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Green Growth and Equity in the Context of Climate Change: Some Considerations

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Abstract

Green growth entails several different kinds of processes: conversion to low-carbon energy, climate resilience, and response to climate shocks. Equity implies a fair sharing of the costs, within countries and between countries. The authors set out to explore some of the ways that equity has been considered in climate change discussions. They discuss per capita emission right approaches, and highlight key challenges in the application of equity in global climate change negotiations. They provide a brief overview of key approaches to carbon financing, focusing on some recent cost estimations of potential climate change impacts, as well as of projected needs for green growth programs. The diversity of estimates and present evidence on the apparent gulf between available public financing and green growth needs are highlighted; and considerations of implementing green growth, focusing on building climate resilience and responding to climate shocks are discussed. In conclusion, the authors present one approach to a global Green Fund to receive assessed contributions of member countries and disburse grant and loan fund to low-income and middle-income countries to pursue green growth programs.

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1. INTRODUCTION

Green growth entails several different kinds of processes: conversion to low-carbon energy, climate resilience, and response to climate shocks. Equity implies a fair sharing of the costs, within countries and between countries. Equity issues have been considered in a number of ways including implications of historic responsibility, development impacts of a carbon budget on the South, impacts on the poor and most vulnerable, consequences of top-down global benefit oriented mitigation policy, official development assistance (ODA) implications of climate finance, etc. Fairness involves both helping to share the incremental costs of adaptation and mitigation, and compensating for damages incurred as the result of climate change. Both the mitigation and adaptation activities (and many actions involve both mitigation and adaptation) are costly. We should undertake them because the social costs of these actions are less than the social benefits they promise. Still, for developing countries the costs are real and compound the ongoing challenges of economic development.

In the first section of the paper we explore some of the ways that equity has been considered in climate change discussions. We discuss per capita emission right approaches, and highlight key challenges in the application of equity in global climate change negotiations. In the next section we briefly overview key approaches to carbon financing, focusing on some recent cost estimations of potential climate change impacts, as well as of projected needs for green growth programs. We highlight the diversity of estimates and present evidence on the apparent gulf between available public financing and green growth needs. In the next section we turn to considerations of implementing green growth, focusing on building climate resilience and responding to climate shocks. The last section of the paper presents one approach to a global Green Fund to receive assessed contributions of member countries and disburse grant and loan fund to low-income and middle-income countries to pursue green growth programs.

2. EQUITY CONSIDERATIONS IN CLIMATE CHANGE DISCUSSIONS

Unlike in the global discussions of sustainable development, equity concerns have received considerable attention in climate change negotiations. In the former, the emphasis was on the global responsibility on the part of developed countries to support sustainable development, rather than on equity between countries (Our Common Future 1987). Equity is coming to be recognized as being critical for the effective linking of environmental, economic and social considerations, in order to achieve sustainable development (UNESCAP et al. 2012). Green growth strategies would help build a “green economy” while enhancing the earth’s natural capital, and reducing ecological scarcities and environmental risks (p. xv). However, it is also recognized that green growth strategies will not by themselves realize sustainable development. Social policies enhancing inclusion, and addressing poverty and the needs of disadvantaged and vulnerable groups are also important. Further, especially in the Asian context, the economic, social, and environmental dimensions need practical integration in systems of governance that promote equity—in resource use and in risk sharing, between and within countries, and both inter and intra-generations. Equity in this expanded sense is the most critical consideration for long-term sustainability and greater socio-economic resiliency of societies.

A number of multi-laterals and governments, in the run up to Rio+20 conference, have pushed for the consideration of a “green economy” as a key framing for national development (UNEP 2011, HM Government 2012, Green Economy Coalition). In the Government of United Kingdom submission to Rio+20, for example, green economy will “maximise value and growth across the

whole economy, while managing natural assets sustainably." (p. 1) Equity considerations are noticeably absent. The emphases instead is on economic growth and wealth creation while reducing environmental impacts, efficient use of natural resources, reduced reliance on fossil fuels and better preparedness for climate change impacts, and to exploit comparative advantage of businesses for green goods and services. The apparent jettisoning of sustainable development in favor of green economy has made some observers nervous. As Khor notes, the hard won gains of sustainable development (such as of sustainability principle, right to development, common but differentiated responsibilities and international cooperation that recognizes the development needs of the South) should be preserved in considerations of green economy (UN-DESA 2011).

In the case of climate change, where emission levels of developed countries are directly linked with changes in the climate, equity between countries has been seen as highly relevant in global negotiations. However, its formulation has been varied, and its application to realize the financing for implementation of climate policies on mitigation and adaptation action in developing counties has been highly uneven. In this section we provide an overview of some of the ways that equity has been considered. In the next section, we discuss global climate financing needs and its actual availability.

It is well-articulated in the United Nations Framework Convention on Climate Change (UNFCC) that now-developed countries need to assume responsibilities to both reduce their own greenhouse gas (GHG) emissions, as well as to support efforts to reduce the vulnerabilities of developing countries to climate change risks. Further, it is widely understood that a vigorous implementation of a global carbon budget in the absence of a rapid transition to a low carbon economy would seriously constrain long-term development in the global South. Equity considerations require financial and technological support and capacity development to developing countries to help them achieve development goals on a green growth path. Climate change policies are also expected to magnify the impacts of existing drivers of climate vulnerability, with some of the biggest impacts on poor people resulting less from the changing climate itself than from policies adopted to mitigate climate change. Further, a rights-based approach has been utilized focusing specifically on the needs of the most vulnerable groups, advocating that they receive preferential support. Climate and development justice requires that poor communities in developing countries, who will bear the brunt of climate change impacts while contributing very little to its causes, need the world's help first and foremost.

The climate system is a shared resource whose stability is affected by emissions of carbon dioxide and other greenhouse gases. The average temperature of the earth's surface has risen by 0.74 degrees Celsius (C) since the late 1800s and is expected to increase by another 1.8° C to 4° C by the year 2100 with massive environmental and socio-economic implications for all of humanity (Solomon et al. 2007). While "greenhouse gases" in the atmosphere, especially carbon dioxide, methane, and nitrous oxide occur naturally, the principal reasons for higher emission over the past 150 years are associated with industrialization activities: the burning of ever increasing quantities of petroleum and coal and land use changes. Almost two decades ago, many countries joined an international treaty—the United Nations Framework Convention on Climate Change (UNFCCC, or the Convention)—to begin to consider actions to reduce global warming and to cope with whatever temperature increases are inevitable.

Equity is given considerable attention in the Convention, while also portending the difficulties that countries (as parties to the Convention) would face in its realization. It notes that "the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs,.." (UN 1992: 1). Further, "[R]ecognizing further that low-lying

and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change,.." (UN 1992: 2) Further, "Recognizing that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial,.." (UN 1992: 3). "The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof." (UN 1992: 4)

In the Convention Principle 3 draws attention to equity issues in a number of ways. They include a focus on common but differentiated responsibilities and respective capabilities, the need for developed countries to take the lead in climate action, a focus on developing countries particularly vulnerable to climate change effects, and recognizing the right of developing countries to development. The Convention clearly holds the industrialized countries to be responsible to both reduce global warming as well help developing countries manage the impacts of global warming. However it is in the identification of precise areas of responsibilities and in their resourcing that the equity framing begins to get diffuse, create differences in interpretation and in general pose difficulties in being operationalized. The various proposals can be classified into two categories: resource sharing and effort sharing. The former, adopting an equal per capita approach to the sharing of the carbon budget, focuses mainly on GHG mitigation efforts. The effort sharing approaches focus on enabling development in the South in a carbon-constrained world. We examine a few of the more well known ones below.

The earth's atmosphere is considered as a global commons, to be shared by industrialized and developing countries alike. Given the carbon-constrained nature of the atmosphere, global negotiations are to devise fair means of sharing the total carbon budget. Industrialized countries have developed without having to internalize the costs of high levels of GHG emissions. With less than one fifth of the world's population, they are responsible for almost three quarters of all historic emissions. On a per capita basis, their historical emissions are more than ten times those of the developing countries. Developing countries, on the other hand, need to in future internalize the cost of carbon emission, while at the same time growing out of poverty (Adger et al. 2006). In climate negotiations industrialized countries are seen as seeking ways to lock in high amounts for themselves based on past emission levels, making carbon budget sharing highly inequitable (Actionaid 2007; Oxfam 2008). A per capita emission approach is seen as being a more fair way forward. Some of the variations in this approach include:

The Agarwal and Narain equal per capita emission rights approach is premised on the rights to the atmospheric commons, distinguishing between "luxury emissions" and "subsistence emissions". Such a distinction allows distinguishing use of carbon (and other GHG sources) to fulfill basic human needs from those used to support luxurious lifestyles. All countries would be awarded emission allowances in proportion to their population, and would be free to trade them. The total number of allowances granted globally would steadily decrease along a path consistent with an agreed climate stabilization goal (Agarwal and Narain 1991).

Contraction and Convergence model: The Global Commons Institute formulated this hybrid approach and presented it at the second Conference of the Parties in 1996. The key idea is to help equalize GHG emissions per capita on a global scale, over time. In principle the rich would

consume (gradually) far less resources per capita than before, while the poor consume more than they have in the past, so that both 'groups' converge towards a common 'fair share' level, which the planet can sustain (GCI 2008). It envisages global emissions peaking and then gradually falling (contraction), while emission reduction is achieved by limiting per capita emissions in such a way that they converge (convergence). It requires large cuts in per capita emissions for developed countries while allowing developing countries to continue growing their economies before they have to make cuts to reach equal per capita emissions. The "fair carbon emission per country" is calculated based on a total population cap for each country.

