon prices could lead to the contraction of dynamic industries in developing countries, which would affect growth adversely.

The sales of emissions rights will lead to large capital flows into developing countries, and this can create the same types of complications as large aid flows or natural resource revenues. Unless the money can be effectively managed or prudently invested, the capital flows could lead to a contraction of the dynamic export sectors as the economy becomes uncompetitive through foreign exchange appreciation. For instance, we find that a plausible combination of carbon price increases and transfers generated through emissions trading could lead to a decline in India's manufacturing output by over 5 percent and in manufacturing exports by over 10 percent.

On the consumption side, higher carbon prices could hurt consumers of energy, including the very poor. The conventional view is that these distributional consequences can be addressed domestically through appropriate taxation and redistribution. But it is almost a condition of underdevelopment that politics and administrative capacity will impede such actions. The experience with industrial policies and "picking winners" has highlighted the demanding and often unfulfilled requirements for successfully doing so. Identifying and assisting the poor may be even harder, as dramatically illustrated in India, where the inability to target transfers has led to carbon-inefficient subsidies for power and kerosene that mostly benefit the non-poor.

Mahatma Gandhi may have been morally astute in lamenting that the planet can survive mankind's need but not his greed. But the adding-up problem suggests that given current technologies, even fairly meeting the reasonable needs of a growing world population will have dire planetary consequences. This problem can only be solved by shifting the focus away from emissions cuts to technology generation.

The "New World" Problem

When the first major climate change talks took place, resulting in the 1997 Kyoto Protocol, there were, broadly, two sets of countries: large emitters that were, on average, rich, and medium to large emitters that were, on average, poor. Since then there have been significant shifts in economic power, and it is now estimated that nonindustrialized countries will account for 70 percent of world GDP by 2030 (measured in terms of purchasing power parity) and nearly 80 percent of incremental

growth over the next twenty years.[10] China alone might account for 15 percent of world trade and 20 percent of GDP by 2030. And by then, China, India, and Brazil will rank among the five largest countries in the world in terms of their purchasing power parity.

Some of the most dramatic changes are likely to occur on the fiscal front. The public sector balance sheet of advanced economies has become extremely fragile, because of rising entitlements, aging populations, the global financial crises that began in 2008, and the contingent liabilities in their financial systems. The time bomb of fiscal unsustainability is ticking not just in the United States but also, perhaps even more furiously, in Europe. Whereas debt ratios for emerging-market Group of Twenty (G-20) countries are expected to remain steady at about 40 percent of GDP, those of advanced economies are expected to rise from close to 80 percent of GDP today to 120 percent by 2015 (see figure 1-4).[11] These ratios for industrial countries are not expected to reach reasonable levels until well into the future—if, that is, large fiscal adjustments are undertaken.

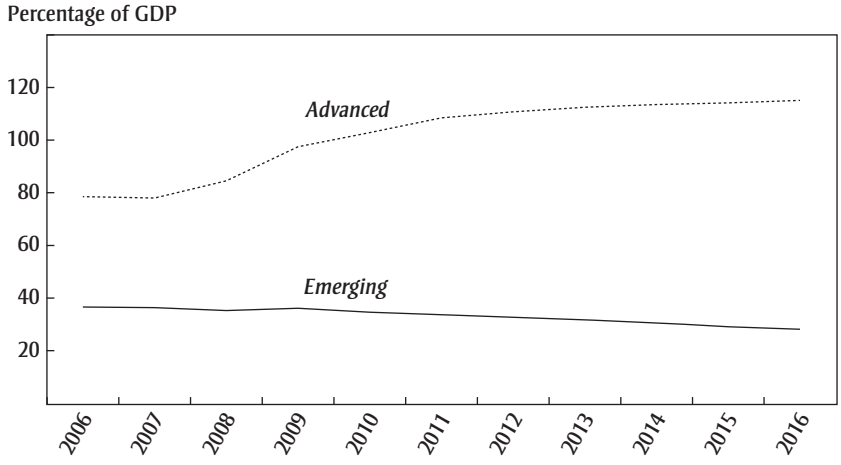
These numbers illustrate the obvious: the United States and Europe are no longer economically preeminent and must now deal with the new rising powers, including and especially China, India, Brazil, and Indonesia. These countries are large emitters—China is number 1 and India is number 3 in the emission rankings—and are now significant players in the world economic system and will have a significant say in the design of any international agreement. These new circumstances have implications for rich countries' being able to offer "carrots" such as financial transfers and wield "sticks," the threat of trade sanctions, as a way of inducing cooperative action.

