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Beyond the Sum of Its Parts

Combining Financial Instruments to Support Low-Carbon Development

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This report has been prepared in response to the recommended actions in the World Bank Group's Strategic Framework for Development and Climate Change. It has been included as part of the work program of the Climate Change Team and the Global Environmental Coordination Unit of the World Bank's Environment Department. It focuses on the blending of resources from different financial instruments to help reduce the growth in greenhouse gas emissions in developing countries. Future papers in this series will focus more on the use of guarantee instruments, support to private sector operations (especially through the International Finance Corporation), and support for resilience and adaptation.

The World Bank team was led by Richard Hosier, Senior Environmental Specialist, ENVGC, and included Nataliya Kulichenko, Senior Energy Specialist, ETWEN; Aditi Maheshwari, Carbon Finance Specialist, ENVCF; Natsuko Toba, Senior Economist, EASIN; and Xiaodong Wang, Senior Energy Specialist, EASIN.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ASTAE	Asia Sustainable and Alternative Energy Program
CAS	Country Assistance Strategy
CCS	carbon capture and storage
CDM	Clean Development Mechanism
CER	certified emission reduction
CF	carbon finance
CFC	chlorofluorocarbon
CFL	compact fluorescent lamp
CIF	Climate Investment Funds
CO_2e	carbon dioxide equivalent
CPF	Carbon Partnership Facility
CPS	Country Partnership Strategy
CRESP	China Renewable Energy Scale-up Project
CSP	concentrating solar power
CTF	Clean Technology Fund
DNA	Designated National Authority (CDM)
DOE	Designated Operational Entity (CDM)
DPL	Development Policy Loan
DSM	demand-side management
EE	energy efficiency
EIRR	economic internal rate of return
ENVCF	Environment Department–Carbon Finance
ERPA	emission reductions purchase agreement
ESMAP	Energy Sector Management Assistance Program
ESCO	energy service company
FCPF	Forest Carbon Partnership Facility
FEC	Les Fonds d' Equipement Communal (Morocco)
FIP	Forest Investment Program
FIRR	financial internal rate of return
GEF	Global Environment Facility
GHG	greenhouse gas
IADB	Inter-American Development Bank

IBRD	International Bank for Reconstruction and Development
ICR	Implementation Completion Report
IDA	International Development Association (World Bank Group)
IEG	Independent Evaluation Group (World Bank)
IFC	International Finance Corporation
IGCC	integrated gasified combined cycle
ISR	Interim Status Report
kWh	kilowatt-hour
LULUCF	Lane Use, Land-Use Change, and Forestry
MDB	multilateral development bank
MIGA	Multilateral Investment Guarantee Agency
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MTR	Midterm Review
MW	megawatt
NAMA	Nationally Appropriate Mitigation Actions
PAD	Project Appraisal Document
PCN	Project Concept Note (IBRD or CTF project)
PDD	Project Design Document (CDM project)
PHRD	Policy and Human Resources Development
PIF	Project Identification Form (GEF project concept note)
PNDM	National Municipal Solid Waste Management Program (Morocco)
PoA	Program of Activities (under CDM)
PPIAF	Public Private Infrastructure Advisory Facility
PRSP	Poverty Reduction Strategy Paper
R&D	research and development
RE	renewable energy
REDP	Renewable Energy Development Project (China)
SFDCC	Strategic Framework for Development and Climate Change
SIL	Specific Investment Loan
SW	solid waste
TA	technical assistance
UNFCCC	United Nations Framework Convention on Climate Change
UTTP	Urban Transport Transformation Project (Mexico)
WBG	World Bank Group (World Bank, MIGA, and IFC)

EXECUTIVE SUMMARY

The *World Development Report 2010* estimates that an additional $200 billion per year* of climate-related financing is needed in developing countries between now and 2030 to keep global average temperature rise within 2 degrees Celsius. Developing countries face increased financing challenges over coming decades as they seek to pursue economic development along a lower emission trajectory. Recognizing these needs, industrial countries pledged at the 15th Conference of the Parties to the U.N. Framework Convention on Climate Change (UNFCCC) in Copenhagen to provide $30 billion for developing countries by 2012 through existing bilateral and multilateral sources and to mobilize $100 billion per year by 2020. A high-level Advisory Group on Climate Change Financing was established by the U.N. Secretary General to assess options for raising as well as effectively using such finance. Through the adoption of the Strategic Framework for Development and Climate Change, the World Bank Group (WBG, or the Bank Group) has committed to facilitating developing countries' access to new financial resources and supporting climate actions in the context of countries' sustainable development plans.

While the climate finance landscape is rapidly evolving, three dedicated climate financing instruments are currently available to the Bank Group as key tools for increasing support to low-carbon infrastructure, particularly the energy and transport sectors: the Global Environment Facility (GEF), the Clean Technology Fund (CTF), and carbon finance, especially the Carbon Partnership Facility (CPF). (See *Box ES-1* for a definition of each instrument.) Another relevant instrument, Scaling Up Renewable Energy in Low-Income Countries, became operational in December 2009 and will offer further lessons in future. Combined, they represent potential resource flows of about $3 billion per year. Although each instrument differs in detail, they are all designed to support market transformation toward low-carbon development. It is also apparent that these or similar instruments will coexist for quite some time while post-Copenhagen negotiations continue. As developing countries give greater attention to achieving economic growth while lowering greenhouse gas (GHG) emissions, blending these resources together—and with development finance (including the International Bank for Reconstruction and Development (IBRD), the International

* All amounts in U.S. dollars unless indicated otherwise.

BOX ES-1 CLIMATE FINANCING — MITIGATION INSTRUMENTS

The **Global Environment Facility** was established in 1991 before the United Nations Conference on Environment and Development to provide incremental cost financing for projects with global environmental benefits. It was originally a partnership between the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank, but it now provides its support through 10 agencies. In recent years, GEF has committed about $250 million per year—largely in the form of grants to eligible countries—as the financial mechanism of the UNFCCC. These projects are designed to support energy efficiency, renewable energy, new clean energy technology, and sustainable transport projects. Its approach focuses on removing barriers to "win-win" mitigation projects by providing support for technical assistance, policy reform, capacity building, piloting, and partial risk guarantees. GEF grants through the World Bank average between $8 million and $10 million each and are meant to be implemented as part of a larger investment engagement.

The **Clean Technology Fund** was established in 2008 as one of the Climate Investment Funds (CIF), a family of funds devoted to climate change initiatives hosted by the World Bank and implemented cooperatively by the MDBs. It is meant to be transformative, taking clean technology investments and markets to scale in the participating recipient countries. Between 15 and 20 countries will participate as recipients during this initial phase, which will run until 2012. The CTF provides limited grants, concessional loans, and partial risk guarantees of between $50 million and $200 million per project to help countries scale up clean technology initiatives intended to transform a country's development path.

Carbon finance refers to the use of the flexible mechanisms of the Kyoto Protocol. Registered projects resulting in GHG emission reductions located in developing countries or economies in transition obtain emission reductions that can be traded in the market, thereby providing a performance-based revenue stream to the project. Carbon finance is something of a misnomer: there is little or no up-front financing involved. In 1999, the Bank created the first carbon fund in the world, the Prototype Carbon Fund, which committed its funds to GHG mitigation projects producing emission reductions prior to 2012. The World Bank has demonstrated global leadership in the development of the carbon markets and continues to play a leadership role in the development of CDM methodologies. The newest initiative of the Bank's expanded program of carbon finance is the **Carbon Partnership Facility (CPF)**, which brings buyers and sellers together in a partnership forum to focus on national priorities and strategies and to develop carbon revenue streams around projects and programs of interest to both.

Source: Authors' data.

Development Association (IDA), the International Finance Corporation (IFC), other multilateral development banks (MDBs), and national resources)—will become increasingly important in order to expand their impact in both developmental and global environmental terms.

The goal of this paper is twofold:

- To provide greater information and clarity on these three mitigation-related climate financing instruments available for the WBG and their application in the context of specific projects and national policy frameworks.

- To draw lessons for the broader development community on how resources from different climate financing instruments can be combined for expanded impact, increased leverage, and enhanced efficiency.

This paper represents an initial contribution to this field and will be followed by papers focusing on guarantees for low-carbon growth support for the private sector and the challenges of financing climate resilience and adaptation.

Case studies of existing or planned projects are used to highlight how these dedicated instruments can be used to make lower carbon alternatives more attractive for World Bank clients. The paper's conclusions, as described in this summary, are as follows:

- The GEF, CTF, and carbon finance instruments are complementary.
- Combining climate finance instruments makes a wider range of mitigation activities feasible.
- Blending is beneficial—especially when finance is scarce.
- Familiarity and reform are the keys to simplifying procedural complexity.
- Effective blending requires sophisticated institutional and technical capacity.

THE GEF, CTF, AND CARBON FINANCE ARE COMPLEMENTARY

Despite differences in orientation, priorities, and governance structures, the efforts and resources from GEF, CTF, and carbon finance complement one another. On a conceptual basis, each plays a unique role in helping stimulate low-carbon growth when viewed at the market-wide, programmatic, and project levels. The goals and uses of each financing instrument differ slightly, but the resources from each can be combined or "blended" into the same project or program (as in blending together different ingredients). When these different sources are used together, they are able to complement one another, reduce transactions costs, and increase their reach and impact. "Complementary" means that the resources contribute in accordance with their face-value to the whole (that is, 2+2 will not equal less than 4).

Furthermore, if carefully designed, projects and programs blending resources from these various funding tools can actually create synergies, wherein the total impact exceeds the face value of the resources contributed as they interact and create transformative processes and increase both scope and scale (that is, 2+2 > 4). In project terms, a "synergy" occurs when the outcome of a project exceeds the outputs expected on the basis of the project's inputs. For example, if in a blended energy-efficient lighting project, synergy might be seen if the entire lighting market is transformed to a more efficient level and many more-efficient lamps devices are installed than were paid for under the blended project. In other words, synergy results when the project or program outcomes exceed the sum of the parts.

COMBINING CLIMATE FINANCE INSTRUMENTS MAKES MORE MITIGATION ACTIVITIES FEASIBLE

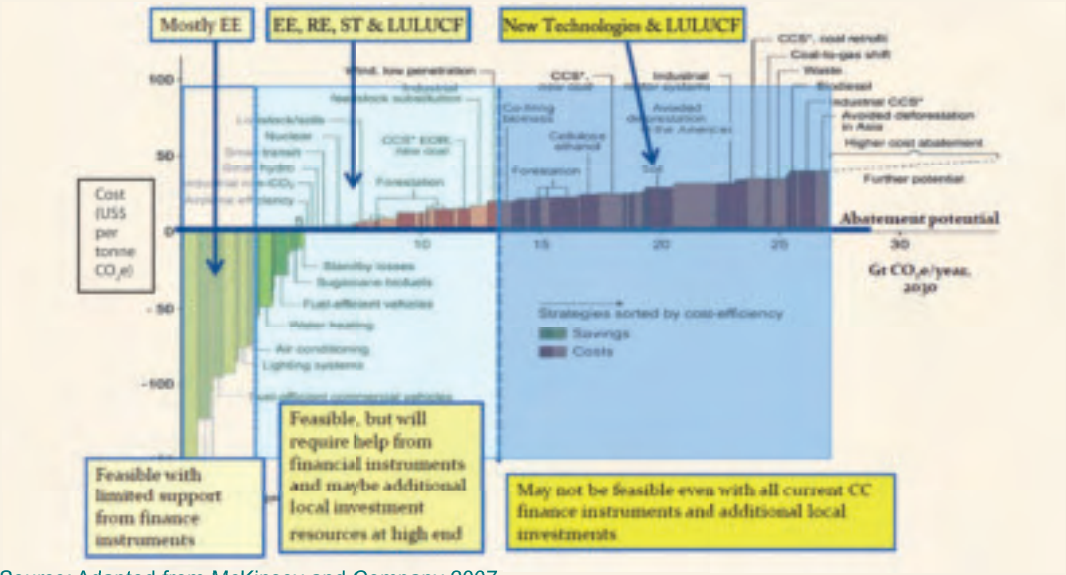
Low-carbon development paths frequently require additional financial support to become financially and economically attractive. Climate financing instruments help to make these mitigation activities feasible. But even so, their reach in

isolation remains insufficient to translate many of the expensive, largely pre-commercial low-carbon technologies from the drawing board into reality.

Figure ES-1 contains the now familiar McKinsey curve of global GHG mitigation activities, running from those considered to be entirely "win-win" on the left (energy efficiency) to those requiring greater support than can be justified on the basis of risk-adjusted returns to the investment on the right (new technologies). Although climate change financing instruments can be applied to technologies across the entire range, a different mix of resources may be required for projects in different bands. Projects on the left-hand side (white shading) are financially and economically attractive on paper at least, but they may require assistance in the form of barrier removal, policy reform, awareness creation, and possibly some revenue enhancement to become financially viable and to be implemented. The China Energy Efficiency Financing Project demonstrates that GEF support alone when coupled with multilateral and national development resources may be sufficient to stimulate the creation of a sustainable market for energy efficiency investments. In other cases and country situations, carbon finance may need to be combined with GEF or other donor resources to cover the barrier removal and learning costs, as in the India Chiller Energy Efficiency Project.

Projects in the second band (light green) may require enabling support, investment support, and revenue enhancement to bring them into economic and financial feasibility. They tend to face both higher costs and operational risks than those on the left hand side of the Figure. Both the Mexico: Introduction of Climate Friendly Measures in Transport Project and the China

FIGURE ES-1 CATEGORIZATION OF MITIGATION OPTIONS (TYPES OF GHG MITIGATION ACTIVITIES AND SUPPORT REQUIRED)



Source: Adapted from McKinsey and Company 2007.

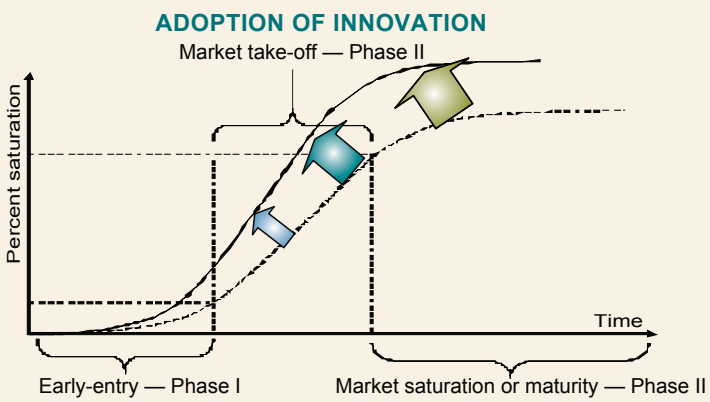
Renewable Energy Scale-up Project made use of multiple sources of mitigation financing to make sustainable transport and wind power investments viable.

The third band in the Figure (light blue), on the right, represents relatively new and unproven technologies that have a rather high cost and risk profile. In such cases, resources from all mitigation instruments may be necessary to make them attractive. But even with all of these resources combined, the underlying projects may be too costly or risky to be implemented. These pressures explain why only a few integrated gasified combine cycle projects seeking to use carbon-capture-and-storage techniques to dispose of the waste GHG stream have been commissioned anywhere in the world to date. Even with all of the dedicated financing instruments combined, some projects (especially new technologies from the right-hand side of the curve) will not be sufficiently attractive to be implemented.

BLENDING IS BENEFICIAL — ESPECIALLY WHEN FINANCE IS SCARCE

Combining resources from these financing instruments will not only help create larger projects, but if used correctly it will also help create synergies leading to a greater impact and stimulation of larger transformational processes than if those resources were used separately. For example, under the India Chiller Energy Efficiency Project, when resources from the Multilateral Fund for the Implementation of the Montreal Protocol are combined with GEF resources, they provide the financial basis to meet the incremental costs of converting only about one-sixth of the eligible chillers to newer, more-efficient, HCFC-free chillers. When carbon revenues are also harnessed, the project will be able to double its effect, reaching over one-third of the chillers in the market. But in addition, by building the capacity of local financial institutions the entire chiller market in India will be transformed to the newer, low-carbon path.

FIGURE ES-2 MARKET TRANSFORMATION— RELATIVE POSITIONS OF THE THREE CLIMATE FINANCING INSTRUMENTS



Source: Authors' data.

At the market level (see Figure ES-2), GEF support is used early in the market's transformation to pilot innovative approaches and to help create the enabling environment of policy and regulatory frameworks. CTF resources support low-carbon infrastructure investments on favorable terms that can help the market to scale up or to move up the adoption-of-innovation curve toward maturity. Carbon finance revenues serve to improve the profitability of investments,

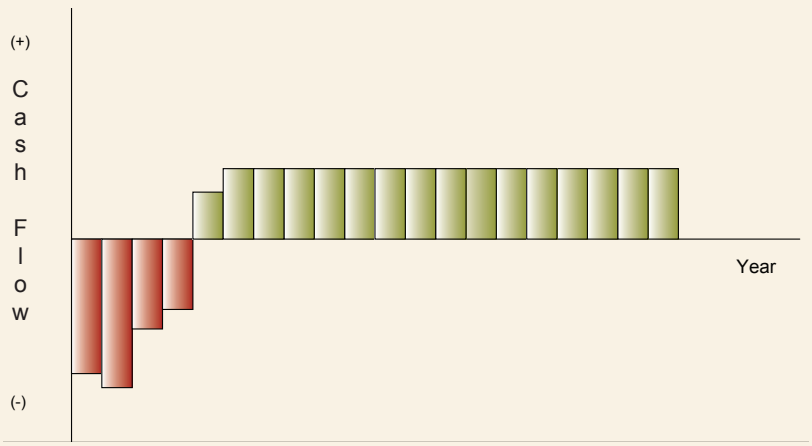
especially those that are already on the borderline of being financially attractive. Together, they can accelerate the pace of market transformation and increase the scale of the eventual penetration of new climate-friendly technologies in the market.

In the China Renewable Energy Scale-Up Project, for example, GEF resources helped the government create a mandated market policy with a feed-in tariff for renewable energy. Together with IBRD financing, the terms of the investment program were still insufficient to make the targeted investments feasible. However, when carbon finance was brought in, the project was pushed over the private sector's hurdle rate of return, making it sufficiently profitable to stand on its own. By combining its own resources with those of GEF and carbon finance, the government was able to create a sustainable policy environment that successfully led to rapid growth in the wind market, making China the fourth largest wind market in the world at the end of 2008.

At the project level, Figure ES-3 presents the standard cash-flow situation of a "regular" development project, in this case a conventional energy supply project. The costs are incurred up front, and once the plant is built the benefits repay both the capital and the interest, leaving additional rents that serve to improve the economic development of the implementing country. Figure ES-4 shows a project with similar development outcomes but with reduced GHG emissions. To reduce these emissions and still achieve the development benefit, the project has been redesigned to use a renewable source (such as geothermal). As a result, it presents higher costs (deeper negative cash flows) but with only similar returns. Such a project may not move ahead, as these higher costs may now exceed the discounted benefits—or at least with the higher costs, the risk-adjusted rate of return may be reduced to below the "hurdle rate."

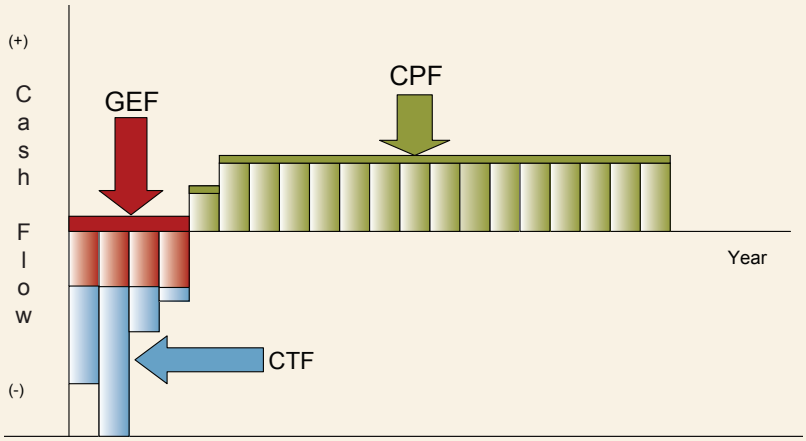
But climate financing resources can be brought to bear to make these higher-cost, low-carbon

FIGURE ES-3 CASH FLOW FOR A CONVENTIONAL ENERGY SUPPLY PROJECT



Source: Authors' data.

