

# New Mechanisms for Financing Mitigation

## Transforming economies sector by sector



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Discussion Paper  
March 2009

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## 1. Introduction: A Breakthrough Design

The UNFCCC negotiations are moving forward in modest ways but, to date, they have left the diplomatic landscape littered with uncertainties that have tended to polarize positions among country groupings and have generated a sense that finding common ground on the general contours of a global climate agreement at Copenhagen will be a Herculean task. Yet, while negotiations may remain arduous in coming months, many initiatives are being offered from a wide range of stakeholders to help facilitate reaching agreement on a post-2012 climate deal.

In the pages that follow, we present the general framework for a Global Financial Mechanism (GFM) to provide new and additional financial resources to developing countries on a grant or concessional basis to support fulfillment of the purposes of the Convention through mitigation, adaptation and technology cooperation. This financial mechanism operates under the guidance of the Conference of the Parties (COP) that sets policies, program priorities and eligibility criteria for operations carried out under its purview. Yet, while ensuring the overall integrity of the mechanism, the COP entrusts all of the operational aspects of this financial mechanism to one or several operating entities that translate the Convention's mandate into operational terms, including allocating and disbursing funds, establishing technical and performance criteria and providing other technical assistance as needed.

This document examines two fundamental elements of the Global Financial Mechanism and the specific institutional arrangements to make it operational. In the first chapter, we examine the GFM's operating entity, called the Climate Oversight Commission (COC), which is responsible for managing the mitigation framework established by the Convention. In addition to examining the Climate Oversight Commission's functions, we will also discuss the functions of accessing entities, the role of a Sector Transformation Registry and the different paths of direct and indirect access for receiving public grant finance to support mitigation activities. In the second chapter, we examine the functioning of a Sector Transformation Fund (STF) whose purpose is to provide financial resources to shift high GHG-emitting economic sectors of developing country economies to lower-carbon trajectories. In this chapter we will examine the three operational phases of the Sector Transformation Fund and how different sources of financing can be used to support reforms in high-carbon economic sectors of developing countries.

This document's focus on mitigation in no way diminishes the importance of developing precise proposals for responding to the challenges of adaptation and technology cooperation, the two companion pillars covered by the Convention. Both adaptation and technology cooperation need to be addressed as separate, albeit complementary, components of a Copenhagen treaty and the to-be-established Global Financial Mechanism and, for each, basic issues of financial requirements, funding sources, allocation and disbursement mechanisms and other operational issues need to be clarified. Many of the issues covered in our discussion of the Global Financial Mechanism have immediate relevance to both adaptation and technology cooperation.

We believe that the Sector Transformation Fund managed by the Climate Oversight Commission presented in considerable detail in following chapters represents a major breakthrough in helping reach a post-2012 climate agreement for three critical reasons:

1. The STF provides a three-phased approach that can assist developing countries transform no fewer than 100 high-carbon emitting economic sectors in developing countries to low-carbon trajectories. By moving through Preparation, Initiation and full Implementation phases, developing countries can:
  - Establish national priorities for reforming economic sectors;
  - Prepare long-term sector mitigation strategies;
  - Determine both amounts and types of funding required in all phases of those strategies; and
  - Make sector specific reduction commitments only when fully prepared to engage.
2. By differentiating the types of costs (incremental vs. non-incremental) in the three phases, the Sector Transformation Fund can initiate sector transformation actions with comparatively modest financial resources provided by industrialized countries directly. Other financial resources provided under the UNFCCC/COP or resources outside the Convention but aligned with measurable, verifiable and reportable (MRV) requirements requested by it, would be harmonized to respond to developing country financial needs for sector transformation. The phasing of different financial requirements over the 10- or 20-year duration of sector change allows developing countries governments, developed country governments and actors in financial and carbon markets to plan and stage financial commitments. This approach can help by-pass the stand-offs that insist that developing countries need to commit to large mitigation targets before knowing how much those commitments would cost and who would pay for them, or that Annex 1 donor countries need to commit large amounts of funding before knowing how the resources would be used and what reductions would be achieved. A viable sector transformation fund would require start-up commitments from industrialized countries in the order of \$10B for the first 5 years of operation, growing to \$35B in the second 5-year period;
3. The Climate Oversight Commission and the Sector Transformation Fund provide the governance and institutional arrangements required to deliver technical and managerial support in response to the differentiated economic levels and institutional capacities of developing countries. The proposal identifies institutional mechanisms that will satisfy the fiduciary and transparency requirements established by under the authority of the COP while opening both direct and indirect access paths to financial and technical resources for developing countries.

The benefits offered by the Sector Transformation Fund managed by the Climate Oversight Commission do not stop there. The design of the STF is based on specific sector analyses of high-GHG emitting countries such as cement and iron/steel in China, cement and iron/steel production in Mexico, coal-based power generation in India, and on mitigation challenges in small developing countries such as Tunisia. By grounding the financial mechanism in the complex realities of these and other countries, we have shifted discussion about financial resources and commitments from the realm of the abstract and global to the real needs of developing countries. This shift opens many opportunities for public and private actors to anticipate and prepare for long-term investments in the restructuring of those sectors with corresponding economic and emission reduction benefits.

While governments around the world are focused on stabilizing their economies and rekindling growth during this time of global economic crisis, pressures may build to forestall undertaking economic reforms in key industrial sectors or committing financial resources to support climate change mitigation in the developing world. The phased transformation process and identification of types of financial resources required in each phase provides reassurance to industrialized governments that start-up financial commitments will not jeopardize the ability of those governments to address domestic financial needs. For developing countries, the Sector Transformation Fund approach provides assurance that they will be in control of their mitigation initiatives and that any reduction commitment will be the result of a thorough understanding of technology needs, costs and funding opportunities.

In coming months we will engage public official and private sector leaders in exploring the applicability of this approach to their respective countries and economic sectors. At this initial stage of our public dialogue we would like to highlight a number of issues that need to be clarified in coming months and that would benefit from public input, as follows:

1. The estimate of minimum contributions from industrialized countries needed to adequately support a new Sector Transformation Fund under the UNFCCC is based on a bottom-up and a top-down approach. The bottom-up estimates are based on case studies examining the cost of mitigation in selected sectors of developing countries and ongoing experiences with mitigation funding. The sources of the top-down estimates are the UNFCCC 2008 estimates of world-wide incremental investment and financial flows needed for mitigation and adaptation in the year 2030 and the McKinsey “Global GHG Abatement Cost Curve”. There are concerns that the UNFCCC estimates are not based on the imperative to secure a less than a 2°C increase threshold and hence may underestimate the true costs of mitigation. Please provide an opinion on the use of these two sources and estimates and, if suggesting different or additional approaches, please provide references to the appropriate data.
2. The Global Financial Mechanism proposal suggests that the funds indicated herein must come from industrialized countries and must be disbursed through grants. However, this proposal does not propose or endorse a specific approach for mobilizing funds, be it through AAUs auction, carbon tax, contributions based on GDP or other means, that would be disbursed as publicly-funded grants. Should the GFM proposal endorse a specific fund raising approach and, if so, which approach, which funding mechanisms and why? And, in keeping with the type of funds proposed, what consequences, if any, would this funding source and mechanism have on the architecture of the Global Financial Mechanism?
3. Regarding carbon markets, the proposal promotes enhanced involvement of carbon market finance in the second and third phases of the Sector Transformation Fund where public grant funding from the STF would play a diminished role in specific eligible sectors. But how can this enhanced interaction be operationalized? For example, should there be a separate UNFCCC carbon market operating entity that independently would assess the viability of sector strategies that rely on carbon market finance? Should that same entity regularly review and provide oversight as to whether the UNFCCC’s carbon market rules and guidelines are in place and being respected in actual operation? Should there be emission discounts to reward the quality of mitigation results in specific countries or sectors? Should there be an established waiting period following implementation of specific activities to ensure the integrity of the reductions and avoid

market overflows? How should the carbon credits resulting from the mitigation activities undertaken with multiple sources of financing be distributed?

4. The Climate Oversight Commission reports directly to the COP and is charged with ensuring the operational integrity of mitigation activities undertaken to fulfill the purposes of the Convention. But are the COC's institutional arrangements adequate to protect the interests of non-Annex I countries as well as the performance standards and fiduciary requirements of industrialized countries? Can the Climate Oversight Commission provide an appropriate framework for the harmonization of the multitude of mitigation funds established over the past months? Are those arrangements flexible and responsive enough to the different technological, financial and institutional conditions in very different developing countries?

5. The Sector Transformation Fund proposal focuses on funding for mitigation, thereby necessarily establishing a dynamic relation with funding for technology cooperation and innovation. Do you have specific proposals as to ways of organizing and expediting funding for technology cooperation and innovation under the UNFCCC?

6. The proposal presented herein assumes that a climate agreement reached in Copenhagen will establish a broader financial framework and architecture, what we have called the Global Financial Mechanism, that will include adaptation and technology cooperation along with mitigation, the specific focus of this paper. Do you have specific suggestions as to how the Climate Oversight Commission and its Sector Transformation Fund, which focuses on mitigation, can be linked to and harmonized with specific institutional arrangements associated with adaptation and technology cooperation?

7. We would welcome interpretations as to whether the Global Financial Mechanism and its Sector Transformation Fund would be compatible with a number of financial mechanism and fund proposals, including from Mexico, China, Norway, Brazil and McKinsey, among others, presented to the UNFCCC Secretariat or the broader public.

We encourage written comments to be sent to [MPO@wwfus.org](mailto:MPO@wwfus.org) by April 17th, 2009.

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March 1 2009



## 2. The Global Financial Mechanism

### 2.1 Context

Governance and institutional arrangements for the financial mechanism of the UNFCCC promise to remain among the most contentious issues in the lead-up to Copenhagen. This is not surprising given that institutional arrangements will determine the terms under which industrialized countries will provide financial resources and terms so that developing countries can gain access to those resources in the post-2012 climate regime. Decisions on governance structures and processes will reflect the approximate balance of influence among the many contending interests joined through the Convention.

