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CLIMATE CHANGE POLICY:
RECOMMENDATIONS TO REACH CONSENSUS

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INTRODUCTION

As the financial crisis continues to take its toll on the global economy, another serious challenge looms large: preventing the planet from warming more than 3.6 degrees Fahrenheit. Policymakers are now faced with the daunting task of stimulating growth without using carbon-intensive practices and stabilizing the climate without dampening economic recovery.

If the financial crisis has shown that the future is unpredictable and that the nations and people of the world are interconnected in ways we do not always perceive, the climate challenge reinforces these lessons and suggests the need for timely, global coordination. In advance of the 15th annual Conference of the Parties to the United Nations Framework Convention on Climate Change in Copenhagen this December, world leaders will convene at a number of high-level forums in the hopes of building consensus around key elements of a post-2012 climate change agreement. These forums include the G-20 Summit in Pittsburgh and an all-day dialogue with the United Nations Secretary-General Ban Ki-moon on September 22 in advance of the General Assembly meeting. World Bank President Robert Zoellick will bring together finance and development ministers in October emphasizing that climate change is not only an environmental issue, but also one that affects economic and financial stability.

With the need to get policies right in short order, Brookings experts and colleagues from the public and private sectors offer a range of recommendations for policymakers to forge sustainable climate change solutions that revitalize the global economy and alleviate the adverse effects of a changing climate on the world's poor.

- **Overcoming Sticking Points at the COP15:** Kemal Derviş and Abigail Jones outline a number of concrete ways to overcome several key sticking points that have marred previous efforts to reach consensus on a post-2012 climate agreement in the short months preceding the negotiations in Copenhagen.

- **Toward a Successful Climate Agreement:** William Antholis recommends a number of ways for the United States to demonstrate real leadership and commitment to a long-term, workable, climate change agreement at the international climate change negotiations in December.

- **A Copenhagen Collar: Achieving Comparable Effort Through Carbon Price Agreements:** Warwick McKibbin, Adele Morris, and Peter Wilcoxen propose that a "price collar" (a progressively rising floor and ceiling price on greenhouse gas emission allowances) be included in domestic climate legislation and in an international climate treaty.

- **Forests and Carbon Markets:** Sandra Brown and Timothy Pearson discuss a suite of options to more fully incorporate forest carbon projects and activities into greenhouse gas abatement efforts.

- **Technology Transfer in a New Global Climate Agreement:** Elliot Diringer explores how policymakers might accelerate the transfer of climate-friendly technologies from the developed to the developing world.

- **Practical Approaches to Financing and Executing Climate Change Adaptation:** Humayun Tai offers a concrete methodology to help decision makers estimate the costs of climate change adaptation, strategizes as to how to cover those costs, and suggests practical approaches to build a portfolio of responses for any country or region.

- **Adaptation to Climate Change:** Mohamed El-Ashry explores a number of win-win interventions that developing countries might pursue to alleviate poverty and adapt to climate change.

These policy briefs were commissioned for the 2009 Brookings Blum Roundtable, which annually assembles business leaders, government officials, academics and development practitioners to forward new ways to alleviate global poverty through cross-sector collaboration.

OVERCOMING STICKING POINTS AT THE COP15: TARGETS, MARKETS, TECHNOLOGY AND FINANCING

KEMAL DERVIŞ AND ABIGAIL JONES
BROOKINGS

Executive Summary

To craft a post-2012 climate change agreement, four key sticking points will need to be addressed in advance of the COP15. First, a number of hurdles must be overcome to put in place global abatement targets for the near- and mid-term—and critically, to establish what countries are willing to do individually to achieve these goals. Next, a more comprehensive carbon market is needed to deliver cost-effective emissions reductions on a global scale and to engage developing nations (which are set to account for the majority of future emissions) in the process. Third, shifting away from high- to low-carbon technologies will require that clean technologies become cost-competitive, brought to sustainable scale, and effectively deployed. Finally, determining burden-sharing for adaptation finance, how revenues are raised, and how funds are governed will be a fourth sticking point for a global deal. Success in Copenhagen will depend on forging broadly acceptable approaches globally in the crucial months ahead with imagination and flexibility, as well as demonstrating substantial political will in the domestic political arenas.

Introduction

In the midst of a global economic downturn, the world's climate negotiators will descend on Copenhagen for the 15th Conference of the Parties

(COP) to the United Nations Framework Convention on Climate Change (UNFCCC) with the aim of crafting a post-2012 climate regime—and the stakes could not be higher.

Since the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report was released in 2007, a growing number of scientists believe that climate change forecasts may have been too conservative and that the rate of climate change may be closer to the worst-case scenarios. With the adverse effects of climate change already apparent in extreme weather, melting glaciers, and altered ecosystems, time is of the essence. Carbon emitted in the next decade will stay in the atmosphere for well over a hundred years, and power plants built in the next decade will determine the carbon intensity of our energy supply for years to come.

As governments struggle to revive their economies, policymakers have taken important steps toward green growth by allocating parts of their fiscal stimulus to key climate change investment themes. On the other hand, fear of unemployment and slower growth prospects may undermine the political resolve to tackle climate change in an ambitious way. On balance it is not clear how strong that resolve is—the events ahead will test it in the coming months.

Given the tight timeframe for action, it may be too much to hope for a comprehensive global deal that settles all of the major sticking points. Success will have to mean, however, that decisive progress is made with a clear roadmap for what is to follow, and that contrary to the Kyoto experience, all major players will have to be part of that roadmap.

Why Act Now?

The scientific evidence that our climate is changing is now overwhelming. The link between greenhouse gas (GHG) emissions and human activity is also well established. However, there still remains a huge amount of uncertainty regarding the processes that mediate between GHG emissions, their concentration in the atmosphere, the effects of different concentrations on climate, and what changes in climate will mean for biodiversity, agriculture, sea levels, and the many other "climate dependent" characteristics of our planet. There is also uncertainty as to how fast all of these processes will unfold; in some cases it seems the phenomena are happening faster than earlier IPCC reports had predicted.

The nature of this uncertainty is such that the decision to address climate change should not be perceived as a "marginal" investment decision aiming to smooth consumption or human well being optimally over time. Strategic global decisions about mitigation should be viewed, rather, as being largely about preventing catastrophic risk. In other words, though we do not know with certainty what will happen and when, we do know that catastrophic outcomes are *possible*. For example, the melting of the Greenland and West Antarctic ice sheets would result in large sea level rises changing the world's physical and human geography. Changes in the thermohaline circulations (the "conveyer belt" of ocean heat that determines much of the earth's climate) affecting the Gulf Stream would lead to dramatic changes in global weather patterns. Climate tipping points could be reached, unleashing self-reinforcing multiplier feedback effects—e.g., saturated carbon sinks, releases of methane from arctic permafrost thawing—that could dramatically amplify temperature increases.

Given that catastrophic events are possible and that the damage they can inflict could be devastating for the whole of humanity, acting to abate greenhouse gases should be viewed as insuring against uncertain but potentially catastrophic outcomes, rather than fine-tuning known consumption paths over time. It is in those terms that the political discussion should be conducted.*

A second, *conceptually distinct,* argument for urgent and ambitious action is grounded in the fact that the world's poorest people—those who are least able to cope—are going to suffer the most and soonest from climate change's adverse effects. Climate stability is in one sense a perfect example of a global public good, because a given quantity of heat trapping gas emitted in Chicago, Istanbul or Beijing, or for that matter anywhere in the world, will have the same effect on atmospheric concentrations. The impact, however, that these concentrations have on climate experienced in any given location as well as the effect of changes in climate on human well-being will be quite different from one region to another.

For example, according to Yale University economist Robert Mendelsohn, usually cautious and even conservative in his assessments of global warming, climate-driven changes in global agricultural output will acutely affect poor households in the developing world. Reductions will be especially severe in rain-fed crop farming (as distinct from irrigated farming and livestock management); for example, Chinese farmers on rain-fed farms will likely lose annual net revenue of $95 per hectare per degree Celsius, while their African counterparts will lose $28. Meanwhile, William Cline of the Peterson Institute for International Economics predicts that developing countries will suffer an average 10-25 percent decline in agricultural productivity under business-as-usual emissions (discounting carbon fertilization). The poor will also suffer from heightened water stress and scarcity. Changed runoff patterns and continued glacial melting will have significant implications on water availability, interacting with already severe ecological pressures on water systems. According to the IPCC, Central Asia, Northern China, and the northern part of South Asia face serious vulnerabilities associated with the retreat of glaciers whose river systems provide water and sustain food supplies for over two billion people.

Climate change projections also point to intensified tropical storms, more frequent and widespread floods, and drought where disaster risks are skewed toward developing countries: while 1 in 1,500 people were affected annually by climate disasters in OECD countries between 2000 and 2004, in developing countries as many as 1 in 79 people were affected. Monsoon floods and storms in South Asia during the 2007 season displaced over 14 million people in India and 7 million in Bangladesh. Globally, the one billion people who live in urban slums, on fragile hillsides, or flood-prone river banks are among the most vulnerable to such extreme weather events.

Climate change is also likely to adversely affect the health status of millions of people with low adaptive capacity. An increased prevalence of malnutrition is likely while changing pathogens and vector-borne diseases will extend the reach of malaria and dengue fever.

The richer parts of the world do not face such negative effects with the same intensity and within the same timeframe. They do, however, potentially face the danger of longer term catastrophic outcomes.

Moreover, the social and political instability that climate change could cause in the poorer parts of the world could have serious consequences for overall peace and stability the world over.

There are, therefore, two fundamental strategic reasons to address climate change. In the near future the consequences of climate change will be felt most acutely by the world's poorest people. In the longer term, the sustainability of development and well-being on our planet as a whole is at stake. On both counts, ambitious and urgent action is required.

Background on the International Climate Change Negotiations

At the COP14, agreeing "in extremis" to what is known as the "Bali Roadmap" or the "Bali Action Plan," Parties to the UNFCCC committed themselves to launching negotiations on strengthened action against climate change. The hope has been that this process would culminate in an ambitious negotiated outcome at the 2009 meeting in Copenhagen, which would enter into force before January 2013.

At the June climate talks in Bonn, a draft negotiating text circulated among negotiators quadrupling to just over 200 pages by the conference's end. This document will have to meet the political requirements of all participating countries and be must pared down to reflect areas of basic agreement. For this to happen in the short months before Copenhagen, a number of key sticking points must be addressed.

Sticking Point #1: Global Targets, Individual Commitments

There is broad recognition globally of the need to stabilize atmospheric concentrations of greenhouse gases below levels that will prevent what could be catastrophic impacts. Much debate remains, however, as to how to achieve this in a fair and equitable manner. There are huge historical as well as current differences in how much countries emit. Twenty-five economies (counting the European Union as one) account for 84 percent of current GHG emissions, yet their per capita incomes at market exchange rates varied by a factor of 58 and their per capita CO_2 emissions differed by a factor of 46 in 2005. This diversity, as well as competitiveness concerns in the major players' carbon-intensive tradable goods sector, has been central to the negotiations.

Many hurdles must be overcome to put in place global abatement targets for the near- and mid-term—and critically, to establish what countries are willing to do individually to achieve these goals. These hurdles include:

- Comparability of Effort Among Developed Countries:

  The critical metric used to determine the comparability of effort expended by developed countries in abating greenhouse gases is the individual emissions targets each country establishes—including, the base year against which developed country abatement commitments are measured. For example, the European Union is pledging to reduce emissions 20 percent below 1990 levels by 2020 (or 30 percent if others pledge equivalent targets) whereas draft U.S. legislation foresees reducing emissions 17 percent below 2005 levels by 2020 (about a 3 percent reduction from 1990 levels). The difference is significant and bridging it will not be easy.

- Differentiated Responsibilities between Developed and Developing Countries:

  A certain degree of consensus has emerged that developed countries will undertake firm commitments to reduce their emissions to agreed ceiling levels, while developing countries will undertake a set of unilateral actions through nationally determined mitigation plans, without at this stage committing themselves to specific emission ceilings. Full consensus, however, on this differentiated approach has not been reached.

  Strong political currents in several key developed countries favor "binding" emissions targets for major developing countries, in particular China. Without emerging market caps in place, some will be pushing to use trade barriers (such as border taxes on carbon content) to protect domestic industries. (Some might claim that the actual cost of carbon should be the same worldwide and that tariffs should equalize the user cost of carbon. Somewhat surprisingly, the Nobel Laureate and economist Paul Krugman recently supported this position. A single global carbon price would of course lead to the most efficient abatement worldwide. However significant distributional implications make this solution untenable for developing countries, which *everyone* at the negotiating table accepts. Large transfers to developing countries could compensate for immediately higher carbon prices, though in practice this remedy is unfeasible given the size of the aid flows that would have to take place.)

- Developed or Developing?

  Discussion also remains regarding which countries should be included in the "developed country" grouping and therefore undertake "legally" binding emissions reduction targets. In addition to current Annex I countries, proposals include adding all current European Union member states, candidate countries, and potential candidate countries (i.e. Bosnia, Croatia, Macedonia, Malta, Montenegro, Serbia, Slovenia, and Turkey); including all OECD members (i.e. Mexico and South Korea); or adding countries whose GDP per capita match the Annex I average (i.e. Bahamas, Israel, Kuwait, Qatar, Saudi Arabia, Singapore, Taiwan, and the United Arab Emirates).

Sticking Point #2: Improve and Broaden the Global Carbon Market

The need to contain mitigation costs in developed countries and to help finance abatement strategies in the developing world has made carbon markets and off-sets central to the post-2012 agreement. Because negotiators broadly agree that developing countries and developed countries have differentiated GHG mitigation responsibilities, the Kyoto Protocol established hard caps on developed world emissions and allowed for the purchase of off-sets in developing countries through the Clean Development Mechanism (CDM). These off-sets have the advantage of both facilitating developed world abatement at lower cost in the developing world, while channeling resources to developing countries that build their GHG abatement capacities.

Yet reform is needed in the successor to the Kyoto Protocol's CDM. Serious concerns have emerged about the current mechanism regarding whether or not credited reductions are additional, real, verifiable, and permanent. A reformed CDM could hold the key to linking regional carbon markets in the future, but much needs to change before that can happen.

Today, half the world's GHG emissions come from developing nations. But in 2030, carbon dioxide emissions from non-OECD countries are projected in the business as usual scenarios to exceed those from OECD countries by 72 percent. According to the U.S. Energy Information Agency, most of the emissions growth in rising powers is likely to come from the consumption of fossil fuels (mainly coal, gas, and petroleum), which are feeding power generation and transportation needs.

Given the importance of having an effective mechanism to help manage abatement costs and create incentives for developing country engagement, changes to the CDM should be included in any new agreement. Reform will hinge on overcoming a number of obstacles:

- Offsets:

  Developed countries can comply with their emission reduction targets at much lower cost by receiving credits for emissions reduced in developing countries as long as administration costs are low. But it is not easy to keep these costs low. Moreover, there is political resistance among environmentalists to allow the "softening" of the developed country ceilings through off-sets. On the other side of the political spectrum, there is resistance within some developed countries to transfer large sums to the developing world.

- Ensuring Additionality:

  In order for a project to qualify for CDM type financing, it must demonstrate that the financed reductions are additional and would not have occurred absent the CDM. This is often not easy to determine. One way forward is to develop off-sets of a broader sectoral nature. Developing countries would commit themselves to cleaner sectoral growth strategies, partly financed by the global carbon market. Going beyond the individual project level would help broaden and deepen carbon markets, and would achieve much more ambitious targets worldwide. There is considerable disagreement, however, on how and by whom sectoral programs should be evaluated.

- Defining Measurable, Reportable, and Verifiable:

  If mutually agreed on, measurable, reportable, and verifiable (MRV) criteria can ensure that developed countries are held accountable to meet their commitments to support developing country action and can improve the availability of information about the range and impacts of actions that countries are taking to mitigate climate change. Bridging divides on who should be monitored, how data should be reported, and what institutions are up to the task of holding countries to account is critical.

Sticking Point #3: Innovation and Technology Transfer

Developing and broadly deploying clean technologies will be critical to achieve sustained economic growth in a carbon-constrained world. Most notably, these technologies must be adopted in the world's largest carbon-emitting countries both in the near and long terms—namely, rapidly emerging and OECD nations. Shifting away from high- to low-carbon technologies will require that proven, clean technologies are cost-competitive, brought to sustainable scale, and are effectively deployed. And to avoid carbon lock-in, this transition must occur in short order.