FIGURE ES-4 CASH FLOW FOR A CLEAN ENERGY PROJECT MAKING USE OF CLIMATE FINANCING INSTRUMENTS



Source: Authors' data.

option projects cost-effective and attractive. GEF resources are viewed as an early benefit, establishing the enabling environment necessary to make the project sustainable. CTF resources reduce the cost-burden of financing the project, covering part of the additional costs that show up as a financing gap early in the project's life. Carbon finance provides performance-linked payments that improve a project's cash flow once it becomes operational. The Morocco Solid Waste Sector Development Policy Loan Project provides an example of how carbon finance, when used in a program of activities (PoA), may provide sufficient additional revenue to make investment opportunities in a frequently ignored sector, like municipal waste, financially attractive.

These three complementary climate financing instruments can make low-carbon development attractive in ways in which it has not been before. Blending resources from these different sources to build upon underlying development investments will increase the scale and accelerate the pace of transformation to a low-carbon development path.

FAMILIARITY AND REFORM — KEYS TO SIMPLIFYING PROCEDURAL COMPLEXITY

The different governance structures for each source of climate financing dictate that pipeline procedures and documentation requirements for these instruments will differ from those of projects funded only through Bank loan resources. To the uninitiated, approval procedures associated with the different instruments may be baffling and sometimes frustrating. Although familiarity reduces the challenges associated with the navigation of these procedural shoals, reforms to simplify the procedures will make them more

user-friendly, enhancing not only the effectiveness of each instrument but also the efficiency with which resources from them can be combined. Familiarity and reform provide the key to simplifying approval processes.

The CTF documents and procedures are most closely aligned with those of the Bank Group and other participating MDBs. Each participating country must prepare an investment plan that summarizes the projects to be pursued. Once the plan is endorsed, these concepts follow the MDB's normal project life cycle. As operational experience with this new instrument accumulates, the effectiveness of the adopted programming procedures will become clearer. As early CTF implementation has progressed quickly, the additional burdens placed upon MDB and country task teams have been manageable.

During nearly 20 years of operational experience, GEF procedures have been revised several times. At present, a GEF project requires two approval steps beyond those required for a Bank or IFC project—one at the concept level and one at the time of final endorsement. The GEF 5 replenishment provides an opportunity to focus on further simplification of the activity cycle to one additional step beyond those normally required by the implementing MDBs.

Because carbon finance operates under an external regulatory and governance mechanism, its approval processes and documents diverge the most from those normally used within the Bank. A review of 10 years of World Bank experience with carbon markets shows that reforms can help at two levels: an external institutional level and the Bank's operational level. At the institutional level, the Clean Development Mechanism (CDM) and Joint Implementation (JI) decision makers need to set clearer universal guidelines on additionality to make the project registration cycle simpler, expediting approval processes. Wider adoption of PoAs will both speed up approval procedures and enable carbon market support to incentivize efficiency in a broader array of projects—notably energy efficiency programs, which have massive emission reduction potential but to date have benefited little from carbon finance. In addition, all carbon market participants should seek to maximize the use of approved CDM methodologies to limit the approval delays.

At the level of the Bank's carbon finance operations, there is scope to tie programming more closely to the Bank's core development operations, as well as to take into account support from GEF and CTF. The CPF has already made progress in this regard, as every project under consideration to date by the CPF has been tied to underlying Bank (and frequently CTF and GEF) financing. Because the CPF is contracting to purchase only a fraction of a project's emission reductions, it is pioneering a new approach for the Bank by working to help its clients sell emission reductions in the larger, open market. With continued growth of the carbon market, the Bank's role in carbon finance will emphasize two key roles: continuing to serve a "public good" role in developing methodologies and assisting clients to sell carbon assets that are linked to Bank projects in the larger market.

EFFECTIVE BLENDING REQUIRES SOPHISTICATED INSTITUTIONAL AND TECHNICAL CAPACITY

The ability to blend resources from climate change financing instruments requires in-depth expertise in both development and climate change finance. In addition, effective blending

requires a good understanding of both the challenges in the target markets and the relative strengths of each instrument. Another requirement frequently goes unmentioned: the commitment, vision, and capacity to identify climate-friendly development plans that are compatible with growth needs of developing countries. This latter intangible element—the willingness to innovate, learn by doing, and build capacity for scaling up—will play an increasingly important role in shifting from conventional least-cost approaches to more sustainable and demanding low-carbon, climate-friendly development. Staffing and personnel will require sophisticated skills and creative ingenuity to be able to pursue these options with greater success. Increasingly, management will need to recognize these extra challenges through provision of incentives and funding.

While blending resources from different mitigation financing instruments has its attractions, not every low-carbon project will require or even be eligible for support from all of the different sources of mitigation-related finance. Some mitigation projects, such as energy pricing reform or the adoption of standards and labels for energy-efficient appliances, can be undertaken with the use of only traditional development finance or technical assistance sponsored by GEF, grants from other sources, or Bank financing. Other activities may need both technical assistance grants and concessional finance in addition to lending support.

The goal should not be to use all existing sources of climate change financing in every project, but rather to appropriately blend only the resources required to achieve the project's outcome. In some cases, the transaction costs associated with packaging various financial instruments may offset the benefit of that packaging. In other cases, efforts and patience in coordinating and packaging various financial instruments will generate greater synergistic impacts, leading to a scaling up of intended activities. Different countries, sectors, technologies, or approaches may require differing combinations of resources in order to ensure project success. While private sector financing will be essential for scale and sustainability, the ability to leverage the private sector into a program may differ by project. Blending is a means to an end, not an end in itself. Only greater experience and familiarity with these instruments will assist in making clearer the benefits and disadvantages of combining resources from different financing instruments in the same project or program.

LOOKING FORWARD

In response to the Copenhagen Accord, some 55 countries—both industrial and developing—submitted information to the UNFCCC about economy-wide emission reduction targets for 2020 and Nationally Appropriate Mitigation Actions (NAMAs). As developing countries prepare and implement their NAMAs, the WBG can assist with various aspects of the process: building on a solid analytical base through supporting some of the first low-carbon-growth studies; providing extensive policy, institutional development, and investment support in relevant sectors; and lending expertise on a wide range of financial instruments. Through this process, the demand for low-carbon investments and programs will increase, creating a need to respond by increasing both the breadth and depth of climate financing. Developing countries attach growing importance to having direct access to resources and arrangements that ensure streamlined channeling of finance to support the priorities articulated in their low-carbon growth programs.

At present, CTF and CPF are new instruments, in a pilot phase and with limited resources, that can support only a limited number of countries.

GEF resources are allocated to the largest emitters. Looking forward, it is critical that all developing countries have access to climate-related financing to support economic transformation along a low-carbon path. In addition, past mitigation programs have focused largely on the energy and transport sectors. But new initiatives will add the urban, forestry, and agricultural sectors to this mix. GEF and CTF eligibility have already begun to address the needs for low-carbon cities, and a CDM PoA focusing on low-carbon growth in urban areas has been developed. Land use, forestry, and agricultural emissions are also the focuses of GEF (Sustainable Forest Management (SFM)), and special programs under the CIF (the Forest Investment Program (FIP)) and Bank's carbon finance business (the Forest Carbon Partnership Facility (FCPF) and the Bio-Carbon Fund). Resources from the FIP and the FCPF are working to prepare suitable arrangements to allow complementary use to strengthen linkages between sustainable forest management, improved livelihoods, and climate change.

This paper contributes to a growing field of work about making the climate finance instruments better serve the sustainable development needs of developing countries. Learning from emerging experiences should provide the basis for more efficient, sustainable, and effective approaches to supporting low-carbon development by making use of all available instruments.

CLIMATE CHANGE MITIGATION FINANCING INSTRUMENTS OVERVIEW

CHAPTER 1 KEY POINTS

Through the adoption of the Strategic Framework for Development and Climate Change, the World Bank Group has committed to help developing countries undertake climate actions in their development programs.

At present, three dedicated climate financing instruments can assist the Bank in increasing support to low-carbon growth in the infrastructure sector: the Global Environment Facility; the Clean Technology Fund; and carbon finance, particularly the Carbon Partnership Facility. Combining the resources from these instruments will become increasingly important as the Bank helps its clients respond to the challenge of climate change. The resources need to be combined carefully so that the energy and transport projects supported might achieve an impact exceeding that of the resources used alone.

INTRODUCTION

In October 2008, the Strategic Framework for Development and Climate Change (SFDCC) was endorsed at the World Bank's Annual Meetings. As the first institutional policy document adopted by the Bank Group on climate change, it defines an ambitious framework for the institution's continued work to pursue its primary goals of development and poverty alleviation while taking into account the challenges imposed by climate change on all development sectors. As part of implementing this Framework, the Bank Group has committed to stepping up efforts to support climate actions in country-led development processes and to mobilizing financial resources.

While this official commitment to pursue a more explicit response to climate change in the context of development is new, the Bank Group's work on reducing emissions of greenhouse gases (GHGs) through the promotion of "win-win" efforts in the energy and transport sectors is not. The share of

the Bank's lending portfolio devoted to energy efficiency (EE) and renewable energy (RE) has exceeded the commitment made at the 2004 Bonn Renewable Energy Conference to increase steadily the share of Bank funding going into these sectors by an average of 20 percent per year (World Bank 2009b). With this progress already in hand, the Bank has chosen to raise the bar and increase the target for renewable energy and energy efficiency in its financing portfolio by 30 percent a year during fiscal years 2009–11.

This impressive growth reflects that there are synergies between climate mitigation and developing country priorities and that the Bank has indeed been working on climate change mitigation using dedicated climate change financing instruments successfully for some time. These instruments have been established and used to make climate-friendly projects that might not otherwise have been of interest to developing countries, economically and financially viable.

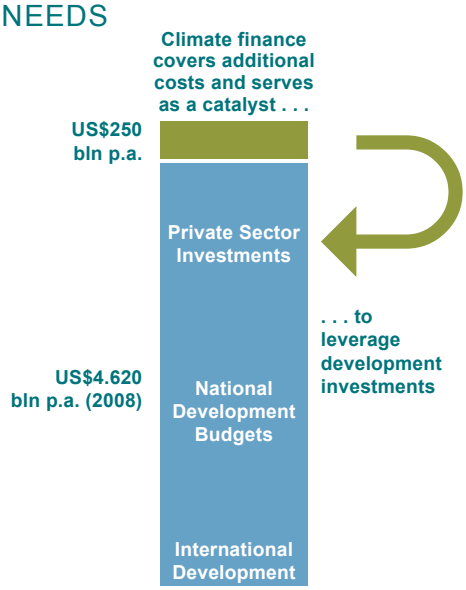
Since the inception of the Global Environment Facility (GEF) in 1991, the Bank Group has been the major implementing agency in the climate change focal area, with a cumulative portfolio of GEF grant resources of $1.7 billion. Since the formulation of the Kyoto Protocol, the Bank became a leader in the field of carbon finance, at first through the Prototype Carbon Fund. The Bank's carbon finance (CF) program has been among the world leaders in the formulation of the U.N. Framework Convention on Climate Change's (UNFCCC's) Clean Development Mechanism (CDM) methodologies and projects. The Bank now manages carbon funds valued at over $2.5 billion. Since the articulation of the Clean Energy Investment Framework, which led to the more comprehensive SFDCC, the Bank Group has worked on establishing and implementing the Climate Investment Funds (CIF), which is a partnership between the African Development Bank (AfDB), Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), Inter-American Development Bank (IADB), and World Bank Group (WBG). The first of these funds to become active is the Clean Technology Fund (CTF), with current pledges for concessional funding of nearly $4.4 billion and a portfolio of 13 investment plans for nine countries with the total envelope of over $4.4 billion prepared in one year. Through its participation in these programs, the Bank Group has accumulated incomparable expertise and practical knowledge in the areas related to mitigation finance.

The 2010 World Development Report estimates the volume of financing needed to meet the additional costs by the international community for climate-change-related development at between $180 billion and $250 billion per year (World Bank 2009d). However, this sum represents only the additional or incremental costs: it would need to leverage nearly 20 times that amount—or up to as much as $4.6 trillion—from underlying investment finance from other public or private sources. Clearly, the challenge is enormous. (See Figure 1.) The Bank Group has experience using existing climate financing instruments to leverage greater resources and achieve greater impact. The Bank Group's GEF portfolio of climate change projects, estimated at $1.7 billion, has leveraged another $13.7 billion from other sources, bringing its total value to $15.4 billion, for a leveraging ratio of 1: 8. The average leveraging value of the projects in the CDM pipeline is estimated at about 1: 6, which means that the Bank's carbon finance portfolio may have leveraged as much as $15 billion in underlying finance and that the entire CDM/JI market may have benefited about $138 billion of low-carbon investments (Kossoy 2010). The first cohort of investment plans endorsed under the CTF demonstrated a leverage ratio of nearly 1: 9; that is to say, anticipated CTF investments of $4.4 billion have been linked to other investment resources valued at $40.5

billion—some of this financing may be viewed as underlying, baseline investments, and some may be newly leveraged, additional financing from other sources. The remaining resource gap dictates the need to become more adept at combining specialized climate financing instruments and leveraging underlying development and private finance to assemble the financing necessary to address the climate change challenge.

By adopting the SFDCC, the Bank Group committed itself to sharing lessons from implementing the CIF—including the CTF, the Carbon Partnership Facility (CPF), and GEF—to promote packaging of its development financing instruments with these climate-mitigation instruments. Weaving resources from these instruments together can be simplified by an improved understanding of each of these tools: each of them has its own unique niche and role to play. Like other grant resources, the GEF is best used to conduct policy dialogue, improve the policy environment, and pilot or demonstrate innovative ideas and activities. Concessional funds, available from the CTF, can be used to scale up low-carbon investments at reduced costs, making them sufficiently attractive to fit into least-cost development plans. Carbon finance provides an output-based incentive that can be used to make low-carbon investments more profitable, pushing public and private sector sponsors toward lower carbon investments. International Bank for Reconstruction and Development (IBRD) and International Development Association (IDA) investments can link to all of these and can provide the baseline investment resources needed to meet the challenges of development. All of these instruments have a critical role to play in shaping future climate-friendly development.

FIGURE 1 CLIMATE FINANCING NEEDS



Source: K. Lvovsky 2009. "Making the Most of Public Climate Finance," Presentation Given at COP 15 in Copenhagen, December 2009. www.worldbank.org/climatechange

For the Bank to use these climate financing tools more effectively to complement development investments, Bank project teams will need to understand not just the broad outline of these instruments but also the intricacies, strengths, and weaknesses of each. The goal of this paper is to provide clarity on the advantages, limitations, and evolution needs of the existing climate change financing instruments—the GEF, the CTF, and carbon finance, particularly the CPF. It can help explain to interested groups and experts how the resources from these different financing instruments can be combined for greater impact, leverage, and efficiency. This paper is meant to be an initial work for combining dedicated climate financing instruments. Future work will address other instruments and opportunities to devise financial products that catalyze private investment, such as guarantees, private sector programming, and adaptation.

SCOPE OF WORK AND METHODOLOGY

This paper first presents a conceptual framework to indicate how resources from the the GEF, CTF, and carbon finance can fit together in the market development and transformation process or the same project to achieve complementary goals and objectives. (For a much wider range of financial options outside the World Bank Group for scaling up activities addressing climate change, see UNFCCC 2009.) Next it discusses how projects or programs can best be structured to take advantage of each instrument in overcoming the barriers and hurdles that team members encounter when piecing together a project consistent with the goals of climate change and development. Chapter 4 provides a number of case studies of projects—ongoing and under preparation—to demonstrate how these instruments can help increase the impact of the client's intervention. The final chapter raises some practical considerations regarding procedures and timing that might prevent these instruments from fitting together gracefully.

The broad characteristics of the GEF, CTF, and CPF are summarized in Table 1. (For a descriptive summary, see Annex 1. For the documents needed during the project cycle, see Annex 2.) These instruments can complement each other if used according to their individual strengths and weaknesses. Blending is not synonymous with comingling: the resources from each source need to be used in a manner consistent with their intent. However, the ability to piece together resources from these instruments requires an in-depth understanding of not only what each instrument offers but also what part of a mitigation project's challenge matrix or risk profile it can address.

Identifying relevant case studies remains a challenge because there are only a few cases where multiple financing instruments have been effectively woven together, in large part due to the novelty of the instruments. There is an 18-year history of GEF projects being coupled with Bank Group projects, and the Bank's 10-year history of carbon finance resulted in one out of four of those projects being associated with Bank operations. Initially, the blending of GEF and carbon finance operations was forbidden. Within the Bank, the GEF was originally given a "right of first refusal" for any carbon finance project in the pipeline. But experience demonstrated that GEF resources and carbon finance resources serve different functions and therefore neither duplicate nor compete with one another. Because of the time it took to understand this, only recently have projects that make use of GEF resources and carbon finance gained approval. And while CTF envisages a strong link to multilateral development bank (MDB) operations, only six CTF projects have been endorsed by the Trust Fund Committee. Of these, four are implemented by the WBG, of which only one has been approved by the Bank's Board (the Turkey Private Sector Renewable Energy and Energy Efficiency Project, approved on May 28, 2009). It has therefore not been possible to find numerous examples that use all of these financing instruments simultaneously. Rather, the case studies discussion highlights what has been done and what could be done differently with future programming to make the Bank more effective in using climate financing tools to achieve greater impact.

WHAT DO COMPLEMENTARY AND SYNERGY MEAN?

The conceptual sections of this paper make the case that resources from the three major dedicated climate change financing instruments can be used together in the same country, the same

TABLE 1 SUMMARY OF ATTRIBUTES OF MITIGATION FINANCING INSTRUMENTS

Attribute	GEF	CTF	CPF
Objective	To transform the market development paths of eligible countries into trajectories with lower GHG emissions in the energy, industry, and transport and land use sectors	To provide scaled-up financing to contribute to demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term GHG emission savings	To target long-term emission reductions; to scale up low-carbon interventions; and to support strategic, transformational interventions in key sectors
Overall approach	Removing barriers for sustainable market development and growth, including through pilots and demonstration—includes reduction of risks and support to innovation	Scaling up low carbon development through support to investments	Increasing the scope and scale of verifiable GHG offsets and the generation of carbon revenues by reducing GHG emissions through output-based approach
Determination of funding requirements	Initial resource allocation through resource allocation framework; incremental costs of each project, including costs of barrier removal	Financing gap necessary to make project viable	Payment made upon certification of emission reductions at negotiated or prevailing market rates
Financial tools	Grants and limited non-grant instruments	Loans and risk mitigation instruments at concessional (IDA) rates; limited grants available	Emission reductions purchase agreements (ERPA) typically pay upon delivery; pricing based upon market prices for certified emission reductions (CERs)
Scale of financing	$250 million per year over four years of GEF-4 (2007–10)	$4.4 billion over four years (2009–12), or $1.1 billion per year	CDM primary transactions in 2008 totaled $6.5 billion
Typical project size	From $5 million to $40 million GEF allocation per project linked to larger Bank project (average size, $8 million)	Between $50 million and $100 million, linked to larger client project, including Bank loan resources	CPF aims to scale up the size of the transactions significantly, typically at least one million emission reduction units

Source: Authors' data.

program, and even the same project. They can be used to help make mitigation activities attractive in both financial and economic terms. The case studies demonstrate that there are emerging examples where funds from these different sources are being effectively combined to create meaningful mitigation programs. But demonstrating that these different resources can be used in a complementary fashion is easier than demonstrating that they have created synergies. Complementarity requires only that the resources not be used in a manner contradictory to, duplicative of, or inconsistent with each other. Synergy requires an interaction between the resources whereby the whole is greater than the sum of the parts. In other words, complementarity requires that 2 + 2 not be less than 4; synergy requires that 2 + 2 exceeds 4.

In the context of a low-emission growth project, what does "synergy" mean? "Synergy" refers to the creation of a larger process or a change in scope or scale resulting in further gains in low-carbon development beyond those whose costs were paid for under the blended project. It entails successful replication through a changing atmosphere or

attitude so that the low-carbon activities take on a life of their own beyond the project's life.