Equal Cumulative Per Capita Emission Rights approaches extends the concept of equal per capita rights to cover the entire carbon budget from the industrial revolution onwards, rather than limiting from near past (from the "Brazilian Proposal"—UNFCCC 1997; Bode 2004). The framing tries to account for the role of industrialized countries in emitting GHGs in the past 150 years. Such past emissions are expressed as a "carbon debt", to be used in calculation of carbon budgets as negative allocation for the future. Many large developing countries, including the People's Republic of China (PRC) and India, have favored this approach, while making different assumptions about the year at which accounting of historical emissions begins.

Right to development of the poor: The most widely discussed effort sharing approach is the Greenhouse Development Rights Framework (Baer et al. 2008). It is based upon national responsibility and capacity with respect to a "development threshold" that excuses the poor from any responsibility to bear the burdens of the climate transition. The majority of emission reductions required to prevent dangerous climate change must be made in the developed world in the coming decades. In the same period developing countries require hugely expanded energy services to meet their developmental aspirations of their citizens. Historically, expansion of energy services always been accompanied by rising carbon emissions. The Greenhouse Development Rights (GDR) Framework proposes a climate regime structured to safeguard a right to development. It is a burden-sharing framework that defines national obligations, based on responsibility for the climate change problem and capacity to solve it. Both are defined with respect to a "development threshold" that serves to relieve from the costs and constraints of the climate crisis those individuals still striving for a decent standard of welfare (Kartha et al. 2009). By focusing on people rather than nation states, the GDR Framework also helps focus on inequities within countries (such as the development needs of the poor in the industrialized countries).

In the remainder of this section we highlight some diverse issues that make the application of equity in climate change mitigation and adaptation so challenging, even when there is broad agreement on its need.

Distinguishing impacts of anthropogenic climate change: The Convention (unlike the IPCC) focuses exclusively on the anthropogenic forcings of climate. Natural variability is of interest only to the extent that it is modified by the anthropogenic forcings. Developing countries seeking resources and technologies through the Convention for enhancing climate resiliency need to first show the "additional" nature of impacts from anthropogenic climate change. Climate science and associated vulnerability studies have not progressed to the extent that this is possible. Especially in the LDCs, climate variability continues to be a key driver of development risk. Does this mean that LDCs should not be allowed to access Convention climate funds to manage climate risks?

On sustainable development: The Convention is specific on the right of developing countries to sustainable development. For purposes of identifying and costing technologies and practices there is little guidance as to what constitutes an acceptable level of sustainable development. Further, the high diversity underlying ecosystems makes this a difficult issue to problematize.

Perhaps attainment of Millennium Development Goals (MDGs) or a certain level of HDI could be considered as a proxy for sustainable development in climate finance calculations.

Per capita based calculations: Per capita based formulations for making available funds for adaptation programs (or per capita emission in the case of mitigation) in developing countries privilege the larger and more populated countries. Smaller countries and those projected to face catastrophic changes to their ecosystems or territorial extents are not well served by such formulations.

On historical start date for calculating obligation: What start date should be used in calculating the obligation of industrialized countries for the existing atmospheric carbon stock? For "full" responsibility, the date should be farther back. How far back? Perhaps frameworks should differentiate "basic" from "luxury" historical emissions, with the latter identified for obligation calculations.

Share of the positives of industrialization: If carbon stock is the negative effect of industrialization, should the positives of industrialization (such as science, technology, medicine) and their benefits to developing countries also need to be accounted? Often controlled by the private sector, intellectual properties have bedeviled international science and technology transfer efforts.

Policies for tackling mitigation: The literature points to the availability of a number of policy instruments for tackling GHG emissions including carbon taxes, emission trading schemes, standards and technology-support, etc. However, there are also a number of existing policies, with economy-wide implications, that make mitigation difficult. They include energy and agricultural subsidies, emissions from deforestation, and barriers to trade in emissions-reducing technologies. Equity considerations of policy changes are as important as devising cost-effective mechanisms.

Adverse impacts of climate change policy response: There is growing concern that developing countries, and especially the poorer populations, may be adversely impacted less by the direct impacts of climate change and more by the policy responses engendered in response to climate change. From 2005 to the middle of 2008, international prices of major food cereals surged upward, causing major panic amongst food importing countries. Along with a number of other suspects, a major reason it seems was the rise in energy prices leading to a surge in demand for biofuels from maize and oil seeds (Headey and Fan, 2010). This has generated much discussion on the potential long-term food security impacts of biofuels. The potential for adverse impacts on local communities from REDD+ programs in areas of poor governance and uncertainty in access are other areas of high equity concern. Barr et al. (2009) note "inequitable distribution of REDD payments could increase disparities in the forestry sector, and could displace and impoverish forest-dependent peoples."

Governance of diverse stakeholders, active across multiple scales: Climate governance, from global to local levels, requires the working of a diversity of actors, from the purely private to the state/public. Rather than state-led efforts alone (the staple of development), there is increasing recognition that guided market-based approaches are required to tackle climate change and build climate resiliency. In addition, the challenges of mitigation and adaptation need them to work across (traditional) boundaries imposed by the nation state, requiring a transnational governance architecture that is at the same time respectful of the nation state. The international climate change negotiations, being state-led, have yet to consider these governance challenges in-depth.

3. LOW CARBON FINANCING: IMPACT COSTS, NEEDS, AND AVAILABILITY

In this section we provide an overview of some recent cost estimations of potential climate change impacts, as well as some projected needs for adaptation and mitigation.[1] We highlight the high variance in the estimations as well as the gulf between the costs of climate change and public financing for adaptation and mitigation from the industrialized countries currently on the table. At the end of the paper, we propose a methodology and architecture for a global Green Fund to promote discussion.

3.1 Climate Change Impact Costs and Projected Needs for Adaptation and Mitigation

Costs of climate change have been calculated for overall impacts, for adaptation and for mitigation activities. Cost estimates have rapidly evolved as understanding of complex systems and associated modeling capabilities have improved, along with further refinement in policy options. Despite these improvements, as we discuss below, significant variations in cost estimates remain. Some of the key reasons for the variations are in accounting for uncertainties (in GHG emission mix and their projections, GHG emission impacts on climate processes – especially on temperature and precipitation amounts and trends, valuation etc.,), time horizons being considered (50, 80, 100 years), and the aggregation of socio-economic impacts (mix of market and non-market, discount rates adopted etc.,). There are also large variations in the different GCMs on the state(s) of future climate. Averaging across the GCMs, as has been often done, does not lead to reduction in uncertainties. A significant potential source of variation in impacts and associated costs is the specific climate characteristic being considered. Calculations of temperature-driven impacts would be quite different from those derived from precipitation variations, leading to further uncertainties (and confusion).

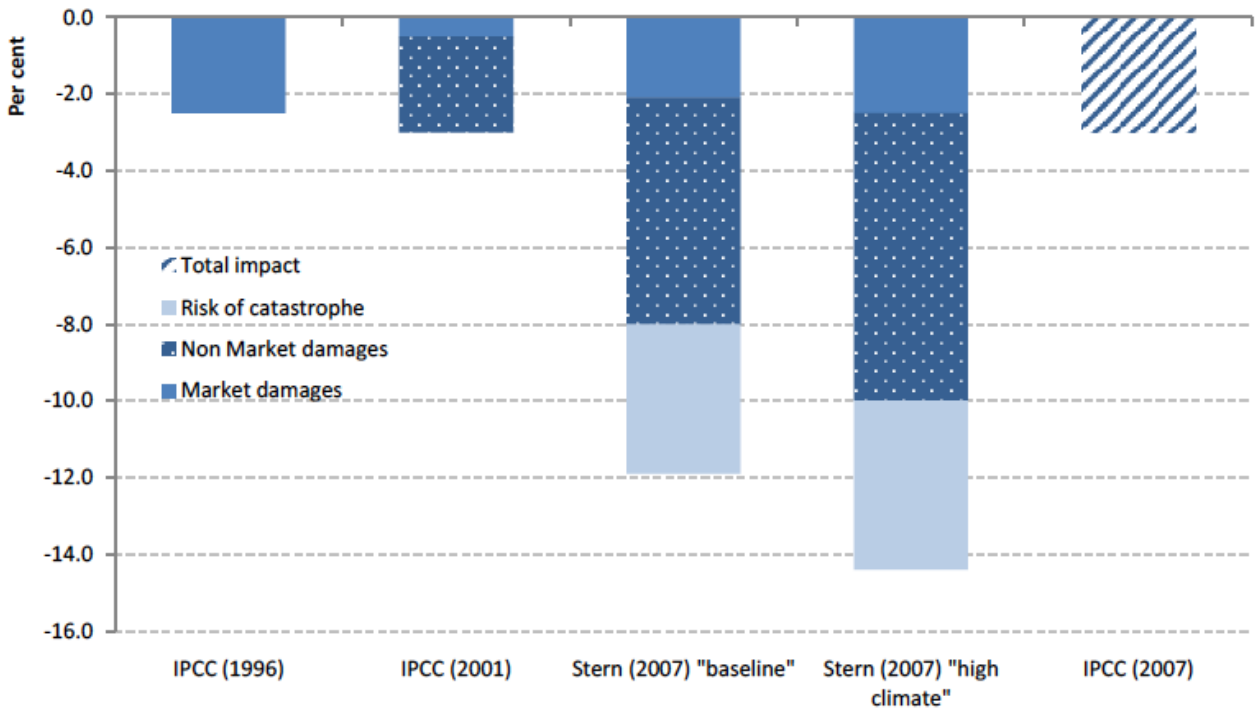
3.1.1 Impact cost estimates

Predicting economic costs of climate change involves modeling a large number of variables. They include changes in emissions scenarios, projections of precipitation, temperature and sea levels, technology changes, population growth, and idealized levels of adaptation. Most integrated impacts cost assessments have used relatively simple models, using a single climate variable (generally global mean surface temperature), aggregating sectoral impact studies, and simplistic treatment of uncertainty such as of climate sensitivity and potential irreversibility of impacts (Jamet and Corfee-Morlet 2009). Figure 1 illustrates significant variation in cost estimates, based on expected global temperature change, impact studies used, and inclusion of non-market and catastrophic event damages.