Because developing countries have much more limited financial or technical capacity to adopt advanced energy technologies and energy-efficiency practices, support for technology transfer will be vital to achieve "green growth." Resolution at Copenhagen on a number of politically charged issues will be vital in driving technology cooperation and innovation forward:

- Intellectual Property Rights (IPR) and Competitiveness:

  For countries able to carve out a niche in the development and production of clean technologies, the economic gains could be immense making cooperation on this issue incredibly difficult. Despite a dearth of conclusive evidence demonstrating whether IPR is or is not a barrier to clean technology diffusion across the range of key technologies, disagreements abound; while many developing countries are in favor of compulsory licensing (including the G77 and China), key developed world officials fear that IPR violations (including IPR enforcement, patent application standards and processes, etc.) let alone compulsory licensing could undermine incentives for clean technology RD&D. (Compulsory licenses as established in the World Trade Organization Agreement on Trade-related Aspects of Intellectual Property Rights are non-voluntary licenses that are granted by an administrative or judicial authority to a third party who can then use the patented invention without the consent of the patent owner.) In order to strike an effective accord at Copenhagen, negotiators must balance countries' desires to secure economic gains with the need to maximize technology diffusion globally.

Sticking Point #4: Financing International Adaptation

Assigning responsibility for meeting adaptation finance needs will likely remain a central obstacle in forging a post-2012 climate change agreement. Although climate change threatens all people, its adverse effects will be felt most acutely in the world's least developed countries and small island states—those countries that are least able to cope. Developing countries believe that historic polluters should pay for the consequences of their actions on the most vulnerable populations. For their part, developed countries have agreed to help developing nations adapt, but the scale of the assistance contemplated so far falls well short of poor country expectations. Developed countries also want to use adaptation finance as an instrument to encourage poorer countries to incorporate mitigation policies into their national development program, introducing conditionality into adaptation aid. The nature of such conditionality as well as the determination of how the burdens are shared, how revenues are raised, and how funds are governed will likely play a central role in who participates in any post-Kyoto agreement. Success will depend on forging an international consensus and substantial political will on the answers to difficult and politically charged questions:

- Levels of Funding:

  High degrees of uncertainty make predicting the cost of adaptation extremely difficult for it will depend greatly on the extent of global warming. Compounding difficulties is the near impossibility of disentangling adaptation needs from traditional development challenges. As such, estimates of the level of funding needed to assist developing countries manage the adverse effects of

climate change vary widely: the UNDP estimates that additional adaptation finance needs will amount to $86 billion annually by 2015, while the UNFCCC places the annual cost between $28-67 billion by 2030.

The UNFCCC currently manages three adaptation funds: the Least Developed Country Fund, the Special Climate Change Fund, and the Adaptation Fund. The Global Environment Facility (GEF) has also started to fund small-scale adaptation projects through its core account. Yet as of June 2008, the $320 million pledged cumulatively since the GEF received its mandate from the UNFCCC in 2001 to pilot adaption action under the three financing mechanisms, only $154 million has been disbursed. Moreover, all are woefully under-funded relative to even the lower register estimates above. Additional funds will be needed to meet the task.

With the G7 Gleneagles aid commitments to Sub-Saharan Africa still $14.5 billion shy of the $21.5 billion 2010 target, the prospects for mobilizing an even greater amount on top of that for climate adaptation throughout the developing world is daunting. China, for instance, has proposed that developed countries allocate 0.5-1.0 percent of their annual GDP to support actions taken by developing countries to tackle climate change. This would currently amount to $185 billion per year for mitigation, technology transfer and adaptation combined—orders of magnitude greater than legislative proposals under consideration in the United States and the European Union. These gaps are another indication of how difficult it will be to reach consensus.

- Mechanisms:

Given the desire to mobilize large sums of money on an annual basis over a sustained period, resource mobilization mechanisms that have some degree of automaticity, such as an automatic share of carbon revenues or some kind of tax on certain transactions have considerable appeal in principle, although not much of a track record in practice. One long-standing proposal looks to link the creation of the International Monetary Fund's Special Drawing Rights (SDRs) with the financing of global public goods, most importantly climate protection. (George Soros has been a leading proponent of such a link to SDRs.)

In both the U.S. and the EU policymakers are considering legislation that would create new adaptation funds capitalized by revenues from auctioning emissions rights under national and regional cap-and-trade programs. According to EPA analysis, the American Clean Energy and Security Act of 2009 (also known as the Waxman-Markey bill, for its principle sponsors) would allocate approximately $3.4-5.4 billion annually by 2020 for direct climate change assistance from the U.S. government to developing countries ($476-786 million for clean technology deployment, $2.4-3.8 billion for international forest conservation, and $476-768 million for adaptation). In Europe, annual auction revenues from the Emissions Trading Scheme (ETS) are estimated at €75 billion ($105 billion) in 2020, of which 20 percent, or €15 billion ($21 billion), would be dedicated to climate-change related activities including adaptation. Taxes on international air travel and bunker fuels represent potential new sources for adaptation

funding that would be more predictable than yearly appropriations, much like cap-and-trade allowances. For example, establishing a levy of seven dollars on each international flight would result in $14 billion in additional revenues annually. Other tax-based proposals on carbon market transactions build on the two percent levy on CDM projects by either increasing the 2 percent levy to 3 to 5 percent or extending the levy to other mechanisms under the Kyoto Protocol (i.e. Joint Implementation and Emissions Trading). Researchers at the World Resources Institute estimate that a 5 percent CDM levy would generate $200-750 million annually between 2008 and 2012, while extending the 2 percent CDM levy to Joint Implementation and Emissions Trading would generate $10-50 million annually between 2008 and 2012 (to increase considerably post 2012).

- Governing Funds:

  Since adaptation planning and implementation must be done across sectors at national and local levels, assistance must be provided horizontally and must be integrated with national development planning. Moreover, for recipients to be active stakeholders, they should have considerable say over the allocation of the funds; something developing countries feel strongly about.

  The structure and governance of new adaptation funds has proven very controversial—witness the uproar within the climate change and development communities over the World Bank's G8-endorsed Climate Investment Funds in 2008. Donors were originally intended to manage the funds in accordance with World Bank precedent, but developing countries (that view adaptation assistance as compensation by polluters to which they are entitled) insisted that allocation decisions be made by national governments or, at a minimum, by global bodies in which developing countries have majority representation.

Overcoming Sticking Points: Recommendations for Action

Recent debates on "multilateralism versus minilateralism" (see Naim, *Financial Times*) and "formal versus informal" mechanisms of global governance are particularly relevant to climate change. The problem is rooted in the fact that a relatively small number of large emitters (counting the EU as one actor) account for more than 80 percent of all emissions. Moreover, China and the U.S. alone account for about 40 percent of GHG emissions. There is, therefore, a strong case for letting the group of major emitters, and particularly the U.S. and China, play a key and leading role in the global solution. It would be a mistake, however, to abandon or marginalize the UN-led, global UNFCCC framework.

Like with all cases of "minilateralism" or ad hoc coalitions, the boundaries of the group are almost by definition ill-defined. This is not a problem in and of itself, but it generates incentives for some members to drop out of a binding agreement on the grounds that some country, with relatively comparable emissions, is not participating. Boundary issues quickly become equity issues. Moreover, minilateral agreements have difficulty establishing broadly accepted and perceived legitimacy, not only among non-members of the coalition, but among members themselves. There is something about a universal or close to universal agreement that generates greater legitimacy than a treaty between a limited number of countries, par-

ticularly when it relates to the future of the planet. It is not unreasonable to suggest that a universal framework for the protection of climate and of related matters such as biodiversity will benefit from a degree of legitimacy and "emotional allegiance" that a simple minilateral treaty will not be able to attract.

The way forward should be to continue to work within the "universal" UNFCCC framework, but support that process with "minilateralist initiatives" and various practical and flexible approaches, with the aim of putting in place the building blocks of globally accepted and enforceable policies.

- Continue Bilateral Negotiations Between China and the U.S.:

  Reaching consensus on climate change between the world's two largest greenhouse gas emitters in a manner that serves the interests of both parties will be central to forging a strong agreement in Copenhagen. Echoing recommendations forwarded by Brookings scholars Kenneth Lieberthal and David Sandalow (now U.S. assistant secretary of energy for policy and international affairs), China and the U.S. should focus their bilateral negotiations on a number of flagship efforts to promote clean energy. Proposals include creating a new dialogue on climate change and energy to parallel the existing Strategic and Economic Dialogue, achieving one or two headline initiatives—such as developing commercial, operational carbon capture and storage projects—and promoting capacity development for monitoring and reporting GHG emissions. These efforts would go a long way toward overcoming issues of mutual mistrust between the two countries and could help significantly in shaping an agreement in Copenhagen. Nonetheless, this should not be presented or interpreted as the emergence of a Climate Change G2 that would impose its views on the rest of the world. Such a perception would generate political reactions that could undermine a broader agreement. U.S.-China cooperation should be explicitly designed to exert the kind of leadership that will bring other countries into a broader deal, not as something they will resent.

- Engage at the Major Economies Forum (MEF) on Energy and Climate Change:

  Continued engagement at the MEF (which includes Australia, Brazil, Canada, China, the Czech Republic, Denmark, the EU, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, South Africa, South Korea, Sweden, the U.K., and the U.S.) could catalyze significant movement on global and individual abatement targets. Mexico's recent commitment to reduce its CO_2 emissions by 50 million tons annually has made it the first developing country to make a unilateral commitment and has positioned Mexico to be a key interlocutor in the months preceding Copenhagen. With the majority of developed countries considering abatement targets well short of the 25 to 40 percent reductions (relative to 1990 levels by 2020) called for by developing countries, the MEF might be the appropriate venue (given its smaller size and Mexico's potential to play an outsized role) to broker palpable departures from current negotiating positions and reach a greater consensus in advance of Copenhagen.

- Base Year: 1990 vs. 2005:

  Given the need to arrive at abatement targets that require comparable degrees of effort within

developed countries, negotiators should consider adopting a new base year. As Elliot Diringer of the Pew Center for Global Climate Change has argued, measuring abatement targets against 2005 levels may prove a reasonable position in reaching a global deal. Relative to 2005, the EU's 20 percent represents a 14 percent reduction, which is roughly comparable to those cuts proposed in the Waxman-Markey bill. The fact that the EU achieved much faster reduction of GHG in the 1990s was due, in part at least, to particular and one-off circumstances, such as the collapse of communist Eastern Europe and the major downsizing of the U.K.'s high-cost coal industry. A 2005-based-year would also make it somewhat easier to compare developed country targets to developing country targets: the key emerging market economies have only "emerged" in the last 20 years—comparing their 2020, 2030 or 2050 emissions to 1990, will always make whatever efforts they undertake from now on look minimal.

- Consider 2030 Targets:

  Because 2050 global abatement targets are distant and 2020 is actually very soon, negotiators would do well to consider adding 2030 to 2020 as a key benchmark in international negotiations. With Waxman-Markey set to go into effect in 2012 *if* signed into law, 2030 provides time to demonstrate the U.S. commitment to economy-wide emissions caps that might elicit additional concessions from key developing world players in a time frame that is needed. A distant 2050 target alone will not be sufficiently credible.

- Re-envision Success:

  The desire to fully realize the Bali Roadmap and reach a broad and binding agreement in Copenhagen should not lead to an all-or-nothing approach at the COP15. While time is not on humanity's side relative to IPCC forecasts, agreement on a broad framework, including 2020, 2030 and 2050 global targets, national targets for all developed countries, agreement to develop national action plans by most large emerging market economies and more detailed consensus on some issues—including reducing emissions from deforestation and degradation in developing countries (which seems likely) and/or technology cooperation—would be welcome progress. Such a "deal" would have to overcome most of the sticking points mentioned in this brief. The exact mechanisms and specific institutional arrangements that will have to govern carbon markets and adaptation finance may require more work, more detailed design and further political compromise. As long as negotiators at the COP15 can craft strong guidelines and ensure follow-up work on these matters, Copenhagen could still be a historic success.

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Note

* Viewing policy choices from a catastrophic risk lens is difficult because accepted frameworks for analysis are scarcer than when investment choices are concerned with essentially marginal decisions on a given growth path (for example, whether or not to build a road) or when probabilities of given outcomes are well known so that one can quantify with much greater confidence the "most likely" outcomes. (The Harvard University economist Martin Weitzman has been a leading figure in the promotion of the catastrophic risk lens.)

TOWARD A SUCCESSFUL CLIMATE AGREEMENT: BUILDING TRUST AND AMBITION

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Executive Summary

The contours of the international climate change negotiations are pretty clear: the U.S., EU and Japan are going to commit to incremental reductions by 2020, more dramatic ones by 2030, and very steep ones by 2050. They are looking to developing countries to more aggressively abate their emissions in the near term, and to start reducing them in the 2030 timeframe, with real reductions coming by mid-century. Developing countries want a steeper commitment by industrial countries, and want to sequence any of their own potential commitments based on whether industrial countries actually live up to their agreements. Industrial countries will also work to increase their commitments on helping developing countries adapt to a changing climate, and on helping poorer nations finance efforts to reduce greenhouse gas emissions and to protect carbon-capturing forests. Whether or not an agreement can be forged on that by Copenhagen is still very much up in the air.

In that context, the U.S. can demonstrate real leadership in four ways. First, stressing the long-term nature of the challenge, the U.S. should help the international community begin to understand that Copenhagen is one step along the way, and that it should be seen as an "agreement to agree" where binding obligations are neither punitive nor competitive arrangements. Instead, Copenhagen should be

understood as the basic rules of the road that are in everyone's best interests. Second, the U.S. can begin to shift the emphasis to concrete, near term reductions that capture the world's imagination, which are as important in the near-term as forging the long-term agreement. Third, the U.S. needs to focus on concrete partnerships with key countries—especially India and China—as a way of demonstrating progress and cooperation between nations, as opposed to competition, confrontation and deadlock. Fourth, the U.S. needs to take a leadership position on both renewable energy and nuclear energy. This last point could be very useful in a difficult domestic setting; it is also critical internationally, where much uncertainty remains.

Introduction

Media attention already has begun to focus on the global climate negotiation about to take place in Copenhagen this December. Can the agreement address the climate crisis? Will industrial and developing countries come to terms on a global pact? Already, the tensions between rich and poor nations are starting to emerge, where these two sets of nations "failed" to reach agreement in advance of this summer's G8 Summit and the Pittsburgh G-20 Summit.

Perhaps the pivotal issue in the midst of all these talks is trust. After a decade of American inaction, the EU does not trust that the U.S. will cut its emissions in the 2020 timeframe. Developing countries share this view—bolstered (in their mind) by lapsed commitments in spheres such as trade and nuclear arms control talks—and will not contemplate their own reductions until wealthy nations demonstrate real action. American legislators, on the other hand, do not trust the EU based on their failure to fully comply with the Kyoto Protocol. And they certainly do not trust that developing countries will make reductions in some future period. The real question for the U.S. is: can it build trust and ambition at the same time?

U.S. Climate Ambition in a Domestic Context

On June 6, 2008, 10 Democratic senators signed a letter to Senators Harry Reid and Barbara Boxer. "A federal cap-and-trade program is perhaps the most significant endeavor undertaken by Congress in over 70 years and must be done with great care." The good news is that, one year later, those members are the last hurdle between the president and a major step forward in fighting climate change. The bad news is that the ambition of such a plan worries these senators, and the president needs nearly all of their votes. Moreover, he is unlikely to get them.

In this context, the first and most significant ambitious step the Obama administration and Congress can do is to gain Senate passage for the American Clean Energy and Security Act (ACESA), which was approved in late June by the House of Representatives. Taken together with the $43 billion in spending on energy efficiency and renewable energy in the 2009 Economic Recovery and Reinvestment Act, this would be as ambitious an energy undertaking as the nation has ever seen.