Sticks-and-carrots tactics worked well in some situations. In the Uruguay Round of multilateral trade negotiations held between 1986 and 1994, which led to the establishment of the World Trade Organi-

10. Subramanian (2011). These projections assume relatively optimistic growth prospects for the United States and Europe.

11. These projections by the IMF are based on its assessment of current policies. In some ways, restricting the time horizon to 2015 understates U.S. and European fiscal problems. In the United States, the real challenges related to entitlements, especially health care, will emerge after 2020.

FIGURE 1-4. Richest Countries Are Burdened with Debt: General Government Debt Ratios, 2000–14



Source: International Monetary Fund, "The State of Public Finances Cross-Country: Fiscal Monitor, November 2009" (Washington: IMF, November 3), p. 15 (www.imf.org/external/pubs/ft/spn/2009/spn0925.pdf).

zation (WTO), many developing countries were disinclined to change their intellectual property laws (IP). The United States and Europe threatened trade retaliation against a number of developing countries unless they changed their domestic IP laws. They also offered market access under bilateral free trade agreements, to Chile and Mexico, and multilaterally, in textiles and agricultural sectors (Subramanian 2011). That the use of sticks and carrots succeeded was reflected in the Agreement on Trade-Related Aspects of Intellectual Property Rights, which created new and substantially higher standards for IP protection around the world.

But a good example of the limits to carrots and sticks relates to China and its exchange rate policy: China keeps the value of the yuan low, which promotes higher exports. The United States wants China to revalue the yuan to a higher value vis-à-vis the U.S. dollar. Despite repeated U.S. cajoling and wielding of threats, China has not substantially changed its exchange rate, a policy that no doubt reflects its growing economic footprint, its huge market, and its pool of cash. In short, its international clout. If Niall Ferguson's famous term "Chimerica" to describe the intertwining of the United States and China means anything,

it is that China has become so important and powerful a player that it is no longer easy to elicit cooperation from the outside.[12] Threats of trade and other sanctions are unlikely to work because China can retaliate—for example, by dumping its vast holdings of U.S. treasury paper—and cause disruption in Western markets.

In the context of climate change, the bargaining dynamic between the United States and large developing countries has been dominated by discussions of financial transfers to developing countries. How much money are we talking about? It is estimated that full compensation to developing countries for cutting current emissions by 30 percent would entail net financial transfers by the rich countries of about $430 billion in 2020, about 1.5 percent of their GDP, and about $3.3 trillion by 2050 (Jacoby and others 2008). Most of these flows would go to the four largest emitters. China and India would receive about $75 and $50 billion, respectively, in 2020 and about $600 billion and $175 billion, respectively, in 2050 (Jacoby and others 2008)—an event that is hard to imagine from a political point of view, especially given that in recent years China has in effect been writing checks to the U.S. government by financing its deficits.

If financial compensation in the form of public transfers from today's rich to poor is ruled out, what about private capital flows to developing countries? An article of faith in climate change discussions is that private resource flows to developing countries from the trading of emissions allocations can alleviate the costs to developing countries from emissions reductions (Stern 2009b). As the *Financial Times* editorialized, "In the actual world, a global scheme of tradable emissions quotas is the best solution" because trade in these quotas would automatically generate the transfers that could offset the costs imposed on developing countries.[13]

When all countries take on binding commitments to reduce emissions, capital flows will be generated through international trading of emissions allocations. How much countries gain is determined entirely by their emissions allocation. For large financial transfers to materialize, countries such as China and India would need to receive large allocations

12. Ferguson and Schularick (2007).

13. "We Cannot Gamble with the Planet," editorial, *Financial Times,* November 28, 2010.

of emissions rights. Yet the heart of the climate change divide is precisely that these large allocations to big developing countries are strongly resisted by rich countries. There may be a kind of "transfer illusion" based on the notion that it is harder to make public financial transfers than generous allocations of emissions rights—after all, it is this illusion that favors cap-and-trade over taxes in a domestic context. But it seems unlikely that this transfer illusion or obfuscation can overcome the fundamental economic and political realities that transfers will be large and hence economically unaffordable; and the potential recipients of transfers or emissions allocations will be the economically dynamic countries China and India.