[1] The climate change focus here precludes discussion of green economy transition cost estimates. Interested readers may consult the IEA Blue Map scenario and the UNEP green economy study for global green economy cost estimates.

Figure 1: Estimates of the Global Damages of Climate Change

(% of world GDP)

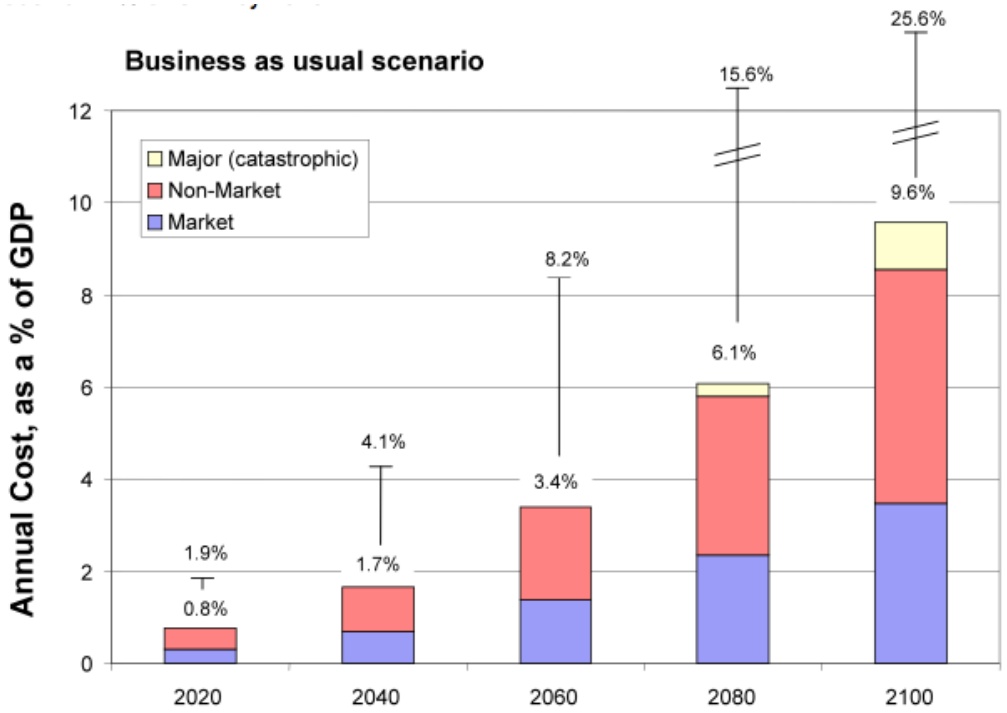


Note from original figure: IPCC estimates represent the consensus among experts of the impact of climate change. IPCC (1996) estimates only include market impacts. IPCC (2007) estimates are the average of the range of possible values that is quoted in the report (from 1 to 5 %). Stern "baseline" scenario produces an average mean warming of 3.9° relative to pre industrial in 2100 while temperature changes are pushed to higher levels in Stern "high climate" scenario through the action of amplifying feedbacks in the climate system.

Source: Jamet and Corfee-Morlet 2009.

In addition to the variation across models and methodology, significant disparities are expected in impact costs across geographic regions. While some studies use sectoral analyses to illustrate differences across regions (such as Stern et al. 2006; Jamet and Corfee-Morlet 2009; UNDP 2007) others provide detailed analysis at a regional scale. Figures 2 and 3 show the application of multiple models to estimate impact costs for Africa and Southeast Asia, respectively (Watkiss et al. 2010; ADB 2009). The latter study, of four countries in Southeast Asia, found significant GDP impacts over the coming decades. A recent study by Brown et al. (2010) finds that precipitation, rather than temperature, is the dominant influence on economic growth. Since estimations of climate change impacts on economic growth often utilize projected temperature changes, this finding suggests an underestimation of impacts.

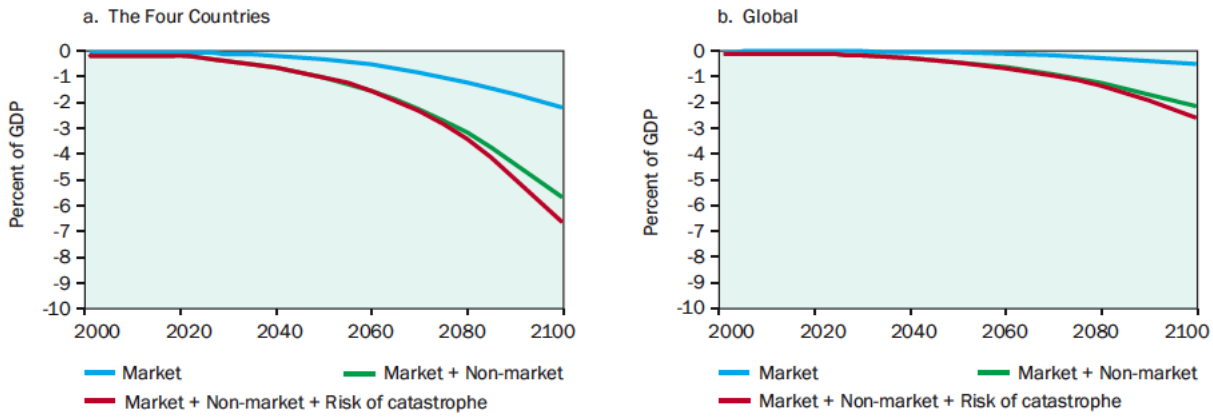
Figure 2: Equivalent Annual Cost of Climate Change in Africa, as a % of GDP



Note: Using PAGE Model and the Business as Usual A2 IPCC emissions scenario. Shows 5% to 95% range.

Source: SEI, Not dated.

Figure 3: Mean Impact of Climate Change on Southeast Asian Countries and at the Global Scale, as a % of GDP



Note: Using a modified PAGE2002 Model and the BAU A2 IPCC emissions scenario. The four countries are Indonesia, Philippines, Thailand, and Viet Nam.

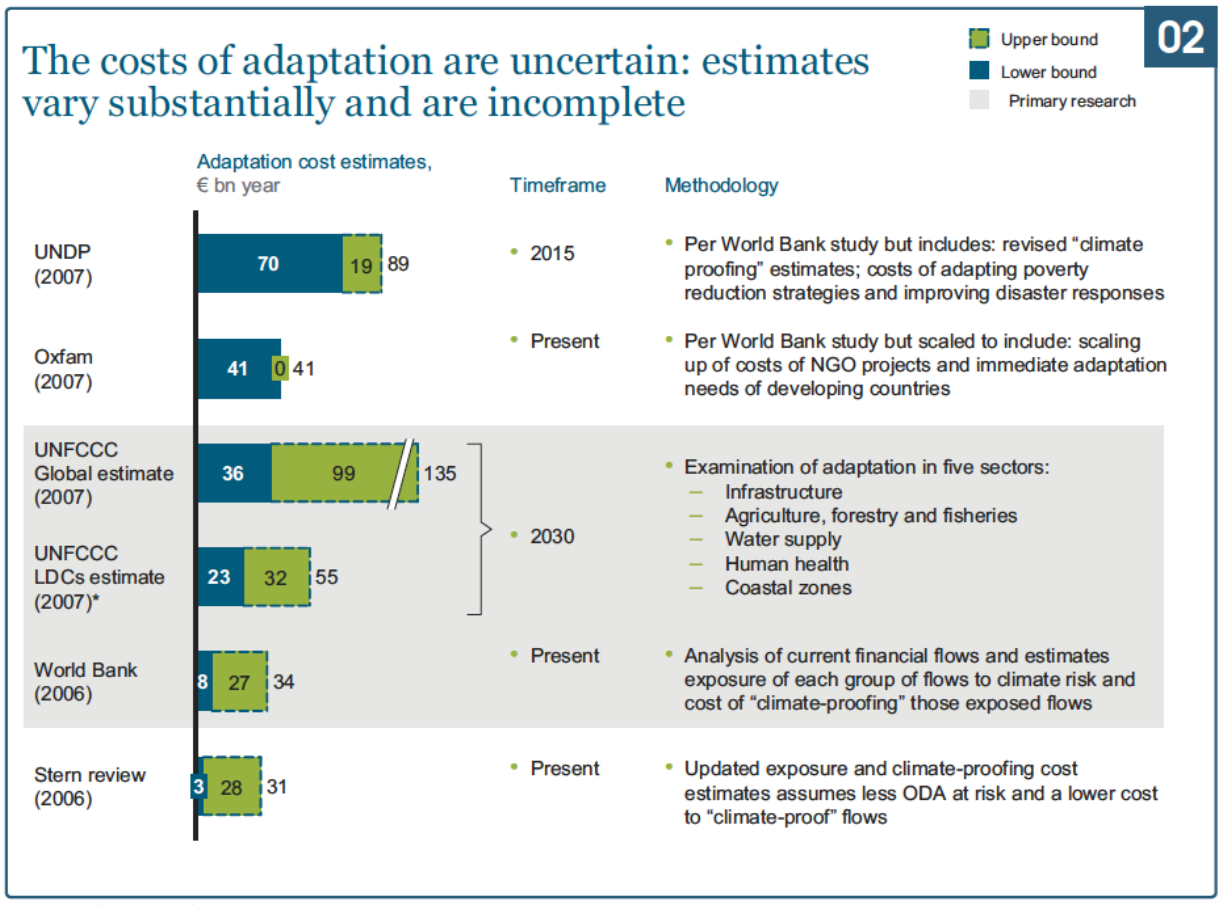
Source: ADB 2009.