ACESA would cut emissions to 17 percent below 2005 levels by 2020, to 42 percent below by 2030, and to 83 percent by 2050. It would also help the world's poor in addressing and adapting to climate change, in several regards. U.S. emitters could seek up to 5 percent of their reductions in overseas forest projects—potentially leading to hundreds of millions of dollars in forest protection. The bill provides for technology offsets overseas for countries that certify that

these investments are helping them reduce emissions below business as usual baselines, helping stimulate investment in carbon capture and other abatement technologies. And it provides for additional offsets dedicated to helping address climate adaptation in the developing world. The Environmental Defense Fund estimates that at $10 per ton permit prices, these offsets would "amount to a total of approximately $66 billion for adaptation and clean technology ($33 billion for each) over the period of years covered by the bill." In addition, the administration has sought over $1.2 billion in direct spending in its FY2010 budget for international efforts to combat climate change, including $313 million for adaptation, $745 million for clean energy (much of this through a new Clean Technology Fund), and $170 million for forests, principally through the World Bank's Carbon Partnership Facility.

While it is possible to argue that the administration could have been more ambitious, this effort may already be beyond what can be accomplished politically. That is, Senate passage is far from certain. Senate rules require 60 of the Senate's 100 members to agree to end debate. Even with Democrats now controlling 60 Senate seats, most recent attempts to count supporters for the current legislation come up with only about 50 votes. Of the 10 members who signed the June 2008 letter, not one has yet to publically endorse the bill. They are mostly Midwestern and Mountain West Democrats—particularly from coal and industrial states—and they find the costs too high. For every one of their votes that the president does not get, he will need to convince a Republican to support the legislation.

Among the possible inducements for this group to support ACESA are more resources for carbon-capture technology, or for nuclear power, or for renewable energy, or for international offsets, or for some combination of all of the above. And that does not even take into account the rest of the autumn legislative agenda—the massive overhaul of healthcare legislation, ongoing attention to the financial crisis, and increasing criticism by Republicans and a growing number of centrist Democrats that the Obama administration lacks fiscal discipline. If, for instance, the administration chooses a relatively expensive healthcare plan and/or it begins to consider another stimulus, it might alienate climate change swing voters. If the stars do align, the international community should see it for what it is: a major step forward, requiring political sacrifice.

U.S. Climate Ambition in an International Context

For several reasons, however, the international community may not give the administration the credit it deserves. For one, the administration will not overemphasize the ambition of this effort between now and December. Negotiations in the Senate require that the administration play down both climate change and international cooperation as motives for action. With unemployment exceeding double digits in many Midwestern states, ACESA will be sold to the Senate—and the American people—for its "clean energy" and "security" benefits.

Moreover, other nations are likely to dismiss the ambition of ACESA. By 2020, Europe has already pledged a reduction of 20 percent below 1990 levels, compared with the U.S. pledge of 17 percent below 2005 levels. In advance of the 2009 G8 Summit, five major emerging market nations—China, India, South Africa, Brazil and Mexico—called on industrial countries to reduce emissions 40 percent below 1990 levels.

Assessing the ambition of the U.S. effort pivots on whether the U.S. should be held accountable for Bush administration inaction. While Europe, Japan and other industrial nations have nearly met their pledges to reduce emissions below 1990 levels, since Kyoto U.S. emissions have grown about 20 percent above 1990 levels. The Obama administration has asked for a clean slate, selecting 2005 as the baseline from which its action should be judged. Many Europeans scoff, urging America to match European ambition for 2020. The administration's response has been to ratchet up ambition into *future* emission reduction periods—namely, by pushing for aggressive targets in 2030 and 2050.

Europe undeniably deserves credit for drawing global attention to the issue and for establishing a continent-wide regime to cut emissions. In the last decade, Europe had been able to come close to meeting Kyoto targets. That said, even some Europeans (such as Sir Anthony Giddens) acknowledge that comparing U.S. and EU action overstates Europe's own accomplishments. Most of Europe's reductions had little to do with intentional action to address climate change. Ambitious targets were achievable, thanks in part to actions that preceded even an awareness of climate change—the shutting down of the inefficient East German economy after the fall of the Berlin Wall, the effort to develop nuclear power in France, and Margaret Thatcher's effort to close the coal mines. (Note the irony: Europe has successfully claimed credit for cutting emissions done for other reasons, while the U.S. will avoid taking credit for the climate benefits of the Waxman-Markey bill as part of its strategy to gain Senate approval.)

Major emerging market countries also have some justification for criticizing the U.S., but within limits. Developing countries have not contributed historically to the problem. They mostly still have very low per capita emissions. They are appropriately upset about a decade of American inaction. Moreover, many have begun taking important steps to improve energy efficiency. Nevertheless, major emerging nations such as India, China and Brazil, continue to ask for specific and extremely ambitious reductions from the United States in the absence of any pledge to reduce their own emissions.

Developing countries point to an agreement made in Berlin in 1995, where industrial and developing countries accepted different responsibilities for fighting climate change. Industrialized countries were rightly seen as principally responsible for the vast CO_2 concentrations in the atmosphere, and for the warming that had and will continue to occur. Developing countries were made exempt from—in fact, they were actually prohibited from—adopting the same kind of binding obligations as industrial countries. Of course, this agreement did not anticipate the explosive economic transformation that occurred between 1995 and 2005, lifting a billion people out of poverty.

Not surprisingly, developing country emissions also grew dramatically—with China alone growing from under 3 gigatons per year, to well over 7 gigatons, surpassing the U.S. For emerging powers to help prevent catastrophic atmospheric warming before the end of this century, they must slow their own emissions growth by 2020 and start reducing them in the decade that follows. Still, as negotiators begin to contemplate ways for them to "graduate" into middle-income status, these nations are wary of taking on any commitment in the absence of real action by industrial nations.

Short of binding targets, many advanced developing countries have begun constructive steps to cut their emissions. Most have expressed a willingness to talk about Nationally Appropriate Mitigation Actions, which itself is a big step. But very few have been willing to talk about making these commitments internationally binding, out of fear that doing so will set them up for action that will not be reciprocated by industrial nations.

Four Additional Ways to Build Trust

Beyond assessing the ambition of targets and timetables, how can the U.S. help to establish trust? Trust between nations comes in various forms—at the negotiating table, in key emissions sectors, among national publics, and some that are a hybrid of all three of these. Even if no formal agreement is reached in Copenhagen, one idea from each of these areas may provide the outline for the U.S. in demonstrating its commitment to a long-term workable arrangement.

Defining "Binding" Commitments: Agreeing to Cooperate

In establishing government to government trust, the administration can start to more clearly define what it means by "binding obligations." Sovereignty-hawk nations—from the United States to China to India to Brazil—fear such entangling alliances. Here, it is useful to remember that for six decades, trade negotiations have developed an artful understanding of "binding." The GATT system built confidence through general agreements, which "bind" by synchronizing and increasing the ambition of domestic action among nations, and do this in a way that less directly calls national sovereignty into question.

In the GATT system, participating nations have pledged to cut tariffs and other trade barriers in a coordinated way—almost always taking on commitments which they knew they could meet. Countries could choose what counted as significant cuts, and would often trade fast action in one area for slow action in another. Countries monitored one another's behavior, and brought complaints to the dispute resolution mechanism. If a defendant country lost a dispute, it had a choice: change its domestic law, or allow a retaliatory tariff or other action by the plaintiff country. In this way, all countries felt the system to be self-enforcing.

Climate negotiators could likewise seek a General Agreement to Reduce Emissions (GARE). Like the GATT, the GARE would effectively link domestic action with an international agreement. If nations tie their fates to one another in "treaties," "general agreements" suggest a lower level of obligation: nations acknowledge one another's autonomy, but also their interdependence and desire to cooperate. As they build confidence in their ability to work together, they may become more willing to strengthen their regime.

Ideally, such an arrangement would occur for all nations through the U.N. Given the gaps that exist in trust and in the various countries perceptions about obligations, however, it might make more sense to lower the obligations suggested for both industrial and developing countries to a "general agreement" standard. Industrial country standards would be higher, but the agreement would provide an outline for how developing countries would graduate to industrial country commitments.

What level of "binding" is necessary for a climate agreement to succeed? First, a core element of success is that most states feel no need to violate the basic agreement. The simple fact of the agreement

allows states to do what they would prefer to do, but might not do because they fear non-compliance by others. Like the stripe down the center of a highway, the agreement gives states confidence that others will live up to the core elements of the bargain—that they will stay in their lane—thereby allowing states to act as they otherwise would. In this case, reduction commitments must be mutually robust so that countries can plan to cut emissions—that is, gear up their commitment—knowing that counterpart nations will do the same.

Second, some agreements succeed because nations realize that the net costs of violating an agreement exceed the benefits. In the case of a climate agreement, the consequences of non-compliance could mean being excluded from emissions trading or earning project credits for alternative energy, forest protection, or nuclear energy. Nations that find such benefits attractive would seek to join, comply and remain a party to the agreement. In this sense, the agreement would bind most nations the way speed limits "bind" most drivers: most people obey most of the time, for fear of getting a ticket or even losing their license.

Lastly, agreements work when nations accept and suffer consequences for their violations, and both the violating nation and the aggrieved nation feel the sanctions to be appropriate and adequate. Some nations that are party to a general agreement may find emissions trading or clean energy development not worth it, and choose to "opt out." They may pursue domestic reductions toward their international pledges, but may see full-compliance as unattractive, and forego the other benefits or accept sanctions.

Of course, this does raise the question of how to deal with those who persist in refusing to join the regime entirely. The Waxman-Markey legislation has one answer to this problem. The bill would require the purchase of emissions "border permits" for any imported good from countries that have not adopted sufficient national emission reductions. These permits would be the equivalent to the carbon footprint incurred in the making of that good.

Such an approach would provide real leverage for nations to actually transfer the costs of non-compliance on a public good—a trade barrier that the WTO may or may not allow. A critical question may be whether this provision were to enter into force before or after industrial countries began to demonstrate progress on reducing their emissions. But regardless of how the WTO rules, if such a provision entered into force before industrial countries took real actions, and before developing countries had been given sufficient time to put together more substantial emission cuts of their own, it might breed resentment and undermine trust.

Concrete, Near-term Reductions

Another way the U.S. can establish trust is to demonstrate concrete, near-term reductions, especially between sectors and companies in industrial and developing nations. A number of such undertakings have already taken place in the last decade under the Kyoto Protocol's Clean Development Mechanism, largely on a company-to-company basis. The U.S. could ramp up such ventures in key sectors, particularly where major, near-term emission reductions are possible.

One such area would be an emphasis on the non-CO_2 gases that cause climate change—particularly black carbon, nitrous oxide, methane, and the synthetic planet-warming gases. For instance, black carbon (soot) is not only a local air pollutant, but it also

causes greater local and global warming. Ramanathan and Carmichael claim that "emissions of black carbon are the second strongest contribution to current global warming, after carbon dioxide emissions." By absorbing heat rather than reflecting it, black carbon contributes to the melting of the Himalayan glaciers and even to declines in the polar ice caps.

Mark Jacobson from Stanford believes that major cuts in black carbon emissions could slow the effects of climate change for a decade or two, helping the climate system avoid a "tipping point" such as the further erosion of the Greenland ice sheets. This could help buy policymakers more time to reduce CO_2 emissions.

Reducing black carbon is relatively easy, especially when compared to abating CO_2. Since 1950, industrial nations already have reduced black carbon emissions five-fold, with considerable health benefits. China and India now account for about one third of total global soot emissions, with the vast majority of the rest coming from other developing nations—particularly poorer ones. Since this problem has largely been addressed in industrial countries, there are available literally off-the-shelf solutions, including wider use of basic clean-coal scrubbers, diesel filters, fuel switching, and more efficient cook-stoves. For instance, the court-ordered shift in New Delhi from diesel to compressed natural gas for public transportation (including buses, taxis, motorized rickshaws, etc.) was the equivalent of cutting local CO_2 by as much as 30 percent.

Wealthy nations could agree to subsidize the delivery of these technologies to developing nations in key sectors such as transport or coal-fired power plants. Poorer nations could agree to an aggressive adoption through incentives and regulation. If the United States or another industrial nation were to pay for such an undertaking, it could count some portion of those emissions against their national cap.

Concrete Partnerships with Key Countries—Especially China and India

A third way to establish trust is for the people of various nations to understand the constraints and possibilities of other nations. In particular, partnerships between cities and states in countries with similarly-sized and similarly-positioned localities can be extremely effective. Power generation and distribution is often done at the state or provincial level, as are major energy intensive infrastructure such as transportation, housing, water and sewer. In the last decade, the United States and Europe cooperated at the local level on a range of climate issues, from regional emission trading arrangements to shared experiences on infrastructure or renewable portfolio standards.

This kind of cooperation can and should start with big emerging nations, and then extend even to poorer ones. China and India, in particular, each share attributes with the United States and Europe that are critical in establishing national plans. Both are enormous federations, with vast numbers of regional and local stakeholders. Different parts of each country—urban and rural, industrialized and underdeveloped, energy intensive and un-electrified, mobile and stationary—will need to come to terms with a new energy future.

David Sandalow and Kenneth Lieberthal encouraged a "Green Cities" program between the United States and China. Both with respect to China and India, these could be expanded to Green Cities and States programs, led by at least two prominent may-

ors and governors from each country—one each from a successful state and city, and one each from states and cities who are at the early end of the reduction process. Indeed, it is possible to imagine an annual "four by four congress" between leading American, European, Indian and Chinese city and state leaders. First, it could provide a real exchange of ideas on key areas. Moreover, having a standing yet rotating group of participants could provide continuity as these various leaders change. Local and state governments also often produce national leaders, providing a long-term pipeline of ideas for national governments.

Big Policy Drivers: Renewable Energy and Nuclear Energy

As the previous example began to suggest, some of the most important policies involve hybrids of corporate, local, state, national and even international interaction. Perhaps the two largest in this regard are renewable energy and nuclear energy. In both areas, the United States can provide real leadership in helping developing and poorer nations move forward.

Renewable energy remains a vastly underdeveloped enterprise, involving a mix of market signals. Most experts agree that some combination of price signals, technology, and regulation will be needed to double renewable energy and approach 20 percent of national energy. Indeed, many industrial nations have moved ahead much more aggressively, with Europe already having established an EU-wide 20 percent standard as a goal by 2020. Some analysts believe China may even surpass the United States in its renewable production in this time period.

The adoption and achievement of a national goal—with a common set of sub-industry standards—would help internationally to drive down production costs, from photovoltaic solar panels, to wind turbines, to geothermal systems, to a wide variety of bio-fuels, to appliance standards. Having taken that step, the U.S. could then help establish global standards for the trade and accounting of these approaches.

American leadership could make similar breakthroughs internationally on nuclear energy—but only if the U.S. is prepared to actively address the full range of challenges that would entail. Choosing an aggressive nuclear energy strategy could be a breakthrough approach. The time has perhaps arrived for such a choice, but it is one that should not—and would not—be taken lightly.

An aggressive nuclear policy would signal to developing nations such as China and India that the U.S. will help develop a carbon-free power source shared by all. The U.S. civilian nuclear deal with India is certainly one step in that direction. India envisions more than doubling its nuclear capacity in the next 25 years, from just over 4 percent of total power to 9 percent. Their efforts, however, had been stymied for years because of their refusal to sign the Nuclear Non-Proliferation Treaty, which thus excluded them from the benefits of the Nuclear Suppliers Group. Should the U.S. choose to move aggressively forward in this regard, it could be tied to a more fulsome commitment by India to cut emissions.

Domestically, this choice could also help gain the support of swing votes in the Senate for comprehensive energy legislation. Having not built new nuclear reactors in nearly three decades, several new reactor projects have filed for permits. The Nuclear Regulatory Commission expects to receive as many as 30 new applications by 2010. This builds on growing public acceptability; nearly two-thirds of Americans surveyed in 2005 had a positive view of nuclear energy.

Still, nuclear power's future remains uncertain both in the United States and abroad. In the U.S., getting from the application stage to the construction phase is no small feat. Loan guarantees by federal, state and local governments are critical to almost all projects, and these have not been easy to come by. Cost overruns and delayed construction on high profile reactor projects in Europe have gained attention, leading many to question the economics of the enterprise. Moreover, the local storage and handling of nuclear waste has meant that support for nuclear power tends to drop when it comes to specific projects.

And the international development of nuclear power with nations such as India and beyond will need to be done with strict attention to the safety and security of nuclear materials. Concerns about nuclear weapons remain high, both for a few key nations—notably Iran and North Korea—and for several non-state actors. Other nations that are seen as less hostile internationally may also choose to develop nuclear weapons. This makes a global development of civilian nuclear power highly questionable in the absence of an established way of managing the fuel-cycle.