An energy-efficient lighting project provides a simple example. GEF support might be used to provide capacity building and to strengthen regulations to expand the market for compact fluorescent lighting. Concessional resources from CTF might be used to help finance the use of 10 million high-quality compact fluorescent lamps (CFLs) in a country's public sector. And a CDM program of activities might be formulated to provide additional payments of about $1 per bulb to replace inefficient incandescent bulbs with CFLs. Such a project would achieve its goals by using the funding from the three sources in a complementary fashion—resulting in policies being adopted, 10 million incandescent bulbs being replaced by more-efficient CFLs, and the government recovering partial costs of the CFLs through carbon revenue. But if the project were designed and implemented more creatively, it might lead to a full transformation of the market so that more than 10 million CFLs were introduced. For example, the authorities might decide to raise efficiency standards for lighting devices, and private actors might make use of the CDM methodology to further obtain carbon revenues to accelerate the uptake of the new, even more efficient lighting devices. In such a case, the final transformation of the market would result from the blended project as the follow-on activities take on a life of their own, eventually leading to the replacement of 100 million incandescent lights. The outcome of the blended project supported by the three blended mitigation financing instruments far exceeds what could reasonably be expected based upon the financing alone. In such a context, synergy would be created by the original blended project: the outcome of the project or program exceeds the sum of the outputs from the blended resources.

This is not to say that a synergistic outcome can result only when multiple mitigation funds are combined into the same project or program. Such results are possible when just a single source of mitigation financing has been used creatively. Some GEF or CDM projects have resulted in the transformation of an entire market or the widespread adoption of an innovative idea regarding mitigation activities. But as resources from these various climate financing instruments are combined together, the larger flow of resources will require the adoption of more ambitious goals. With the attraction of more resources, more personnel and increased effort would be drawn to the mitigation activity, thereby increasing the probability that a project's outcome will be truly synergistic.

The creation of synergy among different funding sources within a climate change mitigation project represents a worthy challenge. Some may view the use of various dedicated funding sources to create a larger funding window as a means unto itself rather than a means to an end. But "piling on" extra concessional or grant resources is not always necessary to achieve the stated outcomes. Too much funding for something that requires careful implementation, such as an energy efficiency project, may be a curse.

Identifying and creating conditions for synergy among the various sources of climate funding requires creativity and vision. What constitutes synergy may differ by sector or project type as well. As the case studies show, creating a synergistic outcome may require minimal use of blending in some cases, while in others the combination of all available resources may still not be enough to push a project into implementation. But that is part of the challenge of climate change mitigation financing.

2 ASSEMBLING THE PIECES A CONCEPTUAL FRAMEWORK FOR COMBINING FINANCING INSTRUMENTS

CHAPTER 2 KEY POINTS

Each climate financing instrument can play a unique role in helping stimulate low-carbon growth when viewed both at the market-wide or programmatic level and at the project level. GEF grants are targeted at removing barriers, conditioning markets, and demonstrating innovative approaches. CTF concessional resources are directed at providing investment support to transform development paths to low-carbon alternatives. Carbon finance, especially the newly created CPF, offers performance-based payments that improve the profitability of GHG emission-reducing investments.

At the market level, GEF support should be used to pilot innovative approaches and to help create the proper enabling environment and investment frameworks. CTF resources support low-carbon infrastructure investments on favorable terms that can take the market to scale. Carbon finance provides a performance-based revenue stream throughout a project's lifetime that serves to improve the return on investments, especially those that are already on the borderline of being economically attractive. It may also help secure financing and create incentives for good management and practices throughout a project's operational lifetime.

At the project level, GEF resources are viewed as an early benefit, covering the incremental costs of barrier removal and market preparation. CTF resources help reduce the cost burden of the project, providing clients with favorable financing to help ease the higher costs of low-carbon investments. Carbon finance revenues may help secure financing early in a project's lifetime, but they largely come into play once the project is operational, providing a performance-reward that increases the project's risk-adjusted financial rate-of-return.

Weaving together resources from all three climate financing instruments provides support to climate change mitigation projects in a way that can create synergies and increase their combined development and low-carbon impacts.

The three existing climate financing instruments are designed to make climate change mitigation in the infrastructure sectors more feasible and attractive to clients. Even though these instruments may have different sources of funding, focus on different aspects of mitigation programming, and require slightly different procedures, they are all generally tied together by the same objective: to encourage recipients to undertake and scale up nationally appropriate mitigation actions in the context of sustainable development. Rather than being duplicative or redundant, these instruments each have a unique role to play in helping transform markets toward cleaner growth. This chapter focuses on how these instruments can be used together to enhance the scale, dynamics, and impact of the mitigation interventions consistent with the country's national development.

DIFFERENT NICHES FOR CLIMATE FINANCING INSTRUMENTS

The GEF, CTF, and CPF are all instruments designed to help make low-carbon development financially and economically feasible. Each one can help make a particular project or program attractive or transform a particular market niche; collectively, they can turn low-carbon infrastructure investments into reality at an unprecedented scale. As such, the three tools can be used together in a complementary fashion to achieve the objective that could not have been achieved by only one instrument. In particular:

- The GEF provides grants to remove barriers, condition markets, and demonstrate innovative technologies and approaches.
- The CTF provides concessional financial support for large-scale investments of a transformational nature.
- The CPF offers performance-based payments that provide extra revenue to scale up carbon-reducing investments.

The GEF has played a leading role in providing resources for removing barriers for sustainable market development and growth, including through pilots, demonstrations, and partial risk guarantees. It has provided some funding to pilot contingent financing approaches, but GEF resources are intended to be incremental to Bank (and other implementing agency) and client-country investments, helping to mainstream climate change into development. The CTF provides precisely a source of funding to take these investments to scale. It is designed to help scale up low-carbon development through concessional support to make low-carbon investments more attractive. When coupled with a Bank loan and other client investment resources, use of the CTF will reduce the overall cost of a country's transformation to a low-carbon growth path, making the pursuit of that path more attractive. Carbon finance also serves to make the adoption of that low-carbon path more attractive through improving revenue. The CPF is designed to programmatically increase the scale and scope of verifiable GHG offset production that, in turn, will provide output-based payments for successfully implemented mitigation projects. The baseline investment projects into which these specialized financial resources are blended may be financed with clients' own resources, Bank resources, or other financial instruments.

In summary, each of the climate financing instruments provides a unique push to the adoption of low-carbon development paths. When they can be linked together in the same program or project, there is an opportunity to have a net effect greater than what would be achievable through the deployment of each instrument individually.

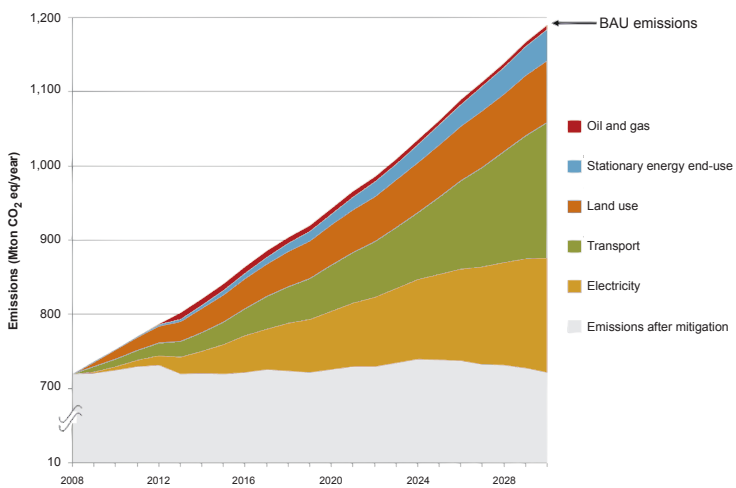
MARKET LEVEL COMPLEMENTARITY IN LOW-CARBON DEVELOPMENT PROGRAMS

When countries start to analyze their options for low-carbon growth, they begin by preparing a baseline projection that attempts to analyze how the nation's GHG emissions will change through time under "business-as-usual" conditions. The next step is to develop a series of scenarios to identify the most effective and inexpensive ways to pursue low-carbon development. These low-carbon scenarios can then be cross-analyzed with the baseline scenario to identify the most promising avenues for reducing GHG emissions while still meeting the energy and development goals in the baseline (see Figure 2 for an example drawn from Mexico). Each low-carbon mitigation opportunity or sector can be described as a mitigation "wedge" or sector of future GHG emissions that can be avoided through the pursuit of the relevant low-carbon growth project or program. (The "wedge" concept was popularized in Pacala and Socolow 2004.)

At the core of each wedge or low-carbon development sector is a specific technology or practice or set of technologies and practices whose adoption will reduce future GHG emissions. Each of these technologies or practices can be viewed within its own context as constituting an innovation for widespread adoption. As such, the market for each such innovation is presented along a learning curve or an adoption of innovation curve (see Figure 3).

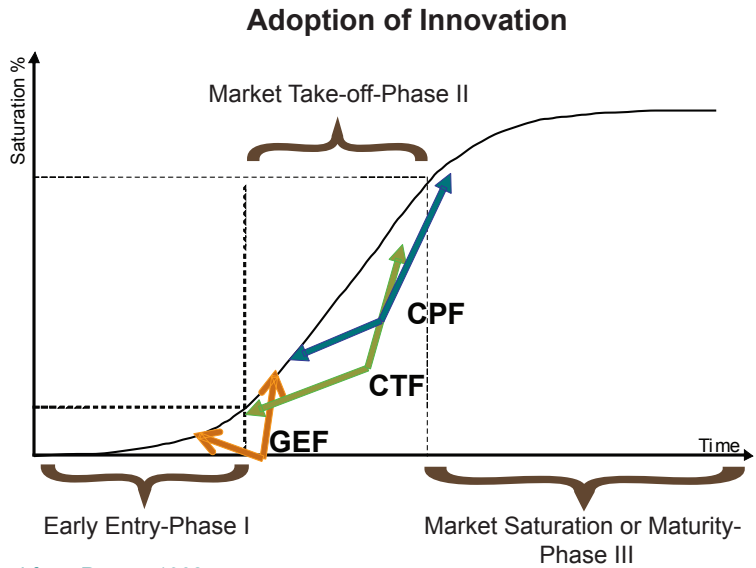
Dedicated financing can be visualized as helping the market mature, increasing both the pace and final saturation level of the newly adopted technology. In this process, the three financing instruments complement and facilitate market entry, growth, and transformation at the national level, helping create opportunities for growth in national-level adoption of innovation in the same market for low-carbon technologies. The three tools can be used differently through the different phases of low-carbon market development:

FIGURE 2 CLIMATE CHANGE MITIGATION WEDGES FOR MEXICO (2008–30)



Source: Johnson and others 2010.

FIGURE 3 MARKET TRANSFORMATION CURVE



Source: Modified from Rogers 1962.

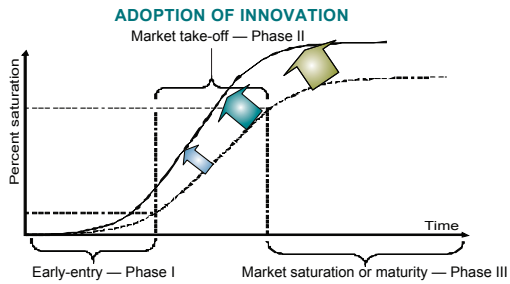
- **Early Entry–Phase 1:** Given the GEF's mandate to innovate and remove barriers, the GEF's limited resources have focused most frequently on the early stages in the adoption of a new technology. By nature, GEF grant resources are relatively risk-prone and are frequently used to remove barriers or establish the enabling conditions for further market transformation and growth. Although such support is necessary to lay the foundation for further development of these markets for low-carbon technologies, the resources are rarely sufficient to transform markets completely. For example, the GEF may provide support to help reformulate regulations for the generation and dispatch of on-grid renewable energy. In contrast, because of the established programming priorities, CTF funds are technologically risk-averse, and they rarely are proposed for use in this early stage. Carbon finance may be used in the early stage, but to date the prevailing market prices have rarely enabled carbon finance to make a significant difference in the early stages of market development.
- **Market Take-Off–Phase 2:** While GEF resources may be used to lay the foundation for a new low-carbon technology, CTF resources will come into effect once a technology is introduced and is beginning to take off. As such, CTF resources contribute to the demonstration, deployment, and transfer of low-carbon technologies that may have been piloted but that are still at lower levels of adoption. Carbon finance can also have a significant impact in this second stage, improving the return on investments in relatively new technologies that might best be considered marginal. Such technologies and practices may not be fully profitable or economically attractive in their own right, or they may remain relatively less attractive than higher-carbon development options. As

a result, these actions will require concessional funding and revenue enhancement to make them economically and financially attractive, thereby shifting the low-carbon options onto a country's least-cost development path.

- **Approaching Market Maturity–Phase 3:** By the time technologies reach this phase in a market, GEF resources may have little role to play. The CTF may still provide an impetus in these cases, but as the market matures, carbon finance resources provide the most significant push into these maturing technology markets. The performance-based incentive provided by carbon revenues helps drive the market toward maturity. Market growth leads to economics of scale that result in cost declines for a particular technology. As the technological cost falls, so does the Unit Abatement Cost, making the project more attractive to carbon investors. For example, carbon finance payments may increase the profitability and attractiveness of electricity generation from wind-generating plants or the adoption of energy-efficient lighting devices. However, once the market approaches saturation or the technology is considered standard practice in a particular context, no support from any of the dedicated climate instruments may be forthcoming as the technology is considered no longer additional or incremental.

These three mitigation financing tools provide support of a slightly different nature, and each may be more appropriate at different stages of market development. If used together, they can bring the adoption of the new technology nearer to the present and possibly increasing its penetration (see Figure 4). The remainder of this chapter looks at how these instruments may be used together simultaneously or sequentially to help drive the market for the low-carbon technology toward maturity by extending the reach of that technology or practice.

FIGURE 4 A MARKET TRANSFORMED



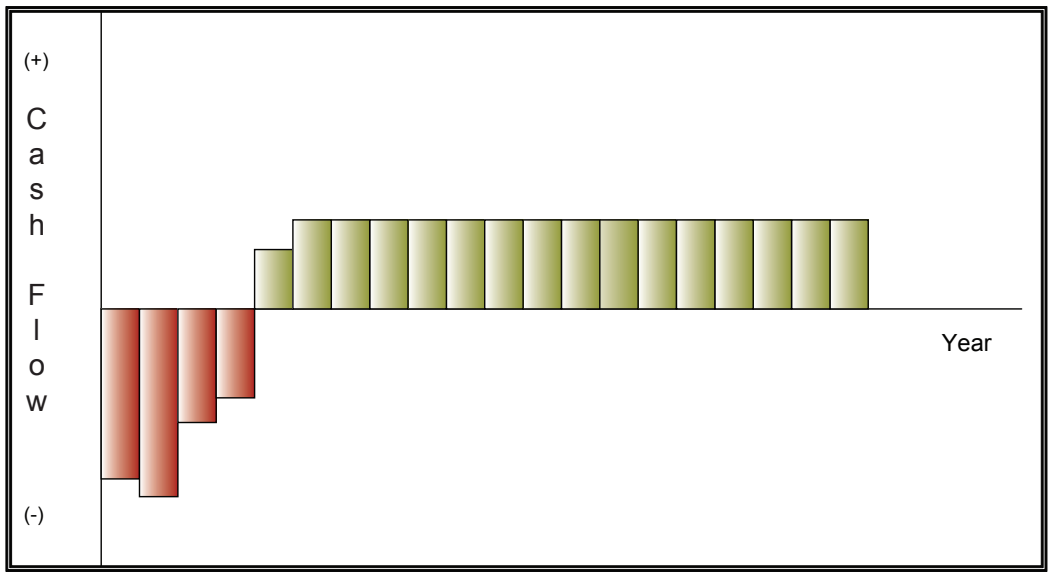
Source: Authors' data.

PROJECT LEVEL COMPLEMENTARITY—CONDITIONING MARKETS, SCALING UP INVESTMENTS, REWARDING SUCCESS

Just as the three climate-change financing instruments can be used together to transform a market, they can also be used to make a single project more cost-effective and to accelerate the growth of the target markets. Figure 5 demonstrates the typical cash flow for an investment project (in this case, a conventional power supply project).

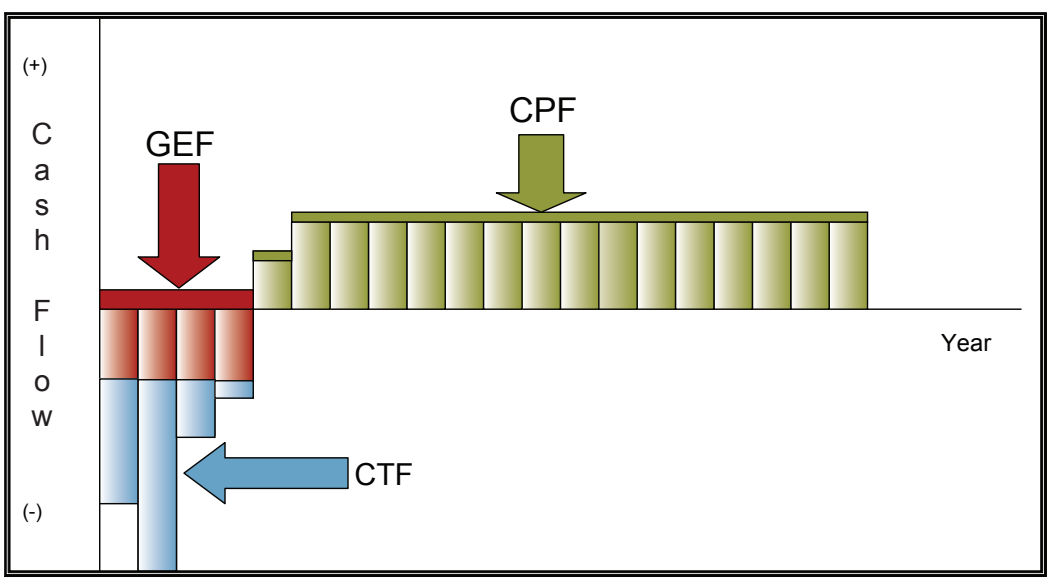
If the project in Figure 5 is redesigned to make it a clean power supply project—such as through an investment in geothermal energy—its shape and dimensions change. Given the relatively high investment costs and the up-front risks associated with geothermal resource confirmation, such a project would have greater costs than an equivalent fossil-fuel-fired power plant. The underlying graph in Figure 6 represents the cash flow of this re-designed low-carbon development project. To

FIGURE 5 CASH FLOW FOR A CONVENTIONAL POWER SUPPLY PROJECT



Source: Authors' data.

FIGURE 6 CASH FLOW FOR A CLEAN ENERGY PROJECT MAKING USE OF CLIMATE FINANCING INSTRUMENTS



Source: Authors' data.

make it feasible, the more expensive geothermal project can be made more profitable and effective by building the project finance structure with the three mitigation financing instruments.

First, GEF resources kick in during the early stages of project development. These resources, which according to Bank economic accounting rules (World Bank Operational Policy OP10.04) are considered as a benefit to the project, reflect the willingness of the global community to pay for the global environmental benefits of the project. GEF resources focus on removing barriers to the widespread use of the investment technology and create the condition for successful replication. In the case of a geothermal project, GEF grant resources can be used to facilitate policy changes to make geothermal investments more attractive and to cover the heavy expenses associated with the up-front risks of resource confirmation.

Second, CTF funds can be brought to bear to make the financing terms for the investment more attractive. These funds are largely in the form of concessional loans and help reduce the costs of financing the project. When blended with conventional Bank resources and the client's own investment resources, the concessional resources of the CTF will help reduce a project's costs and facilitate a clean investment of a larger scale and scope than would otherwise be the case. It can also help push low-carbon projects that are not on a country's least-cost development frontier onto that frontier. In the case of the geothermal project, CTF funds can help defray the high capital costs of geothermal development, which may prevent such projects from being more attractive than conventional fossil-fuel generation plants.

Third, carbon finance funds, including those from the CPF, will start to flow to a project once the investment is completed and begins to operate, reducing GHG emissions. Like GEF funds, carbon finance can be viewed on a conceptual basis as a reflection of the willingness-to-pay of the rest of the world for the certified GHG reductions, partly capturing the externalities of GHG emissions at market rates through offsets produced by the project. The additional revenues provided to the project implementers once the emission reductions are certified provide an incremental revenue stream, reducing the risks and improving the discounted value of the investment. Occasionally, some portion of these funds has been paid in advance of certification, but due to the risk of non-delivery, these additional revenues are typically accessible only once the investment is in operation. Thus, they function rather like a feed-in tariff or a green certificate payment under mandated market policies: they serve as a performance incentive to the project implementers. When carbon prices are at the higher end of their historical limit, the impact of a carbon revenue stream on a project's return will be greater than when it is lower. To date, carbon revenues have only occasionally moved projects from demonstrating a negative rate of return to demonstrating a positive rate of return. More typically, the rate of return improves a few points. There are also instances where, in addition to revenue enhancement, the fact that carbon revenues are normally denominated in hard currency has resulted in a qualitative enhancement of the project's risk profile, leading to possible extension of loan duration, reduced interest rates, or softer amortization terms. So carbon revenues may serve to improve not only the project's financial return but also the financing opportunities that it faces.