In this chapter we go into considerable detail about the specific requirements of a global financial mechanism. There is a rich experience of constructing funds and mechanisms, particularly in recent years, that allows us to highlight the specific functions and requisites that any global financial mechanism must address. These functions are concentrated to a large degree in the responsibilities of operating and accessing entities at national and international levels. We go into particular detail discussing the responsibilities and operation of the Climate Oversight Commission (COC), specifically its responsibilities as operating entity for mitigation activities under the Global Financial Mechanism and its oversight functions and management of a sector transformation registry. Moreover, we explore the significance of using direct and indirect paths for developing countries to access new and additional resources under the GFM, including those provided through the Sector Transformation Fund.

As pointed out in the introduction to our proposal, while the Global Financial Mechanism will address the three pillars of the Convention - mitigation, adaptation and technology cooperation - our discussion focuses on climate change mitigation only. We suggest a similar debate for adaptation and technology cooperation to clarify the basic issues of financial requirements, funding sources, allocation and disbursement mechanisms and other governance as well as specific operational issues.

### 2.2. Mandate

The governance and institutional arrangements for the Global Financial Mechanism should be fully in line with Article 4 “Commitments” and Article 11 “Financial Mechanism” of the Convention. The 13<sup>th</sup> session of the UNFCCC COP adopted the Bali Action Plan wherein Parties decided to launch “a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012.”

Under Paragraph 1 of the Bali Action Plan, Parties decided to address, among other points, the following:

1. Enhanced national/international action on mitigation of climate change, including inter alia, consideration of;
2. Nationally appropriate mitigation actions by developing country parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner; and
3. Ways to strengthen the catalytic role of the Convention in encouraging multilateral bodies, the public and private sectors and civil society, building on synergies among activities and processes, as a means to support mitigation in a coherent and integrated manner.

## 2.3. Governance and Operating Principles

It seems reasonable to assume that the governance arrangements for a new global climate agreement will be reached in the course of and following the COP in 2009 in Copenhagen. It is also reasonable to assume that the COP, as the supreme body of the Convention, will keep under regular review the implementation of the Convention and any related legal instruments that the COP may adopt, and make, within its mandate, the decisions necessary to promote the effective implementation of the Convention.

The Global Financial Mechanism we have proposed will work based on the following operating principles. The GFM:

1. Is underpinned by the principle of equity and common but differentiated responsibilities;
2. Operates under the authority and guidance and is fully accountable to the Conference of the Parties;
3. Has an equitable and geographically-balanced representation of all Parties in the governance structure of its operating entity or entities;
4. Enables developing countries, based on their institutional capacities, to directly or indirectly access funding provided through and facilitated by the GFM; and
5. Facilitates the engagement of relevant national and international public and private partners based on their comparative advantages under an agreed national sector transformation plan.

The GFM also provides a framework to promote greater coherence in the global financial architecture for financing climate change mitigation under the authority and governance of the COP. The Climate Oversight Commission and its Sector Transformation Fund (discussed in detail in the next chapter) will be a centerpiece of that architecture.

Since the focus of this proposal is specifically on climate change mitigation, we will refrain from discussing how the GFM will address similar issues for adaptation and technology cooperation. However, many aspects we discuss for mitigation might, in fact, also apply for adaptation and technology cooperation.

## 2.4. Overall Institutional Functions of the Global Financial Mechanism

The Global Financial Mechanism should fulfill three distinct yet mutually supportive functions. It will:

1. Provide, oversee and monitor technical and performance specifications for the implementation of activities serving the objectives of the Convention and ensure compliance with those specifications.
2. Provide ways for allocating funding, grant and other kinds, through direct and indirect access provided by COP-mandated operating entity(ies) under the Global Financial Mechanism; and
3. Promote coherence and coordination among the many funding sources for mitigation of and adaptation to climate change, including technology cooperation, that are directly accountable to the COP.

Reference in point 3 above to promoting coherence and coordination among funding sources is grounded in paragraph 5 of Article 11 of the Convention that states: "The developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the

implementation of the Convention through bilateral, regional and other multilateral channels." This coordination function of the Global Financial Mechanism is central to the breadth and functioning of the Sector Transformation Fund proposed below as it tries to move global efforts to scale in transforming high GHG-emitting sectors in developing countries. Below, we explore how these functions are operationalized through the GFM's Climate Oversight Commission with its oversight and finance disbursement roles.

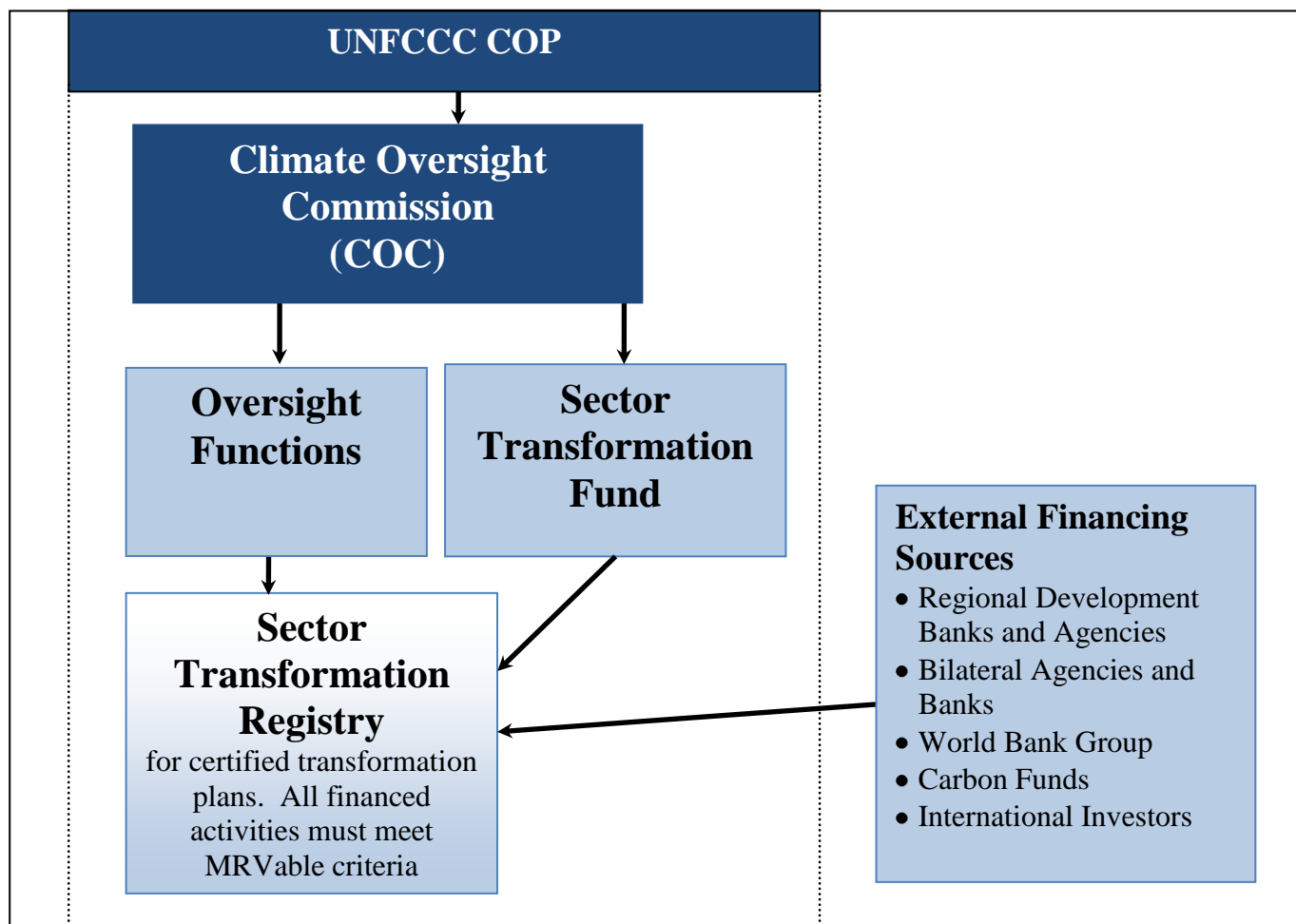
#### 2.4.1 Operationalizing the Global Financial Mechanism for Mitigation Activities

The first critical step in operationalizing the Global Financial Mechanism is for the COP to reconfirm existing or designate new operating entity(s) for mitigation activities. For purposes of clarity, an **operating entity** is the primary operational business entity of the GFM in that all business functions occur within or under that entity's purview. We have designated the Climate Oversight Commission (COC) as the operating entity for the Sector Transformation Fund that will support mitigation activities particularly at the sector level. The Climate Oversight Commission reports directly to the COP and is housed in the UNFCCC Secretariat.

As regards financial transactions, the Climate Oversight Commission must provide a coherent framework for the receipt and disbursement of all financial resources such as grants, concessional loans, risk guarantees and other financial products through COP approved operating entities or funds and mechanisms operating outside the COP. As the operating entity for the Sector Transformation Fund, the COC, guarantees sound financial and administrative management of all resources, whether from public or private sources. It also provides a mechanism for monitoring and evaluating use of all financial resources. It must establish a regular reporting process to the COP certifying the effective use of those resources. The Sector Transformation Fund will be the principal financial body through which the Climate Oversight Commission will handle financial management for mitigation activities at the sector level.