Cooperation in the New World

Any prospect for success going forward will need to address each of the three problems we have identified.

A New Narrative

Narratives matter. Not just for creating and sustaining nationhood, as Isaiah Berlin famously argued, but also, critically, in international negotiations. In the climate change talks, the old narrative must give way to a new one. In our view, the key shift will have to come from the DEEs, with China, India, Brazil, and Indonesia proactively leading the charge for action on climate change. But is this credible or plausible? We believe it is, for two reasons.

First, it is increasingly recognized that the stakes in the near to medium term are much greater for the developing countries than for today's rich countries. They are either in or much closer to the tropics, where rising average temperatures will more quickly reduce agricultural productivity. They have much higher population densities, and therefore much narrower margins for survival as natural systems, especially water, come under stress. And they have much lower per capita incomes, making it harder to cope with coming disruptions by making major infrastructure investments such as building sea walls or extending irrigation systems.

William R. Cline (2007) estimates the costs for agriculture. In the event of a 2.5 percent temperature increase, India's long-term agricultural productivity will decline by about 38 percent, as compared with a U.S.

decline of 6 percent. Overall, India and sub-Saharan Africa will suffer losses of as much as 4 to 5 percent of their GDP from a 2.5 percent temperature increase, compared with less than 0.5 percent of GDP for the United States and Japan.

More recently, William Nordhaus (2011) has calculated the social cost of carbon in terms of the change in long-run consumption due to an additional unit of emissions. He estimates that this social cost is significantly greater for China, India, and other developing countries than it is for the United States or Europe. For example, the social cost of carbon for China is about three times that of the United States and nearly four times that of Europe. For India it is about two times that of the United States and three times that of Europe. These greater costs for China and India result from these countries' greater growth prospects, which would be negatively affected by climate change, and their greater vulnerability to damage from climate change.

Indeed, the alarming prospect for the DEEs is not that they will be asked to contribute too much but that the rich countries might ask too little. The rich countries, reluctant to cut emissions, may opt to interpret inaction by the DEEs as justification for attempting to adapt to climate change instead of taking aggressive actions to avert it. If the rich make this strategic choice, the consequence could be catastrophic for all parties. As the writer Simon Kuper put it, "We in the West have recently made an unspoken bet: we're going to wing it, run the risk of climate catastrophe, and hope that it is mostly faraway people in poor countries who will suffer."[14] The large and vulnerable developing countries must go on a war footing to campaign for action, including by today's rich countries, to avert catastrophic climate change.

A second reason why DEEs will be obliged to take the lead is because industrialized countries are increasingly incapable of doing so. The political consensus for serious action is fraying, especially in the United States. Regarding President Barack Obama's position, the political columnist Hendrik Hertzberg noted that there is a gulf between candidate Obama's passionate embrace of climate change as humanity's and his top concern and President Obama's token allusion to climate

14. Simon Kuper, "Climate Change: Who Cares Anymore?" *FT.com*, September 17, 2011.

change in his 2011 State of the Union address, in the context of energy efficiency.[15] One explanation for Obama's inaction may be the combination of economic problems—high unemployment, low growth, and diminishing prospects for the middle class—that increasingly preoccupy American policymakers. No doubt this tension between the economy and the environment is reflected in the administration's ambivalence toward the Keystone XL oil pipeline from Canada to the Gulf of Mexico. Then, too, the U.S. political and intellectual environment—characterized by the rise of those who don't accept the science of climate change and the rise of the fuel-funded lobby actively opposed to action on climate change—offers little encouragement.

In the past, the DEEs, especially China and India, were accused of being recalcitrants because they were apparently unwilling to assume their "fair" share of the responsibility for climate change action. Now, the growing political acceptance in these countries of the need to act on climate change is creating a serious possibility of a role reversal. But for China and India to articulate the new narrative, to credibly become the new *demandeurs,* they must back up their rhetoric with real contributions to the long-term solution.

A New Arithmetic

If large transfers are off the table, developing countries can meet climate change goals without sacrificing their economic dynamism if they spew less CO_2 for the same amount of activity. This is only possible through rapid technological change—indeed, through radical, historically unprecedented technological breakthroughs.