CONCLUSION

On a conceptual basis, it is clear that all three climate financing instruments can serve complementary roles in driving markets for clean energy technologies toward maturity. These instruments may be used on a sequential basis, with the GEF taking initial start-up risks to initiate market transformation, CTF funds being used to take the market to scale, and carbon finance providing added financial incentives to improve the discounted present value of the project's revenue stream. Beyond this sequential synergy between these financing instruments, there is also the possibility to fold all three into a single project to accelerate the uptake of the mitigation activity or extend its reach to a broader share of the market. Altogether, the three should serve to reinforce each other in accelerating the transformation to low-carbon development paths. With sufficient creativity, foresight, patience, and vision, all three climate change financial instruments can be woven into a single sustainable development project that will reduce the future growth of GHG emissions by making low-carbon development options more financially and economically attractive.

3 MATCHING TOOLS TO TASKS STRUCTURING FINANCE TO FIT PROJECT NEEDS

CHAPTER 3 KEY POINTS

Most technologies or practices employed in mitigation projects are still relatively early in the innovation cycle. Some technologies, such as concentrating solar power or integrated gasification combined cycle, are still emerging from the research and development stage and may not yet be economically or financially viable even with support from all existing climate financing instruments without leveraging additional concessional resources from local or international sources. Others, such as on-grid renewable energy from wind or biomass, are commercially mature and economically attractive but require some preferential support from climate financing instruments to become financially viable. Still others, largely energy efficiency projects, require careful structuring and institutional support to be able to capture the value of energy savings, even though the financial rates of return that they offer are very favorable over the long run. Knowledge of the hurdles encountered by different low-carbon technologies, sectors, or approaches needs to be coupled with an understanding of the nuances of the financial instruments in order to be able to use each one effectively in structuring an attractive and sustainable low-carbon development project.

Most low-carbon growth projects still cannot be justified on the basis of their financial and economic merits alone. This simple fact explains the need for dedicated financial instruments for climate change mitigation. These new financing sources targeting climate change mitigation are necessary to change investment decisions and shift infrastructure investments toward low-carbon development. This is no meager task, requiring changes in policies and business approaches and efforts to overcome inertia among governments, project developers, and consumers. The legal, fiscal, and political structures need to be improved to increase competitiveness.

The Bank Group is uniquely placed to provide this support to developing countries adopting clean energy practices while pursuing the goals of

sustainable development. It can help create the proper enabling environment through policy dialogue, capacity building, the dissemination of knowledge, and awareness-raising. In addition, the Bank Group can provide conventional and concessional development financing to investments—mitigating risks, enhancing credits, and facilitating access to additional revenue streams to make investments more financially attractive. In brief, climate financing instruments are meant to incentivize the pursuit of low-carbon growth paths that would likely not be taken in the absence of additional financial support.

From 1991 to 1998, the GEF was the only dedicated source of climate change mitigation financing available to the Bank to support clean energy projects. Despite the limited nature of GEF resources, they were called upon for use in all aspects of clean energy project cycle development—from preparation and regulatory change to incremental investment subsidies. In 2000, carbon finance became available through the establishment of the Prototype Carbon Fund, providing a second financial instrument to promote low-carbon development using the flexible mechanisms under the Kyoto Protocol. Given uncertainties regarding the linkages and lack of clarity on the acceptability of these two financing sources, only recently have projects been developed to use both GEF resources and carbon finance instruments. The CIF resources constitute a new source of investment funding available for promoting low-GHG-emitting development paths, incorporating a number of new financial instruments into the Bank Group's clean energy arsenal. The CIF is becoming increasingly important as the traditional objectives of the WBG of addressing economic growth and poverty alleviation can be addressed by supporting low-carbon growth.

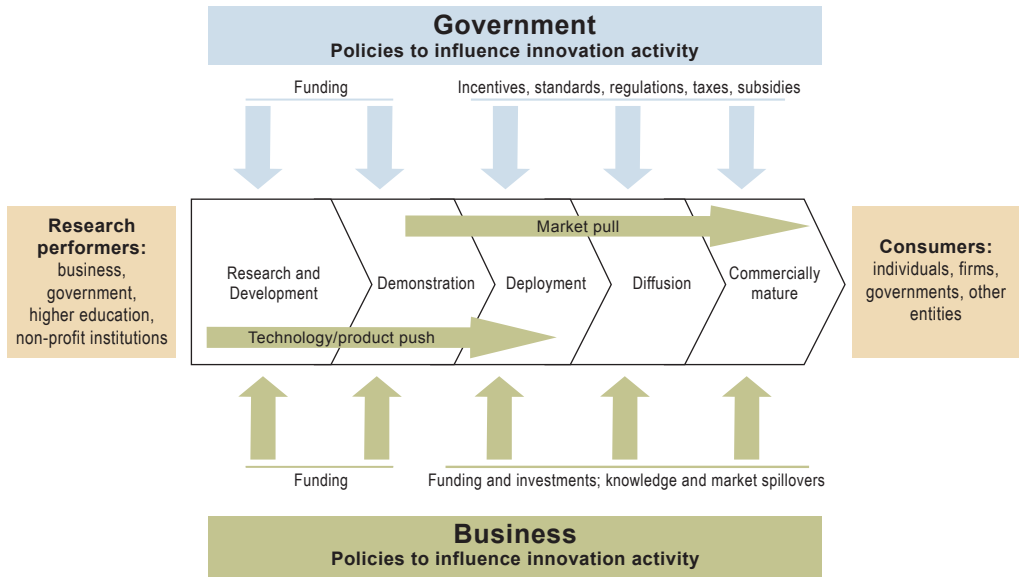
This chapter begins with a general discussion of the challenges and unique financing needs of designing clean energy and infrastructure projects. While some of these require the use of grant resources, others rely more on concessional financing or investment financing to ensure that the project becomes financially attractive, eventually transforming the market so that cleaner options become preferred even in the absence of concessional support.

FINANCING NEEDS FOR CLIMATE CHANGE MITIGATION

Climate change mitigation activities do not form a major component of developing countries' development plans because they are either expensive, difficult to implement, or seen as diverting resources from more important priorities. To be effective, low-carbon growth projects must stimulate the demand for new technologies, change behavior, and create incentives for widespread market adoption of clean technologies. But the development and adoption of new technologies is a complex process. Figure 7 provides the Intergovernmental Panel on Climate Change's (IPCC) recent representation of this process.

New energy technologies tend to follow through the process described in Figure 7, moving from the left to the right. The early stages of research and development (R&D) are supported by both public and private sector funding but represent a technological or supply-side push to the market. As a technology progresses to the demonstration phase, it potentially faces the "valley of death," so-called because many new technologies have languished in this phase while awaiting either further investment capital or effective demand to push them toward commercialization and maturity. Surviving the valley of death and successfully completing the demonstration phase, a

FIGURE 7 TECHNOLOGICAL INNOVATION CYCLE



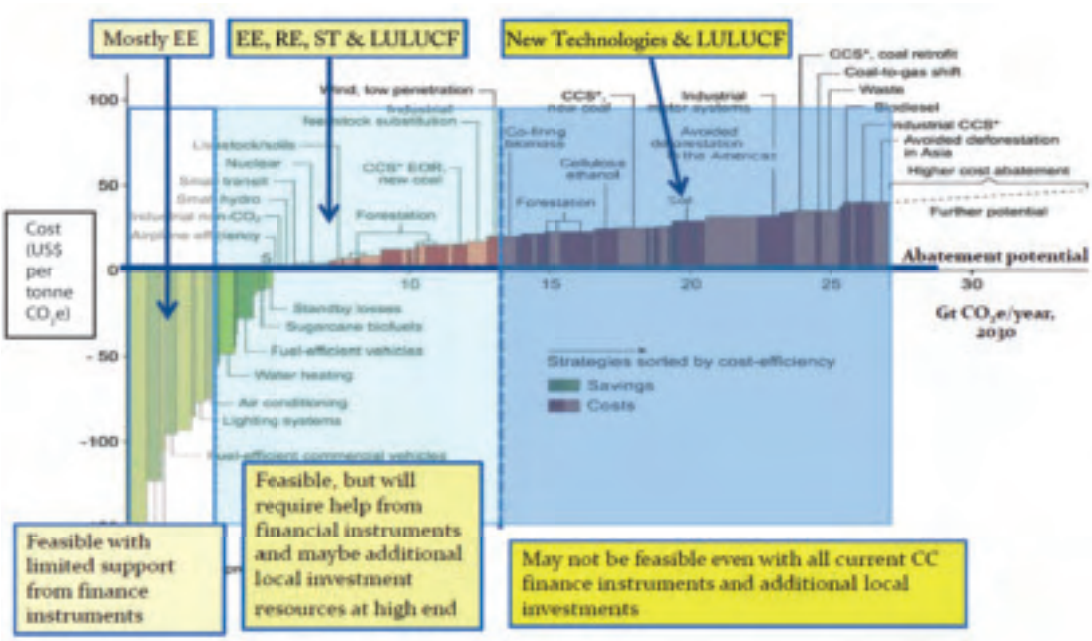
Source: Based on B. Metz, O. Davidson, P. Bosch, R. Dave, and L. Meyer, (eds.). *Climate Change 2007: Mitigation.* Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press. p. 157, figure 2.3.

technology may move through the phases of deployment and diffusion until it reaches the stages of commercial maturity. Traditionally, MDBs have focused on the transfer of technology at the diffusion or commercial maturity phase. Procurement rules require that technology to be procured is commercially available or at least available through more than one source (Anderson and Williams 1993, World Bank 2009a).

Dedicated climate financing instruments have created a focus on newer technologies that are further upstream in the technological innovation process. While still not focusing on technologies in the R&D stages, GEF funding has emphasized early demonstration of clean energy technologies. The thrust of the CTF is to help accelerate the deployment and diffusion of these low-carbon technologies and practices but not to provide any support to technologies in the "pre-commercial" stages. Carbon finance tends to give a revenue boost to technologies that are at the border of commercial viability but that may still need the benefit of additional revenue.

Figure 8 contains the now-familiar McKinsey curve of global GHG mitigation activities, running from those considered to be entirely "win-win" on the left to those requiring greater support before they can be justified on the basis of returns to the investment. (The McKinsey curve is only an indicative and stylized presentation of mitigation analyses that have been undertaken for many years; see Sathaye and Meyers 1995.) Although climate change financing instruments can be applied to all of these technologies, the mix of resources will be differently suited to technologies

FIGURE 8 CATEGORIZATION OF MITIGATION OPTIONS



Note: This graph is taken to be indicative and may not strictly correlate with the opportunities facing any of the World Bank client countries. However, graphs like it have been produced for some time, so the concept is well known. See Sathaye and Meyers 1995.

Source: Adapted from McKinsey and Company 2007.

at different points in the mitigation curve. As many technologies included in the mitigation analysis are relatively new in the market, their costs have not yet fallen as much as those of more mature technologies. Thus, the relative position of an option in the mitigation curve reflects both the costs of the technology and its relative maturity in the technological development cycle.

The options on the left hand side of the curve constitute mostly energy efficiency options using technologies that are well known but not fully adopted or disseminated. Most of these energy efficiency options are cost-effective on a *prima facie* basis but may not have disseminated throughout the market because of existing barriers whose costs may be difficult to quantify, such as limited up-front financing, lack of favorable policies, or inappropriate business models for effectively capturing those returns. The next band of technologies in the Figure require both enabling and investment support to bring them into the realm of feasibility. These options include energy efficiency projects as well as a wider range of renewable energy, land use, and sustainable transport projects. With assistance from climate financing instruments, these options can be readily implemented, although they sometimes require additional support from local investment resources through feed-in tariffs, tax relief, or other preferential treatment. On the far right in Figure 8 are the technologies whose cost

cannot currently be justified, even with climate financing instruments and local financial incentives. These are relatively pre-commercial technologies (such as integrated gasified combined cycle (IGCC) coupled with carbon capture and storage (CCS)) that are still emerging from R&D. Only further R&D support from industrial countries combined with climate financing support can make these options attractive.

As per the principles stated in the SFDCC, the emphasis for the Bank Group and developing countries should be on options than can be implemented using current climate financing instruments combined with Bank and local financial resources—in other words, the technologies in the first two bands on the left-hand side of Figure 8.

Table 2 presents a detailed representation of the financing needs and opportunities of mitigation technologies that fall primarily in these two bands representing more mature technologies. Technologies in the first row of the table are those which are technically viable, but not yet commercially available, economically beneficial, or financially profitable. Examples of this category include CCS affiliated with conventional power plants, IGCC (without CCS), ultra-supercritical fluidized bed combustion, concentrating solar power (CSP) with storage, tidal energy, biochar, and fuel cells. These may still required public sector grant or R&D funding as they are not yet cost-effective due to lack of economies of scale. These technologies frequently face the valley of death as they languish in the laboratory. Moving these promising mitigation technologies out of that valley requires continued demonstration, favorable policies, a legal and regulatory framework, and the internalization of external costs. Grant financing plays a critical role at this stage because the risk-return profile of investments in these technologies will only satisfy the requirements for concessional financing. Revenue enhancement, via the carbon market, can play a role but will be insufficient to push the technology through the commercialization process unless extremely high carbon prices prevail.

The next stage of technology commercialization is one in which the technology is technically viable, commercially available and economically beneficial, but still financially unprofitable for private sector investors. At present a number of renewable electricity-generating technologies fit this description, such as wind energy, CSP without storage, and photovoltaics. Economies of scale have begun to work, but existing market and nonmarket barriers prevent these technologies from being the technology of choice. Appropriate policies can play an important role here in the form of renewable portfolio standards, removal of fossil fuel subsidies, provision of tax credits, renewable generation targets, net metering, or favorable feed-in tariffs. Grants still play a major role in helping to establish the enabling conditions, providing training and capacity building, and even providing some limited risk mitigation or credit enhancement. Investment capital, mixed with some concessional finance, becomes more important for projects in this category as they begin to approach marginal profitability. Revenue enhancement through the carbon market can make an important difference for technologies at this intermediate state.

The final stage for mitigation technologies comes when the technologies are technically proven, commercially available, economically beneficial, and financially profitable. A number of energy efficiency technologies fit this category at present. What prevents these technologies from making their way into a country's investment agenda? Typically, inertia on the part of decision makers, vested interests, market failures such as limited information, inappropriate business models, and a lack of financing tools can prevent them from being adopted. Other reasons may include

TABLE 2 MATURITY LEVEL OF MITIGATION TECHNOLOGIES — SUPPORT TO EXPAND MARKETS AND ACCELERATE UPTAKE

Maturity level or stage	Description/ definition	Issues to be addressed to advance technology	Policy support needed	Project financing needs
Technically viable but not commercially available, economically beneficial, or financially competitive	The basic science is proven and tested in the lab and/or on a limited scale; some technical and cost barriers remain Examples: CCS, IGCC, fuel cells, second generation biofuels; CSP with storage	Development and demonstration needed to prove operational viability at scale—no economies of scale present and no global externalities internalized	• Public and private R&D required to facilitate large-scale demonstration • Need to internalize global externalities through carbon taxes, feed-in tariffs, or cap and trade • Legal/regulatory barriers	Grant resources are essential as technology may still be at R&D stage or in "valley of death"; concessional finance may play a role blended with venture investment capital if together they meet high risk-reward profile and requirements; technology risk is high—requires coverage; revenue enhancement is helpful but by itself insufficient to make project attractive
Technically viable, commercially available and economically beneficial, but still not financially competitive	The technology is technically known and available from commercial vendors; project costs are well understood; technology is economically viable with inclusion of external costs but still not financially competitive with inertia technologies or fossil fuels Examples: renewable electricity, such as wind, CSP no storage	Few economies of scale present, enabling environment and policies still nonexistent; limited information, human capacity, business models, finance, and playing field may still favor conventional, nonmitigation options	• Domestic policies to provide a level playing field: • Remove fossil fuels subsidies and internalize local externalities • Provide financial incentives for clean energy technologies • Provide training, information, finance, and support to mitigation alternatives	Grant resources are important to establish enabling environment, build capacity, and remove barriers; concessional finance very important to meet financing gap; investment capital becomes important on its own; risk mitigation for technical, credit, and business risks; revenue enhancement becomes more important
Technically viable, commercially available, economically beneficial, and financially competitive	Technology is financially viable for project investors—cost-competitive with fossil fuels or with high financial returns and short payback periods Examples: typically energy efficiency, including lighting (CFLs), appliances, industrial efficiency, district heating, buildings	Market failures and barriers hamper accelerating adoption through the market; economies of scale beginning to appear Social acceptability	• Regulations, with financial incentives to remove market failures and barriers • Support for delivery mechanisms and financing programs to expand adoption • Consumer education	Grants help defray costs of establishing regulations, removing barriers, and providing technical assistance (TA); concessional finance important but less dominant in financing mix; investment finance critical to scale up intervention; risk mitigation largely for credit risks or business risks; revenue enhancement may be necessary to push profitability above marginal levels

Source: Authors' data.

stranded assets or asset life cycles, slow stock replacement, and poor enforcement of minimal standards. Rapid building schedules can also squeeze out innovative ideas. For industry, energy efficiency receives a very low priority because it is not a core business. In this scenario, regulations and financial incentives to overcome these barriers are needed. Limited grant resources and some favorable concessional resources will be required.

This is the classic case where third-party finance or energy service companies (ESCOs) can play a significant role, as the projects are profitable on paper but are not being taken up quickly enough across the sector. Revenue enhancement through carbon financing can make a difference in pushing some of these investments into profitability, but in cases where up-front capital is lacking, carbon finance alone may be insufficient to stimulate project financial closure and subsequent implementation. In the face of these financial limitations, some of the Bank Group's carbon finance operations have included provisions to allow advance payments against a portion (typically less than 25 percent) of a project's carbon revenue in order to help clients achieve financial closure. But the front-end-loading of carbon revenues remains rare in the market today, given the nature of both market uncertainty and delivery risk.

Climate change mitigation technologies require special financing for a number of reasons mainly linked to the maturity of the technology and the nature of the market in which it competes. Less mature technologies are riskier and thus are more dependent upon grant resources and concessional finance to mitigate that intrinsic risk. More mature technologies require support in the form of favorable investment terms, performance rewards, and perhaps credit enhancement rather than from grant resources. However, transforming markets for energy and infrastructure to low-carbon alternatives remains a tremendous challenge that involves not only special financing instruments but also a different mix of financing models and mechanisms at different stages of technology and market development. Ramping up low-carbon development will require a familiarity with how best to use these instruments in the most effective manner.

MATCHING THE TOOL TO THE JOB AT HAND — NOT EVERY JOB REQUIRES A HAMMER

The needs can be categorized as falling into four categories: creation of enabling conditions, provision of investment finance, risk mitigation, and revenue enhancement. While the different financing instruments being discussed in more detail here may occasionally fulfill more than one role, each has its own appropriate niche in financing a low-carbon infrastructure project and can be used in combination with other existing and emerging sources of finance. For some activities, only one or possibly two of the mitigation financing tools may be possible or feasible. In others, only if all of the financing tools are available and fully deployed can the investment project be made economically and financially attractive. In some, even with all the support available, the projects fail to reach financial closure. The four categories that serve as an organizing framework are presented briefly in Table 3.