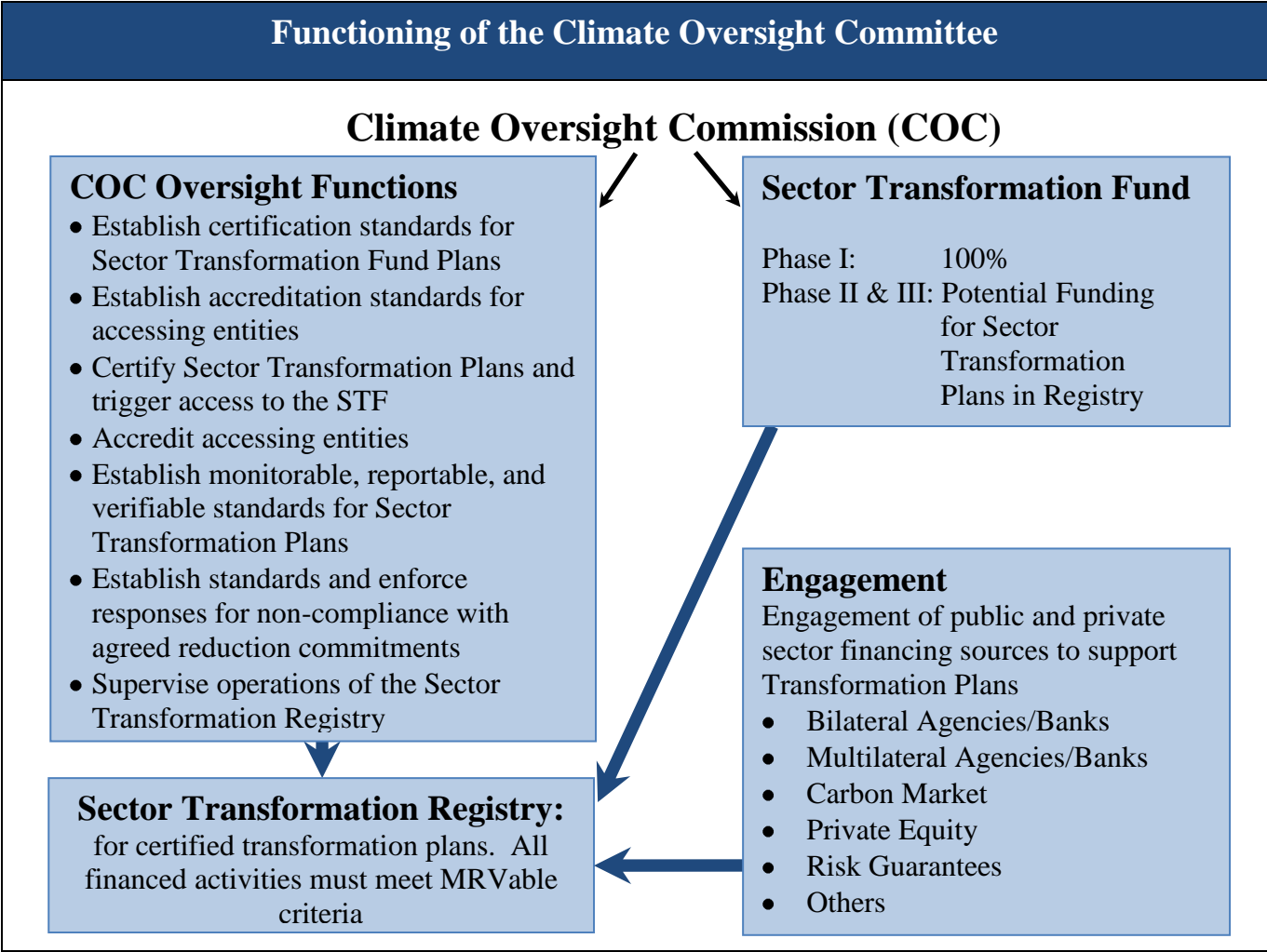
The Climate Oversight Commission's responsibilities extend far beyond financial management of the Sector Transformation Fund. The COC must also carry out a range of oversight functions that include establishing accreditation standards for entities intending to access funds from the Sector Transformation Fund ("accessing entities"), establishing certification standards for operational plans for transforming economic sectors in developing countries, ensuring that accessing entities comply with those standards and establishing procedures for responding to non-compliance with reduction commitments. One of the main oversight functions of the Climate Oversight Commission includes supervising the operation of a Sector Transformation Registry through which public and private actors can provide targeted support to mitigation activities at the sector level proposed by developing countries in form of Sector Transformation Plans. This registry links the oversight and grant disbursement functions of the COC that are presented in Figure 2.

**Figure 1: Mitigation under the Global Financial Mechanism**



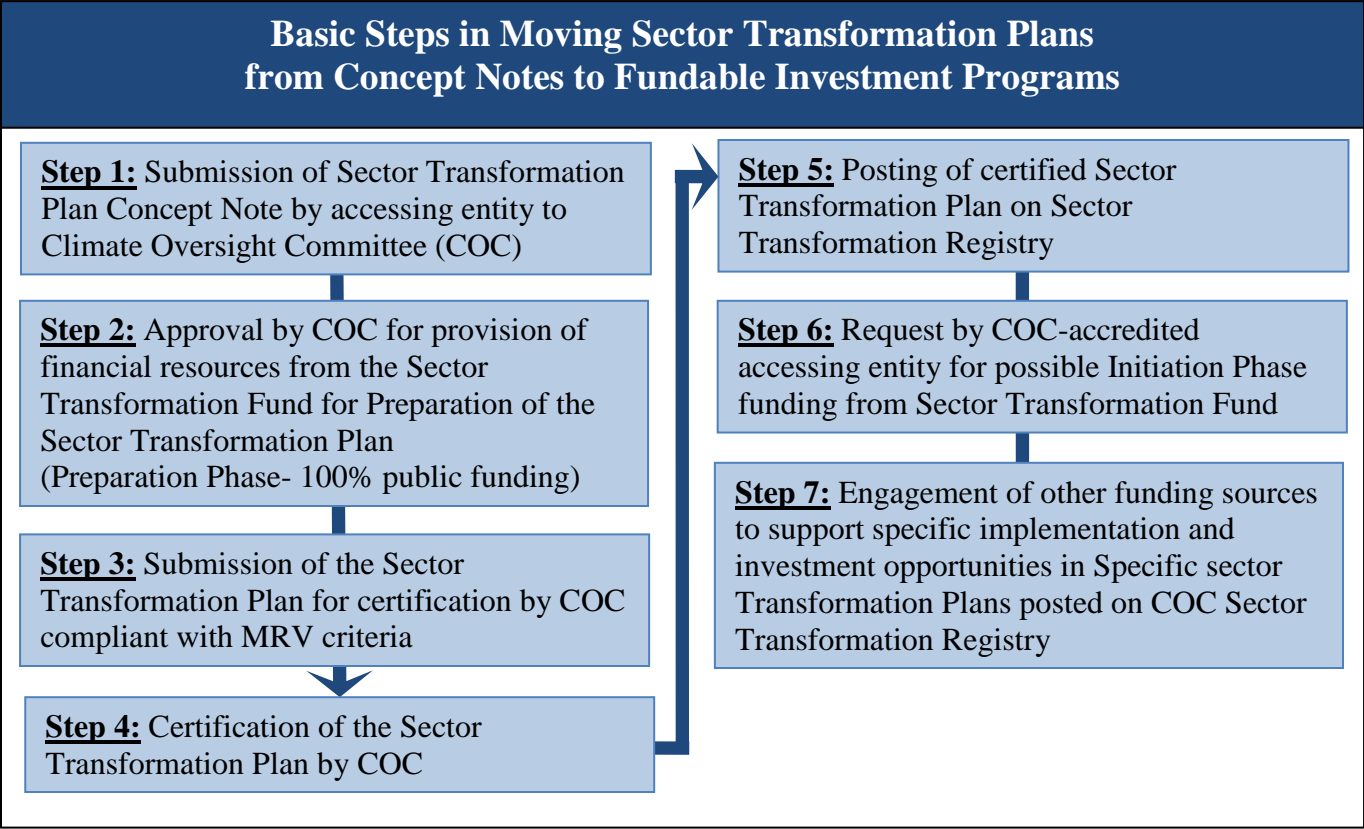
Following its formation by the COP, the Climate Oversight Commission, an operating entity of the GFM for mitigation activities, must establish the standards by which agencies, institutions or offices qualify as an accessing entity for grants provided by the Sector Transformation Fund. **An accessing entity** is a secondary business entity of the Global Financial Mechanism. The accessing entity has the objective to access funds for disbursement at the national level to finance eligible activities associated with the preparation and implementation of the sector transformation plans. This entity accesses funds provided by the COC through the Sector Transformation Fund. The entity can be national or international as long as it fulfills the fiduciary, monitoring and reporting functions so that the assets entrusted to the COC are protected and risks are minimized. An MOU between the Climate Oversight Commission and the accessing entity details the specific roles and responsibilities of both entities. The accessing entity is accountable to the COC, including the implementation of the operational policies, strategies and decisions set by the COC.

**Figure 2: Functioning of the Climate Oversight Commission**



The Sector Transformation Registry is a transparent tool for advertising national Sector Transformation Plans and for soliciting requests for targeted investments identified in the sector plan to be met by national and international, bi- and multilateral agencies and mechanisms. Registered Sector Transformation Plans also identify MRV-able emission reduction targets, against which the entities involved in implementation need to report. The following figure illustrates the role of the Registry in moving Sector Transformation Plans from concept notes to fundable investment programs.

**Figure 3: Basic Steps in Moving Sector Transformation Plans from Concept Notes to Fundable Investment Programs**



#### 2.4.2. Direct and Indirect Access to Funding under the Sector Transformation Fund

The second step for operationalizing the Global Financial Mechanism through the Climate Oversight Commission is to establish how countries can gain access to STF finance through either direct or indirect accessing paths. The issue of direct and indirect access to funding under the GFM is a politically charged matter because the path for accessing financial resources involves establishing measures of accountability between the COC and international and national institutions that are responsible for implementing activities on the ground in developing countries.