3.1.2 Estimates of Adaptation costs

Estimates of adaptation costs carry great uncertainty. Adaptation involves responding to context specificities of vulnerabilities and development risks. A number of criteria need to be considered in the planning and implementation of adaptation efforts including, economic benefits and their

distribution, relation to development objectives, spillover effects, capacities etc. Assessments at the global scale and across sectors are relatively recent, with two significant reports in 2006 (World Bank Investment Framework and the Stern Review) leading to a number of responses and revised estimates. The estimates of annual adaptation investments vary widely, even when the core methodology remains similar (Figure 4).

Figure 4: Adaptation Cost Estimates Based on Various Methodologies

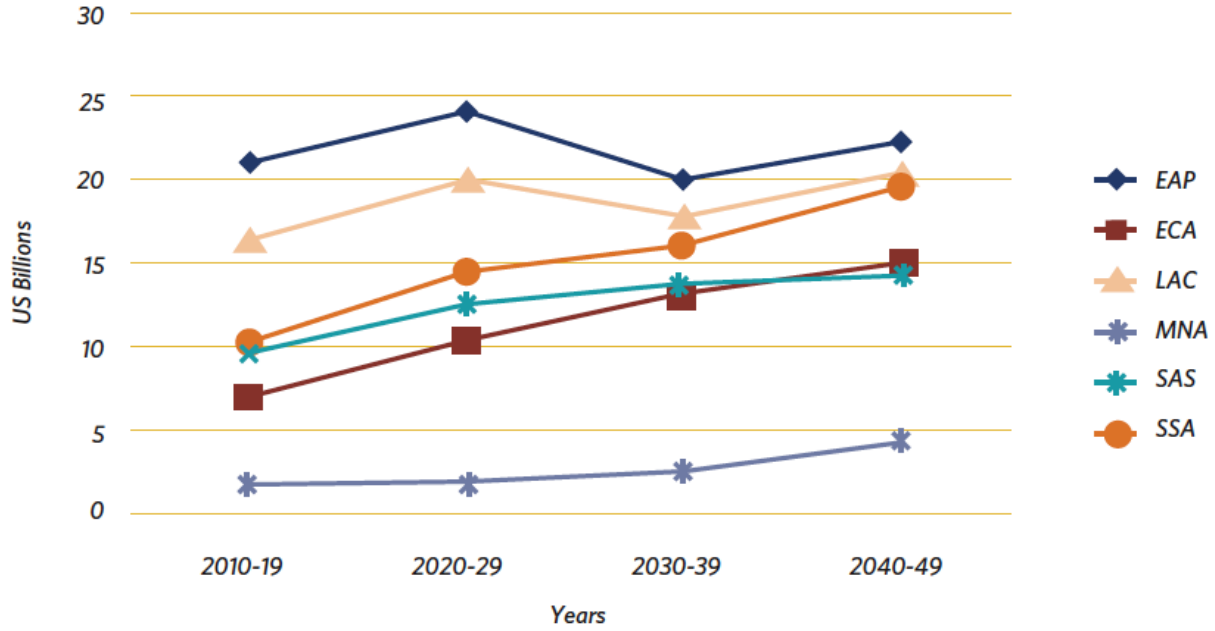


Source: ECA 2009.

The UNDP 2007 Human Development Report suggests that donor countries will need to increase adaptation financing to US$86 billion annually by 2015 (with US$44 billion to "climate-proof" development investments, US$40 billion to adapt poverty reduction activities, and US$2 billion to strengthen disaster response). A number of critiques have been leveled against the climate change cost estimate literature. While some raise concerns about the limited treatment of uncertainty or the vast array of adaptation options (Parry et al. 2009), others note of "issues of double counting, and scaling up to global levels from a very limited (and often very local) evidence base" (Agrawala and Fankhauser 2008: 77).

More recently the World Bank completed the Economics of Adaptation to Climate Change study (World Bank 2010a). In addition to country-level adaptation cost analyses and better cost estimates, the study uses two models to create future climate scenarios: a drier scenario, developed at Australia CSIRO, resulting in lower adaptation costs, and a wetter scenario, developed by US NCAR, with high adaptation costs largely due to sharply higher infrastructure costs (Figure 5), capturing in some ways the potential range of costs. The total estimated costs for 2010–2050 using CSIRO model is approximately 14% less than using NCAR.

Figure 5: Total Annual Cost of Adaptation for the NCAR Scenario, by Region and Decade (US$ billions at 2005 prices, no discounting)



EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, MNA = Middle East and North Africa, SAS = South Asia, and SSA = Sub-Saharan Africa.

Source: World Bank 2010a.

3.1.3 Estimates of Mitigation Costs

Cost projections for mitigation vary significantly depending on the greenhouse gas stabilization target, desired stabilization year, emission reduction strategies employed, population and economic growth assumptions, and climate model. The IPCC review (2007) suggested mitigation costs by 2030 to range from -0.6% of GDP to 3% of GDP, relative to baseline emissions scenarios, depending on the stabilization target (see Table 1).

Table 1: Estimated Global Macro-Economic Cost Estimates of Mitigation Scenarios in 2030 and 2050

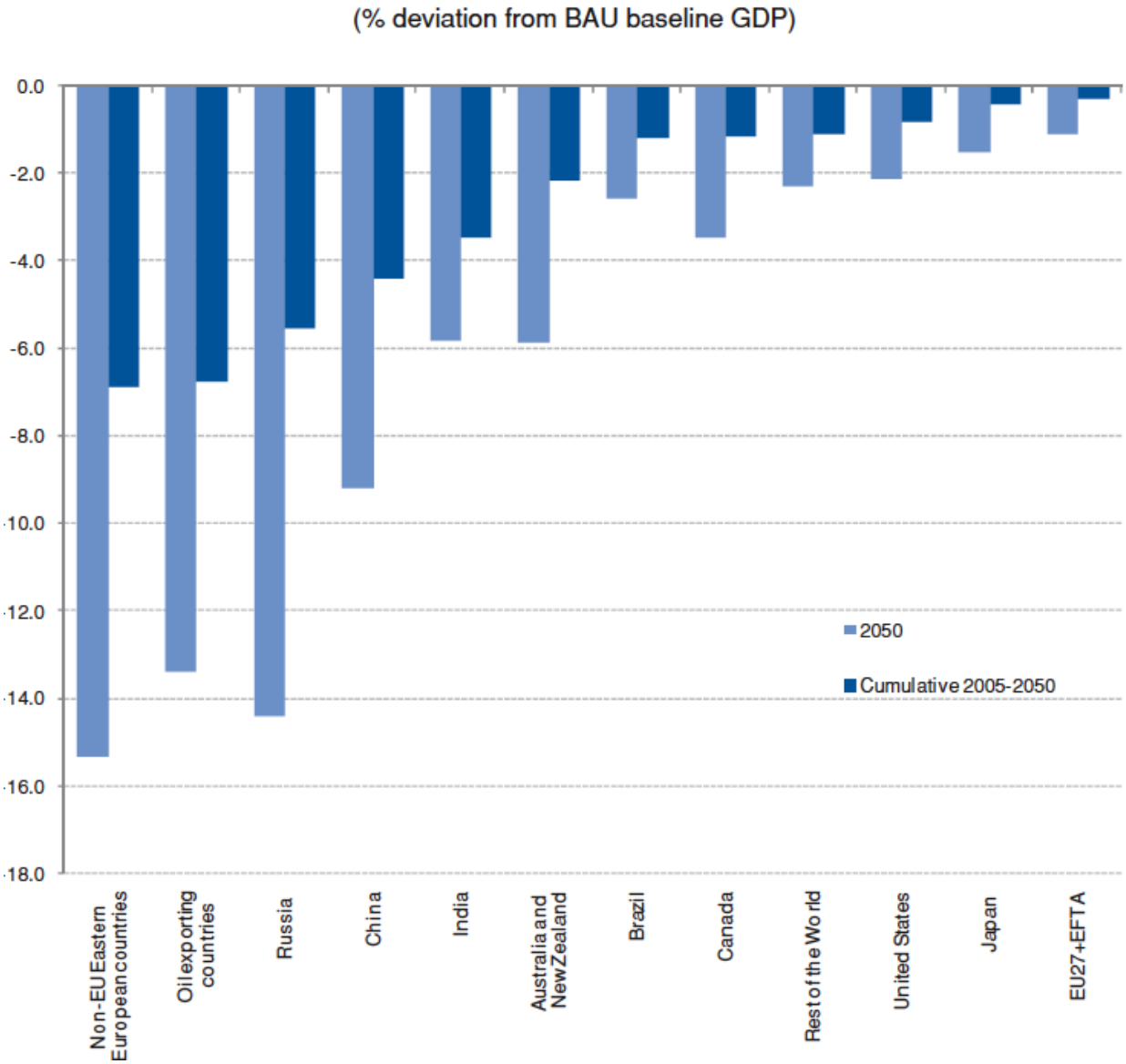
Stabilization levels (ppm CO_2-eq)	Median GDP reduction[a] (%)		Range of GDP reduction[b] (%)		Reduction of average annual GDP growth rates (%)[c,e]	
	2030	2050	2030	2050	2030	2050
445–535[d]	Not available		< 3	< 5.5	< 0.12	< 0.12
535–590	0.6	1.3	0.2 to 2.5	Slightly negative to 4	< 0.1	< 0.1
590–710	0.2	0.5	-0.6 to 1.2	-1 to 2	< 0.06	< 0.05

Notes from original figure—Costs are relative to the baseline for least-cost trajectories towards different long-term stabilisation levels. Values given in this table correspond to the full literature across all baselines and mitigation scenarios that provide GDP numbers. a) Global GDP based on market exchange rates. b) The 10th and 90th percentile range of the analysed data are given where applicable. Negative values indicate GDP gain. The first row (445-535ppm CO_2-eq) gives the upper bound estimate of the literature only. c) The calculation of the reduction of the annual growth rate is based on the average reduction during the assessed period that would result in the indicated GDP decrease by 2030 and 2050 respectively. d) The number of studies is relatively small and they generally use low baselines. High emissions baselines

generally lead to higher costs. e) The values correspond to the highest estimate for GDP reduction shown in column three. Source: IPCC, 2007

Some studies break these costs down by region and country. Figure 6 reveals the significant variation across countries and country groups given a set of OECD modeled policies to achieve a stabilization target of 550ppm. Using the 2009 pledges (Copenhagen Accord), with the aim of limiting average global temperature increase to 2°C, a recent OECD study estimates that while Annex I countries could lose 0.3% of GDP by 2020 due to the pledges, introducing a carbon pricing and trading system could bring over 1% GDP increases in 2020, amounting to more than US$400 billion (Delink et al. 2010).