At some level, the choice is rather simple for the United States. It must decide whether to make nuclear energy a priority. In addition to all the domestic questions, it needs to assess how likely it is to establish an international system for managing nuclear material for civilian reactors. If it feels that it can do so, a major step in that regard could have big payoffs in fighting climate change. But it will need to be done with a seriousness of purpose which has not yet been demonstrated.

Conclusion: Keep Our Eyes on the Prize

The contours of the negotiations are clear: rich countries will commit to incremental reductions by 2020, more dramatic ones by 2030, and very steep ones by 2050. They are looking to developing countries to more aggressively abate their emissions in the near term, and to start reducing them in the 2030 time frame, with real reductions coming by mid-century. Developing countries want a steeper commitment by industrial countries, and want to sequence any of their own potential commitments based on whether industrial countries actually live up to their agreements. Industrial countries will also work to increase their commitments on helping developing countries adapt to a changing climate, and on helping poorer nations finance efforts to reduce greenhouse gas emissions and to protect carbon-capturing forests. Whether or not an agreement can be forged on that by Copenhagen is still very much up in the air.

The glue that will hold all of this together is trust, based on ambition. In that context, the U.S. can continue to demonstrate the latter, and thus foster the former, in four additional ways. First, stressing the long-term nature of the challenge, the U.S. should help the international community begin to understand that Copenhagen is one step along the way, and should be seen as an "agreement to agree," where binding obligations are neither punitive nor competitive arrangements. Instead, Copenhagen should be understood as the basic rules of the road that are in everyone's best interests. Second, the U.S. can begin to shift the emphasis to concrete, near term reductions that capture the world's imagination, which are as important in the near-term as forging the long-term agreement. Third, the U.S. needs to focus on concrete partnerships with key countries—espe-

cially India and China—as a way of demonstrating progress and cooperation between nations, as opposed to competition, confrontation and deadlock. Fourth, the U.S. needs to take a leadership position on both renewable energy and nuclear energy. This last point could be very useful in a difficult domestic setting; it is also critical internationally, where much uncertainty remains.

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A COPENHAGEN COLLAR: ACHIEVING COMPARABLE EFFORT THROUGH CARBON PRICE AGREEMENTS

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Executive Summary

The financial crisis and deep recession illustrate the unforeseen macroeconomic conditions through which climate policy must endure if it is to stabilize concentrations of greenhouse gases over the long run. It has made voters uneasy about climate policy that could raise energy costs and unemployment, even though the next agreement under the United Nations Framework Convention on Climate Change (UNFCCC) would likely not take effect until 2013, beyond the predicted duration of the current recession.

The downturn may make emissions targets harder or easier to achieve, which will complicate the UNFCCC process, which focuses almost exclusively on negotiating commitments by developed countries to reduce emissions relative to a fixed base year. Carbon emissions have likely fallen, so achieving a given target may now be easier. On the other hand, investment in emissions reductions will be more costly if credit markets continue to sputter and large government deficits crowd out private investment.

Although the recent turbulence has been global and unusually severe, significant disruptions occur at the regional and national level quite often. Trends in na-

tional emissions vary widely between countries, as do year-to-year fluctuations around those trends, so achieving similar targets can require very different levels of efforts in different countries. These differences have greatly hampered climate cooperation.

To help improve the political stability of any agreement emerging from Copenhagen, as well as to ensure the comparability of commitments and ease the inclusion of developing countries, we propose that the treaty supplement emissions targets with a price collar. The collar includes an initial price floor and price ceiling per ton of carbon equivalent emissions and an annual real growth rate for both. All major economies must show an effective price on emissions of at least the price floor even if they comply with their target. This prevents targets from being unexpectedly lax. Parties also cannot benefit from targets above expected emissions, such as those for the former Soviet Union under the Kyoto Protocol. The price floor also lowers the downside risk of low-carbon innovation.

Under our proposal, Parties would be allowed to exceed their targets if their price on emissions hits the price ceiling. This prevents the cost from becoming politically infeasible and accommodates developing countries like China that are uncomfortable with hard emissions caps. Developing countries could adopt a price floor without a target or price ceiling at first, and then transition to commitments more like those of industrialized countries.

We provide an example for the U.S. that shows that the price collar can have a negligible expected impact on the outcome that matters for the climate—cumulative emissions.

Implications of Economic Crisis for Climate Negotiations

The recent financial crisis and global economic downturn complicate climate negotiations under the UNFCCC. Perhaps the greatest effect of these developments is political. Policymakers in the U.S., Australia, Canada, and elsewhere face increased resistance from voters uneasy about domestic measures that could raise energy costs and unemployment. Automakers and other manufacturers fear that a cap-and-trade program could worsen their competitiveness and drive jobs overseas. These anxieties are real but they stem largely from short-run economic conditions. Although a cap-and-trade bill will indeed raise fossil energy prices, most studies suggest that the effects on output and employment over the long run should be modest. Further, both the draft bill in the U.S. Congress and the next UNFCCC agreement would likely not take effect until 2012 or 2013, beyond the predicted duration of the current recession. Climate policy, which must address an exceptionally long-run problem, is thus politically vulnerable to short-run macroeconomic conditions.

These short-run political difficulties are exacerbated by the UNFCCC focus on negotiating commitments by developed countries to sharp reductions in future emissions. The downturn has increased uncertainty in most countries about the cost of achieving a potential commitment. Data are not yet available, but it is likely that the economic downturn has reduced carbon emissions. Anemic economic growth could persist for several years, so achieving a given emissions target may require less abatement than previously expected. On the other hand, significant emissions reductions will require a high level of investment in new capital. This investment will be hampered if

credit markets continue to sputter and if large government deficits crowd out private investment through higher real interest rates. The downside of the downturn will be even worse for low-carbon investment if foreigners retreat from U.S. assets because they fear inflation or an eroding U.S. dollar.

The Need for a Better Basis for Negotiations

The UNFCCC talks scheduled for December 2009 in Copenhagen are meant to establish country-level commitments from the expiry of the Kyoto Protocol at the end of 2012 through 2020 and global emissions goals through 2050. But even as diplomats prepare for the new agreement, tensions around the formula for those commitments pose an important threat to success at Copenhagen and indeed the long term prospects for stabilizing the climate. This tension is clear from the failure of the G8 to set a base year for its agreed 80 percent reduction of emissions by 2050.

One of the greatest conflicts is the call for industrialized countries, particularly the U.S., to cut emissions deeply in the coming decade. The EU has called on the U.S. to take a target of 25 percent below 1990 levels by 2020 (about 35 percent below 2005 levels). India and other developing countries say the U.S. should cut emissions 40 percent below 2005 levels by 2020. These demands dampen prospects for agreement given that the climate bill passed recently by the U.S. House of Representatives seeks 17 percent below 2005 levels by 2020 for covered emissions. The Senate shows no appetite to strengthen targets as it now takes up the measure. One clear lesson from the Kyoto Protocol is that U.S. environmental policy is driven by domestic politics, not international commitments. U.S. negotiators could not accept a target more stringent at Copenhagen without risking the treaty's defeat domestically.

The demise of the Protocol in the U.S. was driven both by the stringency of the U.S. target of 7 percent below 1990 levels and the exemption of major developing countries from emissions constraints. In his March 13, 2001 letter to then-Senator Chuck Hagel announcing the withdrawal of the U.S. from the Kyoto treaty, President Bush cited both the potential effects of the Protocol on energy prices and its exemption of "80 percent of the world." Since Kyoto, the international process has grappled with these issues. The UNFCCC's 2007 Bali Plan of Action calls for the Copenhagen agreement to ensure the "comparability of efforts" across developed countries while "taking into account differences in their national circumstances."

The experience of Kyoto illustrates the challenge of achieving "comparable efforts." The Kyoto targets were primarily reductions relative to 1990. However, different industrialized countries had very different patterns of economic growth and emissions from 1990 to 1997, when the Protocol was negotiated, and to 2008 when the treaty would take effect. For example, the U.S. economy grew by about 9 percent from 1990 to 1997, with emissions growing as well, albeit at a lower rate. In contrast, emissions in the United Kingdom and Germany fell substantially in that period due to changes in coal policy in the U.K. and the collapse of the Soviet Union and annexation of East Germany into West Germany. Yet, despite those important differences, many negotiators erroneously assumed that similar targets meant similar levels of effort. Drawn from work by Christopher MacCracken and others, Figure 1 shows the relationship between projected emissions for 2010 under business as usual

conditions and the Kyoto Protocol target for five groups of countries. The higher the bar, the tighter the target. The chart shows that although the U.S. target was one percentage point less stringent than the EU (7 percent reduction vs. 8 percent reduction relative to 1990 levels), the U.S. target required significantly more emissions reductions relative to business as usual to achieve than the EU target. As shown by the yellow bar in Figure 1 for the former Soviet Union (FSU), ignoring post-base-year events can lead to "hot air," targets that are looser than expected emissions.

We see some of the same challenges to achieving comparable effort at Copenhagen. The EU routinely expresses its pledge relative to 1990 levels whereas President Obama proposes a 14 percent reduction relative to 2005 levels by 2020. Japan also prefers a 2005 base year. But just as in 1997, highly varying rates of baseline economic growth, fossil fuel use and availability, land use and agricultural sources and sinks, and historical energy intensity make it impossible to gauge the effort required to achieve a commitment by looking only at a gross emissions target relative to a historical base year's emissions. The focus on base years particularly alienates rapidly industrializing countries such as China and India that will be expected to take on binding emissions obligations eventually if not in 2013. Equal percentage departures from historical base year emissions might seem fair, but ignoring those baseline differences could impose quite different costs per capita, percentage GDP losses, and marginal abatement costs across countries. Thus the problem of crafting commitments at Copenhagen is as much a problem of the "optics" of the target formulation as it is the actual level of emissions.

But even if Parties negotiated emissions levels rather than reductions, they are not assured of comparable efforts because many things that affect the burden of achieving the target can happen between the year of negotiation and the commitment period. The recent financial crisis and global economic downturn are clear reminders of the volatility in the underlying economic environment in which Parties make these emissions commitments. Additional uncertainties include unanticipated economic growth, technology breakthroughs, prices for renewables and natural gas (a lower-emitting alternative to coal), and political instability. To properly protect the climate, the international regime should endure through any number of economic and political fluctuations.

A Price Collar for Major Economies

Here we offer a way to ensure the comparability of efforts based on achieving comparable price signals on carbon. Similar price signals mean that countries will undertake similarly expensive measures to control pollution. This not only promotes transparently comparable effort, but also helps lower the overall cost of achieving a particular level of climate protection.

Under our proposal, all major Parties need to show at least a minimum level of effort regardless of whether they achieve their emissions target, and they would be allowed to exceed their target if they are unable to achieve it in spite of undertaking a high level of effort. Specifically, in addition to a cumulative emissions target for the 2013 to 2020 period, major economies would agree on three things, known collectively as the "price collar":

1. A starting floor price on a ton of carbon dioxide-equivalent emissions for 2013;

2. A starting price ceiling on a ton of carbon dioxide-equivalent emissions for 2013; and

3. An annual rate of growth in the price floor and ceiling that reflects the real rate of interest, such as 4 percent.

To comply with their treaty obligations, Parties must demonstrate two things. First they must show that they have imposed a price on carbon equivalent emissions at least at the agreed floor price over most or all of the commitment period. Second, Parties must show that their cumulative emissions are no higher than their announced target OR that their domestic price on emissions has reached at least the ceiling price for a reasonable proportion of emissions within the commitment period.

This approach has several advantages. The price ceiling allows Parties to comply even if their target turns out to be unduly stringent. The price floor ensures that no Party's commitment is unduly lax and prevents Parties from benefiting from overly generous target formulations (such as the hot air for the FSU under the Kyoto Protocol). The approach accommodates developing countries like China that are uncomfortable with hard emissions caps but might be open to imposing a carbon tax. One approach would be to allow such countries to adopt a price floor without a target or with a low price ceiling at first, and then transition to commitments more like those of industrialized countries. Developed countries also need not agree on a common price collar, as long as they were comfortable with any differences, but competitive concerns would provide some incentive to converge.

Several implementation details would be required. First, the UNFCCC would have to develop guidelines on demonstrating compliance with the price collar. This would include methods of verifying price signals and the extent to which they were in effect. The treaty must also ensure that excess emissions are reasonably proportional to the degree to which the price ceiling binds, measured for example by the duration over which the price ceiling applies, the share of total allowances the government sells at the ceiling price, or the share of emissions taxed at that rate. High excess emissions would need to be accompanied by a long duration of prices at the ceiling or a relatively large share of allowances transacted at the ceiling price.

Parties can implement their commitments as they see fit domestically, including through a tax or cap-and-trade system that provides transparent price signals. Regulatory measures would require special provisions to demonstrate their equivalence to a price signal. For example, countries could calculate a shadow price on emissions analogous to the way the World Trade Organization converts trade protection policies into tariff equivalents. Parties could count toward their price signals any existing fossil energy taxes, but such credit would have to be net of any subsidies to fossil energy or other greenhouse gas emitting activities. Parties could control any revenues generated by their domestic climate policy and use it to offset other tax burdens if they see fit.

The domestic mechanics of the price collar could work in a number of ways within a cap-and-trade system. For example, a central bank of carbon could intervene by buying or selling permits to keep the price within bounds. This is similar to the open market operations of the Federal Reserve in short term money markets. Alternatively the government could place a reserve price on allowances that it auctions.

Establishing comparable national price targets across countries means that trading of permits across coun-

tries would be unnecessary, adding to the system's robustness by avoiding a fragile international regime based on a common allowance market. McKibbin and Wilcoxen (2002) and McKibbin, Morris and Wilcoxen (2009) explain the advantages of coordinated national institutions over global institutions for creating a robust policy regime.

In our approach, the price floor ensures that no Party can use terrestrial sinks alone to meet its commitments. However, the agreement should specify how Parties will account for land-based carbon stock changes when targets are set. Another important element of the agreement is the level of technology transfer and financial assistance to developing countries. Given the complexity of developed country commitments, these issues are best handled separate from the target-setting negotiations.

Some environmentalists are uncomfortable with a price collar approach, domestically or internationally. Some believe that any limit on the price of allowances undermines the environmental integrity of the commitment. However, this belief gives moral status to the cap, an essentially political decision. Even if climate science can inform policymakers about the relationships between greenhouse concentrations and climate impacts, science alone cannot balance the tradeoffs across the benefits and costs of particular short run targets for individual countries. Further, if Parties can only adopt hard targets as commitments then they may choose looser caps or none at all rather than risk excessive stringency or non-compliance.

Another argument against putting an upper limit on carbon prices suggests that very high carbon prices spur technologies that will eventually provide low cost abatement, thus obviating the apparent cost savings of a limit on carbon prices. Clearly, a limit that is lower than the expected carbon price can discourage investment in abating technologies relative to the case without the limit. However, by establishing a price floor as well as a price ceiling—at appropriate levels—a price collar both prevents the collapse of the program and limits the downside risk for investors in low carbon technologies. Both factors bolster investment confidence. Further, we question the notion that volatile near-term prices for carbon will induce sufficient technological development to lower prices in the long run by an amount sufficient to provide positive net present value. Rather, the economic literature has long supported the cost-minimizing case for gradually increasing prices on carbon.

An Illustrative Price Collar for the U.S.

To illustrate how a price collar could work, we constructed several representative climate policy scenarios using the G-Cubed intertemporal general equilibrium model, a widely used model of the global economy. First we established a "reference scenario" that reflects our best estimate of the likely evolution of each region's economy based on the relationship between economic growth and emissions growth in the model's regions over the last decade. The reference scenario also included the effects of climate policies already announced or implemented by governments other than the United States.

The first U.S. policy scenario we present is a target path for U.S. emissions that approximates the Obama administration's proposed targets for 2020 and 2050 of 14 percent and 83 percent reductions, respectively, from 2005 emissions levels. Details appear in Table 4 of McKibbin, Morris, Wilcoxen and Cai (2009). The scenario assumes a cap-and-trade program with a linear path of emissions caps from 2012 to 2020, and then another linear path from 2020 to 2050. It

requires the U.S. to hit each year's emission target exactly, with no flexibility about when the emissions reductions would occur. Also the scenario includes no offsets or other cost containment provisions. Although these assumptions differ from how the program would likely work in practice, the scenario is useful because it produces a price path that can illustrate how the price collar could work.