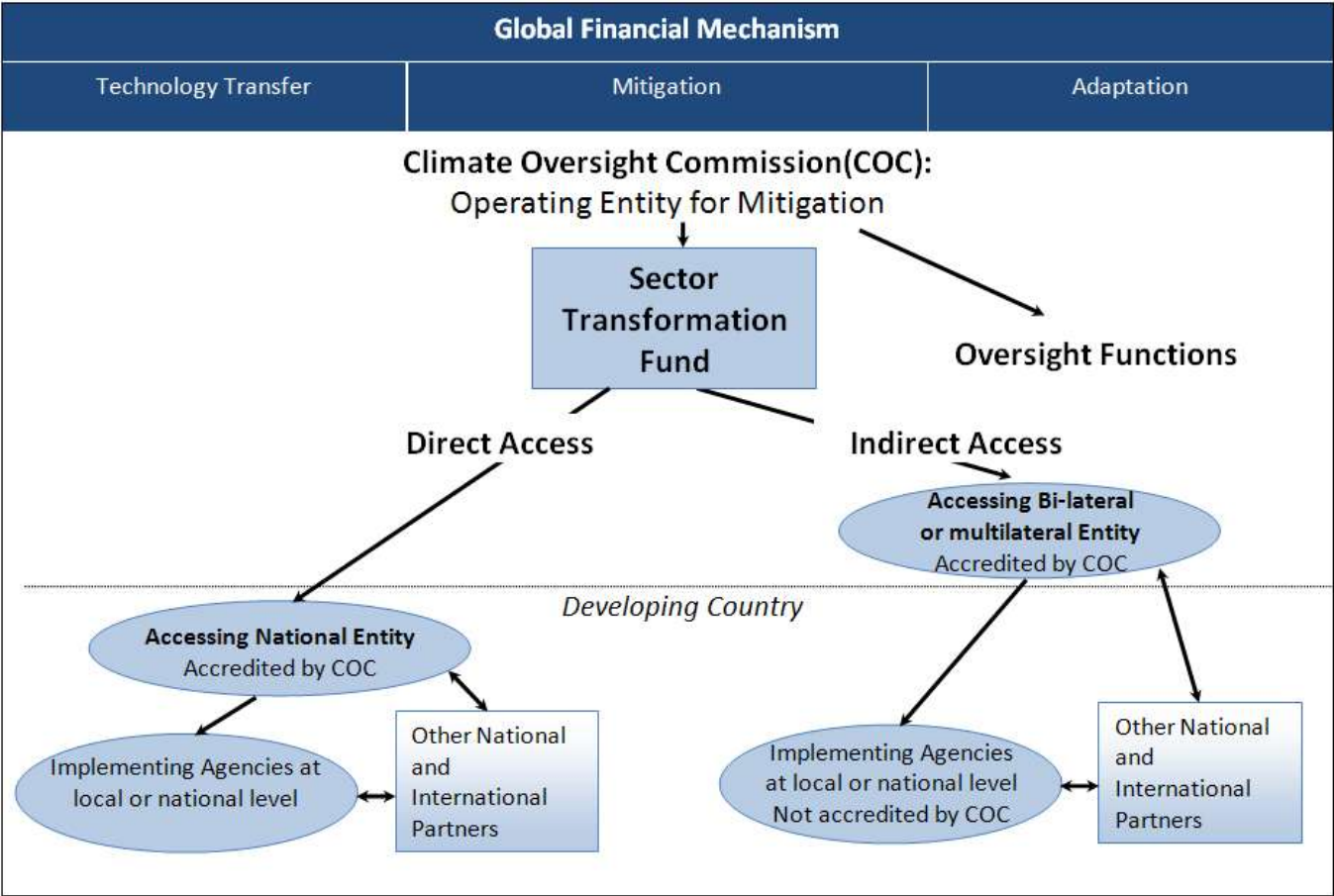
Establishing **direct access** to financial resources managed by the Climate Oversight Commission and held in the Sector Transformation Fund signifies a relationship through which a national institution in a developing country, be it public or private, gains access to funds provided by the STF. To ensure that the financial resources provided through the Sector Transformation Fund are used in a cost-effective, efficient way, the COC must certify that the accessing entity can meet established fiduciary, technical and performance standards as detailed in the following section. Once an accessing entity has demonstrated that it can meet those standards and has been duly accredited by the COC, that entity can gain direct access to financial resources of the STF.

Having **indirect access** to the financial resources of the Sector Transformation Fund signifies a relationship through which a developing country receives funds through a third party that has been accredited by the Climate Oversight Commission. In this case of indirect access, the accessing entity is



not an institution from a developing country. Rather, the country must work through an intermediary international organization, be it public or private, bi- or multilateral, which has demonstrated its capacity to meet standards set by the COC and hence has been duly accredited. Figure 4 below summarizes the modalities for direct and indirect access to funding under the GFM.

**Figure 4: Rendering of Accessing Options of the Global Financial Mechanism**



The Global Financial Mechanism and the Sector Transformation Fund, in particular, will make provisions for both options, direct and indirect access, by which developing countries access financial resources for the development and implementation of their Sector Transformation plans. A country’s institutional capacities, including its technical, fiduciary and managerial capacities, will determine which access model is more suitable. For example, a country with low institutional capacities might need to access funding indirectly under the GFM by using an international accessing entity as an institutional go-between to ensure provision of necessary fiduciary, implementation and reporting functions. Countries with more developed national capacities will be more likely to use the direct access model.

Having direct access to funds under the Sector Transformation Fund will be an important incentive for developing countries. The Global Financial Mechanism, by encouraging use of public resources to strengthen national institutions and managerial capabilities, encourages developing countries to shift from the indirect to the direct access option if a national institution can demonstrate full compliance with the accreditation criteria of the Climate Oversight Commission. Targeted institutional development

focusing on the improvement of technical and performance management capacities will be the key to receiving and maintaining direct access to resources under the Global Financial Mechanism.

### 2.4.3. Accrediting Accessing Entities by the Climate Oversight Commission

The third step for operationalizing the Global Financial Mechanism is for the COC to develop and enforce technical and performance standards for STF accessing entities that ensure compliance of mitigation activities with standards agreed upon by the COP. These activities would include, among many others:

- **Technical management:** Having directly accessed funds from the Sector Transformation Fund, the responsible national or international entity must provide a range of technical activities to support implementation of Sector Transformation Plans activities, including:
  - Providing technical inputs in the design of activities and providing technical inputs to implement agreed activities in the Sector Transformation Fund and, if necessary, to address implementation problems;
  - Establishing data systems to ensure monitorable, reportable and verifiable outcomes;
  - Maintaining public information systems to share experiences drawn from country experiences.
  - Establishing supportive national incentive structures, institutional arrangements and sector policies;
- **Performance management:** Performance management covers an equally broad set of activities that are required to ensure the equitable and transparent implementation of mitigation plans. Those activities include, among many others:
  - Developing adaptive results-based management and annual work plans in line with agreed activities in the certified Sector Transformation Plans;
  - Disbursing accessed funds in a timely, transparent and effective way according to the agreed work plan for the design and/or implementation of the STP;
  - Providing timely, publicly-available reports on progress of mitigation plan implementation based on agreed benchmarks to Climate Oversight Commission;
  - Providing evaluations (internal and independent) and recommendations on implementation to the COC in accordance with the agreed interagency agreement.

Only if an institution can show compliance with these tasks can it be accredited by the COC and hence gain direct access rights to funds in the Sector Transformation Fund. The accreditation process provides any institution, national or international, bi- or multilateral, the opportunity to directly access funds managed under the Global Financial Mechanism.

What is certain, if past experience is instructive, is that industrialized countries will strongly resist providing new and additional financial resources for use by developing countries unless there is consistent delivery and compliance with these technical and performance standards.

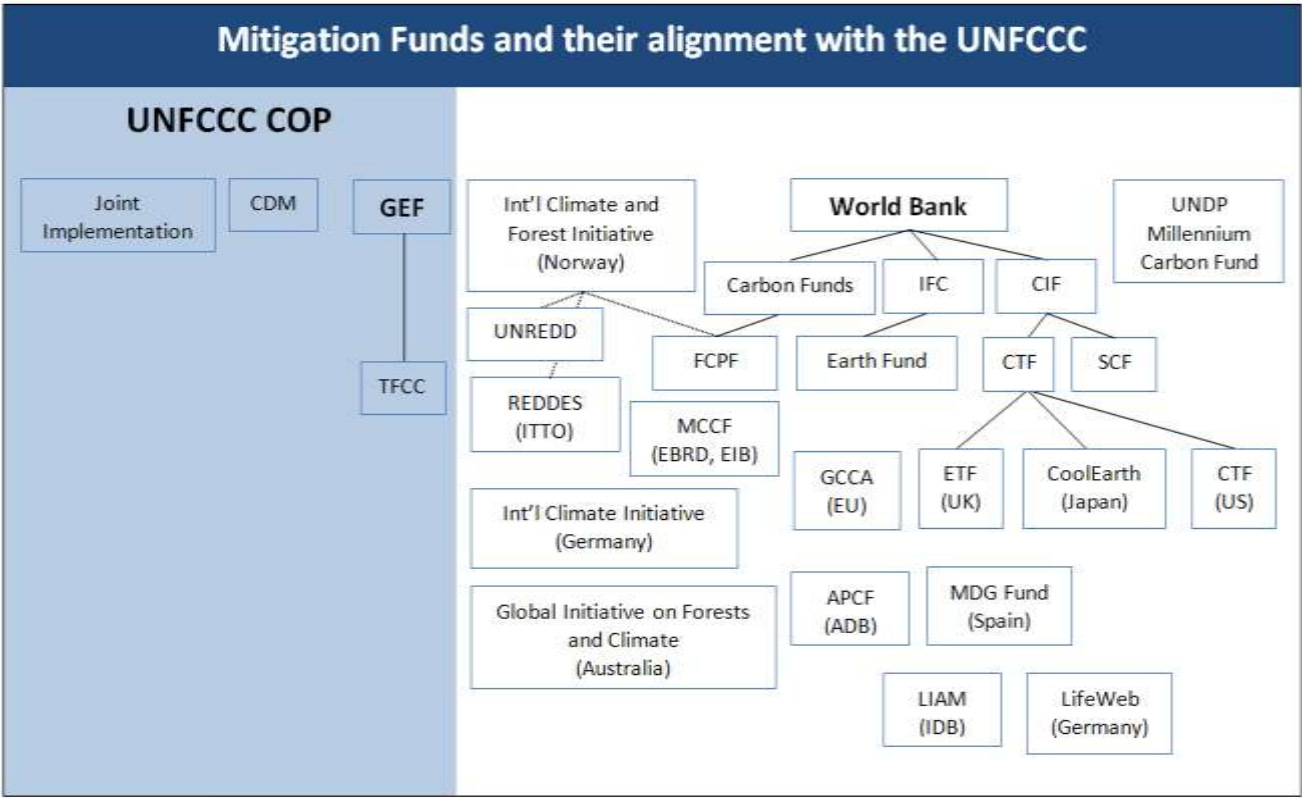


# 2.5. Strengthening Coordination among Mitigation Funds and Mechanisms

Once the Climate Oversight Commission becomes operational, one of its major on-going responsibilities will be to promote coordination among the many public and private sources of funding, including the STF, dedicated to supporting mitigation activities. This task has become increasingly important because more than sixteen international funds and mechanisms for climate change mitigation and adaptation have been announced over the past two years, some of which have actually acquired operational status. This sudden proliferation of funds is unprecedented and has been accompanied by an equally unprecedented lack of transparency, particularly for developing countries trying to access those funds. Moreover, most funds have not clarified their relationship to the UNFCCC, falling back on vague commitments of working to support the goals of the Convention. Today, only a few funds and other mechanisms work directly under the auspices of the UNFCCC. Those include the Global Environment Facility (GEF) Trust Fund, the Clean Development Mechanism (CDM) and Joint Implementation (JI). All other funds and mechanisms work outside the mandate of the UNFCCC. Figure 5 below briefly summarizes the main existing or planned entities involved in climate change mitigation.