Figure 6: Costs from Stabilizing Long-Run GHG Concentration at 550 ppm Across Regions



Note from original figure—Scenario "550ppm-base" (Scenario A) and "2050" denotes the cost as a percent of GDP in 2050 relative to BAU baseline. "Cumulated 2005–2050" denotes the cumulated costs over 2005–2050 and represents the gap (in per cent) between the (undiscounted) sum of annual GDPs over 2005–2050 in the "550ppm-base" scenario and the corresponding sum in the BAU scenario.

Source: OECD 2009.

Some studies vividly illustrate the critical role played by policy instruments at the international, national and sectoral levels (see OECD 2009; McKinsey 2009). Table 2 provides a summary of incremental annual cost estimates of mitigation in dollar terms and the upfront investment necessary to enable mitigation activities.

Table 2: Incremental Mitigation Costs and Associated Financing Requirements for a 2°C Trajectory: What will be needed in Developing Countries by 2030? (Constant 2005 US$)

Model	Mitigation cost	Financing requirement
IEA ETP		564
McKinsey	175	563
MESSAGE		264
MiniCAM	139	
REMIND		384

Note from original table—*Sources*: IEA ETP: IEA 2008c; McKinsey: McKinsey & Company 2009 and additional data provided by McKinsey (J. Dinkel) for 2030, using a dollar-to-euro exchange rate of $1.25 to €1; MESSAGE: IIASA 2009 and additional data provided by V. Krey; MiniCAM: Edmonds and others 2008 and additional data provided by J. Edmonds and L. Clarke; REMIND: Knopf and others, forthcoming and additional data provided by B. Knopf. Both mitigation costs and associated financing requirements are relative to a business-as-usual baseline. Estimates are for the stabilization of greenhouse gases at 450 ppm CO2e, which would provide a 40–50 percent chance of staying below 2°C warming by 2100. "Mitigation cost" refers to the incremental annual costs, while "Financing requirement" is the upfront investment necessary to enable the mitigation activities.

Source: World Bank 2010b.

3.2 Available Public Finance for Mitigation and Adaptation

The previous discussion provided an overview of the costs of potential impacts of climate change, and the financial needs for adaptation and mitigation. We now briefly discuss public climate financing that is currently being discussed—both pledged/committed and those that are now in the planning stages (such as from the Copenhagen Accord).

Attention is drawn here on the recent findings of the UN High Level Advisory Group on Climate Change Financing (AGF 2010). Following the Copenhagen Accord, a UN Advisory Group on Climate Change Financing was established by the UN Secretary General to identify potential sources of finance in order to mobilize US$100 billion per year by 2020. The group recently presented its report. Four potential types of finance were analyzed, including public sources for grants and highly concessional loans (including carbon taxation and auctioning of emission allowances, removal of fossil fuel subsidies, other new taxes such as a financial transaction tax, and general public revenues through direct budget contributions), development bank-type instruments, carbon market finance, and private capital. A substantial share of the revenues was considered likely to remain in developed countries. Carbon prices of US$20–US$25 per ton of CO_2 equivalent in 2020 was used in calculating potential revenues.

- About US$81 billion -US$91 billion were identified to be available annually for "international climate action" in 2020. They are:
- US$30 billion annually from auctions of emission allowances and domestic carbon taxes in developed countries (at 10 per cent of total revenues)
- US$10 billion annually from redeployment of fossil fuel subsidies in developed countries or from a financial transaction tax

- US$10 billion annually from international transportation (allocating between 25 and 50% of total carbon pricing revenues)
- US$10 billion to US$20 billion annually from private net capital flows (allocating 10 per cent of total revenue)
- US$10 billion annually from carbon market flows (from a likely total of US$30 billion to US$50 billion)
- US$11 billion net flows from multilateral development banks

The findings seem to reflect a group consensus, with no major breakthroughs. The revenue streams identified are quite modest. Further, follow up action on the report seem uncertain. The UN Secretary General writes in the Foreword "I hope Governments respond positively to the Advisory Group's findings, and I encourage other key stakeholders, including civil society and the business community, to give this report full consideration" (AGF 2010: 2).

A majority of available public climate finance is for mitigation activities (energy, transportation with forestry recently included in the mix). Other than a few bilateral programs (and with the exception of the extremely modest Adaptation Fund), funds are managed by MDBs with a smaller number by other multilateral institutions. A handful of donor governments are providing the bulk of the climate funds (see Tables 3 and 4). The continuing financial crisis is sure to put strain on these sources in the short term. While developing country governments and other accredited institutions are eligible to apply for funding, there seems to be a wide diversity in requirements along with time consuming and multistep processes. While this is generally a hallmark of public finance institutions, the particular nature of uncertain and context-driven specificities of climate resilience and green growth seem to have further reinforced the tendency. It is perhaps not surprising that LDCs and low-income countries are often frustrated in accessing the very finds that ostensibly have been set-aside specifically for them. While most of the funds are open to supporting programs from the multi-regional to the local, the majority of the efforts seem to be at the sub-national scale, often within a strong sectoral silo (agriculture, health, water, energy, transport). Programs tackling systemic climate change impacts that cascade across multiple spatial scales and administrative levels are a rarity, donor rhetoric not withstanding. Access to the global best science and technology to green growth issues is not systematically organized. Programs managed by bilaterals and multilaterals (with the exception of MDBs that seem to depend to a greater extent on internal staff resources) appear to depend more on project-defined consulting, often from the private sector with the rules of engagement privileging "value for money". Such an approach seriously undermines the ability of developing countries to access the best and most relevant science. "Commodifying" science also disables the free exchange of project experience and best/worst practices. Most project/program reports (at least those publicly available to developing country stakeholders) are uniformly glowing of "successes".

A key issue with respect to climate change funding is its relation to official development assistance. As discussed earlier, UNFCCC principles require that funding is distinguished from development funds, and must be accounted for as "additional" to overseas development assistance (ODA) already being provided to developing countries. The equity issues underlying this distinction—namely, that the burden of addressing climate change should fall on industrialized countries that bear primary responsibility for the problem—are quite valid. However, this has often resulted in awkward calculations. In the case of the Global Environment Facility, funding required for "adaptation" is separated from that required for "development," despite their interconnectedness. In the recent Fast Start Finance pledges, for example, it is not clear how much of Japan's pledge under the Hatoyama Initiative is new and additional (in relation to the earlier Cool Earth pledges).

There are also a number of other questions at hand: how much of the pledged funds are "re-routed" ODA? A relative drop in ODA would have serious implications, especially for the LDCs. Another issue is of "conditionalities." Since climate funds are a result of the "common but differentiated responsibility" principle laid out in the UNFCCC, the nature of conditionality between donor and recipient countries would need to be markedly different (relative to ODA).

For the purposes of discussion, at the end of this paper we suggest one approach for a global Green Fund—based on carbon levy and with assessments paid by member countries determined according to each country's CO2 emissions and the GDP per capita. Perhaps the time is now ripe to distill a similar regional approach that exploits the many potential revenue flows for climate change financing, while mindful of global flows of technology, capital and political will.

Table 3: Climate Change Financing

Name	Funding sources	Management entities	Eligibility	Implementation levels	Pathways to access funds	Volume of funds
Adaptation Fund	From sales of CDM projects' certified emissions reductions (CERs); Donor governments (Spain, Germany, Sweden..)	Adaptation Fund Board, World Bank as trustee	Developing country Parties to the Kyoto Protocol that are particularly most vulnerable	National, sub-national, community	Through National Implementing Entity (e.g., Environment Ministry) or multilaterals (e.g., UNDP, WFP..)	US$310 million pledge, US$ 225 million deposits
Climate Investment Funds - Strategic Climate Fund - Clean Technology Fund)	Donor government (majority from UK, Japan, US and Germany)	Multilateral Development Banks (World Bank, AfDB, ADB, IDB, and EBRD)	Countries eligible for Official Development Assistance (ODA) based on OECD/DAC guideline, with an active MDB country program	Regional, national, sub-national, and private sector	National governments submit country investment strategies/plans with MDB	SCF – US$1.891 billion pledged, US$1.150 billion deposits CTF – US$4.399 billion pledge, US$2.558 billion deposits
GEF Funds - Trust Fund Climate Change Focal Area (TF) - Special Climate TF - National government contributions (SCCF) - Least Developed Countries Fund (LDCF)	TF - National government contributions (large amounts to overall fund from U.S., Japan and Germany) SCCF - National governments (majority from Germany, Norway, U.S., and U.K.) LDCF - National governments (majority from Germany, U.S., Denmark, and Canada)	GEF with World Bank as trustee	TF - UNFCCC criteria / eligibility to receive funds through World Bank or UNDP SCCF - Non-Annex 1 countries eligible. Emphasis on most vulnerable countries in Africa, Asia, and the SIDS LDCF - The 49 LDC parties to UNFCCC	TF - Global, regional, national and sub-national SCCF - National governments, with sub-national project activities LDCF - National planning (preparation of NAPA), with sub-national and community implementation	National Project Proponent requests assistance of GEF Implementing Agency (e.g., UNDP, ADB...). For SCCF, activities must focus on 'additional costs' imposed by climate change on the development baseline	TF – US$2.17 billion pledges, US$1.886 billion deposits SCCF – US$180 million pledges, US$143 million deposits LDCF – US$324 million pledges, US$253 million deposits