In our second scenario, we supplement the targets with a price floor and ceiling that are $10 and $35 respectively per ton of CO_2 emissions in 2012, both rising at 4 percent annually. Figure 2 shows the allowance prices that emerge in the two scenarios. The dashed path labeled "Without Collar" is the price of a ton of carbon dioxide that would emerge if the economy is required to achieve the emissions targets in each year, without allowing banking, borrowing, or offsets. The shaded region shows the range between the price floor and price ceiling defined above. The solid line labeled "With Collar" shows the price that would prevail with the collar in place. It and the "Without Collar" curve coincide in the range between the price floor and the price ceiling.

The price floor triggers briefly at the start, during which time the government would remove some permits from the market. Over the subsequent decade the permit price stays within the price collar. By 2023, the strong demand for permits causes the market price to hit the ceiling and the government offers additional permits at the ceiling price as described above (this is similar to the McKibbin and Wilcoxen (2002) Hybrid proposal). By 2042, the price ceiling has become high enough that it rises above the market price of allowances. At that point, demand for additional permits drops to zero and emissions no longer exceed the annual cap.

Figure 3 shows annual U.S. CO_2 emissions for the two scenarios. Under both policies, emissions fall in every year. With the price collar in place, emissions fall somewhat more slowly when the ceiling is binding. The additional permits are shown by the shaded area.

Figure 4 shows the effects of both scenarios on cumulative U.S. emissions through 2050. Both reduce emissions substantially relative to the reference scenario and are generally very similar. In this example, introducing the price collar increases projected cumulative emissions by about 4 percent, or 6 billion metric tons, relative to the cap-and-trade scenario without the price collar. By imposing an upper bound on compliance costs, the collar increases the net present value of personal consumption (a measure of welfare) by $80 billion relative to the scenario without the collar.

The cap-and-trade legislation currently under consideration by the U.S. Congress includes an important additional provision known as "banking" that allows firms to save unused allowances. Banking provides an incentive for firms to abate some of their emissions earlier than absolutely necessary in order to have more allowances in future years when caps are tighter. To examine the relationship between banking and a price collar, we constructed a third policy scenario in which firms were required to achieve the same cumulative emissions as the first simulation (without the price collar) but were allowed to bank emissions when it was profitable to do so.

Figure 5 compares the estimated price trajectory of carbon allowances under the banking scenario (the dashed curve labeled "With Banking") to that for the price-collar case (the solid curve labeled "With Collar"). Each scenario includes only one of the two

mechanisms: no price collar is imposed in the banking case and banking is not allowed in the price collar case. From 2012 through 2023, the price-collar case lies below the banking case, indicating that the original emissions targets are relatively loose during the first decade. If permitted to do so, firms would want to do more abatement in order to bank allowances. The reduced number of allowances available for contemporaneous use would drive up the equilibrium price to the level shown by the "With Banking" curve.

From 2023 on, however, the two curves are essentially identical. Both rise at the interest rate until 2042 and after that they follow the original price trajectory. The reason the curves are similar is that our price collar is designed to be very similar to the cost-minimizing path (see McKibbin, Morris, Wilcoxen and Cai 2009 for discussion of the relationship between the banking and cost-minimizing paths). Had the initial price ceiling been higher, say $36 per ton, the two curves would have crossed; the collar trajectory would have risen above the banking path.

By design, the banking scenario achieves the same cumulative emissions target as the original scenario, or 6 billion metric tons less than the price collar case. As shown in Figure 6, the additional abatement occurs entirely during the first decade, when emissions are lower in the banking case than the price collar case (the shaded region in the figure). In subsequent years, allowance prices and annual emissions are equal in the two simulations.

A policy combining banking with a price collar will have the best features of both. As long as no macroeconomic surprises occur, banking allows firms to manage their abatement efficiently and thereby minimize the overall cost of achieving the desired emissions reductions. As long as the price collar is set, as it was above, so that the expected market price and the ceiling would be consistently very close, there would be little or no incentive for firms to purchase additional allowances from the government. However, if unexpected events make abatement more difficult than expected, the price ceiling would come into effect, providing protection against sharp spikes in allowance prices. Moreover, our illustrative results above suggest that the consequent increase in cumulative emissions would be very modest.

Conclusion

Allowing for a price collar within a policy focused on long-run cumulative emissions targets is an effective and politically viable way to move international negotiations on climate policy forward. The economic uncertainty surrounding target commitments is enormous, and combining a clear cumulative emissions target with a price collar optimally balances the environmental objective with the need to ensure that commitments remain feasible. Using plausible assumptions, the example in this paper illustrates how a price collar does this.

Focusing exclusively on reductions from historical emissions as the only meaningful form of commitment has greatly hampered negotiations on climate commitments, especially for developing countries where the uncertainty about the future and the cost is greatest. In contrast, the price collar can ease major developing countries into the system by allowing them to adopt only a price floor in the early years. It also offers a transparent and verifiable assurance of the comparability of effort across countries. Further, Parties can design price collars so that they have no effect if predictions about the level of effort required to achieve a target are correct.

Including verifiable actions along with an emissions goal is an important improvement over the Kyoto Protocol because it demonstrates compliance during, as well as after, the commitment period.

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Note

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FORESTS AND CARBON MARKETS: OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

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Executive Summary

The motivations for substantive inclusion of forest carbon in greenhouse gas abatement efforts are strong. For starters, forest carbon projects can be implemented immediately and do not need any new technologies, and the science behind estimating their carbon benefits is robust. Secondly, the projects are unique in that they can positively impact the poorest and most disadvantaged people in the world by providing them with needed financial resources. Lastly, forest carbon projects can be used to simultaneously mitigate against and adapt to climate change.

Yet, as of July 2009, forest projects represent just 0.36 percent of all registered projects and just 0.09 percent of annual emission reductions in the Clean Development Mechanism (CDM). To more fully incorporate forest carbon projects and activities into greenhouse gas abatement efforts a number of issues must be addressed including: the fear of leakage; expanding the sphere of project types eligible for crediting beyond just afforestation and reforestation; and relaxing the overly onerous and costly requirements for projects.

However, if at the climate change negotiations in Copenhagen the "enhancement of carbon stocks" is included under the proposed Reducing Emissions from Deforestation and Degradation (REDD+) mechanism *and* if that enhancement is clarified to include

forestation of lands not currently forested, then REDD+ could become a robust alternative mechanism to CDM for realizing the opportunities of forestry to advance climate goals.

Introduction

The Intergovernmental Panel on Climate Change (IPCC) assessment reports clearly show that there is significant potential to mitigate greenhouse gas emissions cost-effectively from changes in how humans use and manage forests. Yet, here we are almost a decade after the Kyoto Protocol was ratified with little adoption of forest carbon CDM projects for compliance by Annex 1 countries for a variety of reasons that will be presented here. What lessons have we learned from the dismal use of forest carbon markets for mitigating emissions and how can we use the lessons in the new discussions ongoing for a post-Kyoto agreement?

The Role of Forest Carbon in the Clean Development Mechanism

Forestry forms one of 15 project sectors under the CDM. However, as of July 2009, forest projects represented just 0.36 percent of all registered projects and just 0.09 percent of annual emission reductions. These statistics alone show a clear failure of forestry under the CDM. Blame for this failure can be shared between the limitations on the use of forestry projects to meeting Kyoto commitments and the limits placed on investment in forestry offsets particularly by the European Union.

A European-wide emissions reduction and trading scheme (the EUETS) explicitly excluded credits from land use, land use change and forestry. The exclusion of forestry projects from the EUETS represents a substantial barrier to investment. Yet the total market was $126 billion, and primary and secondary CDM transactions alone totaled $33 billion outside the EUETS, so although the EUETS exclusion was a limitation on forestry projects, it alone cannot explain the fact that forestry projects represent only 0.1 percent of all annual emission reductions achieved by the CDM. To fully explain the failure it is also necessary to examine the rules governing forestry projects under the CDM.

It was decided at the Conferences of the Parties to the United Nations Framework Convention on Climate Change in 2001 and 2002 that the modalities under which forestry projects have to operate include the following limitations to their potential to contribute to meeting Kyoto commitments:

Project Type

The CDM modalities limit forestry projects to solely afforestation and reforestation (A/R) despite the fact that substantial cost-effective opportunities exist for other activities such as preventing deforestation or changing forest management. Tree planting projects present challenges for project developers because the great majority of costs occur at the beginning of the project with site preparation and planting expenses, yet credits only become available gradually as the trees grow, with the fastest growth likely to occur 10 or more years into the project.

Land Eligibility Criteria

Afforestation/reforestation projects are only eligible in areas that have been continuously deforested since at least December 31, 1989. The purpose is to avoid a perceived perverse incentive to deforest in order to create lands for afforestation and carbon crediting.

When the modalities were completed in 2002, the end of 1989 was 13 years in the past. It is now almost 20 years in the past. An ever greater area that would potentially be available for tree planting is excluded. In addition, it can be challenging to prove the absence of forest so far in the past in the relatively early days of remotely sensed imagery. The alternative approach adopted by voluntary registries is to set a moving 10 year window in which areas are not eligible for tree planting.

Temporary Crediting

Perhaps the greatest damage to forestry under the CDM was caused by the adoption of temporary crediting—driven by the fear that carbon sequestered in trees would ultimately be returned to the atmosphere. Afforestation and reforestation projects, alone among the 15 sectoral scopes under the CDM, are eligible for temporary certified reductions (which expire after 5 to 9 years) or long-term certified emissions reductions valid for up to 30 years but only delivered in segments alongside the growth of the trees. The fact that any offsets derived from forestry projects must be replaced creates a lower class of credits. These credits are not fungible and as such are not attractive to many investors.

The combination of the restrictive modalities and the exclusion from European trading has been fatal for forestry under the CDM and as such the sector has been a failure. Given the inclusion of "enhancement of carbon stocks" (yet to be defined but could include forestation of lands not currently forested) under the proposed REDD+ mechanism, many of these limitations in the CDM would be removed. If at Copenhagen the "enhancement of carbon stocks" is included under the proposed REDD+ mechanism and if that enhancement is clarified to include forestation of lands not currently forested, then REDD+ could become a robust alternative mechanism to CDM for realizing the opportunities of forestry to advance climate goals. Many of the existing obstacles under the CDM would be removed because forestation would become part of the REDD+ system of national monitoring, accounting, and reporting. Rolling up forestry into the REDD+ mechanism would avoid double counting and start to set in place a more comprehensive land-based GHG accounting and reporting system in developing countries.

Obstacles to Incorporating Forest Carbon Projects and Activities More Fully in Greenhouse Gas Abatement Efforts

The obstacles to forest projects are significant. The most critical obstacle to incorporation of forest carbon is full fungibility. And the issue at the crux of fungibility is permanence. The non-fungible temporary credits came about because of the fear of the impermanence of forest carbon stocks. An innovative solution adopted by much of the voluntary market is the use of a risk buffer. The more risky a project, the larger the proportion of credits that will have to be set-aside in the buffer account. As a project proves itself through time an increasing proportion of the buffer account is released for sale by the project. The buffer account is held centrally so that across the forest project portfolio sufficient credits exist to cover the risk of failure. Under a post-Kyoto regime, the use of buffers to address permanence should be considered.

The second great concern regarding forest carbon projects is the fear of leakage. Some fear that commercial activities will be displaced or that decreases in marketable products will lead to growth in demand and land use change elsewhere in the country or in

the world. However, leakage is not unique to forest carbon projects and accounting for it in non-forest projects appears to be of limited concern. The risk for leakage due to the displacement of activities can be minimized if the livelihoods and needs of relevant stakeholders are taken into consideration during the project design phase.

A third concern is the need to expand the types of projects eligible for crediting beyond just afforestation and reforestation. The lowest hanging fruit internationally is undoubtedly reducing deforestation, although substantial potential also exists in reducing degradation.

The final barrier to forest carbon is overly onerous and costly requirements for projects. Pragmatism is essential in standards. Projects should be allowed to make decisions that significantly reduce their costs, but are conservative with regard to claimed benefits to the atmosphere. In 2008 and 2009 the Afforestation/Reforestation Working Group of the CDM has taken such an approach to the great benefit of projects. Further pragmatic enhancements can include facilitating the process of aggregator organizations, including allowing additional project threads through time (a program of activities approach). Baselines and proving additionality can be further simplified, where appropriate, through the adoption of performance standards.

Clearly there are substantial barriers to forest carbon projects not least of which is fear and resultant political opposition. However, the science and project experience exists to overcome barriers and, in theory at least, little should prevent forest carbon from playing a full role in climate change mitigation.

Stumbling Blocks at Copenhagen

The main issue around forest carbon and developing countries to be addressed in Copenhagen is REDD+. Although the UNFCCC has held numerous meetings and discussions on this topic for Parties, progress is slow. However, there is widespread consensus that REDD+ must add to, rather than substitute for, deep emission reduction commitments from industrialized countries. That is, industrialized countries must not be able to use significant amounts of REDD+ offsets to meet their mitigation commitments. The urgent need for emission reductions across sectors calls for the development of flexible, adaptive REDD+ financial instruments that put in place incentives that enable substantial reductions, monitored, reported and verified to international standards, without further delay.

The June 2009 meeting of the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) produced a document that presents negotiating text on REDD+ (among other issues) to serve as a starting point for further negotiations prior to the COP in Copenhagen. This text is comprehensive and includes a variety of options that cover how to finance such a mechanism: how Parties should measure, report and verify actions (MRV); how Parties that provide support to REDD+ actions shall measure, report and verify such support; and what institutional and financial arrangements are needed to support REDD+ actions.

The financing options include using a specialized fund established under the COP that is financed by public funds, using of a market mechanism for carbon credits for emission reductions, or using of a hybrid approach of public funds and market approaches. All of these options should remain on the table in order

to maintain flexibility to account for differing national circumstances and enhance participation. As stated in a recent report of an assessment of key options for REDD+ prepared by a team of experts of the Meridian Institute for the Government of Norway, varied and flexible financial instruments that produce adequate, predictable, and sustainable financial resources are required to support REDD+ planning and implementation.

Any form of compensation for REDD+ actions will require the establishment of national reference emission scenarios against which performance of the actions can be measured. Thus the setting of a reference emissions scenario is a critical step. However, no decision has been made yet as to how the reference emission scenario should be set. The following steps for setting such a scenario, as outlined in the Meridian report mentioned above, should be given serious consideration: i) development of procedures based on agreed criteria across all countries; ii) using historical emission rates as a point of departure, with attention to national circumstances such as existing forest cover and income level; and iii) final determination of reference levels should be decided upon by a process analogous to that applied to the AFOLU (agriculture, forestry, and other land uses) sector in developed countries. Decisions are needed with respect to the time period over which historic emissions are estimated. It is strongly suggested by experts that this be on the order of the most recent 10-year period (or less), where good data are available or can be obtained to ensure accurate estimates with a higher degree of certainty. In a market phase, carbon offsets from REDD+ activities will be measured against a reference scenario and money will flow to a country based on performance of their policies and practices measured against this reference scenario, thus the need to have a point-of-departure that best reflects past emissions.

The Subsidiary Body for Scientific and Technological Advice (SBSTA) is carrying out a program on methodological issues relating to reference emission levels and MRV for REDD+. It is essential that it report on its advice at the COP15 as planned in order to ensure sufficient time for implementation.

Increasing Developing Country Negotiating Capacity

Unlike most developed countries at the COPs, which have a relatively large contingent of experts and advisors on the negotiating team, most developing country Parties generally have very few members on their negotiating team. However, for countries to be better informed and engaged in negotiations, there is a need for increased knowledge and understanding about the basic issues related to REDD+. With limited capacity it will be difficult for a developing country Party to understand the implications for their country of any decision or agreement regarding, for example, how a reference emission scenario should be set, what specific activities will be included in REDD+ or what the cost implications are of monitoring standards. It is advisable to increase the understanding and knowledge of developing country negotiating teams on these topics in order to improve their capacity and confidence to better negotiate for their country at the COPs.