**Figure 5: Current Landscape of Mitigation Funds, Mechanisms and Institutions working under or outside the UNFCCC Framework**<sup>1</sup>

One reason for the proliferation of mitigation funds and mechanisms is the limited impact that the existing system, especially the GEF, has had in addressing climate change mitigation. The present system has so far failed to deliver transformational change for the global environment. The desire to achieve more immediate impacts in terms of reducing GHG emissions is a major driving force behind



<sup>1</sup> The CDM and JI are not funds proper: they are project-based offset mechanisms designed to help developed countries meet their mitigation targets at least cost through mitigation investments in developing countries.

the industrialized countries' interest in creating new funding mechanisms, as first signaled at the 2005 G-8 Summit meeting in Gleneagles and repeated at the 2008 G-8 meeting in Hokkaido Japan.

Many of the newly created mitigation funds have a sunset clause that sets a limited time horizon and only a few of those funds have made commitments beyond 2012, the anticipated date for entry into effect of a post-2012 climate agreement. One of the benefits of this short time horizon is that it has stimulated testing of new approaches and methods that can be used subsequently in other financing arrangements.

On the other hand, there is great need to move steadily toward a coherent, long-term architecture for climate change mitigation. For the successful implementation of a post-2012 arrangement, the GFM must establish incentives and an easily accessible mechanism by which a wide range of funds and funding approaches can harmonize their mitigation activities. To this end, the Climate Oversight Commission will establish a Sector Transformation Registry (STR). The Sector Transformation Registry will be a repository for all certified Sector Transformation Plans (STP), which that are discussed in greater detail in the next chapter. Once a Sector Transformation Plan is entered in the Registry, the full range of public and private financing instruments can be used to finance the implementation of an entire sector plan or specific elements of the plan. The STP outlines emission reduction targets that are monitorable, reportable and verifiable. Institutions involved in the implementation of the STP need to show progress against those targets.

It is the responsibility of the national body leading the national climate agenda to coordinate the public and private funding sources that will finance a corresponding part of the sector transformation plan. For example, if the World Bank, a regional development bank or bilateral agency wants to finance a set of technology demonstrations in a specific economic sector identified in a certified Sector Transformation Plan submitted a given country, that financial actor must enter the planned public investments in the registry and thereafter coordinate the planning and implementation of those activities with appropriate national counterpart companies or agencies. By the same token, if an international private investor group wants to finance a set of new production plants using more efficient technologies with lower GHG emissions (identified as a need in the registered STP), the investor must enter the planned investments in the Sector Transformation Registry and ensure coordination with other investors engaged in parallel activities in the sector.

In this manner the Sector Transformation Registry provides the mechanism for strengthening coordination among the many different agents interested in supporting reforms in the sector, promotes the engagement of these agents in the implementation of the Sector Transformation Plan based on their comparative advantages, ensures complete public transparency for all investment activities and allows final control of investment activities under the hands of the national body managing the climate agenda in a given country. In addition, progress in implementation of the Sector Transformation Plan can be measured against MRV targets.

### 3. The Sector Transformation Fund

In the preceding chapter, we went into considerable detail explaining the construct and institutional arrangements required to operationalize the Global Financial Mechanism. The reason for this focus on detail is a general lack of understanding of the functions that must be fulfilled and the standards that must be met to ensure obtaining financial commitments from industrialized countries and to deliver the monitorable, reportable and verifiable emission reductions on the ground.

In this chapter we shift attention from the inclusive framework of the Global Financial Mechanism and the oversight functions of the Climate Oversight Commission to a proposal for a specific mitigation fund that would be operated by the COC. While we are reluctant to suggest the creation of a new mitigation fund at this time, it is clear that existing mitigation funds and related mechanisms have neither the focus nor the size to bring about changes at the scale needed to meet agreed goals of keeping climate change below the 2°C threshold. This is the case of the Clean Development Mechanism under the UNFCCC that is limited by its offset project-by-project design. It is also the case of the World Bank's Clean Technology Fund that lies outside the UNFCCC and is limited by the modest scale of the resources pledged from donors and by the misgivings of many developing countries. Other mitigation funds do not have the ambition, design or resources to achieve the needed emission reductions at scale.

In response to this shortcoming, we have proposed the creation of the Sector Transformation Fund operated by the COC and, in the following pages, offer a general blueprint for the operational and institutional arrangements that will allow that fund to accelerate the reduction of greenhouse gas emissions at scale in developing countries. The proposed STF is designed to shift key economic sectors of developing countries from carbon-intensive to low-carbon platforms by providing steadily rising incentives in the form of financial, technological and technical support. The STF is tailored to respond to the different stages of development of economic sectors in developing countries and to ensure compliance with international standards of monitoring, reporting and verification overseen by the COC.

The Sector Transformation Fund is built on a three-phased approach that can be adjusted to the specific needs, preparedness and technological level of each country. The approach provides STF grant financing to support preparation of Sector Transformation Plans that must comply with internationally agreed standards and graduation requirements. Following completion of Preparatory Phase requirements, public funding diminishes significantly in subsequent Initiation and Implementation Phases as the full range of private and public financial sources is brought to bear to accelerate implementation of sector transformation plans. The three-phased approach of the Sector Transformation Fund also provides opportunities for engaging a wide range of financial actors in a harmonized and coordinated manner.

In the sections that follow, we examine in detail the three phases of the Sector Transformation Fund, beginning with the Preparation Phase, then moving through the Initiation Phase and concluding with the Implementation Phase. As we begin this exploration of the three-phased approach, we underscore the point that preparation and subsequent implementation of Sector Transformation Plans must be viewed as a process fully harmonized with and integrated into the broader development strategy of a developing country's macro-economy. Moreover, implementation of sector plans invariably requires institutional and policy changes that, likewise, must be harmonized with the broader development priorities and paths of each developing country.

### 3.1. The Preparation Phase

Achieving emission reductions at scale is an extremely complex endeavor and requires sophisticated plans that will guide a country over years if not decades. Some countries have prepared and are pursuing sector transformation plans to reduce energy intensity and carbon emissions. For example, beginning in 1990, the Chinese government designed and has subsequently implemented important elements of a modernization plan for the cement sector that currently produces upwards of 50% of the world's cement. Although the economic efficiency gains were the principal driver of China cement sector, modernization also resulted in substantial GHG emissions reductions per ton of cement produced. More recently, several developing countries have prepared National Appropriate Mitigation Actions (NAMAs) and similar mitigation blueprints. Many other countries have not yet prepared such plans but may have covered considerable ground in their periodical National Communications or National Adaptation Programs of Action (NAPAs).

The Preparation Phase of the proposed fund is designed to support development and refinement of sector reform programs. The starting point of any transformation program is collection and distillation of required data and information about the current performance of a given sector and the setting of national emission reduction goals through sector reform. This may require completion of life cycle analysis of goods produced and consumed in the sector. Improvement of data management and information acquisition capacity must converge in consolidation of monitorable, reportable and verifiable information systems.

Accompanying the preparation of a sequenced series of reform activities, the plan must identify the financial, technological and technical inputs required through successive years. Each stage of the transformation plan will identify the specific financial needs, the design of specific investment programs, and the anticipated sources of finance. Also, recent experience in sector reform has illustrated that institutional constraints invariably go hand-in-hand with the need to implement new policies to eliminate disincentives and to establish incentives that will encourage new behaviors from public and private actors.

Given that one of the key factors slowing implementation of sector reforms in some countries is the weakness of existing institutions, the Preparation Phase calls for a mapping of institutional capacity and institutional development needs. At the heart of the institutional development process is identification of an overarching national agency, be it housed in a ministry or an inter-agency coordinating body, which will coordinate the increasingly complex activities required to change the technological, financial and institutional foundations of the specific sector.

The professional competence and adaptability of plant managers, infrastructure planners and building designers is another critical factor that has often slowed technological innovation and reform. Addressing the needs of managers and planners demands that transformation plans detail the human capital development process to match the institutional and economic adjustment programs.

The Sector Transformation Fund design focuses attention and resources on the building of national capacity. While a country may launch its transformation strategy with one sector, the STF seeks to ensure that institutional and human capacity development from one sector will carry over and expedite changes in other high-carbon sectors of the economy.

One of the important challenges in moving the Sector Transformation Fund to an operational status will be finding a balance between setting sector transformation standards approved by the COP and enforced by the Climate Oversight Commission while responding to the very different conditions in economic sectors in developing countries. That tension underscores the attention that the COC must give to developing guidelines for certifying the technical content and performance goals in proposed transformation plans. In similar measure the COC must establish certification standards for establishing the readiness of a country to move to the next level of implementation.