How radical would this breakthrough have to be? In chapter 3 we discuss the magnitude of technology improvement and energy conservation needed to ensure that climate change objectives are met without developing countries' having to sacrifice their growth and energy-use goals. Changes of the required magnitude in consumers' energy use and producers' efficiency in the use of carbon were not observed even after the oil shocks of the 1970s, which led to an increase in the price of energy far greater than that contemplated under any of the current proposals on

15. Henrik Hertzberg, "Cooling on Warming," *The New Yorker,* February 7, 2011.

emissions mitigations. At that time, efficiency in the use of carbon increased only by about one-third of what it will take in the future to meet climate change goals.

A New World Focus

But how can countries cooperate to generate the required technological progress? The key will be for the industrial countries to recognize that premature cuts in carbon emissions by developing countries would threaten these countries' economic dynamism. At the same time, the DEEs must focus on what they need to contribute, consistent with their new dynamism, to get the industrialized countries to undertake ambitious emissions cuts. Rather than seeing these emissions cuts as payback for historic sins, they should view these cuts as an investment to help all parties in generating technology, thereby helping to reduce the future cost of their own emissions cuts.

The framing of the issue, at least in the ongoing dialogue, would shift from "cash from industrial countries for cuts by developing countries" to "contributions from developing countries for cuts by industrial countries." Such a change in substance and attitude by developing countries could set in motion a mutually reinforcing dynamic of cooperation. Thus, the formula, informed fully by basic notions of equity, would be "To developing countries according to their growth needs; from developing countries commensurate with their economic dynamism, and to all the common good of planetary survival." This would be the basis for a "Greenprint" for international cooperation.

The Logic of the "Greenprint"

What does our proposed Greenprint look like? The new approach will not look like the old one. The contrast between the old and new approaches is one of moving from a backward-looking narrative—the rich are to blame—to a forward-looking one—the emerging markets will suffer more and hence these countries must take the lead (see box 1-1). The changed narrative enables a new focus, approach, and set of actions that lead to different results. Here it should be noted that the set of actions that we are proposing for the two major groups of economies, today's rich industrial economies and the dynamic emerging ones, should be seen as one possible selection from among a broad menu

BOX 1-1. Contrast between Old Approach and "Greenprint for Cooperation"

Old Approach	New "Greenprint for Cooperation" Approach
Narrative	
Backward-looking—Industrial countries are to blame.	*Forward-looking*—Emerging-market countries are more vulnerable to consequences of climate change and thus must take the lead.
Focus	
On emissions cuts, because required cuts are considered attainable at acceptable cost.	*On technological progress,* because required emissions cuts are not attainable at acceptable cost with current technologies (the "adding-up" problem).
Distribution of burden	
Industrial countries must bear nearly all costs.	*All countries* must contribute to a solution, consistent with their economic situation.
Actions	
Industrial countries and emerging-market countries both cut emissions. Industrial countries compensate emerging-market countries for losses caused by the latters' emissions cuts.	Industrial countries make early emissions cuts. Emerging-market countries: • contribute to fund for developing and disseminating new technologies • commit to making future cuts, conditional on development of new technologies • allow industrial countries to take trade actions under WTO auspices against imports from emerging markets where comparable emissions cuts have not been implemented
Results	
Aggregate emissions cuts consistent with climate change goals.	Aggregate emissions cuts consistent with climate change goals but attained at lower developmental cost because of technological progress.

Source: Authors.

of options. Our aim is to highlight that any plausible plan for cooperation would have to be vastly different from the current one.[16]

Central to our proposal is providing incentives to generate technology that addresses the adding-up problem and to calibrate contributions to current economic conditions. To this end, we propose the following two suites of actions:

—The rich countries would commit to an early and sustained increase in the price of carbon, targeting a steady-state price of carbon consistent with creating a path of emissions reductions that would bring emissions per capita down from just about twenty tons now to two tons in all industrialized countries by 2050—in keeping with a 80 percent reduction from 2005 levels.[17] This carbon price would be the key price signal to galvanize the green technology revolution.

—The large developing countries would complement and facilitate this industrial-country action in a number of key ways: contribute to a global fund for green technology development; allow, under special conditions, industrial countries to impose limited carbon-based border taxes; and commit to future emissions cuts, conditional on improvements in technology; and they would not raise the price of carbon.

DEEs' not raising the price of carbon could create a competitiveness problem for industrial-country producers and hence a political problem for industrial-country governments seeking to raise the price of carbon in the first place. By agreeing to border taxes on carbon, DEEs would be helping industrial-country governments address their domestic political economy problem. If DEEs were able to take the types of actions mentioned, they could comfortably claim the mantle of leadership on climate change, thereby altering the narrative.