UN Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD)	EU and donor governments (Norway...)	UNEP and FAO with UNDP as Administrative Agent	National programs in 13 countries and additional regional programs for knowledge sharing	Global, regional, national and sub-national	National governments work with UN Country Team to establish National REDD Steering Committee.	US$150.8 million pledges, US$97 million deposits
Copenhagen Accord instruments – Green Climate Fund (GCF), currently in development - Fast-Start Financing (FSF)**	GCF - Donor governments (not finalized) FSF - Donor governments (Japan, US, France, UK…)	GCF - World Bank, interim trustee FSF – Donor government agencies	Developing country governments, some through multilateral institutions	GCF - Not finalized FSF – Global to community, with focus on national	GCF – (US$100 billion in 2020) - Not yet finalized FSF - Varies, depending on donor country	GCF – (US$100 billion in 2020) - Not finalized ***FSF – See Table 3***
Climate funds as part of bilateral aid package	Donor governments	Donor governments	Various - Donor country criteria	Varies	Some have independent mechanisms: e.g., Hatoyama Initiative (Japan), International Climate Fund (UK), International Climate Initiative (Germany), Global Climate Change Initiative (US), MDG Achievement Fund (Spain).	Difficult to calculate given plethora of initiatives, and some with overlaps
Global Climate Change Alliance	European Union, EC Fast Start Funding, Donor governments (Ireland, Sweden..)	EuropeAid	Support to eighteen most vulnerable developing countries, and general dialogue support to others	Regional, national and sub-national	Developing country governments / NGOs	

Source: Individual fund websites, www.climatefundsupdate.org, www.faststartfinance.org

Table 4: "New and Additional"—Fast Start Funds (2010–12)

Party	Pledged for 2010-2012 (Million US$)	Requested / committed for 2010–2011 (Million US$)	Funding Areas	Geographic focus (in addition to global)
European Commission	215	72	2010: Adaptation €25mn Mitigation €18 mn, REDD+ €7mn	Africa, Asia, Pacific SIDS
Belgium	215	57	2010: Adaptation €10mn, Capacity building €2mn; Renewable energy €20mn Sustainable forests /REDD+: €10mn	Africa
Denmark	231	53	2010: Adaptation & Capacity Building 48% Mitigation 52%	Africa, SIDS
Finland	157	35	2010: Adaptation 35%, Mitigation 53% REDD+12%	Africa and some efforts SE Asia
France	1,804	601	2010-2012: Adaptation 20%, Mitigation 60%REDD+ 20%	Africa, Asia
Germany	1,804	510	2010-2012: Adaptation 35%, Energy-related mitigation & REDD €350mn	All regions
Netherlands	444	NA	2010-2012: Mitigation At least €280mn	Not specified
Spain	537	192	2010-2012: REDD 20%, Adaptation at least 45% in 2010	Africa
Sweden	1,145	165	2010: Mitigation €59mn, Adaptation €347mn, REDD €11mn	Africa
United Kingdom	2,454	929	2010-2012: Adaptation 50%, Mitigation 50% & REDD	Not specified
Australia	640	?	2010-2012: Adaptation 52%, Low Emission Growth 24%, REDD+ 24%	SIDS
Canada	414	400	2010: Adaptation 35% Mitigation 65%	SIDS and Africa
Japan	15,000	7,200	Adaptation 3% Mitigation >95% (REDD+ $223mn)	Africa, SIDS and LDCs in Asia
Norway	1,000	382	2010 Mainly REDD+	Not specified
Switzerland	159	162	2010: Adaptation 40% Mitigation 60%	Not specified
US	1,705	1,704	2010: Adaptation 35%, Clean Energy 45% Sustainable landscapes 20%	Not specified

Note: Funds with total pledges of more than US$150 million for 2010–12 period are listed here.

Sources: www.climatefundsupdate.org; www.faststartfinance.org; http://www.wri.org/publication/summary-of-developed-country-fast-start-climate-finance-pledges

4. IMPLEMENTING GREEN GROWTH: SOME OBSERVATIONS ON BUILDING CLIMATE RESILIENCE AND RESPONDING TO CLIMATE SHOCKS

Adaptation to climate risks requires consideration of a continuum of risks across critical time scales—from weather and seasonal/inter-annual to multi-decadal. Adaptation involves building climate resilience in sectors and social economic systems as well as responding to climate shocks. We highlight here some of the critical issues involved in their practice.

4.1 Towards Practice of Climate Risk Management

4.1.1 Limitations of current risk management efforts

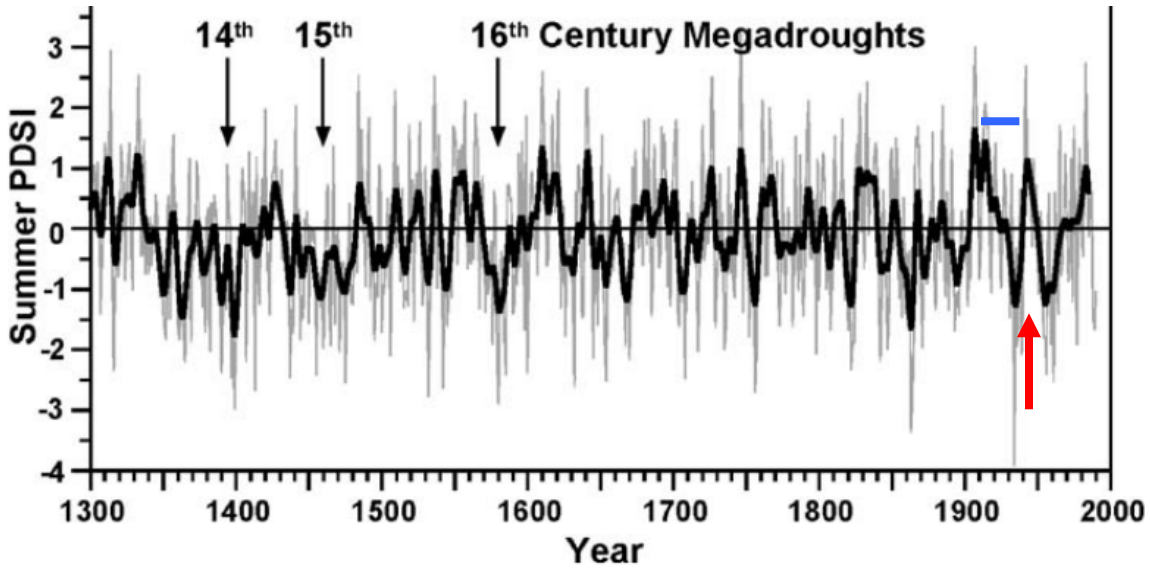
Managing current climate risks establishes a sound base for adaptation to climate change. However, as noted elsewhere, it does not by itself form the entirety of activities needed for adaptation for several reasons (Someshwar 2008):

a. *Effective management of current climate risks is still an emerging field*, requiring innovation and strategic demonstration. While indigenous coping strategies are valuable and need to be better appreciated, most societies are still far from successfully managing current climate risks. Famines and floods associated with the ENSO cycle continue to affect millions of people worldwide, and countries continue to operate only in a reactive mode.

b. "Static" accounting of climate: One reason is that in development programs, climate tends to be accounted for in static rather than a dynamic mode. Much in common with farming communities, policies and plans of governments are based on an understanding of immediate past climate. Observed climate data, generally for the past 30 years, is used to calculate key statistics of weather and climate—average conditions, maxima and minima across seasons of temperature and precipitation, anomaly content and timing (onset delays, dry or wet spell lengths and breaks, timing and intensity of frost etc.). Climate dependent environmental information such as stream flow and aquifer recharge capacities is also based on immediate past climate.

c. Limits of systems resiliency: An appreciation of the limits of climate buffering of cities and regions from current planning and infrastructure systems is badly needed. It requires a thorough examination of variability characteristics (at weather and climate scales) that underlie infrastructure systems and resource transfer agreements (Someshwar 2010). Decisions and policies needing to get a handle on future resource availability typically use statistical average of past years. For example, the Colorado Water Compact of 1922 used average flows of the preceding 30 years to design water allocations (Figure 7). A more historically informed view tells us that the design period was "above normal". The system should hence be prepared to handle more years of water scarcity in the future.