**Table 1. Preparation Phase**

Outputs	Eligible Activities	Funding Modalities	Graduation Requirements
<b>Transformation Assessment</b> This assessment will identify barriers and constraints to sector reform, including life cycle analysis, and institutional mapping.	<b>Analysis</b>  <b>Planning activities</b>  <b>Preparation of transformation plans</b>	<b>Funding for 100% of preparation activities will be provided by grants from the STF</b>	<b>Certified Transformation Plan</b> The COC will establish standards for certification of transformation plans to signal readiness to move to the Initiation Phase.  With certification, plans must be registered with the Sector Transformation Registry, allowing potential financial support from the STF and from other funding sources.
<b>Transformation Plan</b> The transformation plan will include a timetable with goals and cost estimates for each step. It will provide a plan for mobilizing financial resources, building institutional capacity and implementing policy/incentive reforms. GHG reduction targets are identified and monitorable, reportable and verifiable (MRV) Certification of Sector Transformation Plans	<b>Institutional capacity building</b>		
<b>Transformation Mitigation Response</b>			

A second key issue regards the type and origin of financial support provided to complete the Preparatory Phase requirements. While total financial requirements for preparing Sector Transformation Plans vary from country to country, the GFM will provide 100% of those funding needs from public sources provided by industrialized countries.<sup>2</sup>

<sup>2</sup> The United Nations Framework Convention on Climate Change (UNFCCC) Article 4, numeral 2 states: “The developed country Parties and other parties included in Annex I commit themselves specifically as provided for in the following: (a) Each of these parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases.....”;

Article 4, numeral 3 states: “The developed country Parties and other developed parties included in Annex II shall provide new and additional financing resources to meet the agreed full costs incurred by developing country parties.....”

Currently, Annex I encompasses 43 countries and separately the European Union. It includes all developed countries and most of the so-called “economies in transition”. Annex II encompasses 23 countries and separately the European Union. Annex II includes the list of

Finally, we should underscore the point that there is no predetermined duration for the Preparation Phase. For countries that have engaged in considerable preparatory work and are ready to submit Sector Transformation Plans, the Preparation Phase could be completed in a matter of months. For countries, just embarking on development of transformation plans, this phase could last several years.

**Box 1: Experience with the Preparation Phase of mitigation initiatives in developing countries <sup>3</sup>**

UNFCCC Parties recognized relatively early in its work that in order to undertake large-scale mitigation or adaptation programs, extensive and expensive preparatory work would be needed. Those activities would include planning, strengthening institutions, establishing baselines, building monitoring facilities, creating an adequate regulatory environment, among other activities. Moreover, Parties recognized that many developing countries would require international support to move through these preparatory tasks.

In the past two years the leading experience with international support for developing countries' climate related preparatory activities has been the World Bank's "Readiness Mechanism" of the Forest Carbon Partnership Facility (FCPF). The Readiness Mechanism's purpose is to build the capacity of developing countries to access a future system of incentives that would reward emission reductions achieved by curbing deforestation (REDD).

The FCPF's Readiness Mechanism (RM) makes available up to \$3.6M per country to establish REDD reference scenarios, build accounts of historical emissions, analyze future developments that could influence deforestation trends and develop an emission reduction strategy. The process also allows countries to develop informed REDD negotiation positions based on an assessment of country REDD opportunities and constraints.

Developing countries have responded positively to the FCPF's Readiness Mechanism funding incentive. Over 40 countries have applied and 25 qualified for initial financial support by late 2008. With that positive response, the World Bank decided to expand by 50% the RM's original \$100 million budget. Moreover, shortly thereafter the UN REDD initiative, funded principally by the Government of Norway, put in place a RM equivalent called "Quick Start."

The Sector Transformation Fund's Preparation Phase draws on lessons learned from the REDD readiness process. It does not stop, however, at funding capacity and institutional strengthening for developing countries, but aims at ending with a full Sector Transformation Plan that would allow a country to match investment needs with domestic and international financing sources. Thus, when the country decides to commit to the reduction program, it can move to the next phases of initiation and implementation.

One of the most important features of the Sector Transformation Fund's Preparation Phase is that developing countries would not be required to commit to any investment or emission reduction until the very last stage of the preparatory process. At that time, the developing country government could make emission reduction commitments in full knowledge of what activities would be required, how much activities would cost, and the available financing options. Until that final point in the Preparation Phase, developing country engagement would come without any strings attached. It would only require the willingness to participate in a Preparatory Phase.

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traditional international donor countries -- Canada, USA, Western Europe, Japan, Australia and New Zealand (Turkey appeared in the original Annex II list but asked to be removed in 2001).

<sup>3</sup> This box is based in a GFM supporting report, C. Streck, 2008 "Sectoral Mitigation Plans as Strategic Planning Tools."

### 3.2. The Initiation Phase

Recent experiences in middle-income countries illustrate the extraordinary complexity of changing the technological foundations of an economy or a leading economic sector. These complexities underscore the imperative of supporting an intermediary phase before embarking on a full-scale transformation of an important economic sector.

Reflecting these challenges, the main purpose of what we have called the Initiation Phase of the Sector Transformation Fund is to ensure that the institutions, human capacity, data systems, policy environment, and innovative technology applications are in place for an accelerated, scaled-up sector reform process that will follow. An important part of this second phase is demonstrating the commercial and technological feasibility of innovative projects such that they are ready for broader application in a given sector. Implementing demonstration projects to test the deployment of innovative technologies is one of the central activities to be carried out during the Initiation Phase. Technologies proven in other countries need to be adapted to new economic and cultural contexts before a commercial strategy can be promoted and scaled up. To that end, a staged roll-out of those technologies, infrastructure, or production systems is a principal output of this second phase

Another important, equally difficult challenge is ensuring that an enabling, supportive policy environment is in place to reinforce and consolidate the changes being proposed. Not only must new financial and social incentives supporting a low-carbon economy be established through economic and social policy. In addition, old policies and incentives associated with the previous economic regime must be dismantled often in the face of opposition from groups and associations benefiting from that system.

Financing sources for activities can begin to diversify during the Initiation Phase. Other sources of public finance, both international and national, can amplify Sector Transformation Fund grants. Furthermore, many core activities, such as institutional strengthening, certification of data systems and human capital development, may require public funding. Other activities, including demonstration projects and testing of new technologies should attract a full range of commercial and private funding. For example, private investors can hold equity shares in production or transport systems being tested in a developing country. Loans from public institutions such as regional development banks and the International Finance Corporation can provide start-up capital for demonstration projects. Guarantees and insurance can be extended through public-private partnerships.

We estimate that, on average, the Sector Transformation Fund could provide 25% of the Initiation Phase costs as grants with the remainder coming from other international and national public and private sources. Our use of the term “average” allows for a larger or smaller participation of the STF in Initiation Phase activities in keeping with the requirements and economic conditions of the country and specific sectors. (For a more detailed explanation of the rationale for this funding mix see Chapter 4.)

Graduation from the Initiation Phase will be dependent on meeting agreed performance standards established by the Climate Oversight Commission. At the heart of those standards are the development, testing and certification of those data collection and management systems that can provide monitorable, reportable and verifiable reductions in GHG emissions.



**Table 2: Initiation Phase**

<b>Outputs</b>	<b>Eligible Activities</b>	<b>Funding Modalities</b>	<b>Graduation Requirements</b>
<p><b>Capacity Development</b></p> <p><b>System Testing</b></p> <p><b>Demonstration Projects</b> These projects will include testing and deployment of innovative technologies and its contribution to a MRV reduction in GHG emissions.</p> <p><b>Creating an Enabling Environment</b> Priority focus will be given to policy and institutional reforms.</p>	<p><b>Institutional Development</b></p> <p><b>Human Capital Development</b></p> <p><b>Certification Processes</b></p> <p><b>Acquisition of IP</b></p> <p><b>Demonstration Projects</b></p>	<p><b>Funding will include a package combining STF grants and other financing options:</b></p> <p><b>STF Grants:</b> The STF grant will, on average, not exceed 25% of the total costs of the Initiation Phase.</p> <p><b>Other international and national public funds</b> could provide additional grants or other types of soft funding</p> <p><b>Loans from public institutions:</b> These will include loans from RDBs, the IFC; MIGA; bilateral agencies, banks and others.</p> <p><b>Public-Private Partnerships</b></p> <p><b>Private sector finance:</b> These instruments can include equity shares, insurance guarantees, carbon banking, among others,</p>	<p><b>International Certification of Standards Compliance</b></p> <p>The COC will establish the standards and methods for ensuring compliance with certification requirements.</p>



## **Box 2: The Sector Transformation Fund is More than a Sectoral Approach<sup>4</sup>**

Since 2005 there has been a growing policy discussion inside and outside the UNFCCC MOP/COPs regarding the use of sectoral approaches to climate change mitigation. In its essence, a sectoral approach is a strategy to achieve emission reductions across an economic sector, as opposed to a countrywide or a project-by-project mitigation strategy such as the Clean Development Mechanism. Beyond this basic commonality, sectoral proposals differ widely in defining their goals, scope and operational criteria. Support or opposition to those proposals has varied considerably. A brief typology of sectoral approaches is presented below:

- Sectoral approaches in Annex 1 countries as part of those countries' strategies to comply with its emission reduction commitments. There are many examples in virtually all Annex1 countries. Since these strategies are integral parts of national policies they have not generated international controversy.
- International, business-driven, voluntary sectoral approaches to GHG emission reductions that include businesses in Annex1 and non-Annex1 countries. One example would be the Cement Sustainable Initiative of the World Business Council on Sustainable Development. No controversies have arisen from these programs.
- Proposals to mitigate bunker fuel emissions. As these emissions are associated with international shipping and air transport they were excluded from Kyoto Protocol negotiations because of their international character. There is now an international consensus that bunker emissions should be addressed as part of global climate agreement, although there is no consensus regarding the best way to do so.
- Proposals for internationally binding sectoral approaches aimed at attaining emission reductions in heavily traded economic sectors such as steel, chemicals and aluminum. These binding sectoral approaches would encompass both Annex 1 and non-Annex 1 countries as suggested by Japan's sectoral proposal. That proposal has been met with strong opposition from developing countries because it seeks binding targets on developing countries and because of fears that it would introduce "level playing field in international competitiveness into UNFCCC discussions. The STF does not endorse this approach.
- Proposals for voluntary national sectoral approaches in developing countries, also called "sector non-lose targets". This approach supports voluntary mitigation plans to be decided and driven by the developing country. The plans could elicit financial support from developed countries, but would entail no penalties if the country failed to achieve those targets. Since Bali 2007, this approach has gained support among many COP parties, one example being the REDD proposals that have been tabled during 2008.