The creation of the proper enabling conditions for an investment includes the initiation and maintenance of a policy dialogue, adjustments to policy and regulatory frameworks, project preparation, technological piloting or demonstrations, capacity building, training, and awareness creation. As most of these activities cannot be directly linked to concrete investment returns, most clients prefer to use grant resources to pay

TABLE 3 USING CLIMATE CHANGE FINANCING INSTRUMENTS TO MEET NEEDS IN PROJECT DESIGN

Project financing needs	Available financing instruments
Creation of enabling environment	
To initiate and/or continue a relevant policy dialogue To make adjustments to policy or regulatory framework To provide project development funds To undertake technology piloting and demonstration To build capacity and train personnel To increase awareness	GEF Multilateral Fund (Montreal Protocol) Trust funds, such as Energy Sector Management Assistance Program (ESMAP), Asia Sustainable and Alternative Energy Program (ASTAE), Public Private Infrastructure Advisory Facility (PPIAF) Bilateral donor funds Foundation funding IBRD resources also available
Investment resources	
Private financing: To invest in those projects that have a favorable risk-return profile for private sector financiers	International private sector resources National private sector resources IFC resources
MDB or government financing: To invest resources for short- to medium-term investments with rate of return at or near market levels	IBRD (Specific Investment Loan (SIL) or Development Policy Loan (DPL)) Government resources
Concessional financing: To provide significant investment resources to blend with MDB, government, or private sector resources for medium- to long-term investments to fill a financing gap for marginal investments	IDA (SIL) CTF or CIF Government resources GEF (limited incremental investment resources)
Risk mitigation	
To cover risks or enhance credits associated with new technology, business models, resource certainty, and country or currency risks	CTF (partial risk guarantees) GEF (limited resources for non-grant risk coverage) Carbon finance (may help defray currency risks, as ERPA are normally hard-currency denominated) Multilateral Investment Guarantee Agency (MIGA)
Revenue enhancement	
To provide additional revenue stream to improve financial viability of investment	Carbon finance (CPF and other CF funds) Output-based aid (Global Partnership for Output-Based Aid) Non-World Bank carbon funds Voluntary carbon markets

Source: Authors' data.

for them. These are the cases suited to the GEF's barrier-removal strategy: figure out why a good sustainable energy or transport project is not taking off and use grant resources to create the conditions under which it can thrive. Beyond the GEF, grant funding may come from the

Multilateral Fund of the Montreal Protocol; Bank-managed trust funds, such as ESMAP, ASTAE, or PPIAF; bilateral donor funds; private foundations; and other sources. Bank loans may also be used for these purposes, but most clients prefer to obtain grants to meet these costs. This first piece of the project—creating the enabling conditions—frequently entails the longest and most labor-intensive preparation, implementation support, and serious client-government commitment; it is the most difficult to obtain funding for; and it requires vision and persistence to obtain the necessary results.

The opportunities for investment financing will depend on the project and its financial and economic profile. Government's own resources, national development banks, other MDBs, and the private sector's investment resources are normally available for clean energy and transport projects. For concessional financing, favorable terms can be made available from IDA, the CTF, WBG, and other MDBs and national investment sources. In some cases, GEF resources may be sufficient to pay for limited incremental investment costs; in other cases, they remain most appropriately directed at creating enabling conditions only. Increasingly, GEF projects are expected to be tied to projects with Bank IBRD or IDA funding in addition to local counterpart funding. CTF resources must be tied to an MDB loan (from the IBRD, IADB, ADB, etc.) of one form or another. With continued growth in the carbon market, the Bank's carbon finance program, including the CPF, will increasingly focus on Bank-financed projects as well. The CTF's resources fall within the category of concessional finance, and the exact terms of the loans will depend on the needs of the particular investment and the host country. Other innovative financing mechanisms are being developed and explored by the donor community. For example, the output-based approach applied to bridging the gap between the production cost of electricity generated from low-carbon sources and wholesale power system tariffs might present a new financing mechanism to strengthen the revenue stream of clean energy projects.

Ultimately, the goal of Bank involvement in supporting low-carbon development is to have these low-carbon options became the norm—that is, they become the least-cost options that are commonplace for private investors. In particular, the involvement of climate financing instruments seeks to engage the private sector in the form of project developers, investors, or financial intermediaries. However, private sector participants are frequently reluctant to invest in mitigation projects without further risk mitigation or credit enhancement. Often they view the technology, country, or business model as too risky and would like some coverage to minimize their potential losses. The engagement of the private sector is essential as the market encourages participants to find least-cost solutions to environment problems, while command-and-control structures impede innovation. To cover these risks, the Bank's Multilateral Investment Guarantee Agency (MIGA) normally can offer country-related risk guarantees for Bank client countries. The CTF can provide support in the form of partial risk guarantees for the projects that form part of a recipient country's investment plan. In the past, the GEF has taken a limited number of first-loss positions with various Bank and IFC projects through funds administered by financial intermediaries. (Both the CTF and GEF have explicit policies to encourage private sector engagement.) These guarantees have been most effective when linked to providing leverage for greater private sector investments in energy efficiency or renewable energy.

To enhance the financial return from a project, carbon finance provides a market-

based performance subsidy linked to the verified emission reductions from a mitigation project. Experience to date has shown that at prices prevailing in the carbon market, the revenue enhancement from carbon finance alone in most cases has been insufficient to boost an unattractive project's return to an acceptable level. However, many projects with returns just shy of a hurdle rate have been pushed into the range of attractiveness by prevailing carbon prices. If the market price for carbon rises over time, this boost to financial returns for low-carbon projects will increase, making a wider range of mitigation projects financially attractive.

USING CLIMATE CHANGE FINANCING INSTRUMENTS TO MAKE CLEAN ENERGY PROJECTS ATTRACTIVE

Most experience to date with climate financing instruments has focused on renewable energy and energy efficiency projects. The discussion here serves to highlight how these activities can best be built to take advantage of the dedicated climate financing instruments in order to become economically attractive.

The information presented in Table 4 links the financing needs for making a renewable energy project economically and financially attractive with the various dedicated climate change financing instruments, using the information summarized in the preceding discussion. RE investment projects are capital-intensive by nature, but they also require the creation of a sound enabling environment to be replicable and sustainable rather than being limited to a single demonstration project. Although some client governments may be willing to borrow to meet these "soft" expenses, experience to date has shown that their preference is to pay these "barrier removal" costs out of grant resources. For these activities, GEF grants or resources from other grant-based funding sources are typically preferred. The disadvantage associated with these resources is their limited size: a typical GEF grant to a World Bank RE project has averaged less than $10 million, meaning that most of it is used for these "soft" costs of the renewable sector investments.

Concessional funds, such as the CTF or other concessional investment resources (IDA, Kreditanstalt für Wiederaufbau (KfW), Agence Francaise du Development (AfD), Japan Bank for International Cooperation(JBIC), etc.), can serve an important function by helping make large environmentally interesting projects financially attractive. With respect to the need for risk mitigation beyond what can be done through project design, both the CTF and GEF are willing to allow their funding to be used for partial-risk guarantees or other forms of credit enhancement beyond that available through MIGA. Such support to fuel-supply risk for biomass or dry-hole guarantees for geothermal energy exploration can provide a critical link in stimulating RE investments. Finally, carbon financing has proved itself capable of improving the revenue stream from RE projects, again helping projects exceed risk-adjusted return hurdles. Although carbon revenues are not available until the projects begin operating, the guaranteed extra revenue stream can play a critical role in enhancing project payback.

In contrast to renewable energy projects, which are basically energy supply projects, energy efficiency projects cover a wide range of activities focusing on providing a given or enhanced level of energy service while reducing energy consumption. Because EE projects are not as asset-based as energy supply projects, they face greater difficulties in obtaining financing even though

TABLE 4 USING CLIMATE CHANGE FINANCING INSTRUMENTS TO MAKE RENEWABLE ENERGY PROJECTS ATTRACTIVE

Financing needs	Available financing instruments
Creation of enabling environment, including capacity building	
• *Policy and regulatory frameworks:* Design of mandated market policies (e.g., feed-in tariff, renewable energy portfolio standards, competitive tendering, etc.), long-term power purchase agreements, and incentive policies • *Project development funds:* Pre-feasibility studies paid for on a matching grant basis with private developers • *Technology development and improvement:* Creation of a local manufacturing industry, technology standards, testing, and certification • *Capacity building and awareness campaign:* Raise capacity and awareness in government agencies and private sector and civil society at all levels • *Renewable resource and environmental assessment:* Establish wind speed site data, confirm geothermal resource potential, or assess biomass resource availability	Grants from the GEF, Bank Trust Funds (ESMAP, ASTAE, PPIAF, Policy and Human Resources Development (PHRD) Fund, etc.), foundations, or other donors are the most appropriate (Clients may also borrow to meet these costs, but typically prefer not to)
Investment resources	
Private financing: RE may still not meet private sector risk-reward profiles, requiring longer tenure and lower return rates to be competitive	International or national capital
Long-term financing for existing commercially available renewable energy technologies: RE is capital-intensive, so long-term financing is critical; IBRD lending to this sector helps countries adopt international best practices	IBRD (SIL or DPL) or government resources
Concessional financing: Focus on supporting economically beneficial but not financially profitable emerging renewable energy technologies • New emerging RE technologies, such as CSP, require concessional financing to cover both the incremental costs and technology risks • More mature RE technologies, such as wind or biomass, require less concessionality than less mature technologies, such as CSP	CTF IDA (in low-income countries) Concessional financing from other donors (AFD, KfW, or JBIC) GEF resources (for piloting or demonstration only)
Risk mitigation	
To cover exploration risks for geothermal or fuel supply risk for biomass	GEF grants can cover partial risk guarantees
To cover country risks	MIGA
Revenue enhancement To increase the return to an investment by increasing revenue from project production	Carbon finance (CPF and other Bank carbon funds/facilities)

Source: Authors' data.

they often demonstrate favorable financial returns. While efficiency investments may demonstrate favorable payback periods and rates of return, the management or organizational requirements necessary to get access to them remain challenging (see Table 5). Dedicated climate financing instruments play an important role in realizing these identified but elusive energy and GHG savings.

The creation of the enabling environment for EE projects often requires regulations or standards for energy-using devices, such as appliances or building codes. Grant resources from the GEF, other MDB trust funds (such as ESMAP, PHRD, or PPIAF), foundations, or bilateral donors may be available to cover the costs of this preparatory work for energy efficiency investments.

Other EE projects may demonstrate high economic rates of return on paper but are difficult to finance as the financial returns are not always easy to capture. Utilities hesitate to borrow money to pay for activities that lead to a reduction in sales of electricity or gas to their customers. The principal-agent or landlord-tenant problem provides another example of split incentives that may undermine EE projects. Concessional financing can make a big difference in such projects by providing consumer rebates, financing ESCOs, or paying non-recoverable program costs for utility EE or demand-side management (DSM) projects. The promise of carbon finance revenues may provide access to needed up-front resources to help extend the reach of EE programs through soft loans, even though the carbon-linked revenue stream is by itself rarely front-end-loaded. This partly explains why carbon finance has made limited inroads to enhancing the revenues of EE projects.

The challenge for energy efficiency lies in obtaining the up-front capital, not in improving revenues. The delivery risk on carbon payments still makes most buyers unwilling to make up-front payments for carbon revenues. Second, the CDM still requires projects to demonstrate that they are "additional" to what would happen in an economically rational baseline. As most energy efficiency projects have favorable economic characteristics at least on paper, CDM regulators have only recently shown a willingness to consider them "additional" to the baseline. Third, many EE investments represent individual, small installations that fall below the minimum size threshold (measured either in value or volume) necessary to gain investment commitment. The new programmatic approach to the CDM, wherein many small projects are bundled together for a larger aggregation of carbon credits, is a promising avenue that should be used more to enhance the attractiveness of energy efficiency projects (Figueres and Philips 2007).

TABLE 5 USING CLIMATE CHANGE FINANCIAL INSTRUMENTS TO MAKE EE PROJECTS ATTRACTIVE

Financing needs	Available financing instruments
Creation of enabling environment, including capacity building • *EE regulations:* energy efficiency appliance standards and labeling, building codes, industry performance targets, fuel efficiency standards • *Regulatory reforms:* removal of subsidies (power and heating pricing reform), decoupling sales from revenues • *Technical assistance:* to ESCOs and other EE project developers to build an ESCO industry and prepare financing deals; to financial institutions to develop financial products; to government agencies on public procurement rules; to utilities on EE/DSM program; district heating design	MDB resources are available to meet these costs, but clients frequently prefer to use grants, not loans, for these activities Grants from the GEF, Bank Trust Funds (ESMAP, ASTAE, PPIAF, PHRD, etc.), foundations, or other donors
Investment resources	
Private financing: EE projects may be profitable and have short payback periods, but they suffer from other barriers such as inertia, principal-agent problems, or managerial challenges	International or national investment capital may be used if investment meets risk-reward requirements
Long-term financing can be provided to governments on a sovereign guarantee basis for the following: • *Lending for district heating:* Lending to municipalities or nationally owned district heating entities • *Lending to local financial institutions:* Lending stimulates on-lending for EE investments • *Public procurement:* Bulk procurement of energy-efficient retrofits for government buildings	IBRD (SIL or DPL) Government resources
Concessional financing: • *Financial incentives:* Providing consumer rebates • *ESCOs:* Providing initial capital to set up ESCO industry • *Dedicated revolving EE fund:* Operating like a dedicated investment fund • *Utility EE/DSM fund:* Paying costs of utility-based efficiency programs	CTF IDA (in low-income countries) Concessional financing from other donors (AFD, KfW, or JBIC) or GEF resources (for piloting or demonstration only) Carbon finance may assist with energy efficiency programs
Risk mitigation Partial risk guarantees for investments or technology	The CTF can provide partial guarantees The GEF has provided limited risk guarantees and first-loss positions
Revenue enhancement Additional revenue based on product or output of investment	Carbon finance has proved difficult to date because of additionality requirements (on paper, energy efficiency looks profitable from the savings), but the acceptance of programmatic approaches to the CDM have begun to facilitate end-use energy efficiency programs under the CDM

Source: Authors' data.

4 FROM THE DRAWING BOARD TO THE EXECUTIVE BOARD CASE STUDIES

CHAPTER 4 KEY POINTS

Six case studies highlight the combination of resources from climate financing instruments with those from development finance, including resources available from IBRD loans and local investment capital. Although these projects are at different stages of development and implementation, they provide interesting examples of ways to increase the reach and pace of low-carbon growth by blending finance to maximize impact.

The China Renewable Energy Scale-up Project and the Energy Efficiency Project highlight the importance of establishing enabling conditions and institutional capacity to stimulate low-carbon growth. The India Chiller Energy Efficiency Project demonstrates that by using different climate financing tools, the total resources and the fraction of the market to be reached with those resources under a project can be increased. These projects emphasize the importance of leveraging national investment resources to ensure long-term sustainability of low-carbon initiatives, especially when revenue can be paid in either local or foreign currency. The Mexico Municipal Transport Project is an interesting case of using GEF resources to lay the foundation for bigger investments through the CTF and national sources. It even managed to attract carbon finance to a challenging sector like urban transport.

Carbon finance has brought attention and investment into the much-neglected waste management sector, as exemplified by the Morocco waste management proposal.

Without the contributions from these climate financing instruments, none of these projects would have moved ahead. The IGCC-CCS project in China demonstrates that, with foresight, all climate financing tools can be brought to bear in a single project. However, simply mapping out how these resources might fit together is no guarantee that the project will move forward.

All of these projects pose challenges to design and implement. To make them a success, Bank staff and in-country proponents must share the interest and commitment to pursue these more challenging and innovative projects over their more conventional baseline alternatives.

Climate change financing is a rapidly evolving field. To the extent that this interest in and commitment to increasing climate change mitigation on the part of the Bank and its client countries continues to grow, familiarity with using these mitigation financing instruments will also have to grow—making the blending of these instruments a more common practice.

Six case studies drawn from recent Bank Group's experience with financing demonstrate how multiple mitigation financing tools can be deployed either simultaneously or sequentially in the same project or program (see Table 6). Some of these projects are nearly complete, while others are still on the drawing board and do not represent firm commitments of any party involved.

TABLE 6 CLIMATE CHANGE MITIGATION FINANCING CASE STUDIES

Project	Status	Sector	Financing instruments used				
			GEF	IBRD/ IDA	CTF	CF	Other
China Renewable Energy Scale-up Project (CRESP)	2005–present	On-Grid Renewable Energy Generation	$40m	$173m		$15m or about 1 $mtCO_2e$	
China Energy Efficiency Program	1998–present	Industrial Energy Efficiency	$14m	$200m		$12 m or 750 $ktCO_2e$	$371m
Morocco Municipal Solid Waste	Board approval March 2009	Urban Solid Waste Management		€100m		$30m or 2 $mtCO_2e$*	
India Chiller Energy Efficiency Project	Board approval June 2009	Energy Efficient Appliances & CFC Phase-out	$6.3m			$5.8m or 485 $ktCO_2e$	MLF $1m IDBI/ private $70m
Mexico Urban Transport Transformation Program (UTTP)	Board approval October 2009	Sustainable Transport	Mexico City $5.8m + $8m from STAQ to 4 cities	$200m	$200m	~$50m or about 3 $mtCO_2e$	$868m FONADIN+ $732m private sector + $225m from cities
China IGCC Project	In discussion	Efficient Power Generation	$10m	$100–200m	$100–200m	TBD	~$400m

Note: *Value of CERs to be determined in market.

Source: Authors' data.

Two of the six case studies featured in this chapter use GEF, IBRD/IDA, CTF, CF, and national investment resources. The other projects use two to four of these financing sources. As the CTF is the newest source (eight projects have been approved to date by the Trust Fund Committee), the possible examples of its use are limited. But as the CTF portfolio grows and the Bank Group's experience with combining these financing instruments increases, future projects will combine these resources more frequently and in more ambitious ways in order to help countries achieve low-carbon growth.

CHINA RENEWABLE ENERGY SCALE-UP PROJECT

CRESP (see Table 7), approved in 2005, built upon the lessons of its failed predecessor, the China Renewable Energy Development Program (REDP), initiated in 2001. The REDP provided resources to support the establishment of demonstration wind farms, but this component failed and was cancelled. In analyzing the situation, the

TABLE 7 FINANCIAL PACKAGE FOR CHINA RENEWABLE ENERGY SCALE-UP PROJECT

Project financing need	Financial instrument	Targeted outcome
Create enabling conditions, including capacity building • Implementation of mandated market policies at national and provincial levels • Technology improvement (local manufacturing) • Resource assessment • Project development fund • Cost-shared pilot or demonstration • Capacity building/training	GEF Grant: $40m ASTAE Grants	Successful implementation of RE law Local manufacturing industry created Resource information available A bankable project pipeline built Local capacity strengthened
Investment resources • 2 wind farms: 2x100 MW • 1 biomass power plant: 25 MW • Bundling small hydro plants < 10 MW	IBRD loan: $173m	In addition to investments implemented, the wind power projects are the first large wind farms (100 MW) in China; CRESP introduced international best available technologies through international competitive bidding
Revenue enhancement An additional revenue stream from carbon financing enhances financial viability of the Inner Mongolia wind farm	Carbon finance: $15m	For the Inner Mongolia wind investment of 100 MW carbon finance proved instrumental in improving the project's financial viability from a marginal 7 percent to a financial internal rate of return (FIRR) of 9 percent that made the project attractive to developers when the feed-in tariff would not

Source: Authors' data.

task team came to understand that the failure could be attributed to the lack of agreed approach to sharing the incremental costs of the investments between the national and regional grids, as they far exceeded whatever grant resources could be mustered. None of the actors was willing to pay the extra fee per kilowatt-hour (kWh) required to make the wind investments sustainable.

In response, the Bank helped the Chinese government obtain resources from both GEF and the Asia Sustainable and Alternative Energy Program to evaluate international experiences and best practice with respect to RE mandated market policies and to develop its own RE policy framework. China developed and passed an RE Law that lay the basis for sustainable renewable energy development, one of the first in developing countries. This technical assistance laid the foundation for an IBRD SIL ($173 million) that provided support for co-financing two 100-MW wind farms, a 25-MW biomass power plant, and a bundled package of small hydro projects. The Bank loan was seen not only as investment support but also as a way to bring international best practices to bear in private sector renewable power development.

For one of the wind investments (Inner Mongolia) targeted as part of CRESP, the Chinese government specified that the wholesale power tariff should not exceed 5 cents/kWh, a price that made wind uncompetitive. At this point, the Bank's carbon financing helped improve the project's financial viability by committing to purchase 1.6 million emission reductions from the project, raising the financial internal rate of return from 7.2 percent to 8.8 percent, a point where the project became attractive. Therefore, by integrating GEF and ASTAE grants, IBRD lending, and carbon finance payments, CRESP has had an effective transformational impact on RE development in China. The country is now considered the second fastest-growing wind market in the world and, with 12.2 GW of installed capacity in 2008, has the fourth largest wind market in the world (REN21 2009).