If all parties implemented these actions, we would expect green technological change to be galvanized and better technologies to start flowing. At that stage, it would become easier for the DEEs to take on emissions reductions obligations, which would be triggered when certain

16. It is an open question as to whether cooperation should follow the current paradigm of seeking one grand agreement or involve a variety of loosely coordinated smaller-scale agreements (Barrett and Toman 2010).

17. The carbon price that can achieve the emissions reductions objective will of course be intensely debated because it will depend on a host of economic, technological, and ethical factors.

technology thresholds are met, such as the price of renewables falling sufficiently relative to fossil fuels. Specifying these thresholds, and calibrating individual countries' emissions obligations to these thresholds and other economic circumstances, would need to be carefully discussed and perhaps would need to be enshrined in legal commitments.

A Menu of Options for DEE Contributions

In this section we elaborate on the specific contributions that DEEs could choose to take.

1. From receiving to forgoing to giving: an emerging-market Green Technology Fund
2. Accommodating modest border taxes to facilitate deeper emissions cuts by industrial countries
3. Technology triggers: conditionally committing to cut future emissions
4. Committing to phase out fossil fuel subsidies
5. New carrots with sticks

These contributions would be in lieu of their own cuts and a quid pro quo for significant emissions cuts by industrial countries. Not all developing countries would be expected to make contributions—only those whose economic dynamism has enabled them to attain a certain development threshold, and contributions would be calibrated to relative economic strength. The threshold would be more or less defined by the countries in the IMF's emerging economies group. Countries below this threshold would be exempt and remain net recipients of finance and technology. Contributions could come from both what countries actually do (such as providing finance and technology) and what they forgo (the right to seek compensation, to acquire technology at less than market cost, and to preserve existing access to foreign markets).

1. From Receiving to Forgoing to Giving: An Emerging Market Green Technology Fund

Large developing countries continue to see themselves as potential recipients of financial inflows. The new reality, however, is that industrial countries simply cannot afford to provide financial compensation

for action on climate change. DEEs could make a virtue of this new reality. One option would be simply to declare, as China has implicitly done, that they would not be claimants for international transfers related to climate change. A more ambitious option would be to help set up and even contribute to an international fund for technology generation and dissemination.

The good news is that if industrial countries undertake ambitious emissions cuts, technology generation will be given a sharp boost. But the problem for developing countries is that much of this technology might be created in the private sector, underpinned by strong intellectual property (IP) protection. Developing countries can seek access to this technology by demanding that IP regimes be weakened, as they have demanded in the past. But this could weaken the incentive to create the right technologies in industrial countries as well as in their own markets, which are large and growing. In the event that new green technologies are not easily copied, weak IP regimes become a disincentive for technology transfer. In this case, the international fund could finance the technology transfer.

Such a fund could have a second objective: to provide incentives for creating a public "commons" of green technologies, with the clear understanding that any such technologies would be freely available because they would not have been privately funded. This part of the fund could be set up as advance market commitments, financial commitments to subsidize future purchases of a product or service up to predetermined prices and volumes. Michael Kremer and Rachel Glennerster (2004) have shown how such a structure could be applied to developing a pneumococcal vaccine in a pilot project by the GAVI Alliance and the World Bank (see also Berndt and others 2007). A coordinated technology fund could overcome problems of fragmentation and insufficient incentives that might arise from purely national efforts.

This new fund could be the first postwar and post–G-20 international institution with a governance structure reflecting the economic importance of large developing countries. Contributions could be based on two criteria, ability to pay and potential benefits, which would differentiate these countries on a simple, fair, and transparent basis. If twenty-two emerging market countries contributed about 0.2 percent of their GDP annually over fifteen years, their contribution alone to the global technology fund would be about half a trillion dollars.

2. Accommodating Modest Border Taxes to Facilitate Deeper Emissions Cuts by Industrial Countries

One possible impediment to ambitious emissions cuts by rich countries when they are not being made by developing countries is that the rich countries' energy-intensive producers would be at a competitive disadvantage if the price of carbon were higher for them than for others. In fact, we estimate that with even modest emissions mitigation actions by the United States, its energy-intensive, internationally exposed firms would experience export and output declines of 12 percent and 4 percent, respectively (discussed in chapter 5).