The STF's goal is to facilitate the scaling up of developing countries' voluntary mitigation initiatives. From a STF perspective, country mitigation initiatives can take many forms, including sectoral approaches, cross-sectoral policies, demand management strategies, sustainable policies and measures, and more. All of them would qualify for financial support from the GFM, provided that they meet agreed technical standards.

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<sup>4</sup> This box is based in a GFM supporting report, S. Magnoni, 2008 "Sectoral approaches to GHG mitigation and the post 2012 climate framework"

### 3.3 The Implementation Phase

The two initial phases of the Sector Transformation Fund are designed to facilitate a comprehensive restructuring of the designated sector to reduce emissions and increase energy efficiency. Upon graduation from the Preparatory and Initiation Phases, the national climate body will have brought together the institutional, policy, technical, financial and human resources required to implement the national Sector Transformation Plan and move aggressively to meet agreed mitigation goals for the entire sector.

In contrast to the preceding phases that are built around meeting specific certification requirements, the Implementation Phase introduces a very diverse set of activities, instruments and partnerships to accomplish the full set of emission reduction commitments for the designated economic sector. The most significant change resides in the expanding scale of operations undertaken. Whereas a limited number of demonstration projects were carried out in the Initiation Phase, multiple investment areas will be launched to modernize plants, build and upgrade infrastructure and refurbish industrial and residential building stock. We expect that in the Implementation Phase the percentage of total funding requirements coming from the Sector Transformation Fund would be significantly lower than in the Implementation Phase while the share of other international and national public funds and the contributions from market-based and private financial instruments would continue to rise.

The magnitude of the activities that can be undertaken and the scale of financing required in this phase are illustrated by the restructuring of the Chinese cement industry. Of the 13,000 cement plants in China, about 1/3 now use modern equipment. Although the Chinese government launched a sector modernization program in 1990, thousands of factories still need to undergo technological conversion, hundreds of the converted plants need additional modernization and many outdated plants need to be shut down. In addition, training thousands of professional staff and managers must be carried out.

Changes of this magnitude require partnerships and financial resources of unprecedented scale. As the past two decades of reforming the Chinese cement sector have demonstrated, market dynamics can serve as the driving force of change. On a very basic level, the needs of individual plants to increase efficiency and improve product quality drive the impetus to modernize. National public and private capital, imported technology and technical/management assistance can support the modernization process and have been enormously successful in helping modernizing 1/3 of China cement plants and over half the country cement production. But deepening the modernization drive and extending it to the rest of the industry is proving more difficult due to a mix of economic, political and social issues.

Modernizing the rest of China cement sector and further reducing emissions throughout it may require upwards of \$45B of additional investment and financial support over a 10- to 20-year period. But, in keeping with the incremental criteria of the UNFCCC, only a portion of these costs may qualify for funding from the STF, thereby obliging the Chinese government and/or private investors to intervene in a rather massive manner. It is precisely in this context that many innovative investment and financing mechanisms can be brought into play including: other international public funds; national public funds; international and national development banks; UNFCCC regulated carbon markets; international and national equity investors; and international and national not-for-profit programs.

Clearly, not all countries will embark on sector transformation programs as extensive as cement in China. Nonetheless, regardless of size, the challenges posed to any middle- or low-income country will be comparable and will require sophisticated coordination mechanisms and equally sophisticated financing and technical support arrangements that can be delivered through the Climate Oversight Commission and its Sector Transformation Registry. All agencies that have registered with the Sector Transformation Registry to implement Sector Transformation Plans activities will report back to the COC on progress against agreed benchmarks. Those agencies that have accessed Sector Transformation Fund grant funding will have to report not only on progress towards agreed MRV-able results but on the use of STF funds as well. If progress is not satisfactory or irregularities are detected, the COC will engage with the involved agencies and agree on adjustment measures. If severe concerns arise from the use of STF grant resources in terms of performance, the COC can decide to cancel temporarily the accreditation of the accessing entity institution until standards can be met again.

Each reform process entails restructuring the economic foundations in a given sector. While the country's populace and the planet as a whole will benefit in the long-term from reduced emissions, some social and economic groups will be negatively affected in the short-term by the technological change. One of the key responsibilities of the ministry or agency overseeing implementation activities is to anticipate the dislocations caused by the reforms and to undertake counterbalancing measures to reduce the social and human costs of sector changes. Modeling exercises similar to the T-21 that we used to explore the country-wide impact of changes in China's cement sector could be a valuable tool here.

### **Box 3: Applying the Sector Transformation Fund to Sector-wide Changes in Agriculture and Forestry**

According to the IPCC fourth assessment report (AR4) (2007) agriculture and forests ecosystems are both potential sinks for GHG but through unsustainable management, constitute a source of 13.5% to 17.4% , respectively, of the total GHG emissions contributing to global climate change. While the forest sector mainly releases carbon through deforestation and forest degradation including forest fires, agriculture releases a variety of GHG such as carbon dioxide, methane and nitrous oxide. Some of the emissions occur as a direct result of interaction between the two sectors, notably through deforestation and conversion of forests to agricultural lands.

Agriculture and forestry (and mixed landscapes) are two important wedges in the GHG reduction scenario but only recently have received attention commensurate with their emissions. Issues relating to Reduced Emissions from Deforestation and Forest Degradation (REDD) are the most prominent in the current public debate and are a key element of the UNFCCC negotiations over the Protocol that will replace the current Kyoto Protocol when it expires at the end of 2012. One reason for the recognized importance of the REDD issue in the UNFCCC negotiations is that agriculture and forestry are not addressed adequately under the current Kyoto Protocol. Continuing to exclude the emission reduction potential from Agriculture, Forestry and Other Land Uses (AFOLU) in a post-2012 framework will increase the risk that the overall emissions reduction objective of the UNFCCC will not be achieved. Moreover, developing countries, and specifically those with economies rooted mainly in agriculture and/or forestry, have stated that their support for a post-2012 agreement will be conditional on the inclusion of mitigation options from agriculture, forestry and other land uses under terms that are comparable with those applicable to developed countries accounting practices for these sectors.

The proposed sector approach of the Global Financial Mechanism provides a vehicle to shift sectors from a high-GHG emissions path to a significantly reduced /low GHG emissions path, including the agriculture and forestry sectors. Below we outline a potential application of this approach to support a fundamental change in the agriculture and forestry sectors that are affecting the terrestrial carbon balance.

*Preparation Phase.* The first requisite of developing a sector-wide approach is to conduct a full assessment to understand the drivers of high GHG emissions rates and to assess the potential for carbon sequestration and retention in agricultural and forested lands. This assessment would allow countries to identify the emissions reduction potential of these functionally linked sectors and to review existing data, means and barriers to realizing the necessary scale of emission reductions to avoid catastrophic climate change. This analysis would examine national circumstances and drivers such as overarching land use policies, the status of enforcement of existing laws and regulations related to land use, the contribution of current land tenure systems and resource ownership rights, current incentive systems, the technology pool available for strengthening technical and institutional capacities for sustainable natural resources management. This assessment would also identify the scope and scale of international drivers, beginning with the current lack of prices for global ecological services that are provided by developing country forests. Moreover, this assessment should identify trade-related issues such as the impact of protectionist barriers that affect the ability of developing countries to engage in a fair and equitable manner in the global market for forest and agricultural products. Based on the assessment, sector transformation plans for agriculture, forestry and land use (AFOLU) will be developed that will align policies and measures to stimulate environmentally and socially responsible investments and establish clear deadlines, disbursement milestones and parameters for monitoring, reporting and verifying climate impacts.

In keeping with the overall design of the Global Financial Mechanism, industrialized countries should finance all preparation activities undertaken by developing countries.

*Initiation Phase.* The objective of second operational phase of the GFM as regards AFOLU is to ensure that the enabling environment is in place for an accelerated, scaled-up reform process related to the sectors. The barrier removal process related to policy and regulatory frameworks, incentive systems, institutional and human capacity and access to knowledge and technology associated with sustainable agriculture and forestry will dominate this phase and will be further consolidated during the Implementation Phase. Demonstration projects such as testing the impact of methodologies for improved forest management to reduce emissions from deforestation and forest degradation can be supported under this phase as well. The initiation process corresponds to a stepwise acquisition of implementation capacities that coincides with a sequencing of nationally appropriate mitigation actions to increase the rigor and credibility of measurement and reporting of emissions reductions attributed to these policies and measures. Whereas public resources will finance the preparation activities, a much wider array of financing instruments will be needed to finance eligible activities. During this stage of work, public financing can and should be used to support the creation of an enabling environment while demonstration projects that allow countries to test new financial instruments such as concessional loans, risk guarantees or carbon trading and reflow arrangements should be encouraged.

*Implementation Phase.* The main objective of the Implementation Phase is to reduce GHG emissions from agriculture and forestry (AFOLU) activities by applying a diverse set of activities, instruments and partnerships at a much broader scale. Care must be taken to ensure that these sector changes do not

jeopardize contributions to national economic development objectives from these sectors. The limited number of demonstration projects carried out in the Initiation Phase will need to be up-scaled and expanded to areas having similar ecological and socio-economic conditions. Modernization of legal and regulatory systems will allow for improving management systems of silvo-pastoral and forested lands with greater ownership by communities and reduced risk for private landowners and will encourage upgrading infrastructure and increasing access to a diverse pool of proven technologies and knowledge for REDD. Capacity building must continue and reach actual land-users. Sector policy reform processes must be consolidated and adapted as needed through authentically participatory processes. The Implementation Phase will require drawing on the full range of financial instruments that can be mobilized from both the public and private sectors, ultimately with private financing as the main source of capital driving the development of the sector.