Figure 7: Colorado Water Compact of 1922



Source: Drawn from Goddard et al Near Term Climate Change: IRI-PRED Priority Area presentation (2010), based on Stahle et al., 2007. **Red arrow:** Colorado River Compact (1922) **Blue line:** Portion of record used to estimate flows. Dr. A. M. Greene personal communication.

d. Limits of responding to climate "surprises": When climate anomalies occur, plans are in place to manage impacts of climate "surprises". The success of many governments in Asia in preventing famines, despite deep and widespread droughts, is mainly due to the internalizing of variability in the immediate past climate (Kaosa-ard and Rerkasem 2000). However, the very approach of using deterministic information to mobilize action—launching emergency food security operations after a drought has occurred, for example, means that institutions are not geared to handle uncertain and time ahead forecasts. As Miles et al. (2006) observe, "Despite the increasing predictability of climate, … Every empirical study conducted to date has shown that climate forecasts are not used to their full potential." While disaster response efforts will still be needed, managing (future) uncertainty requires appreciation of potential risks and the adoption of anticipatory risk management, prior to actual impacts.

e. *Climate is not the only dynamic element* that communities and nation states need to respond to. Demographic pressures resulting in intensification of resource demands, declining terms of trade to cereal production and for natural resources, rapid urbanization, societal upheavals due to religious, sectarian and class differences are some of the dominant dynamic drivers of development. In designing systems for managing impacts of climate change it is important to consider non-climate shocks and or trends as well. For many existing climate sensitive systems, such as water supply systems, changing demands from population growth and higher levels of per capita demand often impose higher burdens than those due to changes in the climate. This is especially the case for the near term (out to about 30 years) in fast growing regions of the world (such as urban areas centers in Asia). Often, discussions of adaptation seem oblivious to the real world non-climate shocks that systems must respond and "adapt" to.

f. *Effectively managing shorter-term climate risks does not always translate to building effective resiliency* with respect to the range and types of risks expected over the longer term. The amplitude, pace and frequency of hazards in the future may be quite different than that experienced by societies in the recent past. Adaptation measures undertaken for today's

hazards may well be insufficient, and in some cases may even compound risks from more intense and frequent hazards. Climate change is also expected to bring new kinds of hazards for which societies have no prior experience, such as from sea level rise and glacial melting.

4.1.2 Need for improved climate risk management

From the point of view of adaptation to climate change, managing current climate risks is important for at least two reasons. First, the operational use of strategies and programs that build resilience to current climate hazards (such as floods, droughts, and heat waves), have high applicability to the climate change risks since the latter are a heightened variation of past climate anomalies. Second, better climate resiliency results in realizing higher level of socio-economic development, affording social and economic climate buffers at household, community and societal levels.

The methodology developed and tested by the Earth Institute in a range of low and medium income countries involves the following:

- **Spatial analysis of historical and current climate impacts,** integrating climate and socio-economic data to arrive at past and current impacts;
- **Estimations of ranges of future climate conditions** and their reliability, using past climate as well projections to identify ranges of uncertainty, including sea level rise and frequencies of extreme events;
- **Assessment of likely impacts on development from a changing climate**, derived by stakeholders placing estimates of future climate risks in the context of policies and development plans over the next 30 years, with a particular emphasis on planned policy initiatives to help achieve selected MDGs; and
- **Identification of a suite of anticipatory risk management considerations in each country** to address priority risk areas.

4.2 Engaging the Form and Function of Policy Making for Climate Resiliency

Departures from historic climate averages due to long-term anthropogenic changes to the global climate system pose critical management challenges to agencies and institutions. When the very basis for climate and environmental characterizations that underpins resources availability and their management (for example, reduction in return periods of drought and floods, major alterations in the spread and timing of the Asian monsoon systems, alterations in the hydrology of river basins) is being altered by climate change, planning and management need to be reimagined. The extensive and deep nature of potential changes calls for a large-scale shift away from (current) reactive climate management and towards anticipatory risk management.

Many adaptation programs often are less based on development aspirations of communities and policy makers, than of long lead development scenarios characterizing a more or less uniform future. The approach can be defended perhaps over the very long term, given the apparent economic “convergence” of societies. However, this does not mean ignoring the diversity in country situations of the drivers of vulnerability. Green growth needs to be built on localized aspirations of (long-term) development. Regional development, for example, is realized by plans with a time horizon of about 20 to 30 years. Infrastructure, land use, housing, and alternate growth centers are planned for. In investigating the socio-economic future of a place, we need to consider the available development plans as a starting point. In order to arrive at likely estimates of specific place-based development futures, spatial modeling of

environmental, socio-economic, market and policy variables would be needed in the context of the economic future laid out in the development plan.

Due to uncertainties in characterizing future climate as well as development, formulating knowledge of future development requires systematic engagement with a critical body of key development stakeholders in the country. This would help leverage expert opinion, experience and intuition, permitting use of the limited available information in order to develop "forecasts" of development. Such an approach requires analyses of the policy, institutions and decision landscapes characterizing socio-economic development in each country. Results are the identification of a matrix of institutions that are currently critical for disaster risk reduction and climate risk management, a typology of policies that are considered critical to manage disaster and climate risks, a typology of vulnerable geographies (highland, coastal, delta and riverine systems, for example), and the nature of institutions and development policies needed to build resilience to emergent climate risks. Scenarios developed in a participatory mode, including use of Delphi techniques, can yield invaluable insights on current and past development trends, policies and trajectories.

4.3 Risk Management Institutions in Practice

The interdisciplinarity of policy development is both strength as well as a weakness. It is a strength because it affords chance to draw on the insights of a number of disciplines such as economic, sociology, history, political science etc. It is a weakness since it prevents the development and use of a common shared metric. Given the dominance of economics, many climate resilient policies are evaluated solely for efficiency, optimization, marginal cost and marginal utility. Power relations and risk averseness of institutions that influence their functioning and efficacy, to name two issues, are rarely studied.

Governance institutions are struggling to keep pace with complex and fast-changing ground realities. The nature of many risks—including those related to climate—is dynamic, the result of many factors that are themselves undergoing change. For example, in urban areas in many Asian countries, increased frequency of flooding cannot be solely attributed to a changing climate. Wetland loss, increased paved area, ever growing landfills to accommodate waste, groundwater extraction, and other factors all figure in the calculation. Climate change adds a new layer of complexity, and uncertainty. In this light, it is all the more urgent to develop scientific and institutional capacity to enable managers to understand and make use of risk management approaches and tools (see discussion on risk transfer mechanisms below). Adaptation programs that are cognizant of institutional issues tend to focus on facilitating creation of "evidence" base of climate impacts, enhancing data availability, and training on tools and methods for better management of climate risks. A minority of programs also attempt to engage institutions across individual operational silos by creating new "coordinating" entities, often with limited success. A smaller number attempt to "refocus" agencies by reengineering incentives that are at the very core of institutional productivity and efficacy. Political economy considerations that govern institutional efficacy are often ignored in climate change adaptation efforts.

Regional risk transfer and insurance mechanisms

Natural disasters can result in crippling financial and human losses. National governments typically bear the greatest costs and responsibilities in managing recovery efforts. While many developing countries often receive emergency relief funds and donor aid for recovery efforts, they are either insufficient or arrive too slowly. Many governments also require immediate funds to continue functioning. Sovereign insurance options typically require evidence of loss, which can cause significant delays. Depending on the risk profile of the country, premium rates for

individual country insurance policies can be prohibitively expensive, as well. Regional catastrophe risk insurance facilities are a recent innovation, and aim to provide immediate resources and liquidity following a disaster, expedite payments by relying on pre-defined indexes of events and losses, diversify overall risk portfolio by aggregating risk spatially (e.g., across countries), and improve premium stability through guaranteed donor capital, reinsurance protection and capital market investments.

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) is often cited as a good model for similar entities in other regions, including in Asia. Contributions from donor governments, the World Bank, the Caribbean Development Bank and membership fees paid by the sixteen government members helped create the Multi-Donor Trust Fund of CCRIF. [2] Originally designed to cover hurricane and earthquake events, the facility may also cover excess rainfall events in the near future. In order to expedite payouts, CCRIF uses parametric triggers based on a suite of independently verified catastrophe risk models.[3] Low and stable premiums are afforded by pooling risks. Since it is highly unlikely that all member countries would be affected by major anomalies in the same year, the diversified regional risk portfolio reduces reinsurance costs. Importantly, CCRIF funds are not intended to cover all losses in the event of a catastrophe; the payout is only meant to provide short-term liquidity for disaster response and basic government functions. As of 2010, the Facility's aggregate policy exposure was around US$600 million, with the ability to payout for a series of loss events with less than 1-in-10,000 chance of occurring.[4]

CCRIF is serving as a model for similar efforts in development in other regions. They include the

- Inter-American Development Bank with Swiss Re to launch the Regional Insurance Facility for Central America or RIFCA (Inter-American Development Bank, 2011). This is intended to complement the IDB's Contingent Credit facility, which finances loans up to US$100 million per country for natural disasters.
- The Pacific Catastrophe Risk Assessment and Financing Initiative is a joint effort by the World Bank, ADB and SOPAC, with funding by the Government of Japan and the World Bank's Global Facility for Disaster Reduction and Recover. The proposal, being discussed by the Pacific island country governments, includes a Pacific Disaster Reserve Fund and accompanying Pacific Disaster Risk Financing Multi-Donor Trust Fund (World Bank 2010c).
- At the 2010 Ministerial Conference on Disaster Risk Reduction in Africa, ministers recommended to the African Union Summit "to explore the feasibility of continental financial risk pooling in working towards the creation of an African-owned Pan African disaster risk pool" (UNISDR Secretariat—Africa 2010).
- In April 2011, ASEAN Finance Ministers tasked their insurance officials "to explore risk financing options and mechanisms that can be developed as part of the regional framework for disaster management and disaster risk reduction" (ASEAN 2011).

[2] For details see www.ccrif.org and World Bank's A Review of CCRIF's Operation After Its Second Season, 2010.

[3] Input parameters have been developed for exposure, vulnerability, damages, and losses for each hazard type. Public sources are used for data to run the models after a disaster event. By using public information and predefined parameters, the Facility is able to avoid reliance on loss adjusters, reduce delays and eliminate subjective loss assessment.

[4] Since inception, only a few events have triggered policy payouts by the Facility: payout for Hurricane Ike (US$6.3 million) to the Turks and Caicos Islands, and for Haiti earthquake of US$7.75 million (maximum covered by the policy.