How can these competitiveness concerns be addressed? One way is through legislation now in draft form in the United States and the European Union to provide free allowances to vulnerable producers, those in trade-intensive and energy-intensive sectors. These allowances, which are essentially political pork, would be costly in fiscal terms, but they would soften the resistance to climate change action and head off the clamor from domestic industry groups for trade actions.

We believe, however, that the current fiscal problems in the rich countries have so altered circumstances that free emissions allowances will seem less attractive politically than border taxes as a way of meeting competitiveness concerns. Recently, Senators John Kerry of Massachusetts and Lindsey Graham of South Carolina stated: "There is no reason we should surrender our marketplace to countries that do not accept environmental standards. For this reason, we should consider a border tax on items produced in countries that avoid these standards. This is consistent with our obligations under the World Trade Organization." Nicolas Sarkozy has stated: "We need to impose a carbon tax at [Europe's] borders. I will lead that battle." At the same time, there is a growing intellectual legitimization for these taxes. The Nobel Prize–winning economist Paul Krugman—generally a proponent of free trade—has issued his own endorsement of carbon taxes at the border, arguing that they are "a matter of leveling the playing field, not protectionism."[18]

18. John Kerry and Lindsey Graham, "Yes We Can (Pass Climate Change Legislation)," op-ed, *New York Times,* October 10, 2009; Sarkozy quoted in Peggy Hollinger, "Sarkozy Calls for Carbon Tax on Imports," *FT.com*, September 10, 2009; Paul Krugman, "Climate, Trade, Obama," *The Conscience of a Liberal* (blog), June 29, 2009.

If the DEEs agreed to border taxes on carbon being imposed by rich-country governments, it would help the latter deal with their domestic political economy problem. At the same time, the DEEs could explicitly formalize the prohibition of more extreme forms of trade action. For the United States and the EU, the possibility of trade actions could reassure domestic energy-intensive industries and environmentalists that they would not be "surrendering the marketplace" or exporting carbon to countries with lower environmental standards.

The question is whether such taxes can be designed in a way that addresses industrial countries' concerns regarding competitiveness while limiting the trade costs for developing countries. What has to be avoided is the imposition of tariffs applied across-the-board on the basis of the carbon content of imports, which would be a "nuclear option" in terms of trade consequences. For example, such an action by the United States and the EU would be the equivalent of imposing a tariff of over 20 percent on China and India, resulting in lost exports of about 20 percent.

We see two possible solutions. One would be across-the-board tariffs and rebates for exporters based on the carbon content *in domestic production*. These would almost completely offset the adverse effects on U.S. output and exports of energy-intensive manufactures, while limiting declines in China's and India's manufacturing exports to about 2 percent.

Another possibility would be tariffs based on the carbon content of imports but applied only to a narrow set of carbon-intensive products. These would dampen the adverse effect of emissions reductions on U.S. output and exports of energy-intensive manufactures, which would decline by only about 0.5 percent and 7 percent, respectively, while limiting declines in China's and India's manufacturing exports to about 3 percent. But this option would be tougher to implement because it would require information on foreign countries' carbon content and hence would be more prone to abuse by protectionists.

3. Technology Triggers: Conditionally Committing to Cut Future Emissions

Lord Nicholas Stern has argued that developing countries should "conditionally commit to commit." By this he means that the key conditions for them to cut their emissions would be ambitious emissions reduc-

tions by the industrial countries and the delivery of financial assistance. Ambitious emissions reductions by industrialized nations would still be a key condition because that is the sine qua non for incentivizing technological progress. However, the Stern condition on financial assistance is now politically infeasible, at least for India and China, as discussed earlier.

The reason for developing countries to commit to some emissions reductions is to strengthen the incentives for technology creation in the long run by assuring innovators of a bigger market that would include the large developing countries. But this commitment is only credible if technological progress mitigates the costs to developing countries of emissions reductions.

Accordingly, developing country emissions reductions could be made conditional on, or triggered by, technology improvements in key areas such as carbon capture and storage; car battery; fuel efficiency, and so forth (Patel 2010). Future discussions should establish how these technology triggers could work in practice. This approach is consistent with developing countries' willingness, expressed at Durban, to take on legally binding commitments in the future.