Scottish LTS International's report, "Capability and Cost Assessment of the Major Forest Nations to Measure and Monitor their Forest Carbon," includes an extensive assessment of the state of data and capacity for monitoring forests in 25 developing countries from each of the three main regions. While

providing only a broad picture of each of the countries considered, results of the LTS International report reveal that many countries have significant capacity in remote sensing, especially in Latin America, while capacity in forest inventory methods is generally low. Very few countries have the capacity to estimate carbon emissions and removals based on anything better than the default values given in the IPCC GPG. The most striking lack of overall capacity appears to be among the central African forested countries who have demonstrated virtually no capacity in either forest inventory methods or remote sensing. At the other end of the spectrum, India and China already have sufficient inventory and remote sensing capacity and are likely to require little outside support. Other countries have some capacity in one component but little in the other.

In an attempt to increase the capacity of developing countries in greenhouse gas inventory methods, workshops have been organized by a variety of organizations. For example, the Coalition for Rainforest Nations (CfRN) has held three workshops to enable non-Annex 1 Parties to fulfill the procedural and methodological requirements for a transparent, accurate, consistent, complete and comparable monitoring and reporting systems for the forest sector. They have included topics such as techniques and practices used in establishing national GHG inventory systems; guidance on the procedural aspects of completing a national GHG inventory under the UNFCCC; monitoring land cover change, including the introduction to sound scientific practices of detecting and tracking land cover changes due to deforestation and degradation; and how to measure and estimate carbon stocks and carbon stock changes in forests.

Although the CfRN workshops and related activities will enhance the capacity of those who participated in them to improve their REDD+ negotiating skills, it is likely too little too late to make a big difference for most developing country negotiating teams at COP15. Most developing countries wanting to engage in REDD+ activities will need enhanced capabilities in technologies in remote sensing applications, in methods for measuring and estimating carbon stocks in key pools, in applying the IPCC GPG procedures, in designing a MRV system, and in developing and implementing national strategies. Although financial resources for such capacity building activities are available under a variety of programs, including the World Bank's FCPF, UN-REDD, and many bilateral agreements, the resources have only just started to flow and most of the efforts are still in the planning stages with little progress on actually building capacity. A concerted and immediate effort to enhance capacity in developing countries, beyond the "talking and yet another meeting phase" is needed to prepare countries for improved negotiating skills and participation in REDD+ activities post 2012.

The types of capacity needed include, for example, training staff of related agencies and ministries to perform the steps for developing their reference scenario, including technical training and acquiring the hardware and software; developing MRV systems; augmenting analytic capability to analyze the costs of REDD+ activities to their economies (including opportunity costs and benefits of regulating forest land use change under a REDD+ mechanism and cost of implementing an MRV system); and training national policymakers on the importance of engaging all stakeholders, including forest dwellers and indigenous peoples, in national consultations. The capacity building activities need to be sustained over several years, through, for example, the provision of secure support to national universities or other national educational organizations—the key is to train a large

number of people to ensure the sustained supply of well trained people in all aspects of climate change mitigation, adaptation and impacts.

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TECHNOLOGY TRANSFER IN A NEW GLOBAL CLIMATE AGREEMENT

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Executive Summary

A successful climate change agreement must help accelerate the "transfer" of climate-friendly technologies from developed to developing countries. This must include direct assistance from developed countries, including substantial and predictable public finance. But the challenge must be understood more fundamentally as one of building strong, sustainable markets for low-carbon solutions. This requires a suite of complementary efforts on multiple fronts, including clear commitments by the major developing countries to the types of national measures needed to create genuine technology demand. Other key elements in a new global climate agreement should include: strong developed country emission targets to drive the global carbon market and, thereby, low-carbon technology deployment in developing countries; and a new technology body to monitor, assess and advise on technology-related issues. Other elements of a global strategy are better addressed outside the U.N. climate framework. These include: cooperation on research, development and demonstration, which is best pursued through bilateral and plurilateral initiatives; and efforts to reduce trade barriers and resolve intellectual property issues, which are best addressed through the established forums of the World Trade Organization. An agreement in Copenhagen can establish this broad division of labor and spur stronger efforts on all of these fronts.

Introduction

A new global climate change agreement will not be tenable or effective unless it includes measures to "transfer" technology from developed countries, where most of the relevant know-how resides, to developing countries, where most future greenhouse gas emissions will occur. This central and enduring issue is among the most complex and polarizing in the climate negotiations. It invokes deep-seated tensions between North and South, and bears directly on government treasuries, diverse commercial interests, and ultimately, on countries' competitive positioning in the emerging low-carbon economy.

A new technology transfer strategy must, to begin with, deliver on developed countries' obligations to help developing countries forge low-carbon pathways, in part by providing new public finance. But for technology to transfer and take hold, the challenge must be understood more fundamentally as one of building strong, sustainable markets for low-carbon solutions. This requires not only direct assistance, but a suite of complementary efforts on multiple fronts, both domestic and international. Among these are clear commitments by the major developing countries to carry out the types of national measures needed to create genuine technology demand. (While technology transfer is needed in the area of climate adaptation as well, the focus here is mitigation—reducing emissions.)

Negotiating Context

The issue of technology transfer has been contentious since the start of the global climate negotiations. In the 1992 United Nations Framework Convention on Climate Change (UNFCCC), developed countries agreed generally to "take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how" to developing countries, and to "support the development and enhancement of [their] endogenous capacities and technologies" (Article 4.5). The delivery thus far has fallen well short of the need.

The Bali Action Plan, which frames the current round of negotiations, designates technology development and transfer as one of four pillars of a new climate agreement (along with mitigation, adaptation and finance). It calls specifically for "effective mechanisms and enhanced means for the removal of obstacles to, and provision of financial and other incentives for, scaling up of the development and transfer of technology to developing country Parties…"

Within the negotiations, developed and developing countries remain far apart. The G77 and China, the principal developing country bloc, has put forward a comprehensive proposal under which developed countries would finance efforts along the full technology chain, from basic research to the construction of high-tech factories in developing countries. Developed country governments have yet to lay out a coherent alternative. They are under increasing pressure from domestic industries fearful of any loss of intellectual property rights, and are having difficulty building political support for significant financial outlays, particularly to would-be competitors.

These issues play out against two important backdrops. The first and most obvious is the global economic crisis, which makes significant financial commitments all the more challenging. The second is the drive by the major emerging economies to rebalance global power-sharing arrangements dating back

to Bretton Woods. How governance issues are resolved in the climate context may help set the pattern for a broader realignment of roles and responsibilities among the world's major economic powers.

Technology Needs and Dynamics

One area where all appear to agree is the scale and urgency of the technology challenge. The low-carbon transition needed to avert climate disaster requires massive deployment of alternative technologies, both existing and new, across virtually all major economic sectors.

According to the International Energy Agency (IEA), cutting global GHG emissions in half by 2050—the minimum needed to limit warming to 2 degrees Celsius over pre-industrial levels—will require additional energy-related investments on the order of $45 trillion. The needs are largest in the areas of efficiency, renewables, and carbon capture and storage. Sixty percent of the total investment is needed in developing countries, where the rapid expansion of energy infrastructure threatens to lock in high-carbon technologies for decades to come.

Another area of broad agreement is that most of the investment needed must come from private flows (including through the carbon market, discussed below). In energy, as in other areas, the provision of technology—from early innovation to final deployment—is largely facilitated by private capital. An analysis by the UNFCCC Secretariat of investment flows found that only 14 percent of global investment in climate mitigation and adaptation in 2000 came from public resources. Less than 1 percent took the form of official development assistance. Even with a dramatic increase, public resources could generate only a fraction of future investment needs.

The more critical role for government is to create the conditions under which private capital—both domestic and foreign—will favor low-carbon alternatives. Governments must, in other words, use the powers at their disposal to create markets for climate-friendly technologies. In part, this means providing "enabling environments"—the transparent legal and institutional frameworks needed to attract private investment of any sort. But even more, it requires effective policies—whether price signals, standards or other measures—creating sustained demand for these alternative technologies. The close nexus between policy driver and technology uptake is starkly illustrated by the erratic history of U.S. tax incentives for wind power. Investment in new wind generating capacity rose and evaporated from year to year as Congress alternately provided and withdrew a production tax credit, and has risen steadily now that the incentive is being maintained.

Globally, scores of technologies that can lower emissions today remain on the shelf for lack of policy drivers. Indeed, the IEA estimates that 70 percent of the reductions needed to halve global emissions by 2050 can be achieved with existing technologies. The implication for technology transfer is that any "push" achieved through stronger external support will be effective only if complemented by the "pull" of stable policy frameworks that sustain demand on the receiving end.

Governments also must help build markets by clearing away barriers. Those cited most often in the context of technology transfer are tariff and non-tariff barriers, and intellectual property (IP) constraints. In the first category, the Office of the U.S. Trade Representative reports that among the 25 top greenhouse gas-emitting developing countries, most apply import duties

as high as 35 percent on technologies that can help curb emissions. USTR also points to non-tariff barriers such as investment restrictions and weak legal infrastructures. An analysis by the World Bank concludes that removing tariff and non-tariff barriers in 18 major developing countries would increase the flow of efficiency, wind, and solar technologies by 64, 23, and 14 percent, respectively.

Among many in the developing world, however, intellectual property rights are seen as a greater barrier to technology transfer. This has led to proposals for the use of "compulsory licensing"—forcing companies to license their technologies—as was done to dramatically lower the cost of HIV drugs in Africa. Technology companies argue vociferously in response that intellectual property is a critical innovation driver, not a barrier, and that their rights must be fully protected. (In the recent debate over climate legislation in the U.S. House of Representatives, technology companies pushed for provisions to suspend mitigation and adaptation assistance to countries deemed to be violating IPR protections.)

In the case of HIV drugs, intellectual property represents an especially high proportion of a product's overall cost, and a single patent held by a single company may have no substitute. With clean energy technologies, neither is typically the case, and there are clear examples of developing country success in acquiring IP and know-how through normal commercial channels. Joanna Lewis of Georgetown University documents how two companies, Goldwind and Suzlon, used standard licensing arrangements to acquire the basic technology they needed to become the largest wind turbine producers in China and India, respectively, and among the largest in the world. (Lewis notes that a "supportive national policy environment" was critical in both cases.) Looking at wind, solar and biofuels, John Barton of Stanford Law School similarly finds that IP is not a significant obstacle to technology access for domestic production and use. "In all three of the sectors," Barton concludes, "developing nation firms have succeeded in entering industry leadership."

Technology transfer is neither linear nor straightforward. It reflects a far-flung web of interrelated processes mediated through both markets and governments. Nor does technology flow exclusively from North to South. Indeed, over time, South-South flows may prove even more critical. The question before governments is how best to deploy their limited powers and resources to ensure developing countries access to—and, ultimately, the ability to self-generate—the suites of technologies needed to sharply curtail GHG emissions. The answer entails a mix of efforts on multiple fronts to ease barriers, boost public finance, and establish demand-driving policy frameworks that steer private capital toward the right technology choices.

Elements of a Global Strategy

Measures to promote technology transfer are an essential element of a new global climate agreement, whether in Copenhagen or beyond. But it is neither feasible nor sensible to address the full range of issues under the climate Convention. Politically and institutionally, other venues are far better suited for addressing key aspects of technology transfer and development. A new UNFCCC agreement could expressly acknowledge this division of labor and provide a means of monitoring, if not coordinating, efforts across multiple venues. As core elements, a global strategy should aim to:

- Focus efforts under the Framework Convention on rapidly transferring existing technologies by: establishing strong mitigation commitments to drive in-country demand and the carbon market; building developing country capacities; and committing substantial, predictable public finance.

- Strengthen cooperation on research, development and demonstration largely outside the Convention, through bilateral, plurilateral, and public-private efforts.

- Address tariff and non-tariff barriers in, and defer intellectual property issues to, established forums under the World Trade Organization.

UNFCCC: Rapid Deployment

The highest priority under the Convention should be to promote the rapid transfer and deployment of existing climate-friendly technologies. Strong mitigation commitments by the major economies are essential to drive demand for these technologies. First, commitments by the major emerging economies are needed to ensure sound policy frameworks creating indigenous demand. Second, strong developed country targets are needed to drive the global carbon market and, thereby, create further demand for emission reduction and technology deployment in developing countries. The other essential element is developed country support for capacity building and to help finance technology deployment.

Developing Country Commitments

Integrating developing country efforts into a global framework requires a more flexible approach to commitments than under the Kyoto Protocol. While all developed countries should be expected to have Kyoto-type emission targets under a new agreement, the emerging economies are not prepared for economy-wide emission caps. Most, however, are undertaking or considering a range of policies or actions—such as efficiency standards, renewable energy targets, or forestry goals—that moderate greenhouse gas emissions. The challenge is to strengthen these efforts and bring them into the international framework.

Under the Bali Action Plan, developing countries are to undertake "nationally appropriate mitigation actions…supported and enabled by technology, financing and capacity building." Both the mitigation actions, or NAMAs, and the support for them are to be "measurable, reportable and verifiable." Determining how NAMAs will be structured and how they will be supported are perhaps the central issues in the negotiations. Many developed countries are unlikely to assume binding emission targets of their own unless the NAMAs, at least in the case of the major emerging economies, are also regarded as commitments. While the Bali Action Plan does not call for developing country commitments, it does not exclude them either, as did the Berlin Mandate framing the Kyoto negotiations. The likelihood of developing country commitments, in turn, hinges heavily on commitments of financial and other support from developed countries.

A number of Parties have proposed that NAMAs be put forward within, or supplemented by, low-carbon development strategies outlining longer-term pathways. One important role for such a strategy would be to provide a comprehensive assessment of a country's mitigation potentials and of the technologies needed to achieve them.

Developed Country Commitments and the Carbon Market

Perhaps the most important vehicle for mobilizing private capital for technology transfer is the carbon market. Under Kyoto's Clean Development Mechanism (CDM), developed countries investing in emission-reducing projects in developing countries can credit those reductions toward their emission targets. This provides lower-cost reductions for developed countries while financing clean development in developing countries.

Although technology transfer is not a specific mandate of the CDM, the UNFCCC Secretariat has tracked its role in enabling the "use of equipment or knowledge not previously available" in a host country. The most recent analysis found that of the 3,300 projects in the CDM pipeline as of mid-2008 (an estimated investment of nearly $100 billion), 39 percent entailed some form of technology transfer. Japan, Germany, the United States, France and Great Britain were the predominant technology originators, and China, India, Brazil, Mexico and Malaysia the leading recipients.

In the UNFCCC negotiations, Parties are debating going beyond the CDM's project-based approach to allow "sectoral" or "policy-based" crediting. These broader approaches could facilitate greater reductions, investment and technology transfer. However, future demand for developing country reductions—and, hence, the potential for the carbon market to drive technology transfer—is largely contingent on the strength of developed country emission targets.

Public Finance

A pivotal issue within the negotiations is the nature and extent of new multilateral finance. (Under any outcome, much of the future public finance is likely to flow bilaterally; a related question is how these flows are regarded under a new climate agreement.) Technology could be one of the "windows" within a comprehensive new climate fund, or the focus of a separate fund. In either case, critical issues include: the level of finance; how the funds are generated; how they are allocated and disbursed; the best institution(s) to manage a new fund (or funds); how the fund is governed; and how to ensure accountability.

To best promote rapid transfer of existing technologies, a new fund should have two overriding objectives: building developing country capacity and directly subsidizing deployment. On the capacity-building side, many developing countries need help in identifying their best mitigation options, developing and implementing effective policy frameworks, and assessing their present and future technology needs. All are critical complements to direct deployment support.

In selecting projects for deployment funding, the primary criterion should be cost-effectiveness—delivering the greatest emission reduction per dollar invested. Deployment support can be delivered through concessional loans, grants or other instruments depending on the project and the host country. What is critical is that a fund be structured to maximally leverage private investment. This can be done at the project level by, for instance, bundling direct assistance with carbon finance and conventional market finance.

For expediency, and to avoid duplicating institutional capacities, the new fund should be operated from an existing institution such as the World Bank, and

governed by an independent board under the guidance of the UNFCCC Conference of Parties. For this to work, however, its governance must depart from the traditional donor-recipient model and give developing countries an equal voice. The interim Clean Technology Fund established recently at the Bank, which provides for balanced representation from developed and developing countries, may point toward an alternative model. Here, the technology transfer issue intersects with broader questions of power-sharing at the Bretton Woods and other multilateral institutions. How governance is resolved in the case of climate funding may well shape—but, given the urgency of climate action, must not be contingent on—broader outcomes.