ASEAN, World Bank and UNISDR are following up on by jointly hosting the ASEAN Disaster Risk Financing and Insurance Forum in November 2011.[5]

- The ADB is also pursuing parallel efforts to create regional disaster risk solutions in Indonesia, the Philippines and Vietnam, including the possible use of parametric triggers for insurance or contingent credit mechanisms (ADB 2011).

While insurance mechanisms discussed so far focus on addressing disaster impacts for national level governments, the South East Europe and Caucuses Catastrophe Risk Insurance Facility Project (SEEC CRIF) of the World Bank is pursuing a different model.[6] The project supports countries in the region to join and benefit from the Europa Reinsurance Facility (Europa Re), with the goal of increasing the number of individuals and small and medium enterprises (SMEs) insured by the private insurance market against catastrophic risks. While countries are the top-level participants in the facility, the ultimate beneficiaries are individuals and SMEs. Development of Europa Re and the SEEC CRIF were partly, though explicitly, motivated by climate change risks.

The Horn of Africa Risk Transfer for Adaptation (HARITA) project, Oxfam and Swiss Re along with IRI of the Earth Institute as a technical partner have successfully applied an index-based weather insurance scheme at the farm level to help farmers smooth risks and access credit. It is now being scaled up across the region in partnership with the WFP.[7]

4.4 Building Urban Climate Resiliency

The year 2007 marked the first time in history that over one-half of the world's population lived in urban places. By 2030, 60% of the world's population—almost 5 billion people—will live in urban areas. By mid-century the forecast is for two of every three people to be living in urban places. In Asia alone, 1 billion more people will live in cities in 2030 than in 2005. By 2015, there will be 22 mega-cities with populations of 10 million or more; 12 of these will be in Asia.

In most developing and some industrialized countries, urban areas are already stretched, due to population growth, in-migration, increasing per capita demands on precious resources such as land and water and on urban service systems such as transport and health, in combination with the rapidly deteriorating condition of the infrastructure due to ageing. Cities in both developing and industrialized countries are also marked by deep inequalities, with the poor living in marginalized areas where water, sanitation, and housing infrastructure is almost non-existent and access to other forms of infrastructure dependent services (transport, health, education, etc.) is severely limited. Ecosystems supporting current urban areas are already under stress.

Infrastructure is one of the defining features of urban life and landscapes, and plays a critical role in shaping the social resiliency as well as economic dynamism of cities. Infrastructure is highly reflective of the choices that governments make, both economically and socially, and provides insight into issues of equity, governance and the strength of local institutions. Fast paced growth, both in terms of spatial area and resource demands, will outstrip existing capacities of infrastructure for water, sanitation, transportation, and strain the carrying capacity of ecosystem services.

It is already hard to argue that urban development in Asia in the 21st century is sustainable, let alone a contributor to lowering the aggregate carbon footprint as the world's population

[5] See http://www.aseandrr.net/RegionalNaturalDisasterRiskFinancingandInsur/Summary.aspx

[6] See http://go.worldbank.org/0FNT2MJNW0

[7] See http://www.oxfamamerica.org/issues/private-sector-engagement/weather-insurance

expands. When we overlay a consideration for the new stressors set loose by newly appreciated climate hazards, the situation is even more acute.[8] Thus, even as urban growth exacerbates existing vulnerabilities under current climate conditions, decision-makers must also grapple with an uncertain future climate. The patterns of inequitable development that characterize much of the present growth in urban areas in Asia are likely to be exacerbated by such changes. Pressures may include increased flooding and storms in coastal areas, where many cities are experiencing rapid population growth, and increased frequency of breakdown in vital urban infrastructure as a result of climate anomalies, in the context of increased fiscal pressure on urban policy makers to reduce GHG emissions and "go green". Rather then being centers of innovation and engines of compact and efficient economic growth and well being, the impacts of a changing climate could well propel the cities of the global South into increasing poverty and endemic strife.

Cities are of enormous importance as engines of economic and social growth, especially for the low- and middle-income countries of the global South. Careful planning and investment will be required to realize this potential, particularly if it is to be achieved without increased inequities. Urban climate resiliency efforts especially require a problem-driven approach, mindful of the historic evolution of the cities, socio-cultural fabric of city making, economic inequities and institutional decision-making. All too often urban adaptation efforts focus solely on climate as the dominant driver of urban economic/social risk. Urban mitigation efforts, on the other hand, focus exclusively on GHG emission reductions in transportation, building efficiency and energy generation sectors. Green growth efforts need to inform better urban governance and management and finance, and enable economic growth with equity—a set of converging goals along with GHG emission reductions and the creation of climate resilient cities.

4.5 On the Architecture of Green Growth Governance

The emphasis in global negotiations has been on making available climate change financing from the North for adaptation and mitigation programs in the South. Given the poor demonstration record of many countries of the North in fulfilling their stated commitment, such an emphasis is very appropriate. Global and regional architecture of finance utilization are also very significant. It has been assumed that the selected administrative agent (such as a multi-lateral institution) would impose its administrative and fiscal management on the climate fund.

The limited absorptive capacity of developing countries for the effective use of climate finance is a serious concern. One response on the part of the donors has been to exercise more control on all aspects of the program, often deploying consultants from the North. While this may make for more effective projects, overall it perpetuates poor capacities in the South. Project-based capacity building efforts are simply not sufficient.

Many green growth efforts are consciously aligned to respond to demands of the developing country clients. Unfortunately, the clients are often not able to access the full range of scientific and technological options available globally, nor able to fully asses their fit in the local socio-economic and environmental context. Also, access to knowledge alone does not promise that the right choices have been made. Scientific and technical expertise, independent of the donors,

[8] The lack of climate-smart infrastructure is not just a problem in the global South—it is endemic in the industrialized countries as well. New York, for example, is struggling to adapt current infrastructure to the future effects of floods and storms, and to better plan future infrastructure projects. The transit, water supply and sanitation infrastructure, among others, are all extremely vulnerable to the effects of climate change and the city is ill-equipped to handle even today's severe weather events, let alone increased severity and frequency of storms and sea-level rise in the future.

is critically required to be made available to developing country clients, along with the long-term programs to build their capacity.

5. THE GREEN FUND: AN APPROACH BASED ON THE PRINCIPLES OF "COMMON BUT DIFFERENTIATED RESPONSIBILITIES"AND EQUITY

Purpose. The Green Fund will receive assessed contributions of member countries and will disburse grant and loan funds to low-income and middle-income countries to pursue programs of climate-change mitigation and adaptation.

Duration. The Green Fund will operate until the sustainable reduction of GHG emissions sufficient to meet the objectives of the UNFCCC. This is targeted to occur no later than 2050.

Members. All signatories of the UNFCCC are members of the Green Fund.

Governance. The Governing Board will include two representative countries of each Regional Development Bank. Each RDB will select its representatives according to procedures set by the Governing Boards of the respective banks. The countries will serve for two years. At least one of the two countries will be a recipient country of the Green Fund. Each MDB will have a non-voting representative, as will relevant UN agencies.

Funding. The Green Fund will be funded by assessments paid by member countries. Assessments will be determined according to each country's CO_2 emissions and the country's GDP per capita (World Bank Atlas method). The formula is as following for country i:

Assessment (i) = CO_2 Emissions (i) x CO_2 Assessment Rate x GDP Factor (i)

The Assessment Rate is expressed in $US/tons of CO_2

The GDP Factor is as follows:

High-income country (>$12,276): 1.0

High Middle-income country ($3,976-$12,275): 0.5

Low Middle-income country ($1,006-$3975): 0.25

Low-income country (<$1,005): 0.0

Consider the illustration in Table 5 for an assessment rate of $2 per ton, based on national CO_2 emissions in 2010 from the consumption of energy resources.

Table 5: Illustration of Proposed Green Fund Assessment Rates

Country	CO_2 emissions (million tons per year)	GDP/capita Ranking	GDP Factor	Total Assessment (at $2/ton)	Assessments as % of GDP (PPP equivalent)
PRC	7,710	Upper Middle-Income	0.5	$7.7 billion	0.08%
India	1,602	Lower Middle-Income	0.25	$0.8 billion	0.05%
Mozambique	2.35	Lower Income	0	0	0
United Kingdom	520	Higher Income	1	$1.0 billion	0.05%
United States	5,420	Higher Income	1	$10.8 billion	0.07%

Source: Authors.

The assessment rate will be fixed every five years to produce the targeted funding stream. Note that a modest assessment rate will produce significant revenues for the Green Fund, at very low cost to the consumer. A $1 levy per ton produces $24 billion worldwide. The implied levy per gallon of gasoline is 0.9 US cents for high-income countries, as shown in Table 6. (To convert to cents per liter, multiply cents per gallon by 0.26).

Table 6: Potential Green Fund Revenues Based on CO_2 Levy

$/ton of CO_2	Total Green Fund Revenues Worldwide	Cents Per Gallon in Low-Income Countries	Cents Per Gallon in Low Middle-Income Countries	Cents Per Gallon in Upper-Middle Income Countries	Cents Per Gallon in High-Income Countries
1	$24 billion	0	0.2	0.4	0.9
2	$42 billion	0	0.4	0.9	1.8
3	$72 billion	0	0.7	1.3	2.6
4	$96 billion	0	0.9	1.8	3.5

Source: Authors.

Disbursements. All low-income countries will be eligible for grant financing from the Green Fund. Middle-income countries will be eligible for loan financing on the terms of the respective MDBs.

Criteria. The Green Fund will finance both mitigation and adaptation projects, on a ratio of approximately [50] percent to each category. Each MDB will set guidelines for the suitability of projects, based on criteria including cost effectiveness, social equity, and environmental impacts.

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