4. Committing to Phase Out Fossil Fuel Subsidies

Developing countries could directly contribute to climate change mitigation by committing to phase out subsidies for fossil fuel consumption, which impose large economic costs within these countries, especially because they encourage profligacy in the use of water for agriculture. These water-related costs will only increase in the presence of climate change and growing water scarcity. Of course, there could even be a quid pro quo, with the DEEs demanding a reciprocal elimination of tax breaks for the fossil fuel industry in rich countries.

The OECD estimates that the removal of energy subsidies in all non-OECD countries would lead to a substantial decline in emissions from fossil fuel consumption, amounting to a 10 percent decline in global GHG emissions in 2050 compared to business-as-usual. China's emissions would be reduced by over 10 percent, India's by close to 25 percent, and Russia's and other oil-exporting countries' by around 30 percent.

5. New Carrots and Sticks

Note that in the old approach, the rich countries were wielding the carrots of financial transfers to induce emissions cuts by the poor countries and the stick of trade action as the penalty for not undertaking such cuts.

In the Greenprint we envisage some significant role reversal as to who brandishes the sticks and who offers the carrots, reflecting shifts in economic weight and power. The DEEs would implicitly be offering carrots if, consistent with their fiscal strength, they were to make financial contributions to the Green Technology Fund that would benefit all countries, and if, to facilitate emissions cuts, they were to allow rich countries to take trade actions against the exports of DEEs.

Could the DEEs also wield sticks against any failure of the rich to contribute to climate change prevention? One possibility would be for the DEEs to threaten to take trade action against the exports of rich countries—or at least their energy-intensive exports—if they failed to undertake the early emissions cuts that, according to the Greenprint, are critical to unleash technological innovation.

The DEEs could even enact legislation according to which they could take trade-restrictive action against all countries that exceeded a target level of per capita emissions (say, five tons) by 2025. Such a stick would be a natural complement to the carrot of constructive engagement that they would offer. The stick would also implicitly help set an international standard of equity and fairness on emissions targets that is an alternative to the current one, advanced by industrial countries, of reductions in absolute emissions.

Such a dramatic role reversal could play a part in breaking the policy paralysis on climate change in the rich countries, especially the United States. If, for example, the DEEs target U.S. manufacturing exports, these industries could be galvanized into putting pressure on the carbon-based sectors to loosen their grip on climate change policy.

For a dramatic role reversal whereby the DEEs wield sticks against the rich for noncooperation to have credibility, it might be necessary for the DEEs to either take or commit to some serious actions that put serious pressure on rich countries. One possibility might be for the DEEs to eliminate fossil fuel subsidies, or to commit to achieving that goal within, say, five years, and set a path for future carbon prices. They could then more credibly threaten trade action if the rich countries do not undertake emissions cuts.

Is the New Approach Plausible?

What are the odds that our proposed Greenprint would be embraced by either the large developing-country emitters or the rich countries, especially the United States?

There is reason for optimism regarding the large developing-country emitters because they are already following the same approach domestically. To preserve its existing comparative advantage, China is not confronting traditional manufacturers with higher carbon prices. Instead, it is providing incentives for green technologies to help its comparative advantage evolve in new directions. It plans to generate 15 percent of its energy from renewable sources by 2020. In 2007 China invested $12 billion in renewable energy, which placed it second in the world in absolute dollars spent, just behind Germany. Over the next decade it plans to spend between $440 billion and $660 billion on new energy development, made doable by its economic dynamism and strong fiscal picture.

India and other large developing-country emitters such as South Africa are acting similarly: instead of raising the price of carbon, they are paying much higher prices for renewable energy sources. India has begun reducing fuel subsidies and deregulating the pricing of some petroleum products; it intends to generate 15 percent of its total power from renewable sources by 2020. David Wheeler and Saurabh Shome (2009) estimate that this policy is equivalent to a total CO_2 charge of about $80 billion for emissions from new coal-fired power facilities between 2010 and 2020. The relative price changes induced in this manner may have a less disruptive effect on downstream users of energy than an increase in carbon prices, with the government absorbing the dislocation costs that would otherwise be imposed on the private sector.

More broadly, this strategy is resulting in large developing countries' taking the lead in shifting to low-carbon energy development. For example, Wheeler (2010) estimates that 68 percent of the increase in low-carbon energy generation—including biomass, solar, wind, geothermal, hydro, and nuclear—during the period from 2002 to 2008 has been in developing countries.