Both REDP and CRESP projects provide successful examples of technology transfer of renewable energy technologies with climate financing instruments (GEF). REDP has successfully stimulated the building of a domestic photovoltaic module manufacturing industry in China, while CRESP helped develop Chinese-made large (> 1 MW) wind turbines. Through both projects, GEF funding was used to cost-share matching grants with manufacturers to accelerate their learning and experience with the newer technologies. These cost-sharing grants reduced the cost of the technology initially in China but eventually on the international market. Under CRESP, GEF funding mobilized additional funding from subgrant recipients of about three times GEF grant support. Combined with the government's requirement of 70 percent locally manufactured content for wind farms in China, this has also boosted a large domestic wind manufacturing industry in China, which is on its way to becoming one of the world's largest producers of wind turbines.

What might be done differently if the CTF or other concessional investment finance were made available through CRESP? There is a risk that an accelerated process created by a larger volume of concessional terms would have created so much additional pressure for rapid disbursement that the project team and counterparts might not have returned to the drawing board, regrouped their efforts, and refocused on the mandated market policies or feed-in tariff. As a result of the early failure of REDP's wind component, a transformation took place that required a number of years to complete. Clearly, getting the policy environment right needs to remain at the core of low-carbon development programs no matter

what quantity or type of climate financing instruments is available. In this case, the government of China agreed with the Bank to pursue a longer-term sustainable option—involving a change in the regulatory system—rather than a quick, one-off demonstration project. This decision—and the efforts to implement it—made the program truly transformational.

CHINA ENERGY EFFICIENCY PROGRAM

Many financial institutions tend to regard energy efficiency investments as being relatively small in size, with high risks and higher transaction costs. As a result, EE has frequently been relegated to the realm of social responsibility as opposed to a profitable business line. With support from the GEF, the European Commission, and a World Bank loan, the China Energy Conservation Project created the first three ESCOs in China in 1998. These three energy service companies, in Beijing, Shandong, and Liaoning, successfully pioneered the energy service company business model, adapting it to Chinese conditions.

Launched in November 2003, the Second Energy Conservation Project has helped stimulate a robust Chinese ESCO industry that has grown to make energy efficient investments from their own resources valued at more than $1 billion in 2007 (see Table 8). The ESCO Loan Guarantee Program implemented under this project created a bridge for many ESCOs into the world of formal financing through the issuance of loan guarantees. Twelve Banks have provided support to over 40 ESCOs. With $16.5 million of GEF funds placed in a special guarantee reserve fund, the project issued loan guarantees totaling about $52 million from 2004 through April 2008, providing support for specific energy performance contract investments totaling over $90 million. The program will continue to expand through the creation of new loan guarantee products. In parallel, the GEF technical assistance grant helped build capacity for ESCOs through the ESCO Association and developed financial products with the guarantee company.

Based on the energy savings and carbon emission reduction rates actually achieved in 226 investments supported through the ESCO Loan Guarantee Program, estimated energy savings from 2007 energy performance contract investments total about 53 million tons of standard coal equivalent. Associated carbon dioxide emission reductions from investments made in 2007 alone total about 139 million tCO_2e, a 900 percent increase from 2004.

Subsequently, the Bank financed a China EE Financing Project to provide IBRD long-term financing, and the GEF grant was provided to increase the local financial institutions' confidence in jump-starting energy efficiency financing through learning by doing. GEF funding ($14 million) has been used to assist the participating banks in preparing a project pipeline and building their capacity. IBRD lending ($200 million) was also used as a sweetener to engage domestic financial institutions to on-lend to large industrial enterprises and ESCOs for EE investments.

In the process of developing an EE pipeline, a Bank carbon finance deal was reached for Baotou Iron and Steel Company. This project, with a total investment of $67 million, is a coke dry-quenching operation that will make use of waste heat to generate 45 MW of electric power. It has contracted to sell 900,000 tCO_2 valued at approximately $12 million (€8.5 million). The carbon revenues have raised the FIRR of this project from 11.5 percent, which was considered financially unattractive, to over 14.3 percent, which was considered attractive. This project provides an interesting example because it shows

TABLE 8 FINANCIAL PACKAGE FOR CHINA ENERGY EFFICIENCY FINANCING PROGRAM

Project financing need	Financial instrument	Targeted outcome
Create enabling conditions, including capacity building • Assist participating banks in capacity building, marketing, due diligence, and pipeline development • Assist other banks and overall banking sector to begin investing in EE • Preparation of pilot projects • Monitoring and verification • National policy and institutional support to National Energy Conservation Center	GEF Grant: $14m	A project pipeline built Increased capacity of local banks to develop and evaluate EE projects and to incorporate carbon finance in their operations National Energy Conservation Center fully operational
Investment resources On-lending through two selected domestic banks to medium and large-scale EE investments ($5–25m per subproject)	IBRD loan: $200m	Energy saved and CO_2 reduced
Risk mitigation	Loan guarantee program operated by I&G	Enabled ESCOs to expand financing
Revenue enhancement An additional revenue stream from carbon financing enhances financial viability of the Baotou Iron Steel EE project	Carbon finance €8.5 m for 900 $ktCO_2e$	Enhanced financial viability of waste-heat utilization project—for Baotou Iron and Steel Co., FIRR jumped from 11.5 to 14.3 percent

Source: Authors' data.

that the Bank's long-term commitment and engagement in China has paid off handsomely and that a programmatic approach is the most effective way to scale up EE investments. This remains the largest single EE project being implemented by the Bank.

A comparison of the experiences in investing in energy efficiency in China, India, and Brazil undertaken by a team from ESMAP showed that TA and capacity building alone were not sufficient to make local banks interested in EE lending using their own capital in any of the case studies examined. Rather, what was necessary was outside funding that could be used to experiment with various approaches and learn the process of investing in energy efficiency (Taylor and others 2008). Weaving GEF and IBRD resources together in EE financing is critical. Early EE lending projects without GEF grants languished because of insufficient deal flow. The most important lesson learned from the Bank EE financing portfolio is the critical need for technical assistance, particularly at the beginning, to raise awareness of energy efficiency, to provide training and advisory services to the local financial institutions in developing financial structures, and to build the capacity of project developers. On the other hand, grant-based TA alone is not sufficient to engage local financial institutions

and interest them in EE lending, as demonstrated in the three-country study (Taylor and others 2008).

What could be done differently with the new resources available? The availability of concessional investment resources might have accelerated the uptake of financing through local financial institutions, but the concept of being able to experiment using grant resources has proved critical to developing an energy efficiency business for financial intermediaries. The project team has received requests for capacity building from financial intermediaries who were very keen to understand the rules of the CDM and how it might become an additional service line in their existing lending business. But without the assistance made available to develop and work through the business model using grant funding, the financial institutions would never have been convinced that energy efficiency could be profitable. After the business model was tried and developed, carbon finance played a role in providing incentives for greater replication of EE practices. In a similar manner, concessional finance could be used to increase the scale and scope of EE lending by the financial intermediary. But the GEF foundational support provided the enabling environment in which carbon finance can flourish, and concessional finance can play its role as an accelerator for financial intermediaries.

MOROCCO MUNICIPAL SOLID WASTE PROGRAM

This Development Policy Loan (DPL) was designed to support the government of Morocco in implementing its National Municipal Solid Waste Management Program (PNDM) by reforming and improving the financial, environmental, and social performance of the municipal solid waste (SW) sector in Morocco. The program design includes two single DPLs (valued at $140 million or €100 million), with the first DPL focusing on support for the key foundations of the government's reform program, which establishes the enabling environment for an integrated and affordable municipal solid waste system. The planned second DPL will support scaling up of the program, capitalizing on the momentum gained during the first operation while deepening the reform through results-oriented actions at the regional and municipal levels.

The Moroccan municipal solid waste management sector faces challenges related to a weak legal and institutional framework. The Solid Waste Management DPL includes the preparation of a programmatic CDM solid waste activity. The CDM SW program will help improve financial sustainability and promote sound environmental practices in the sector. The program will also contribute to Morocco's participation to the global effort in climate change mitigation (see Table 9).

The CDM program will initially focus on municipalities and sites included in the first phase (2008–12) of the DPL to support the PNDM. It will create an incentive for municipalities to invest in landfill gas use and to use carbon revenues to fund further landfills. Up to 11 landfill gas projects, including those of main Moroccan municipalities in the first phase of the PNDM, may join the CDM program. If implemented, these 11 subprojects would process 2.9 million tons of waste per year with estimated emission reductions of 7.561 million tCO_2e over 10 years, worth approximately $115 million at current prices. These payments alone are nearly sufficient to recover the cost of the loan package.

The CDM program will be developed as a Program of Activities, and each landfill gas project under the PoA can be treated as a component without the need to go through a

TABLE 9 FINANCIAL PACKAGE FOR MOROCCO SOLID WASTE MANAGEMENT PROJECT

Project financing need	Financial instrument	Targeted outcome
Investment resources Sovereign guaranteed loan-term concessional project financing	IBRD Development Policy Loan	IBRD financing will support a waste management policy framework to achieve the following outcomes: • Improve governance of the sector • Create additional legal, regulatory, and institutional measures designed to establish a clear framework for the sector • Eliminate overlap and/or gaps in the policy-making, regulatory, and operational structures • Improve sustainability of the sector through the introduction of financial mechanisms and incentives for municipalities to improve their SW management systems • Mainstream social and environmental considerations into the planning, implementation, and operations of solid waste services and investments
Revenue enhancement A supplementary revenue stream to leverage commercial financing for additional municipal landfill projects and create incentives for private sector participation	Carbon finance	A CDM Program of Activities (PoA, or "programmatic CDM") will be developed to provide additional incentives for municipalities to invest in landfill gas elimination or reuse projects with additional resources resulting from the sale of certified emission reductions generated by such investments. Landfill gas projects will be implemented by the individual municipalities. The PoA will be considered as a CDM project activity, and each individual landfill gas projects can be added to the PoA umbrella.

Source: Authors' data.

separate registration process. The landfill gas CDM program activities will be implemented by individual municipalities. The Fonds d' Equipement Communal (FEC) would either construct and operate the project themselves or contract the private sector to do so. The FEC will be the coordinating entity. It will help prepare individual CDM program activities and sell a portion of the CERs to the Carbon Partnership Facility. At this early stage of the program preparation, and based on preliminary discussions with the FEC, it is anticipated that the CPF would purchase around 2 million tCO_2e over 10 years.

What might be structured differently with the Morocco project with more climate financing instruments? There is no straightforward answer. The GEF Council has still not agreed to the provision of incremental funding to DPLs in general, as the Council perceives itself as a project funding mechanism. This policy may be tested in the future, however, as more of the Bank's financing for middle-income client countries is being provided through DPLs, and a few of these have focused on climate-related activities. Early in the pilot phase, the GEF did provide financing for landfill gas and liquid biomethane projects, and it might support removing barriers and creating successful market conditions for large-scale landfill methane projects. With respect to concessional financing such as the Clean Technology Fund, a program like Morocco's PNDM would

have to be defined as truly transformational in order to be eligible for support. But the provision of concessional finance for such activities would again scale them up in an accelerated fashion. In conclusion, there is no clear answer as to whether or not the project could be structured to increase its scale and scope using other climate financing instruments.

INDIA CHILLER ENERGY EFFICIENCY PROJECT

Chillers, which serve as the heart of large-scale air conditioning systems, remove heat from buildings and release it to the environment, consuming electricity in the process. Non-chlorine fluorocarbon (CFC) based centrifugal chillers manufactured today can achieve energy consumption of about 0.48 kWh/RT (kilowatt-hour per ton of refrigeration), representing a 40 percent improvement in energy consumption over older CFC-based centrifugal chillers (0.8 kW/RT or higher, depending on maintenance and operational standards). Despite this clear private benefit to chiller owners, most building owners have not embraced early or even timely replacement of outdated chillers. It appears that managers make such decisions in an environment of competing investment opportunities and resource constraints, where the mission-marginality of the chiller investment, perceived technology risks, and high opportunity costs constitute a formidable barrier to early adoption of the more-efficient alternative. In fact, the India chiller sector study determined that Indian chiller owners apply an implicit discount rate as high as 30 percent on potential returns from chiller replacement projects.

The India Chiller Energy Efficiency Project was designed to replace older CFC-based centrifugal chillers with non-CFC-using chillers that are more energy efficient (see Table 10). This project concept is in line with the objective of supporting the transformation of the Indian electricity sector toward a less carbon-intensive path, thereby establishing an in-country mechanism to provide chiller owners with an incentive that is sufficient to overcome the identified barriers. The objective is to replace 370 chillers over three years, with an average incentive of 20 percent, with precise amounts varying upon chiller age and timing of participation in the project, based on an agreed-upon sliding scale. Funds from the Multilateral Fund for the Implementation of the Montreal Protocol (MLF) are being used to structure the project and build capacity for implementation. Grant funds from both the GEF and MLF are being used to provide an up-front subsidy to chiller owners to encourage them to invest in the new equipment. Before chiller owners receive the incentives, they must agree to render any future carbon revenues to the project. These carbon revenues will be managed as a revolving fund to provide further incentive payments to replace additional chillers. Of the targeted 370 chillers (out of a total market size of about 1,200 chillers), 185 of them will be supported by the funding from the GEF and 30 by the funding from the MLF. The other 155 chillers will be replaced through carbon revenues earned from those early replacements.

With the total cost of replacement of about $90 million, the project will rely on local investment capital to pay for the bulk of the replacement costs. This investment capital is expected to be provided either by the chiller owners themselves or through a loan that they would obtain from a local financial institution—possibly, but not necessarily, through the implementing agency, the Industrial Development Bank of India (IDBI). The incentive payments from the GEF, MLF, and CDM are designed to meet 20 percent of the replacement costs. To avoid the problem of free-riders (chiller owners using the subsidy to replace

TABLE 10 FINANCIAL PACKAGE FOR INDIA CHILLER ENERGY EFFICIENCY PROJECT

Project financing needs	Financing instrument	Targeted outcome
Creation of enabling environment • To continue the relevant policy dialogue • To provide project development funds • To train relevant staff • To monitor, verify, and certify outcomes	Multilateral Fund of the Montreal Protocol ($565,000)	• Project is prepared consistent with evolving government policy • Capacity is built • Staff are trained • Credible monitoring framework established
Investment resources Conventional Resources: To provide significant investment resources for chiller replacement Concessional Resources: To improve the financial feasibility of investments in chillers in order to overcome inertia, to ensure favorable rates of return, and to promote replication resulting in market transformation	National investment resources, from both public and private sector, and financial intermediary (IDBI Bank Ltd. (IDBI)) resources ($70m) pay for baseline investment costs GEF ($5.7m) and MLF ($220k) grant resources devoted to providing incremental cost subsidy for early adopters of new chiller technology	National investment resources combine with GEF, MLF, and CF resources to pay for retrofitting of 370 chillers Reduction of 159 million tons of CFCs Saving of 3.9m MW-hours and 48 MW electricity over 20 years Direct reduction of GHG emissions by 4.50m tCO_2e over 20 years Indirect reduction of GHG emissions by 8.68m tCO_2e over 20 years
Risk mitigation To cover risks or enhance credits associated with investment in CFC-free energy-efficient chillers	GEF/MLF resources serve as a partial subsidy to improve profitability of chiller investments—revenues from carbon finance also contribute to revolving fund resources	FIRR for individual investor estimated at 30 percent after tax or payback of 3.3 years EIRR for project as a whole estimated at 68 percent without carbon revenues or 71 percent with carbon revenues included
Revenue enhancement To provide additional revenue stream to improve financial viability of investment and ensure replication of activity	Carbon finance resources will be devoted to renewing a revolving fund to retrofit more chillers (targeting 155 of the planned 370)	Sale by project of approximately 488 thousand Certified Emission Reduction Units (CER's) equivalent to 488 $ktCO_2e$

Source: Authors' data.

a chiller past its useful lifetime), an age limit is placed on eligible chillers: only those still within their estimated useful lifetime (typically 20 years) will be eligible for support. With the investment promotion, the financial return to the chiller owner comes to about 30 percent after taxes, but it has a payback period of slightly more than three years. Given the capital-short nature of most Indian enterprises and the opportunity set that they face, such projects would be unlikely to

move ahead without an incentive payment. In this case, the carbon payments will be used to further the replication of the program, re-endowing the revolving fund to provide further incentive payments to other interested chiller owners.

What could be done differently with additional climate change mitigation resources? This project began with a kernel of seed capital from the MLF. It approached maturity with the approval of the GEF funds, and the approval of the CDM methodology by the CDM Board completed the package. Because early assessments made it clear that chiller owners had sufficient access to investment capital from local sources, no IBRD loan-financing was requested. As the project predates the CTF or the CIF in general, there was no opportunity for further concessional financing. Had it been available, it would have increased the speed of the transformation from old, inefficient chillers to new, more-efficient ones. However, the trade-off might have been the financial intermediary's reduced reliance on its own resources. The key to full replication across the market—as shown in the China Energy Efficiency Project—is the involvement of local banks that will first learn about EE investment using grant resources prior to pursuing further efficiency investments with their own capital. So the trade-off in design and timing might have made the faster option less desirable over the long run, as the benefit of having the local financial intermediaries gain more experience with EE business models might well have outweighed the costs associated with the slower replacement. How long will it take to transform the chiller market fully and retrofit all 1,200 chillers in India, given that the project only provides incentive premiums to replace about 370 chillers? This answer to this question is unclear, but the trade-off in project design—less funding may actually leverage larger long-term investments—is clear.

MEXICO URBAN TRANSPORT TRANSFORMATION PROJECT

The objective of the Mexico Urban Transport Transformation Project (UTTP) is to transform urban transport in cities to a lower carbon growth path. Achieving this objective will significantly reduce the carbon footprint of the transport sector as well as reduce air pollution. The UTTP will bring together the agendas of local urban transport, national poverty reduction, and global climate change, while responding to the government's voluntary pledge to reduce GHG emissions.

Demand for transport in Mexican cities is leading to increasing motorization, with growth rates of around 10 percent per year. In many cities, private cars today account for 80 percent of total motor vehicles but represent not more than 30 percent of the daily passenger trips. This growing motorization has led to demand for more roads, including ring roads and multilane highways, which has led to diversion of public funding for private transportation enhancement. Although there is considerable variation between cities, the government is generally not in a position to respond adequately to the demand. The transport policy and framework is inadequate, the institutions responsible for public transit are weak, and there is a shortage of capable professional staff to manage transport corridors adequately.

The project focuses on urban areas across the country and is designed around three components: increasing the human and institutional capacity to prepare and carry out sustainable transport investment policies and projects; developing integrated transit systems, including mass transit corridors and public transport enhancement; and stimulating the market for low-carbon

buses in these urban areas as well as scrapping older, inefficient buses. Altogether, the program is seen as an ambitious effort to transform the urban transport sector across Mexico (see Table 11).

The project has been built around earlier and existing GEF support to the transport sector in Mexico. One earlier GEF-supported project focusing on Climate Measures in the Transport Sector of Mexico City helped develop the

TABLE 11 PROPOSED FINANCIAL PACKAGE FOR MEXICO URBAN TRANSPORT TRANSFORMATION PROJECT

Project financing need	Financial instrument	Targeted outcome
Create enabling conditions for implementation of Rapid Transit Systems in Mexico and development of CDM projects	Initial GEF grant in Mexico City	Support for transport policy reform for Mexico's urban sector, including the following: the formulation of a city-wide climate change strategy; restructuring of a regulatory and business structure framework for surface transport in cities; and with carbon finance support, the generation of data and experience on the deployment of advanced bus technologies and on the operation and maintenance of Bus Rapid Transit systems under actual operating conditions.
Enhance capacity building to include additional municipalities in the program	GEF grant to Mexico for four cities as part of Regional Sustainable Transport and Air Quality (STAQ) project	The Mexico GEF STAQ grant will help four cities—Ciudad Juarez, Puebla, Leon de Guanajuato, and Monterrey—prepare projects to be financed eventually by the proposed program
Investment resources		
Sovereign guaranteed loan-term concessional project financing	IBRD loan	IBRD financing will be provided to a local financial intermediary, Banco Nacional de Obras (BANOBRAS), to provide credit lines to municipalities for implementation of low-carbon transport projects
Concessional long-term financing to bridge the financing gap	CTF concessional loan	CTF financing will be supplemental to IBRD and local funding to reduce financial barriers to implementation of urban low-carbon transport projects, including adoption of advanced and cleaner drive systems, scrapping programs, and internalizing some of the climate benefits that are not typically rewarded by the financial markets
Risk mitigation	At present, no risk mitigation measures are being considered	
Revenue enhancement An additional revenue stream from urban transport projects	Carbon finance	Provision of carbon revenues to boost project return

Source: Authors' data.