Governments have proposed a number of international mechanisms to generate finance, such as a levy on aviation or an auction of emission allowances. However, many appear to favor a "scale of assessment" approach, in which an agreed formula sets each donor country's share of the total, and each generates its contribution domestically. This approach has been successful in other areas, including funding under the Montreal Protocol supporting the phase-out of ozone-depleting substances in developing countries. In that case, however, funds are raised through periodic rounds of pledging, not commitments per se. In the case of climate change, the scale of need is much greater and firm commitments are needed to ensure predictable flows.

A New Technology Body

To support activities under the Convention, and to provide some linkage to efforts elsewhere, a new technology body reporting to the UNFCCC Conference of Parties should be established. Its specific functions could include:

- Periodically assessing, on the global scale, priority areas for technology transfer and development;
- Monitoring and assessing the full range of international technology-related efforts within and outside the Convention, including major plurilateral and bilateral initiatives;
- Assisting developing countries on national technology assessments and strategies;
- Advising the Conference of the Parties on the guidance it should provide to the governing body of the new technology fund; and
- Developing and/or applying standards for the "measurement, reporting and verification" of technology support.

To ensure the necessary balance and expertise, the body should be comprised of government, independent and private sector experts, as in the Montreal Protocol's Technology and Economics Assessment Panel.

RD&D Cooperation

Stronger collaboration is also needed in the research, development and demonstration of new technologies, but these efforts are more practical outside the Convention through bilateral and plurilateral arrangements. Successful initiatives are likely to involve more limited partnerships among key countries—and with the private sector—which a 180-nation intergovernmental process does not easily accommodate.

The track record on international RD&D cooperation is not strong, and a spate of technology-focused climate initiatives such as the Asia-Pacific Partnership have produced meager results. The United States hopes to use the Major Economies Forum in part as a springboard for new technology initiatives and, like Europe, is actively exploring closer bilateral collaboration with China in areas such as carbon capture and storage. Such partnerships can contribute directly to technology transfer by strengthening innovation capacities in developing countries and through the sharing of the intellectual property that emerges.

An agreement under the UNFCCC can help spur these efforts by committing countries to higher levels of public finance for RD&D. Countries undertaking RD&D initiatives also could choose to include them among their UNFCCC commitments, or could agree at least to report their efforts to the UNFCCC to facilitate monitoring and assessment.

WTO: Trade Barriers and Intellectual Property

Also more sensibly managed outside the Convention are the issues of trade barriers and intellectual property.

Reducing or eliminating tariff and non-tariff barriers to "environmental goods and services" generally is among the many issues languishing in the Doha round of WTO talks. The United States and the European Union have jointly proposed a two-tiered agreement that singles out climate-related goods and services for rapid liberalization. A commitment by Parties in a new UNFCCC agreement to accelerate liberalization of trade in climate-related technologies could spur efforts within the WTO.

The WTO also provides an established forum on intellectual property—the Trade-Related Aspects of Intellectual Property Rights, or TRIPS, agreement. TRIPS sets out the international legal framework governing intellectual property, including the potential use of compulsory licensing. In cases where a party believes intellectual property poses a substantial barrier to technology transfer, the evidence should be considered and the remedy fashioned within this framework. More routinely, the question of IP costs can be implicitly addressed through public finance for technology deployment. A new UNFCCC agreement can most productively address IP by reaffirming and deferring to the TRIPS regime.

Objectives for Copenhagen

A comprehensive new climate agreement under the UNFCCC can best accelerate the transfer of climate-friendly technologies to developing countries by:

- Establishing verifiable commitments for effective policy frameworks in major developing countries;
- Delivering substantial, predictable public finance for capacity-building and for deployment of existing technologies;
- Driving the global carbon market through strong emission reduction targets for developed countries;
- Committing countries to scale up public finance for RD&D efforts outside the Convention;
- Committing countries to accelerate efforts in the WTO to reduce or eliminate tariff and non-tariff barriers;

- Reaffirming TRIPS as the appropriate forum for addressing intellectual property; and

- Establishing a standing body to assess technology needs and to monitor and assess technology-related efforts within and outside the Convention.

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PRACTICAL APPROACHES TO FINANCING AND EXECUTING CLIMATE CHANGE ADAPTATION

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Executive Summary

There is increasing consensus that climate change may slow worldwide economic growth and could impact up to 20 percent of the global GDP in the long term, according to the Stern Review. Countries must quickly learn to calculate the risks they face and invest in adaptation measures to couple with their ongoing mitigation efforts. Developed nations will also have to help their developing neighbors adapt—and help pick up the pieces in the wake of climate-related disasters.

With these challenges in mind, a first step toward climate-compatible development is helping decision makers assess and address total climate risk. This paper presents an overview of how to estimate the costs of climate change adaptation, how to cover those costs, and practical approaches to build a portfolio of responses for any country or region.

Introduction

Around the world, countries are trying to determine how to adapt to climate change while protecting economic growth. How much adaptation will cost, and where the money will come from, are subjects of considerable debate, particularly in developing nations.

Leaders know they need to quantify adaptation costs before they can gauge incremental financing needs. But few have yet considered how to measure the impacts of adaptation efforts—a key to guide how and when funds are spent. Decision makers need more facts and support tools to develop a practical approach to make the wisest possible adaptation investments.

This policy brief offers a "top-down" global perspective on the costs of adaptation and the mechanisms for delivering funding, as well as a "bottom up" guide to assess climate impacts within a region and develop a tailored portfolio of responses.

The brief closes with a discussion about how execution is linked to overall adaptation costs and financing, which is imperative with the impending United Nations Framework Convention on Climate Change conference in Copenhagen later this year that looks to establish a binding global climate agreement among as many countries as possible. It is critical that decision makers in attendance (both public and private) are prepared to engage on the international and national stage where policy can trigger action at all levels (e.g., Bangladesh's national budget has a line item dedicated solely to climate adaptation which has corresponding effects across all subordinate budgets within the country). Research suggests that a significant portion of adaptation needs may be met through growth and development objectives being achieved in a climate compatible manner. While incremental, external financing will continue to be necessary, a broader understanding of adaptation financing approaches by decision makers will help shape the debate and lead to more informed and effective allocation.

Estimating Adaptation Costs

While it is clear that our climate is changing (i.e., 26 natural catastrophes in 1972 compared to 137 in 2008), the impacts of climate change, and the costs of adaptation, vary widely.

Experts within the scientific community disagree about numerous predictions regarding climate change, such as whether rainfall will increase or decrease in East Africa in the next 20 years. Nearly everyone agrees, however, that climate change will significantly increase the cost of economic and social development, that it will be impossible or too expensive to adapt to every aspect of climate change, and that the world's poor will suffer the most from adaptation failures.

Some adaptation is proactive, some reactive. Proactive measures include creating and sharing public goods such as drought-resistant seeds and agricultural best practices. "Climate-proofing" infrastructure and offering people new incentives for adaptation can also help prepare for climate change.

Reactive measures, taken after climate impact, include disaster management and longer-term social adaptation to prevent disasters from leading to long-term poverty. Money and supplies can help farmers re-establish their livelihoods after a cyclone, for example, and help rebuild housing or enable children to return to school.

While extensive work has been done on the impact of climate change, estimates of the cost associated with climate change are less robust. Estimates of global adaptation costs vary depending on many factors, such as assumptions about climate scenarios and funding

horizons. Estimates, in current dollars, for annual climate-proofing investments for developing countries include:

- World Bank 2006: $9-41 billion per year for developing countries based on climate-proofing public and private investment;
- Stern Review 2006: $4-37 billion per year for developing countries based on climate-proofing public and private investment;
- Oxfam 2007: Over $50 billion, including climate-proofing and national adaptation programs of action (NAPAs); and,
- UNDP 2007: $86 billion per year by 2015, including climate-proofing and social adaptation.

Since these "first-generation" estimates offer limited insight into the breakdown of adaptation needs, the UNFCCC made "second-generation" estimates for agriculture, coastal regions, health, water and infrastructure. With these sectors in mind, the UNFCCC forecasts that the world will need to spend $44-165 billion on adaptation each year by 2030. Building on that approach, Project Catalyst estimates that developing countries will need $27-78 billion per year by 2030.

Each region will require its own unique adaptation measures, of course, but decision makers will need to know more about risks, options and trade-offs before they can develop bottom-up cost estimates. Local research and adaptation planning must begin immediately, and it must account for development and climate-compatible growth.

For this to happen, developed nations will need to meet overseas development assistance commitments with an eye on the Millennium Development Goals. Failing to reach these goals will likely raise the costs of adaptation in the long run. Developing nations will need additional financing for adaptation to achieve development goals in a harsher climate even if they continue to grow at unprecedented levels and even if developed countries meet their current aid commitments.

Sources of Adaptation Funding

Considering the estimates above, it's easy to see that current adaptation funding will not meet forecast needs and is not well-suited for the least-developed countries. About $3 billion has been committed through 2012, including $300 million from the Adaptation Fund, $240 million from the Pilot Programme for Climate Resilience, $130 million from the LDC Fund, and $91 million from the Special Climate Change Fund.

Much of this funding has yet to be disbursed, and least-developed countries are often disadvantaged in accessing the money because they lack eligibility criteria or the capabilities to apply. Building their capabilities and simplifying application processes will help ensure that funding reaches more people in need.

Where the costs are additional and incremental, additional funding for adaptation will be required for developing countries. Possible funding sources include internal financing, such as national budgets, direct government transfers or grants from developed countries, "assigned amount unit" or cap-and-trade auctioning, and levies on aviation and shipping.

Project Catalyst estimates that auctioning could provide $6-38 billion per year by 2015, depending on the percentage of credits auctioned, and that transport levies could provide an additional $13-26 billion per year by 2015. A combination of these sources and others would likely be necessary to close the funding gap.

For auctioning and international transport levies to become viable sources, countries will need to make significant shifts in policy. Developed countries would need to accept limited control over these funds (as they would be raised externally to budgetary processes), and developing countries would need to accept responsibility for demonstrating that funding was productive. New institutions and governance structures would be required to manage these funds, possibly in the form of an international body representing both developed and developing countries.

Developing countries view many funders and financing mechanisms with distrust and see some conditions as unnecessary or overly restrictive. Meanwhile, donor countries need to ensure their funds are being put to good use, which requires monitoring, reporting and verification.

To overcome these challenges, many developing countries need help immediately to build capabilities so that they can use funds productively—and demonstrate success. Meanwhile, institutions and mechanisms will need to allocate and distribute adaptation funding according to actual needs. Given historical grievances on both sides, institutions will have to build trust for the system to work.

The need for adaptation funding is growing as the impacts of climate change become increasingly apparent. Existing institutions, such as the World Bank and regional development banks, may be best equipped to raise and allocate funds to those in need quickly. But the world will need to find a balance between making the most of current systems and creating an ideal system.

Practical Approaches to Adaptation Economics

While discussions continue on external financing, decision makers need to find ways to measure costs from the "bottom-up" and invest in adaptation in their countries. Currently, they lack a practical framework for evaluating local climate risk, assessing the costs and benefits of possible responses, and integrating a portfolio of such measures into their broader economic development agendas.

Societies that fail to take action on climate adaptation may have to fall back on aid in the wake of costly disasters. New thinking in this area has emerged from research by the Economics of Climate Adaptation (ECA) working group, a partnership among the ClimateWorks Foundation, European Commission, Global Environment Facility, McKinsey & Company, Rockefeller Foundation, Standard Chartered Bank and Swiss Re.

The group has proposed an approach to quantifying a location's "total climate risk." Taking today's climate into account, along with a range of future scenarios, the process uses cost-benefit analysis to assemble a portfolio of investments—infrastructural, technological, behavioral and financial—to adapt to that risk. The approach has been applied and tested through on-the-ground case studies conducted in eight distinctly different climate-sensitive regions from South Florida to Mali.

The approach is formed through five steps that begin with defining the most substantial hazards, applying scenario modeling, building a balanced portfolio of responses based on cost-benefit analysis, and then focusing on implementation and learning.

The findings from the analyses could help decision makers and practitioners reframe the way they think about adaptation economics. Five major findings have emerged from the ECA's research:

Enormous economic value is already at risk.

If current development patterns continue, the locations studied will lose between 1 and 12 percent of GDP by 2030 even *without* climate change, with poorer populations, such as small-scale farmers in India and Mali, losing an even greater share of their incomes.

Climate change could double climate-related losses in the near term.

In the eight areas studied, climate change alone could drive 45 to 70 percent of losses from total climate risk to 2030. This points to an urgent need for funding for adaptation over and above development resources.

Despite many uncertainties about the eventual effects of global warming, we know enough to make investment decisions now.

This is true even in developing countries, where data are limited. Climate change scenarios vary widely, but they can still help identify adaptation measures that would be useful against a range of outcomes.

Economies are more adaptable than some people think—so much so that most losses can be averted.

A portfolio of cost-effective measures can address most of the risks in any given region. In the locations studied, between 55 and 95 percent of expected losses to 2030—even from severe climate change impacts—can be averted through adaptation measures whose economic benefits have been shown to outweigh their costs. These include infrastructure improvements, such as new reservoirs and wells to combat drought; technology, such as better fertilizers; and systemic and behavioral initiatives, such as awareness campaigns. Risk transfer and insurance also have key roles to play in recovering losses from low-frequency, high-severity events such as cyclones and once-a-century floods.

For example in the China case study that analyzed the effects of drought in North and Northeast China, up to 50 percent of the expected losses can be covered through a balanced portfolio of effective measures, such as seed engineering and pipe water conveyance, with the vast majority being cost-effective (cost-benefit ratio < 1).

In some instances the measures identified had a negative cost-benefit ratio, meaning that cost savings exist in the long term. For example, soil conservation techniques create large cost savings from less tillage operations and fertilizer use—although their overall benefit is slightly limited by the small loss averted during drought conditions and a lack of crop yield improvement in normal conditions. Throughout all the cases that the working group analyzed, a majority of the expected losses could be averted through the use of a balanced portfolio of cost-effective measures.

Annual expected loss is a statistic that reflects the total climate risk anticipated each year through 2030. Individual regions face risk differently depending on the frequency and severity of actual events (e.g., flood) in affected areas. Therefore, the evaluation focused on a short list of measures that have a level of "loss averted" capability. Adding up the average loss averted for each measure allows decision makers to get a total sense of how much loss could potentially be averted.

The analysis shows that a large portion of the expected loss from climate change can be averted, much of it cost-effectively, if decision makers act now and implement a methodical approach to adaptation.

In the medium term, the economic benefits of adaptation outweigh its costs.

A balanced portfolio of adaptation measures can have a profound and positive impact on economic development, especially in developing countries. In Mali, for example, climate-resilient agricultural development could bring in billions of dollars in additional revenue each year. Such measures, with demonstrated net economic benefits, are much more likely to attract investment and trigger valuable new innovations and partnerships. The opportunities to target adaptation funding—and to attract investment for climate-resilient development—are tremendous and largely untapped.

The ECA's research also implies that proper reallocation of internal capital to adaptation may reduce countries' reliance on incremental, external development financing. Ultimately, incremental financing for a given country will need to take into account how much adaptive capacity is available but dormant due to suboptimal spending at the national level, and then additional financing could be a complementary resource to close the gap.

The ECA findings underscore that now is the time to invest in workable, cost-effective programs that greatly improve climate adaptation while boosting sustainable development.

Countries need to plan for adaptation with much greater rigor, focus, and urgency and do more to align public, private and NGO stakeholders. Global institutions need to build their own capabilities and those in developing countries with an eye on the social costs of adaptation and impacts on marginalized populations.

The Next Horizon

Swift policy action, continued research, and systems development by all stakeholders involved in managing climate change are particularly urgent given the ECA working group analysis. Developed nations and global institutions must continue generating financing agreements and building funding mechanisms to support adaptation in developing countries. Researchers must continue developing a fact base for measuring climate change impacts and refining decision tools for selecting adaptation responses. Local, regional, and national governments must continue developing practical approaches that can be implemented promptly.

Timing of these actions is critical due to the upcoming COP in Copenhagen in December of this year, which can act as a springboard for global change. Sizable funding for developing nations is likely to emerge from the conference, however, it is likely that this total will not cover all of the costs required to ad-

dress global climate risk, but rather lay a solid foundation that begins to address the problem.