Are we asking too much of developing countries? We don't think so. First, our approach reflects the key equity principle of preserving full development opportunities for the poorer countries; that is why they would not be required to make any significant emissions cuts initially. Second, consistent with this equity principle, it is industrialized countries

that would be required to make ambitious (large in magnitude and front-loaded) emissions cuts. Third, many of the contributions we suggest merely internationalize actions that the DEEs are already pursuing domestically. Fourth, our proposed contributions are a menu of options rather than a must-do package.

As for rich countries, amid the generally gloomy political climate, there may be some spurs for action. Just as the melting of the Himalayan glaciers has aroused a new sense of urgency in India, so the repeated forest fires in the western United States, coinciding with nine of the ten hottest years ever recorded, can shake the United States out of its torpor.[19]

Second, the United States faces a medium-term fiscal crisis of unprecedented proportions. The arithmetic is such that new sources of revenue will have to be found to bridge the deficit, and taxes on carbon or the auctioning of any carbon caps could feature prominently as part of the solution to the fiscal crisis. Action on climate change could thus be forced by fiscal rather than scientific or moral imperatives. In 2011 Professor Alan Blinder made a case for a U.S. carbon tax of 8 cents on every gallon of gasoline in 2013, rising to 26 cents by 2015, to kick in after the current recovery takes hold.[20] He argues that such a tax not only would address the U.S. fiscal problem but also would be good for the environment, stimulate innovation in green technologies, and reduce fuel dependence.

Third, the shale gas revolution has made available a cleaner source of energy, which will make it easier for the United States to meet given emission targets. Put differently, the carbon tax that will need to be imposed by the United States will likely be lower than previously, even though some of the emission benefits may be diluted because of the reduced incentives to develop even cleaner sources of energy such as solar and wind.

In addition, the United States might be motivated by a desire to avoid a trade conflict with Europe, which notwithstanding its ongoing

19. The implications for emissions reductions of the Fukushima tragedy in Japan remain unclear. Germany, for example, announced a policy to phase out nuclear power plants. Whether such reactions signal just a shift away from nuclear energy or a renewed interest in other sources with a clear impetus toward reduced GHG emissions remains to be seen.

20. Alan S. Blinder, "The Carbon Tax Miracle Cure," *Wall Street Journal*, January 31, 2011.

economic difficulties has a durable interest in climate change policy. If Europe takes further action on this front, it will want to safeguard the competitiveness of its energy-intensive industries from those not similarly encumbered by carbon taxes. In air transport, the EU is already insisting that foreign airlines operating in Europe buy emissions quotas just as European airlines will be obliged to do. The irony is that the United States, which has considered wielding the trade instrument against recalcitrant developing countries, might find itself the target of such instruments.

Then, too, the United States might be roused into action by the growing technological threat from China. Already, U.S. business has been alarmed at China's attempts to develop technology in other areas through government support and obtaining technologies from abroad. The thought that China could easily replicate these actions in the new green areas is weighing heavily on U.S. business and government.

Conclusion

Reducing greenhouse gas emissions to prevent catastrophic climate change needs a new Greenprint for international cooperation. The pre-Copenhagen formula of "cash for cuts" was predicated on a division of the world into rich and poor. The recent financial crisis and the longer-term forces of economic convergence have combined to put that world behind us. Now, an economically enfeebled industrial world must engage with a financially strong and economically confident developing world on the basis of a new assessment of strengths and constraints.

Will cooperation on climate change be easy? Almost certainly not. But we are confident that the current approach will not work. That is why in writing this book we have attempted to provide ammunition to escape the stranglehold of the old approach, characterized by a narrative of recrimination and recalcitrance. Developing countries focus on the past, when rich countries "colonized" the carbon space, and seek contributions commensurate with historic responsibility. In contrast, industrial countries focus on the hypothetical future, when the dynamic developing countries will be large emitters, and complain that the future despoilers are unwilling to begin making contributions now.

We urgently need a new narrative, one characterized by leadership and innovation. In particular, developing countries must recognize their immense stakes in averting climate change, stakes that are even greater than those for the rich world, which will be affected less and has more resources to adapt. They must now take the lead and prod an increasingly reluctant West, especially the United States, to act. By making meaningful contributions of their own, they can claim the mantle of leadership. This means bringing into play policy instruments beyond carbon pricing, redefining the categories of rich and poor, and modifying the roles of financiers and recipients of funds. Our Greenprint suggests a way to help efface humanity's potentially catastrophic carbon footprint.