Insurgentes bus corridor, as well as testing various types of buses. This early support not only helped provide basic demonstration of the importance of Bus Rapid Transit systems, it also stimulated the development of a CDM methodology on such systems. This current project seeks to transfer these lessons and experiences beyond Mexico City to other urban areas.

The program is ambitious in design and scope and, if successful, will truly have a transformative impact on the urban transport sector in Mexico. It builds around an IBRD SIL of $200 million and an additional CTF concessional loan of $200 million. These resources will be channeled through the Banco Nacional de Obras (BANOBRAS), which will serve as a financial intermediary in the project. BANOBRAS will then provide loans to the participating municipalities. This will be combined with up to $868 million from the National Trust for Infrastructure (FONADIN). The private sector and the municipalities themselves are expected to make contributions of up to $732 million and $225 million, respectively. An estimate of the potential for carbon revenue payments is only approximate, but using just the existing Bus Rapid Transit methodology could add up to an additional $50 million. Urban areas that complete and propose Integrated Transport Plans will be eligible for access to the funding. Four of the eligible cities—Ciudad Juarez, Puebla, Leon, and Monterrey—are also participating in an ongoing GEF-supported region-wide transport project called the Sustainable Transport and Air Quality (STAQ) Project, which will help them prepare plans.

Although in retrospect some activities might have been structured differently or the program designed more directly, the Mexico Urban Transport Transformation Project represents the type of ambitious program with an ambitious agenda that, if successful, will demonstrate the type of synergistic, transformative outcomes that will justify the existence of these climate financing instruments.

CHINA INTEGRATED GASIFIED COMBINED CYCLE PROJECT

Despite China's interests in improving energy efficiency and shifting to cleaner energy sources, coal is expected to remain the dominant source for electricity production in the foreseeable future. In a significant effort to improve the efficiency of coal-based power plants, the government has announced plans to close down inefficient coal-based plants of an aggregated capacity of 130 GW. While China has made great strides in accelerating technological development so that the coal plants being built in China now use supercritical or ultra-supercritical technology, progress toward commercialization of integrated gasified combined cycle power plants remains limited. Higher capital and operation and maintenance costs (translated into increases in electricity tariffs) along with technology risks are cited as the key barriers to promoting IGCC. Carbon capture and storage (CCS) has been identified as one of the key technologies to climate stabilization (IEA 2008), but it has yet to be proven in commercial coal-fired power generation installations.

The World Bank and the government of China have discussed the initiation of a project to construct a first IGCC plant equipped with post-combustion CCS. Although still at early stages of discussion, the demonstration CCS system will separate the CO_2 from about 5–10 percent of the flue gas emitted from a first-stage plant; subsequently, a carbon dioxide pipeline will transport the separated CO_2 to a nearby oilfield for use in

enhanced oil recovery and permanent geological storage (see Table 12).

Government support for IGCC is based on the assumptions that the technology is more economically viable than wind and biomass under the prevalent economic and environmental conditions in China. It could become the most economically practical option among all coal-fired power generation technologies under realistically achievable conditions if the technology is commercially deployed, and is the most economically feasible option for the integration of CCS into the power generation industry.

The main obstacle to deployment of IGCC plants is their higher up-front capital expenditures, which result in elevated economic and financial costs to be translated into increased consumer tariffs. China is the largest potential

TABLE 12 PROPOSED FINANCIAL PACKAGE FOR CHINA IGCC PROJECT

Project financing need	Financial instrument	Targeted outcome
Create enabling conditions Capacity building CCS project preparation Hydrogen production and utilization studies Implementation of test programs and knowledge dissemination	GEF Grant	Establishment of a legal framework including institutional arrangements for the CCS component Equipment design specifications and updates on geological surveys Drilling tests for identification of storage capacity Assessment of options for hydrogen use in industries and transport Implementation of test programs to assess equipment performance and reliability and operational and maintenance costs Establishment of a technology advisory committee, carrying out workshops, production of publications on technical standards and guidelines for IGCC project planning and implementation
Investment resources Sovereign guaranteed loan-term concessional project financing Concessional long-term financing to bridge the financing gap	IBRD loan CTF concessional loan	Equipment procurement, site preparation, gasification technology licensing fees, and construction and equipment installation activities Incremental financing to help overcome a significant cost barrier and technology risks associated with IGCC and CCS
Risk mitigation	At present, no risk mitigation measures are being considered	
Revenue enhancement An additional revenue stream from IGCC-related efficiency gains and CCS component	Carbon finance	Funding required to develop two new CDM methodologies being provided by the CPF; Sale of project credits provides additional revenue stream, boosting project return—quantity of credits and hence revenue is yet to be determined

Source: Authors' data.

market for clean-coal based power generation, and the prospects for IGCC deployment warrant the initiation of several commercial-scale demonstration projects in the immediate future. The technology development experience of the last three decades in China shows that several demonstration projects involving a number of different industry players are necessary to learn and acquire the requisite skills and manufacturing capabilities.

To date, the discussion has centered on structuring a financing package for designing and doing feasibility studies for an IGCC plant, obtaining favorable financing terms, and finding ways to reduce risks (both technological and currency-related) and maximize additional revenue. For the preparation and feasibility work, a GEF grant of $10 million is envisioned to lay the foundation and undertake the final pre-feasibility testing. Debt financing of $100–200 million would need to be matched with a concessional loan (on similar terms to financing under the CTF) of approximately equal value. Local investment resources would have to be provided at roughly equal value to the amount of debt financing. Finally, carbon finance would have to provide an additional revenue source for a quantity of emissions reductions that is yet to be determined. An IGCC plant is being considered by the Chinese Designated National Authority (DNA) as one of the first Chinese projects to be proposed to the CPF.

It remains to be seen whether or not the structuring of this initial project along these lines will be sufficient to bring the cost of IGCC power within a competitive price range. With the financing package described, the cost per kWh would still be lower than the price currently mandated for biomass power in some parts of the grid. With cost reductions comparable to those achieved in China for pulverized coal generation technologies, IGCC could generate electricity at a level of $0.058/kWh (¥0.40/kWh) and become a financially attractive generation option within the next decade.

The purchase of carbon credits from this project is complicated by the fact that appropriate CDM methodologies need to be developed. CPF is providing a preparatory grant to facilitate the preparation and approval of this methodology. As an IGCC installation with CCS, this project will require a new methodology drawing on consolidated baseline and monitoring methodology for new grid-connected fossil-fuel-fired power plants using less GHG-intensive technology (ACM0013) and on CCS for coal-fired power plants.

If the CDM Executive Board approves the new methodology, Emission Reductions Purchase Agreements could be prepared and signed, giving a significant boost in earnings to the project operator.

This case study differs from the others as it remains largely on the drawing board. Interest has been expressed by the Chinese authorities in pursuing this project under the CPF, but China is not participating in the CTF. As a result, it is not clear when this project might move ahead. But the case study is included here for two reasons. First, it shows that with foresight and creativity, financing packages can be created to improve the attractiveness of difficult projects. Second, it shows that for a pre-commercial technology like IGCC linked with CCS, resources from all of the climate financing tools currently available still may not be sufficient to bring projects into existence.

5 BARRIERS TO COMBINING

CHAPTER 5 KEY POINTS

If combining resources from different climate finance instruments is so simple, why is it not more common? What barriers need to be removed so that combining climate financing resources becomes more commonplace?

An initial but somewhat superficial response revolves around the relative novelty of the instruments and the awareness that they can be combined. Since the CTF has only been in operation since 2009, the cumulative experience with programming is limited. For the GEF and carbon finance, which have a longer history, only recently has awareness that they do not duplicate one another and serve distinct functions allowed collaborative programming to move forward. With greater experience, combining will become more common.

A more profound answer about barriers to blending quickly focuses on three particular constraints. The first has to do with resource limitations in terms of both quantity of resources and coverage of countries. Clearly, current resources are inadequate to meet the demand for low-carbon development, so the limitation in the number of countries is a rationing device linked to the limitation of overall funding. To address these issues, the Bank needs to work not only as an advocate to raise resources to support more countries, but it must also work creatively to further leverage other sources of funding, including private sector developers, investors, and financial intermediaries currently on the fringes of the process.

The second barrier has to do with approval procedures. Because each instrument is governed differently, the approval processes differ from one another as well as from those of the Bank. Bank staff and clients may be daunted by the complex array of procedures required to combine resources. Two elements

(*continued*)

CHAPTER 5 KEY POINTS (*continued*)

hold the key to navigating this complicated procedural arrangement: familiarity and reform. Greater familiarity will enable task teams to move smoothly between processes and manage the procedures for document flow. Reforms can be applied to improve effectiveness and responsiveness of all instruments —including those of the Bank.

The third barrier is the knowledge and experience of the staff and clients working to combine resources from these instruments. This paper has been prepared to help increase the knowledge about these possibilities and to reduce the amount of collective trial-and-error. But Bank staff already possess a unique set of skills in identifying, preparing, processing, and supervising complex projects related to low-carbon growth. They represent the most promising global human resources for effective utilization of the various climate change instruments that exist to respond to the challenge of climate change in the fragmented financial architecture of the post-Copenhagen world.

Source: Authors' data.

Previous chapters have argued that the three different mitigation financing alternatives available to build support for low-carbon growth not only are consistent with one another but can be used in a complementary fashion within the same project or program in a synergistic manner to expand the effectiveness, impact, and efficiency of pursuing low-carbon development. As the interest in and commitment to low-carbon development grows, demand for support from these instruments will increase, and examples of the synergistic use of the resources from them will proliferate.

The principles of blending are fairly clear and no "rocket science" is involved. Furthermore, the evidence of the improved impact and reach from blended projects would seem to strongly support a dramatic increase in combining resources from different climate change financing instruments. Why has blending not been more common to date? Why are there not more good case studies to draw upon? Clearly there must be some identifiable barriers to blending resources from climate change financing instruments, or it would be more common by now. What are the barriers to blending, and what can be done to overcome them?

A superficial response to this question would point to the relatively short time period in which the three climate financing instruments have been in place. Only one year has passed since the CTF was implemented. That there is any experience with blending its resources with those of the other two is a testament to the efficiency of the processes and the pent-up demand for support. For the two longer-lived instruments (the GEF and CTF), it was only recently that their distinct natures and emphases became known. So the examples that are used are also fairly recent in nature and may have occurred during implementation rather than during project inception.

But a more serious examination of the barriers to blending highlights three different issues. First,

and most important, the funding available through these instruments is inadequate. Second, the approval procedures are complex and somewhat daunting. Third, sophisticated skills and specialized knowledge are necessary to be able to weave resources from these different financial instruments into whole cloth. This chapter addresses these barriers.

RESOURCE ADEQUACY

The first barrier to the expanded blending of climate change mitigation financing instruments is the sheer lack of resources. The World Bank has estimated the need for financing of low-carbon or mitigation activities in its client countries at upwards of $200 billion per year of incremental or additional financing. With the three climate financing instruments discussed here, the total funding may run as high as $5 billion per year, of which less than half is available as up-front financing. Clearly, there is an order of magnitude difference in the amount of funding available and the amount required.

One of the rationing devices put in place to deal with the limited quantity of available resources is a limit on the resources available to any given country. Under the GEF, the resource allocation framework was imposed during GEF-4 to place an upper limit on the amount of funding any country could obtain. Most countries—110 out of 140—received an allocation that was approximately $1.4 million. Thirty countries received allocations ranging from $4 million to $ 150 million, with the amount being tied closely to the country's GHG emissions. In the CTF, an early decision was taken to limit the number of participating countries to no more than 15 so as not to spread the resources too thin. By and large, the countries participating as recipients in the CTF are large emitters (but not the largest ones).

Under carbon finance, resources naturally flow to the countries with the greatest potential to reduce future emissions. As a result, China has been the dominant supplier in the carbon market to date. Although the World Bank's carbon offset portfolio is more geographically balanced than that of the world as a whole, the bias toward large emitters is consistent across these sources. Small middle-income countries and low-income countries will receive little financing from these climate financing sources.

Practically, this resource limitation will constrain the ability of the World Bank to respond to requests for low-carbon development support in all of its client countries. No matter how much the Bank would like to comply with the requests it receives, it will not, under current or foreseeable circumstances, be able to meet the requests it receives. It can respond by working harder to leverage additional resources not just from the public sector but especially from the private sector by using its convening power, strengthening enabling environments, providing guarantees and risk mitigation where appropriate, and working directly through the IFC to reach the private sector directly. This is not new: carbon finance is directed at bringing private sector compliance resources into the developing country mitigation and sustainable development picture. Both the GEF and CTF have well-articulated private sector policies and eagerly seek innovative ways to bring private sector developers, investors, and financial intermediaries to the table (GEF 2005, CTF 2010). But still, more resources are needed.

In response to the resource limitations and the constraints that it places on Bank programming, the Bank can best become an advocate for greater funding for low-carbon growth and a wider distribution of the mitigation resources that it has under its control. The solution is not operational but rather political. In this context, the Bank needs to continue to push for deeper and wider

climate change funding provisions, so that it can help its clients achieve their low-carbon development goals.

APPROVAL PROCESSES AND PROCEDURES

Because the different financial instruments fall under different governance structures, their approval processes differ according to the specific opportunities and constraints faced under that structure. World Bank staff members are accustomed to steering projects through the processes associated with Bank Board approval. Any other approval process will look complex and difficult to those unfamiliar with it.

On the one hand, familiarity with both the required documents and the approval processes of these instruments provides a key to understanding how to smoothly sail through the approval process associated with all instruments. On the other hand, the insistence of the decision makers of a particular financial instrument on a particular procedure or set of procedures does not mean that the procedures cannot sometimes be changed with positive effects. All such decision making experiences bureaucratic creep, with new requirements being incrementally added to a process that may have originally been relatively swift. Hence, reform serves as a second key to managing these processes and making them more streamlined for the same efficiency and effectiveness.

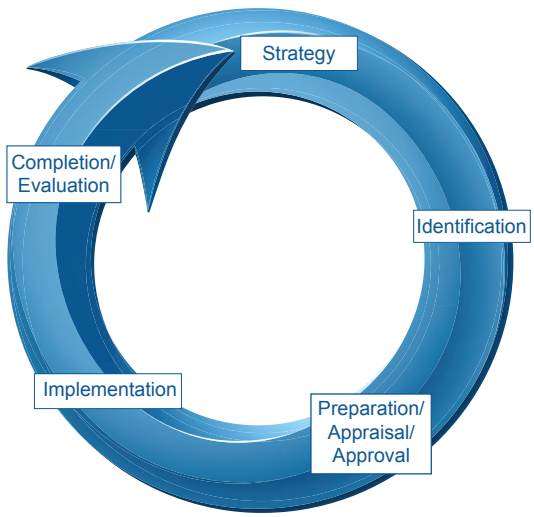
FAMILIARITY

The project cycle is familiar to Bank task teams and clients, as it has been used to identify, prepare, appraise, approve, implement, complete, and evaluate development projects for decades. Ultimately, the Bank's Board of Executive Directors oversees this process, and it is Senior Management's job to ensure that all tasks are completed to the satisfaction of the Board and its client countries. This cycle is well known and described throughout the development literature. It is summarized in simple schematic form in Figure 9. It begins with a country's development strategy and moves through the stages of project identification; preparation, appraisal, and approval; implementation; and completion and evaluation. While different but similar versions of this cycle exist for different development agencies, this one has been fine-tuned to the needs of the Bank.

One of the challenges of working with these different sources of climate change finance is that each has its own governing body and approval procedures. As a result, the project cycle for each financing instrument differs, because each of them makes use of a different governance mechanism. Inevitably, this complicates the process of preparation, approval, and implementation for projects seeking to use MDB funding in collaboration with any of these dedicated funding sources.

An IBRD or IDA project builds upon the directions set in the Bank Group Country Partnership Strategy (CPS), or Country Assistance Strategy, which are supporting government plans and strategies, such as the Poverty Reduction Strategy typically prepared by IDA countries. CAS and CPS are documents that are prepared by the Bank in consultation with country stakeholders and approved by the country. The identified project concept is described in a Project Concept Note and approved by the respective country director. At this stage in a project's life, all information is made publicly available via the internet and the Info-Shop. The next step is to prepare an

FIGURE 9 THE PROJECT CYCLE



Source: Adapted from World Bank OPCS Home Page.

appraisal document, the terms of which are negotiated with the client country's representatives prior to being approved by the Bank's Board of Executive Directors. Once the project is approved by the Board, it is presented to the client government to obtain sovereign approval prior to effectiveness.

Once a client has decided to undertake a low-carbon growth project or program with the assistance of the Bank, the question to be asked revolves around what the specific needs of the project might be. As discussed in Chapter 3, for example, a renewable energy project might require support to make the policy environment more favorable to renewable electricity, financing on favorable terms to compensate for the capital-intensive nature of renewable energy, and some revenue enhancement. Identifying these needs in the low-carbon growth project or program being pursued is an important first step.

A second step is a frank assessment of the possible climate financing instruments that are available to help meet the extra costs associated with the special needs of the low-carbon growth effort. If GEF resources would be helpful, the GEF Focal Point needs to be consulted with respect to the quantity and suggested deployment of those resources, as he or she will ultimately be the one requesting the GEF allocation. It is hoped that this consultation takes place early in a GEF replenishment round so that all resources have not been pre-committed. If a project will require concessional financing from the CTF, it will be important to verify first that the country is a CTF participant, as only 13 investment plans (12 countries plus one regional plan) have been approved thus far (see Annex Table A-2). Second, the proposed project will have to be included in the country's endorsed investment plan or the plan will have to be modified to allow for the project. Finally, for carbon finance, any initiative

must first be approved by the Designated National Authority (DNA) prior to being registered and certified through the CDM Executive Board. But there also need to be significant potential carbon reductions to justify the extra work entailed in gaining approval and registration.

In general, if resources are not available from these sources for the needs identified, other sources of potential funding will have to be canvassed prior to abandoning the concept. At present, the bulk of the mitigation resources are concentrated in a handful of countries, and it would be prudent to anticipate the availability of resources before committing to work on low-carbon projects that require them.

Such preliminary assessments need to be undertaken early in a project's life to set the direction of further project preparations. If a project can be successfully implemented without using any of the climate financing instruments, then there is no need to complicate matters by trying to use them. Grant and concessional resources will always be in short supply. Some mitigation projects, such as energy pricing reform or the adoption of standards and labels for energy-efficient appliances, can be undertaken with the use of traditional development finance or technical assistance sponsored by GEF, grants from other donors, or Bank loans. The goal is not to use all existing sources of climate change financing in the same project, but rather to appropriately blend only those resources necessary to make the project effective. In some cases, the transaction costs associated with packaging various financial instruments may offset the benefit of that packaging.

Once this stock-taking regarding needs and availability of climate financing has been realistically undertaken, the project preparations need to make their way toward approval. However, it is important to bear in mind that the approval procedures for each climate funding instrument reflect its specific governance structure. At the concept level, the project needs to be approved not just by the Bank's country management unit but also by the GEF, CTF, and CPF or carbon finance operations. Similar documents covering the conceptual rationale, justification, and likely results must be prepared for submission to each approval body. (The documentation required for approval for each source is summarized in Annex Table A-3). The Project Concept Note being used in the Bank's own process can be submitted to the Trust Fund Committee (TFC) of the CTF for its endorsement. In this case, the document will need to make the case for transformational impact.

For the GEF, a Project Identification Form (PIF) needs to be submitted to the GEF Secretariat for review and eventual approval by the GEF Chief Executive Officer (CEO) and Council. The emphasis in such a presentation will be on the incremental reasoning: Why is GEF funding needed to make this proposed activity happen? For a project seeking carbon finance, a Project Design Document (PDD) will need to be prepared and submitted to the DNA and the CDM Board. To be more efficient, it is preferable for that submission to make use of a methodology that has already been approved by the Board. The submission will need to focus on how the project is "additional" and would not happen in the absence of the CDM support. But at the concept level, the documents being prepared and the arguments being advanced are all fairly similar, and they may well be undertaken in parallel or, at a minimum, with frequent "cutting-and-pasting."

At the appraisal stage, the focus for the GEF and the CTF turns on the Project Appraisal Document (PAD). As this document is also needed for the Bank Board's approval, there are some efficiencies in preparation. Both the GEF

Council and the CTF Trust Fund committee will review the same document as the Bank's Board, simplifying the document preparation process.