Clearly, developing countries will require additional sources of financing to meet urgent adaptation needs—a major sticking point in international negotiations. To facilitate discussions at Copenhagen and the world stage, the Project Catalyst working group on adaptation has proposed a set of guiding principles:

- Countries should be free to be spend resources on any measures, whether focused on development or adaptation, that promote climate-resilient development;

- Funds should add to existing flows and provide a steady, predictable income stream;

- Funds should be prioritized to help the most vulnerable countries;

- Governments should have most of the responsibility for allocating adaptation funds; and

- Countries should demonstrate that funds are spent in cost-effective ways.

Progress in these areas will take us to the next horizon of adaptation: where financing is not dictated from the top but motivated by a bottom-up assessment of each country's unique needs and capabilities. This shift will occur as the world looks beyond the direct and immediate financial costs of adaptation to the long-term benefits to civilization, progress and humanity itself.

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ADAPTATION TO CLIMATE CHANGE: BUILDING RESILIENCE AND REDUCING VULNERABILITY

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Executive Summary

Given the far-ranging adverse impacts of climate change, adaptation must be an integral component of an effective strategy to address climate change, along with mitigation. Adaptation should be approached as an opportunity to rethink development as usual, and should be based on "upstream" interventions that will yield benefits regardless of specific, climate-related events in the future. This policy brief examines win-win strategies for development and adaptation in three key sectors—namely, ecosystems and natural resources, food and agriculture, and health—and focuses on interventions that will be valuable regardless of the uncertainties we face in determining precise climate change impacts.

Introduction

Climate change will have significant impacts on development, poverty alleviation, and the achievement of the Millennium Development Goals. Hard-fought progress made in achieving these global goals may be slowed or even reversed by climate change as new threats emerge to water and food security, agricultural production, nutrition, and public health. Countries and regions that fail to adapt will contribute to global insecurity through the spread of disease, conflicts over resources, and a degradation of the economic system.

Given the far-ranging adverse impacts of climate change, adaptation must be an integral component of

an effective strategy to address climate change, along with mitigation. The two are intricately linked—the more we mitigate, the less we have to adapt. However, even if substantial efforts are undertaken to reduce further greenhouse gas emissions, some degree of climate change is unavoidable and will lead to adverse impacts, some of which are already being felt. The world's poor, who have contributed the least to greenhouse gas emissions, will suffer the worst impacts of climate change and have the least capacity to adapt. Elementary principles of justice demand that the world's response strategies and adaptation funds give special priority to the poorest countries. Poor countries account for only 8 percent of global greenhouse gas emissions; yet 98 percent of those seriously affected by climate change live in those countries.

Adaptation is about building resilience and reducing vulnerability. Adaptation is not simply a matter of designing projects or putting together lists of measures to reduce the impacts of climate change. A national policy response should be anticipatory, not reactive, and should be anchored in a country's framework for economic growth and sustainable development, and integrated with its poverty reduction strategies.

Information is crucial to planning for adaptation to climate change. Countries need the capacity and resources to track meteorological patterns, forecast impacts, and assess risk in order to make good decisions and provide timely information to their citizens. Capacity for monitoring and forecasting climate change can significantly affect livelihoods. For farmers, for example, having access to technologies for adaptation and knowing early about abrupt changes in rainfall patterns or temperature can make the difference between a bountiful harvest and crop failure.

The science is clear: climate impacts are being felt today and greater impacts are unavoidable tomorrow. Adaptation is essential to reducing the human and social costs of climate change, and to development and poverty alleviation. Adaptation strategies abound that will yield benefits in their own right.

Rethinking Development

Climate change provides both an obligation and an opportunity to reconfigure development strategies so that they meet the needs of the present generation without compromising future generations' abilities to meet their needs. Adaptation strategies should be evaluated by the following four principles:

- Scale: Match responses to the growing numbers of people in danger.
- Speed: Waste no time because climate change is happening faster than predicted.
- Focus: Manage risk, build the resilience of the world's poorest people, and enhance the ecosystem functions upon which those people depend.
- Integration: Recognize the relationships between environment, development, and climate change, and manage synergies and trade-offs between mitigation and adaptation.

Development that can be sustained amid a changing climate must be enabled by building the adaptive capacity of people. Adaptive capacity results from reduced poverty and enhanced human development. One critical input to this new development process will be the production and dissemination of appropriate climate information, tailored to end-user needs and delivered in a timely manner.

While infrastructure such as new seawalls, dykes, and irrigation systems will be needed, the real adaptation needs of people are for education and knowledge; for political voices to articulate views and concerns; and for effective local governments efficiently connected to national governments. Many of these needs must be met at the level of people, their families and villages. So much work on climate change, even on adaptation, is done at the global level. These approaches need to be turned "upside-down" and institutions should be encouraged to begin at the local level.

Building Resilience

Climate change increases risk, particularly for those who rely on weather patterns, agriculture, water, and other natural resources for their livelihoods. The magnitude, timing, and location of these climate impacts are inherently unpredictable, but the threats are not likely to be new; they will, in most cases, be magnifications of existing threats.

Given these uncertainties, adaptation strategies should be based on "upstream" interventions that will yield benefits regardless of specific, climate-related events. Examples of such win-win strategies include developing more diverse crop strains tolerant of a variety of different conditions (heat, drought, salt, etc.); bolstering social capital and resilience; creating early warning systems and preparedness plans; improving public health infrastructure; and bolstering disease surveillance. These strategies will be valuable regardless of the exact impacts of climate change at a particular time or location.

The following highlights adaptation challenges in three key sectors that are crucial to sustainable development: ecosystems and natural resources, food and agriculture, and health. Because each of these sectors is closely intertwined, national adaptation and sustainable development plans should deal with them in an integrated manner.

Ecosystems and Natural Resources

Climate change will destabilize and degrade many ecosystems that are already threatened by destruction and overuse, and result in direct and severe impacts on those who depend on them for their livelihoods. Unlike the wealthy, poor people often lack access to alternative services and are highly exposed to ecosystem changes that could result in droughts, floods, and famine. The poor often live in locations that are vulnerable to environmental threats, and lack financial and institutional buffers against these dangers. Climate change can also lead to ecosystem failure and large-scale population displacement.

The Millennium Ecosystem Assessment (MEA), published in 2005, assessed the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems. The MEA made it clear that human actions are depleting Earth's natural capital, "putting such strains on the environment that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted."

Food and Agriculture

Climate change affects agriculture and food production in complex ways. It affects food production directly through changes in agro-ecological conditions and indirectly by influencing growth and distribution of incomes, and thus demand for agricultural products. According to the IPCC, the adverse impacts of climate change on agriculture will occur predomi-

nantly in the tropics and subtropics, in Sub-Saharan Africa, and to a lesser extent in South Asia. Yields from rain-fed agriculture in some African countries could fall by 50 percent by 2020. In some South Asian countries, a substantial reduction in crop yields from rain-fed agriculture could also occur. In Central and South Asia, crop yields could fall by up to 30 percent by 2050, and India could lose 18 percent of its rain-fed cereal production. In addition, freshwater availability in these regions is projected to decrease, and coastal areas will be at the greatest risk due to increased flooding. Sea level rise in Bangladesh, for example, is expected to affect more than 13 million people with a 16 percent reduction in national rice production.

Health

Global climate change threatens human health in ways that are numerous and profound. Many parts of the world will experience more extreme events such as droughts, heat waves, altered exposure to infectious disease, and more frequent natural disasters that will put added strain on an already overstressed health system. Moreover, climate change threatens the bases of public health around the globe: sufficient food and nutrition, safe water for drinking and sanitation, and secure homes to live in. It will make the MDGs that much harder to achieve.

Many low-income countries with populations at the greatest risk from climate change are already overwhelmed with existing public health challenges from treatable conditions such as malnutrition, diarrhea, acute respiratory infections, malaria, and other infectious diseases. Diverting limited personnel and resources away from these ongoing problems to address future threats from climate change could make things worse instead of better.

The greatest health impact of climate change may be its impact on global nutrition. It has been estimated that at least one-third of the burden of disease in poor countries is due to malnutrition, and roughly 16 percent of the global burden of disease is attributable to childhood malnutrition. Climate change is also expected to alter exposure to infectious disease, including waterborne disease outbreaks caused by a variety of organisms, and to increase food poisoning events. In addition, the distribution of vector-borne diseases, which affect nearly half the human population, is expected to change as a result of changes in temperature, humidity, and soil moisture. While there is some debate about the net impact of climate change on the distribution of these diseases, there is little debate that they are likely to spread into regions where they have not been historically endemic.

Financial Needs

Although there is uncertainty about the cost of adaptation, the scale of finance needed is significant. Several calculations, based on rough assumptions, have estimated the cost of adaptation in developing countries to range from $9 to $86 billion per year.

According to Article 4.4 of the UNFCCC, "developed countries are required to assist developing countries in meeting the costs of adaptation to the adverse effects of climate change." Developing countries regard funding for adaptation as indicative of historical responsibility and argue that resources for adaptation should be additional to Official Development Assistance (ODA).

However, one recent analysis found that developing countries have received less than 10 percent of the funds promised by developed countries to help them adapt to the impacts of climate change. This lack

of action has caused concern among international negotiators, who have warned that a new global agreement on climate change is at risk if developed countries do not make the necessary funding available to address adaptation in developing countries. The failure to act is fostering deep distrust between developed and developing nations, and adaptation funding is crucial to rebuild trust.

The concurrent global financial crisis and threat of a global recession have called into question the feasibility of raising significant financial resources for climate action, including adaptation, around the world. Climate change, however, will not wait for the resolution of the financial crisis. Besides, the financial crisis has shown that trillions of dollars of public funds can be mobilized in a very short time. What is required for climate action is on the order of tens of billions of dollars. A small percentage of the funding in national stimulus packages would go a long way toward addressing climate change now.

As some global leaders have pointed out, the financial crisis should not be used as an excuse for inaction on climate change. Addressing climate change at the requisite scale can be an integral part of the solution to the financial crisis. The transition to a low-carbon economy can support global recovery by creating new jobs and opportunities across a wide range of industries and services.

However, ODA and other public funds are unlikely to provide the "new and additional" resources required to finance the adaptation efforts of all developing countries. The current level of available funding is an order of magnitude below even the most conservative cost estimate. It is also scattered across different sources and is allocated with no clear coordination. Without a significant increase in financial support for adaptation and better coordination of international efforts, the world will fail to deliver what is urgently needed to cope with climate change in countries that are highly vulnerable to its impacts, such as the least developed countries (LDCs) and small island developing states.

Recommendations

In order to effectively adapt, national policy responses should anticipate the adverse effects of climate change and should be anchored in a country's framework for economic growth and sustainable development. National governments bear the responsibility to develop and implement integrated policies and programs that build the resilience and reduce the vulnerability of their populations, emphasizing preventive local actions, to manage the risks associated with the impacts of climate change. The following recommendations offer a suite of options to effectively meet the adaptation challenge in the developing world:

Rethink the Development Paradigm

Because climate change provides both an obligation and an opportunity to reconfigure development strategies, new thinking is needed at both the global and local level from national governments to development organizations. Guidance from the international level is needed from the Secretary-General of the United Nations who should establish a high-level task force to define a new vision for global sustainable development. This new vision must be based on a low-carbon economy and examine the interconnections between the crises the world has witnessed in recent years—financial, food, water, energy, and

climate—and the ability of global public policy and institutions to deal with them simultaneously.

Roles for Local, National and Global Policy

The highest political and organizational level should lead national policy coordination for adaptation, disaster risk reduction, poverty alleviation, and human development. Local institutions should have the main responsibility for supporting the poor and vulnerable and assisting them in building safe settlements, disseminating appropriate information, and moving resources efficiently from global and national to local levels.

Focusing on the local level does not in any way decrease the role of the national government. It suggests instead that national governments must be much better at connecting with remote areas and peoples. In addition, the instinct to rely on local people is correct, for they have been managing climate variability for centuries and have much pertinent knowledge and many necessary skills. Similarly, international organizations must become more skilled in reaching the local level directly and working through local governments and civil society organizations.

Without viable institutions and effective policy frameworks at the national level, progress on adaptation to climate change will falter. Disseminating information, building knowledge, articulating needs, ensuring accountability, and transferring resources—all are guided by and happen through institutions.

Take Advantage of Triple Win Policies in the Forestry Sector

Win-win policies can be designed that protect the climate and enhance ecosystems. For example, an initiative to reduce deforestation and to promote reforestation and the recovery of degraded lands would achieve multiple objectives: sequestering carbon from the atmosphere; strengthening ecosystems and biodiversity; expanding food production; and providing employment, principally to the poor and to indigenous peoples.

A large-scale international initiative to reduce deforestation and promote reforestation and the recovery of degraded lands should be launched and means for effective transfer of resources to local communities and people should be assured.

Build Local Capacity for Food Security

Climate change is primarily a multiplier of known risks, such as food insecurity, that have in the past rarely received sufficient attention or funding because they have fallen in the gap between disaster relief and development. The World Bank, for example, the largest investor in agriculture, has in the past paid little attention to food security. Similarly, the current architecture of the United Nations in addressing food security is weak and needs strengthening. There is much overlap between three UN agencies—the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development (IFAD), and the World Food Programme (WFP)—leading to duplication of efforts.

On the other hand, the Consultative Group on International Agricultural Research (CGIAR) is a global partnership working on cutting-edge science to foster agricultural growth. CGIAR is well positioned to assist developing country farmers who face economic and environmental constraints given the impacts of climate change. Therefore, centers for

regional adaptation in agriculture to develop and widely disseminate technologies for adaptation (for example, salt- and drought-resistant crop cultivars) should be established by CGIAR, especially in Sub-Saharan Africa and South Asia.

Strengthen Public Health Infrastructure and Surveillance

The international community must make a serious commitment to help lower-income countries adapt to the health threats from climate change through improving basic health services. Doing so will have the added benefit of helping those countries address challenges that have been an ongoing scourge to their economies and their people even absent climate change. Though national governments bear the responsibility for the health of their populations, international financial support should be provided for strengthening developing countries', especially least developed countries', public health infrastructure and surveillance capabilities.

Approach Adaptation Finance With Both Short- and Long-term Goals

A number of new (and innovative) sources of funding have been proposed to finance adaptation needs. Three promising, possible sources that are "adequate, predictable, and sustainable" as called for in the Bali Action Plan are:

1. ***Auctioning International Emissions Trading Allowances*:** Norway has proposed that a small portion of allowances could be withheld from national quota allocation and auctioned by an appropriate international institution. Auctioning 2 percent of global allowances would generate between $15 and $25 billion per year. The resulting revenue could then be placed in a fund to support climate action, including adaptation in developing countries.

2. ***International Air Passenger Adaptation Levy:*** Maldives has proposed, on behalf of the LDCs, an adaptation solidarity levy on international air passengers. This levy would provide funding for adaptation activities in the poorest and most vulnerable countries and communities. The proposal is to establish a small passenger charge for all international flights—differentiated with respect to the class of travel ($6 per economy and $62 per business/first class trip)—which would raise between $8 billion and $10 billion annually for adaptation in the first five years of operation, and considerably more in the longer term.

3. ***International Maritime Emission Reduction Scheme (IMERS):*** IMERS is a "cap-and-charge" scheme as opposed to cap-and-trade, based on a carbon levy on fuel for international shipping that recognizes different national circumstances. Applied worldwide and collected centrally, IMERS would raise approximately US$10 billion annually for climate action in developing countries while reducing currently unregulated carbon dioxide emissions from international shipping. The levy would be set at the average market price of carbon. The anticipated impact of the scheme on final consumers is only a percent increase in the price of imports to developed countries.

In the short term, $1 to $2 billion of additional ODA should be provided immediately by developed countries to help LDCs (especially in Africa), selected small island developing states (below a certain GDP), and other most vulnerable developing countries that are already suffering from climate impacts. The funds should be used for the implementation of National

Adaptation Programs of Action (NAPAs) that have already been developed. Funds should flow to community-level organizations, women's groups, and NGOs. This would help narrow the "trust gap" between developed and developing countries and serve as a building block toward a long-term approach to adaptation within the context of a new and comprehensive agreement on climate change.

In the longer term, a climate fund (or funding mechanism) should be established in conjunction with a new and comprehensive climate agreement to support developing countries' actions for mitigation and adaptation. Starting at $10 billion and growing to $50 billion per year, in addition to ODA, it should consist of innovative and predictable sources of funding, including auctioning revenues from carbon markets and global market-based levies, such as from international air travel and maritime emissions reduction.

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