For a carbon finance operation, the process remains distinct from those of the Bank, the GEF, or the CTF. Once a CDM proposal has been validated at the PDD stage, an emission reductions purchase agreement is negotiated, approved, and signed by the Bank acting as Trustee. After receiving the Letter of Approval from the DNA, the CDM Executive Board will register the project. Once the flow of emission reductions from the project is initiated, the Designated Operational Entity must monitor and verify the project's performance in generating emission reductions, usually on an annual basis. The verified emission reductions are then certified by the CDM Board, which issues the CERs to the national account of the buyers. (Joint Implementation has similar but separate procedures to those described here for the CDM.) This process continues providing the flow of emission reductions until the termination of the ERPA.

How long will these extra steps take? To date, the small number of CTF projects that have progressed through the approval process have resulted in only minor delays compared with those of a non-CTF World Bank project. For GEF projects, the PAD process can take anywhere from six weeks to six months as the GEF Secretariat reviews the documents to confirm that they are consistent with the concepts contained in the PIF prior to submitting them to the GEF Council for a four-week review period. Considerable streamlining could occur if this second review of the project by the GEF Secretariat and Council could be delegated to the Bank's Board. But because the GEF and the CTF are framed within the multilateral development assistance system, efforts to reduce delays can be encouraged through reform.

For carbon finance operations, the largest delay is encountered when initial methodologies are submitted for approval. In these cases, the approval of a methodology may take up to two years. Hence, the importance of fitting projects within the framework of already existing methodologies. If a project uses an existing methodology, then the delays would be a matter of months and might be constructively designed to coincide with the other dead times (final approval, reviews, waiting for effectiveness) found in the Bank's normal operations.

When considering the procedures and processes required for combining climate financing into the same project, it is useful to enter the process with eyes open. Time can be saved by using similar documentation and by working around the waiting periods or "dead time" in each of the project cycles being managed. Client and staff need to be aware of both the strengths and the limitations of the funding sources as well as the extra steps in the processing schedule so that they can anticipate them to ensure smooth delivery, approval, and implementation of low-carbon development projects.

REFORMS

While all three climate financing instruments that serve as the focus of this paper have been shown to be effective in their own right, their effectiveness and timeliness can be improved. Reforms should seek to reduce delays in preparation and approval, to improve conceptual clarity and responsiveness to client's needs, and to increase overall ease of blending for greater impact. All three climate financing instruments will continue to evolve and improve in response to experiences of being used individually and in blended format. And, it is important to note, so will core WBG instruments and processes.

Investment lending reform aims to make the Bank Group more responsive and to better differentiate risks.

All low-carbon development projects do not require financing from all or even any of these financing instruments. Some projects focusing on energy pricing reform or building energy efficiency may not require any funding beyond that available from normal Bank or official development assistance sources. Others may require more resources than can be mustered and therefore may still not be implementable. The intention should be to use only the mitigation resources necessary to make the best low-carbon growth projects move ahead into implementation. Different countries, sectors, technologies, or approaches may require differing combinations of resources in order to ensure project success. In this context, blending must be seen as a means to an end, not an end in itself.

As the newest of the climate financing instruments, operational experience with the CTF has been limited to date. Only a handful of projects have made it through the screening of the Trust Fund Committees to final approval. As the approval procedures of the CTF are closely aligned with those of the implementing MDB, however, it is unlikely that significant delays will be attributable to the CTF review and approval procedures. To date, the CTF has made an impressive and timely start in its operations by building both on Agency procedures and on existing in-country knowledge, information, and capacity. One further advantage in this regard is that CTF operations require blending with MDB lending and, wherever possible, with GEF and carbon finance operations as well. Nevertheless, as the CTF matures, evaluators will begin to consider what reforms would help improve its efficiency, effectiveness, and responsiveness over the longer term.

The GEF, as the oldest of these instruments, has undergone numerous evaluations and reforms since its inception during the early 1990s. Reforms have typically focused on reducing delays, improving responsiveness, and increasing impact. Delays have always been a concern of project teams and clients. As a demonstration of this, the average time from concept approval to project implementation across all Agencies was estimated at 44 months in 2006 (GEF Evaluation Office 2007). Subsequent reforms have improved this situation and the imposition of a 22 month deadline is meant to bring finality to the project preparation process. One concrete reform suggested for GEF 5 is to delegate the final or second review by the GEF Secretariat and Council to the Executive Board of the MDB implementing the project. (This reform would apply only to projects implemented by MDBs, as U.N. Agencies have no full-time standing Boards of Directors able to undertake such reviews.) For World Bank projects, this would simplify the approval procedures and reduce delays by at least two months. Other reforms that will be considered for GEF 5 include flexibility for a country to shift funds from a focal area with few resources to one with greater resources in order to improve responsiveness, reduce administrative costs and delays, and improve impact. Bank task teams can simplify GEF procedures by working strategically to blend GEF resources more seamlessly with national investment resources (IBRD, IDA, and national) with national priorities. This also would reduce transaction costs and enhance impacts.

Carbon finance also stands in need of reform at two levels: the system-wide level and the Bank's operational level. System-wide reforms would have to be agreed upon in the UNFCCC and Kyoto Protocol context. But many critics, including the Bank's Carbon Finance Unit, have highlighted the need for clarity and simplification in the determination of a project's additionality.

Because methodological approval and project registration require roughly two years, actions are needed to expedite this process. Such reforms would no doubt be welcomed by all the concerned participants in the carbon market.

Based upon lessons to date, the Bank is working to improve effectiveness, simplify procedures, and reduce delays in its carbon finance operations (World Bank 2009c). For example, the initiative to define PoAs to cover energy efficiency programs or urban mitigation programs have been spearheaded largely by the Bank. PoAs have been shown both to increase administrative efficiency and to improve ownership and commitment of client country teams. Task teams working with carbon finance can also reduce delays by seeking to use approved methodologies. On another level, teams should also seek to tie carbon finance operations more closely to Bank lending operations. Under the CPF, this has become an explicit objective, and to date all CPF projects under consideration are tied to Bank and—where possible—CTF and GEF operations.

Since the formation of the Prototype Carbon Fund, the Bank has played a lead role in developing and pioneering CDM methodologies. This role will no doubt continue to be an important one. But as the carbon market has grown, the share of total market issues made up of emission reductions from Bank-managed funds has decreased to as little as 1 percent. In light of this fact, the Carbon Partnership Facility will emphasize catalyzing the development of carbon finance programs and assisting its clients to sell carbon assets tied to Bank operations. The CPF is already actively encouraging sales to a broader market by limiting the fraction of a project's carbon credits that can be purchased by the CPF, leaving the clients free to sell the bulk of the credits to other buyers in the carbon market.

KNOWLEDGE AND EXPERIENCE

While reforms will improve the efficiency, effectiveness, and impact of climate change mitigation finance, it will still fall to committed practitioners to prepare blended projects. This paper is meant to provide them with the knowledge and skills that are needed to be able to prepare and implement these relatively complex operations. For example, the Climate Change for Development Professionals Program has prepared training modules dealing with all these instruments in order to share the knowledge and experiences with World Bank staff in all regions.

Although the challenge of blending resources from different mitigation financing instruments does not require rocket scientist skills, it does require a specific skill set, knowledge, and experience to be able to implement. Experience may be the best teacher. Optimizing the mix of resources for a low-carbon development project represents an intellectual puzzle with practical implications for both development and the global climate system. Innovative sustainable projects with transformational potential are possible only if the necessary information—in this case, information about the nature of financial instruments—is available.

The lack of a comprehensive, over-arching climate change financial architecture in the wake of the Copenhagen Accord means that ambitious climate finance packages will continue to be assembled from different sources for the foreseeable future. As a result, the skills and knowledge of combining them to respond to client needs for low-carbon growth will become increasingly important. It is hoped that this paper will help development professionals and clients better manage the unavoidable complexities associated with development projects that lay the foundation for a low-carbon sustainable future.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ANNEX 1
FINANCIAL INSTRUMENTS FOR MITIGATION FUNDING
A BRIEF SUMMARY

Dedicated climate financing instruments have been created in order to provide additional financial and economic support to make low-carbon development more attractive to the World Bank's developing country clients.

The Global Environment Facility (GEF) was established in 1991 before the United Nations Convention on Environment and Development to provide incremental cost financing for projects with global environmental benefits. It commits about $250 million per year—largely in the form of grants to non-Annex I Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in support of energy efficiency, renewable energy, new clean energy technology, and sustainable transport projects. Table A-1 provides a cumulative summary of the GEF funding committed to World Bank–implemented climate change projects. For more information, see www.thegef.org.

The Clean Technology Fund (CTF) was established in 2008 as one of the Climate Investment Funds, a family of funds devoted to climate change initiatives hosted by the World Bank and implemented cooperatively by the multilateral development banks. It provides limited grants, concessional loans, and partial risk guarantees of as much as $200 million per project to help countries scale up clean technology initiatives that will transform a country's development path. Table A-2 summarizes the allocation of CTF funding to approved investment plans as of December 7, 2009. Further information is available at www.climateinvestmentfunds.org.

Carbon finance refers to the use of the flexible mechanisms of the Kyoto Protocol. Registered projects resulting in greenhouse gas emission reductions located in developing countries or economies in transition obtain emission reductions that can be traded in the market, thereby providing a performance-based revenue stream to the project. In 1999, the Bank created the first carbon fund in the world, the Prototype Carbon Fund (PCF). The newest initiative of the Bank's carbon finance unit is the Carbon Partnership Facility (CPF), which brings buyers and sellers together to focus on national priorities and strategies and to develop carbon revenue streams around projects and programs of interest to both. Figure A-1 summarizes the cumulative allocations and emission credits associated with World

Bank implemented carbon funding. Figure A-2 provides an indication of the range of unit abatement costs for various types of carbon finance projects. More information is available at www.carbonfinance.org/cpf.

TABLE A-1 GEF CLIMATE CHANGE FUNDING TO THE WORLD BANK BY REPLENISHMENT PERIOD (MILLION DOLLARS)

	Total GEF grant amount	IBRD/IDA co-financing	Other co-financing	Total co-financing	Total
GEF Pilot Phase (1991-1994)	186.1	908.5	2,450.5	3,359.0	3,545.1
GEF 1 (1995-1998)	363.6	413.6	1,193.4	1,607.0	1,970.5
GEF 2 (1999-2002)	456.2	1,094.2	2,639.1	3,733.3	4,189.5
GEF 3 (2003-2006)	341.6	443.2	1,101.7	1,545.0	1,886.5
GEF 4 (2007-2010)*	351.4	1,106.7	2,359.7	3,466.4	3,817.8
TOTAL (1991-2009)	**1698.9**	**3,966.2**	**9,744.4**	**13,710.7**	**15,409.4**

Note: * Because GEF 4 runs from 2007 to 2010, the Table only includes a summary until the end of FY 2009.

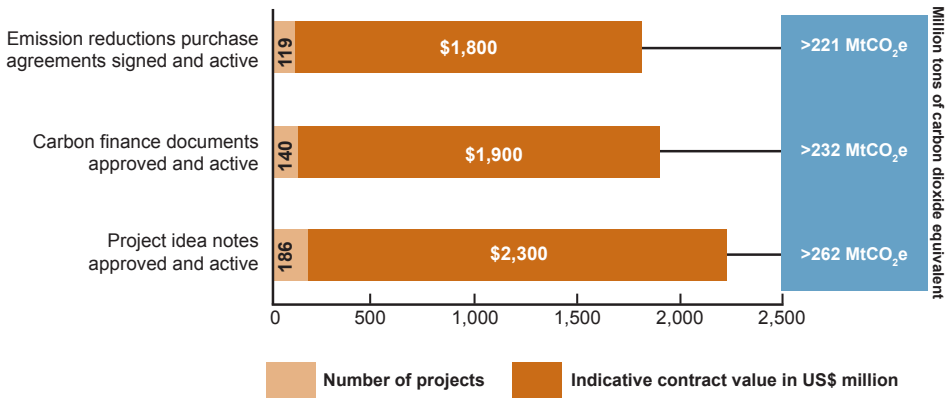
Source: Authors' data.

TABLE A-2 CLEAN TECHNOLOGY ENDORSED INVESTMENT PLANS: SUMMARY AS OF MARCH 31, 2010 (MILLION DOLLARS)

	Estimated CTF contribution	Estimated co-financing	Total
Colombia	150	2,845	2,995
Egypt	300	1,621	1,921
Indonesia	400	2,710	3,110
Kazakhstan	200	1,069	1,269
Mexico	500	5,697	6,197
MENA CSP Program	750	4,854	5,604
Morocco	150	1,800	1,950
Philippines	250	2,530	2,780
South Africa	500	1,850	2,350
Thailand	300	3,963	4,263
Turkey	250	1,850	2,100
Ukraine	350	2,255	2,605
Vietnam	250	3,195	3,445
Total	**$4,350**	**$36,239**	**$40,589**

Source: Data drawn from CTF Web Site: http://www.climateinvestmentfunds.org/cif/Country%20Investment%20Plans.

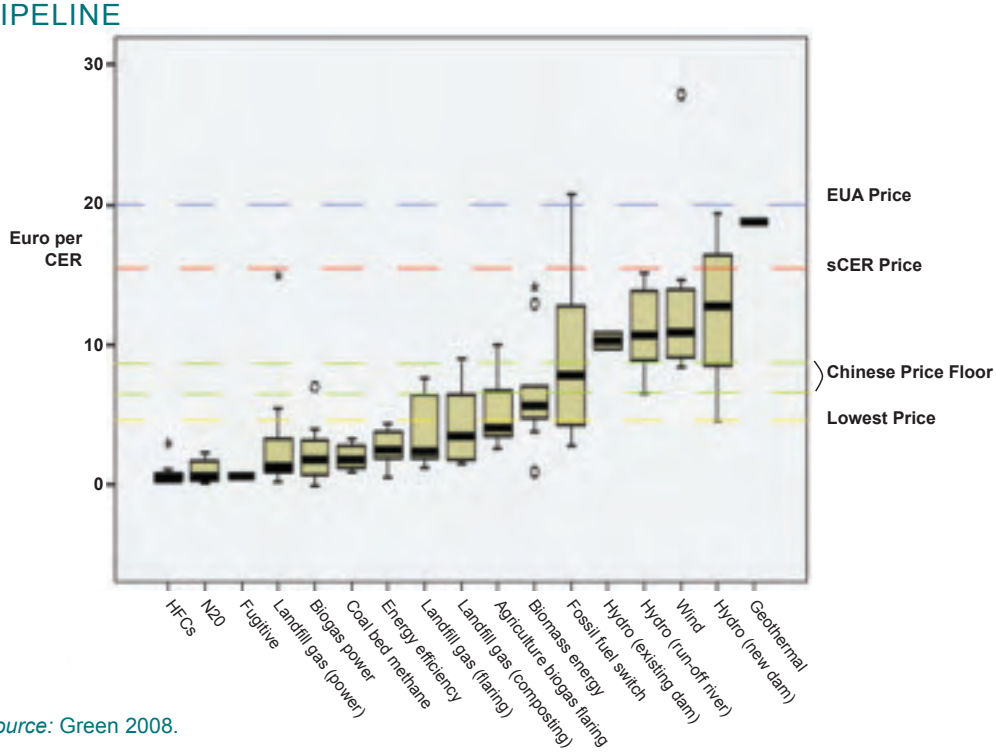
FIGURE A-1 WORLD BANK CARBON FINANCE PROJECT STATUS (CUMULATIVE)



Note: The above figures exclude options purchases.

Source: World Bank Carbon Finance Unit data.

FIGURE A-2 COSTS OF CERS FROM PROJECTS IN THE CDM PIPELINE



Source: Green 2008.

ANNEX 2
PROJECT DOCUMENTATION

The documents that need to be prepared at various stages of the project cycle are summarized in Table A-3. Basically, they fall into categories consistent with the different stages of the project cycle. For the strategy development stage, a regular Bank operation should be tied to the strategy developed and presented in the Bank's Country Assistance Strategy (CAS) or Poverty Reduction Strategy Paper (PRSP). But the providence for operations using mitigation financing will require this origin as well as a link to a national strategy on its own. For example, GEF support would ideally come from needs identified in the country's national communication to the UNFCCC. CTF projects need to be based on the approved investment plan for the country. Carbon finance operations require endorsement from the country's Designated National Authority (DNA) stating that the project is consistent with the country's sustainable development needs. In addition, the CPF requires that operations in partner countries fall within a range of partnership priorities.

At the project identification or concept stage, Bank operations require a Project Concept Note (PCN). The PCN also meets the requirements for CTF support, but an independent expert review is required at this stage. The GEF concept document, the Project Identification Form, presents similar material to a PCN but requires additional information regarding the rationale justifying the GEF's incremental financial contribution. For a carbon finance operation, the Project Idea Note basically contains similar information as the PCN but requires additional information on the emission reduction estimates and methodology to be used for Clean Development Mechanism (CDM) Board approval, including verification and certification.

For appraisal and approval, the Project Appraisal Document (PAD) is required for Bank operations and is the key document for GEF Council endorsement as well. CTF operations require a "no objection" review from the CTF's Trust Fund Committee members for the preappraisal package. For carbon operations, a Project Design Document (PDD) must be prepared for verification and approval by the CDM Executive Board, and the emissions reduction purchase agreement is negotiated and signed between purchaser and sponsor.

During project implementation, Bank operations—including the Bank's GEF and CTF operations, where the Bank is an implementing agency—make use of Bank monitoring procedures, producing an Interim Status Report (ISR) each year and a Midterm Review (MTR) at the project's midpoint. The Implementation Completion Report (ICR) is prepared and submitted to the Bank's Independent Evaluation Group (IEG) for consideration at the time of project completion. All GEF operations require an independent evaluation. For carbon operations, the monitoring requires periodic progress reports until construction is completed, at which point the CDM project proponent or the designated third party (e.g., consultants) begins monitoring project output and emission reductions and producing monitoring reports. These reports are then verified by the Designated Operational Entity (DOE) and certified by the CDM Executive Board, and certified emission reductions (CERs) are issued. This process continues until the end of the emission reductions purchase agreement (ERPA) period, with no requirement for final evaluation.

TABLE A-3 DOCUMENTS REQUIRED DURING PROJECT CYCLE

Stage of project cycle	IBRD/IDA project	GEF project	CTF project	CF project (when linked to Bank operation)
Strategy	CAS or PRSP	Project should be justified in CAS, also in UNFCCC National Communication	Investment plan prepared by Joint MDB mission must be approved by government and Trust Fund Committee	Consistent with national priorities; DNA must approve
Identification	Project Concept Note	Project Identification Form: similar to PCN with additional emphasis on incremental rationale	Single PCN for the IBRD/IDA and CTF co-financing with additional emphasis on consistency with CTF criteria	Project Idea Note: similar to PCN except it emphasizes carbon flow, methodologies for verification and monitoring; less information required on financing arrangements
Preparation, Appraisal, and Approval	Project Appraisal Document	PAD same as for IBRD/IDA but includes incremental cost annex and GEF-required indicators Chief Executive Officer Endorsement Memo required to highlight key points	Single PAD for the IBRD/IDA and CTF co-financing, with a CTF-specific annex and inclusion of CTF indicators in the PAD Results Framework	PDD: As per CDM/Joint Implementatoin rules including baseline study, emission reduction estimates, etc. PAD prepared separately Anticipated terms of ERPA Registration of Project/ Determination Report; and Operations and Monitoring Plan.

(*continued*)

TABLE A-3 DOCUMENTS REQUIRED DURING PROJECT CYCLE
(*continued*)

Stage of project cycle	IBRD/IDA project	GEF project	CTF project	CF project (when linked to Bank operation)
Implementation and Supervision	Implementation Status Review and Midterm review	ISR submitted annually and MTRs provided when available	Single ISR for IBRD/IDA and CTF co-financing submitted annually	Monitoring report produced by project entity Annual Verification Report (prepared by DOE) Annual certification and issuance of CERs by CDM Executive Board If project closes prior to or during ERPA or crediting period, supervision responsibility is passed back to the Carbon Finance Unit(ENVCF)
Completion	Implementation Completion Report	ICR plus mandatory independent evaluation	Single ICR for IBRD/IDA and CTF	Project crediting ends at the end of the crediting period—frequently, but not always, the end of the ERPA period
Evaluation	ICR submitted to IEG for random evaluation	IEG reviews ICR and conducts project performance audits following IBRD/IDA procedures	IEG reviews ICR and conducts project performance audits, following standard IBRD/IDA procedures	Closing date of the carbon finance transaction occurs after the final payment of the signed ERPA; an ICR will be completed either by the Task Team Leader or the Deal Manager, depending on whether project is under supervision of ENVCF or Regional Vice President

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