Prepared by Andrea Kutter

#### **Box 4: Financing Mitigation and the Technology Action Programs**

In the UNFCCC framework, financing is usually discussed under three headings: adaptation, mitigation and technology cooperation, with technology cooperation including issues of research and development, as well as issues of demonstration, acquisition, transfer and deployment. While there are clear differences between adaptation, mitigation and technology cooperation, there are also many overlapping and gray areas.

Take the case of technologies for mitigation. On one end of the spectrum are distinct technological research and development issues. Then, along the spectrum are issues of technology demonstration, acquisition, transfer and deployment. Part of these activities may be situated more clearly in the realm of financing for mitigation. By way of specific example, our case study on wind and concentrated solar power in Tunisia discusses how international financing could help small developing countries become dynamic participants in these technological demonstration and deployment activities.

Regarding the broader issue of financing for technology cooperation, both for adaptation and mitigation, WWF and E3G tabled at Poznan 2008 a proposal to create, in the framework of the UNFCCC, a set of *Technology Action Programs (TAPs)*. The proposal builds on the experience of the global technology cooperative effort launched by the Montreal Protocol some 20 years ago, that was highly successful in helping phasing out ozone-depleting substances worldwide.

These TAPs would run for periods of 5 years, and have the flexibility to support both rapid advances in the deployment of more mature technologies, and the lower pace of R&D in less advanced options.

Assessing the TAPs baseline –e.g. understanding and informing how developed the technology is and the barriers to its transfer and use in developing countries—and setting clear targets for each TAP would bring predictability to technology cooperation efforts, thus facilitating the participation of developing countries, and sending clear signals to the private and finance sector, governments, research institutions and the public at large.

According to WWF and E3G at least 20 different action programs could be established in areas like wind energy, solar energy, renewable energy grid systems and grid loss reduction, electric vehicles, energy efficient appliances and lighting, phase-out of hydrofluorocarbons (HFCs), and pro-poor technologies to avoid salinity intrusion and the expansion of salinity-tolerant crops.

**Table 3: Implementation Phase**

<b>Outputs</b>	<b>Eligible Activities</b>	<b>Funding Modalities</b>	<b>Graduation Requirements</b>
<b>Sector modernization/ technology change</b>  <b>MRV-able sector emissions reduction</b>  <b>Increased sector energy efficiency</b>  <b>Enhanced enforcement</b>  <b>Mitigation of negative sector impacts (macro/equity)</b>  <b>Conducive policy environment</b>  <b>Dissemination of lessons to public</b>	<b>Activities will include, among others:</b>  <b>Plant/Building/ Infrastructure modernization</b>  <b>Acquisition of IP</b>  <b>Applied R&amp;D</b>  <b>End-user efficiency</b>  <b>Policy reform</b>	<b>Funding will include a package combining:</b>  <b>STF Grants:</b> STF grants would cover on average 15% of total costs during this phase.  <b>Other international and national public funds</b> could provide additional grants or other types of soft funding  <b>Loans from public institutions</b> These will include loans from RDBs, the IFC; MIGA; bilateral agencies and others.  <b>Regulated and voluntary carbon markets</b>  <b>Public-Private Partnerships</b>  <b>Private sector instruments:</b> These instruments could include equity shares, insurance guarantees, carbon banking, and others.	<b>Progress reports to the COC and national climate body.</b>

## 4. Establishing a UNFCCC Sector Transformation Fund

### 4.1. The Global Costs of Mitigation in Developing Countries

Considerable attention has been devoted in recent years to estimating the worldwide costs of mitigation. Despite the many studies, considerable uncertainties remain. For example, low estimates put these costs at around 1.1 and 1.7 percent of the world annual investment by 2030. High estimates push the numbers to 3 to 4 percent of the world annual investment (also circa 2030). Below, we present two alternative estimates for developing countries mitigation costs: the UNFCCC 2008 figures and the McKinsey 2008 cost curve figures.

#### **Box 5. Two Estimates of Annual Investment and Financial Requirements for Mitigation in Developing Countries**

<b>UNFCCC estimates<sup>5</sup></b>	<b>McKinsey cost curve estimates<sup>6</sup></b>
\$ 64.7 billion per year by 2030 of additional investments and financial flows (in 2005 \$US)	€ 55-80 billions per year from 2010 to 2020
Assumptions: (a) consistent with world emissions of 30 Gt of CO <sub>2</sub> eq per year by 2030; (b) consistent with developing countries emissions reductions of 7 Gt of CO <sub>2</sub> eq. per year by 2020; (c) includes emissions reductions from forest and agriculture; (d) doesn't include investment in technology; (e) doesn't include operation and maintenance costs; (f) doesn't include capacity building; (g) doesn't include policy reform costs; (h) no estimates provided for years before 2030	Assumptions: (a) consistent with world emissions of 35 Gt of CO <sub>2</sub> eq per year by 2030; (b) consistent with developing countries emissions reductions of 12 Gt of CO <sub>2</sub> eq. per year by 2020; (c) includes emissions reductions from forest and agriculture; (d) includes transaction costs and allowance for higher discount rates in developing countries; (e) includes operation and maintenance costs (f) doesn't include investment in technology; (g) doesn't include capacity building; (h) does not include policy reform costs; (i) no estimates provided after 2020

There have been concerns that the UNFCCC estimates are not based on a goal of less than 2°C increase, and a maximum of 450ppm, and hence may underestimate the true costs of mitigation. Actually, emission abatements scenarios are similar in both UNFCCC and McKinsey estimates -- achieving a 30 to 35 Gt CO<sub>2</sub> equivalent of annual emissions by 2030. The UNFCCC and McKinsey data differ in several points including in the trajectory of emissions (McKinsey emissions estimates peak earlier) and in the costs of abatement (UNFCCC estimates tend to be lower). However, regarding mitigation costs in developing countries, the largest difference results from the fact that McKinsey estimates have more abatement taking place in developing countries, particularly in the 2020 horizon: 7 Gt CO<sub>2</sub> equivalence in the UNFCCC estimates, against 12 Gt CO<sub>2</sub> equivalence in the McKinsey proposals. Furthermore, all estimates of mitigation incremental costs, as referenced in Box 5 above, are very sensitive to the price forecasts for traditional fuels. The more expensive traditional fuels become, the lower the incremental costs of mitigation will be, and vice versa.

<sup>5</sup> UNFCCC, 2008 "Investment and financial flows to address climate change: an update. FCCC/TP/2008/7

<sup>6</sup> McKinsey, Global GHG Abatement Cost Curve v2.0

## 4.2. Where Should the Resources Come from?

There is a consensus that financial resources to pay for mitigation in developing countries should come from a variety of sources, including,

- International public funds;
- National public funds;
- Growth of UNFCCC regulated international carbon markets as mandatory mitigation (cap-and-trade) extends and tightens<sup>7</sup>;
- Development of voluntary international carbon offset markets; and
- National and international private investors, compelled either by emissions regulations, carbon taxes or the pursuit of profit opportunities in the shift to low emission business models.

Moreover, there has been a proliferation of innovative financial products to support or actually develop some of these potential sources of funding. These include venture capital, offset banks, carbon stock exchanges, carbon bonds, risk sharing instruments, and auctioning of emission allowances, among others.

A significant limitation of the mitigation financing discussion thus far is that the appropriate contribution of each of these sources has not been clarified or agreed to. Some quarters argue that almost all mitigation costs will be paid by the carbon markets and private investors, while others argue that all, or almost all, mitigation costs in developing countries should be paid by international public funds from industrialized countries. While allocating specific percentage would be arbitrary, we believe that a general pattern is beginning to emerge:

- International public funds are particularly important (a) in the start-up phase of mitigation efforts in all developing countries; (b) in all phases of mitigation efforts in the case of poorer developing countries; and (c) when other important financing options, particularly carbon markets, are still underdeveloped;
- National public funds may be an important source of funding in middle-income countries, particularly in the initial phases of mitigation efforts;
- The importance of carbon markets and other forms of private funding will grow as these mechanisms mature and expand, and as developing countries move into full mitigation implementation, therefore having solid mitigation results that can be marketed.

In a nutshell, all sources of financing for mitigation in developing countries are important but, in the short-run, increasing the availability of international public funds is absolutely critical. This is particularly the case in helping the poorer countries achieve sustainable growth and reduce poverty while limiting GHG emissions.

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<sup>7</sup> Regulated carbon offset markets (e.g. the EU carbon market) face three major limitations to become a large as sources of funding for mitigation in non Annex 1 countries: (1) they actually don't add to worldwide emission reductions. They simply swap reductions from Annex 1 to non Annex 1 country; (b) Access of non- A1 countries to regulated markets would depend on the market rules that are established by Annex 1 countries; and (3) In order to create an offset market large enough to buy significant amounts of developing country carbon offsets, developed countries should have to commit to very deep emission cuts, way beyond what has been tabled thus far.



The amount of public funds, especially those that are new and additional, that industrialized countries are ready to commit to this purpose will be a major issue at COP15. Linked to this debate will be the discussion whether these resources will be made available under the UNFCCC/COP authority.

### **4.3. Existing and Proposed Sources of International Public Funding for Supporting Mitigation Actions**

There are currently several international funds and mechanisms with limited capacities for supporting mitigation actions under the framework of the UNFCCC. The most prominent one is the Clean Development Mechanism, a clearinghouse mechanism, that certifies Annex I mitigation investments in developing countries, so that those investments can be recognized as part of the emission reductions commitments of the Annex I investors.

Also in the last five years, more than a dozen international funds have sprung up and have been capitalized by contributions from industrialized countries. These funds are currently operating outside the UNFCCC framework. Some of these funds focus exclusively on climate change mitigation in developing countries; others have multiple goals, often including funding opportunities for mitigation and adaptation. A few of them are programmed to dissolve in 2012 when the Kyoto Protocol ends. Others still seem to have been established for the long run.

Regardless of their purpose, there is a consensus that currently available international funding will fall far short of needed finance to significantly reduce GHG emissions. It is assumed that the UNFCCC COP will play a major role in guiding the scaling-up of international public funding for climate change mitigation in developing countries.

Hence, as of late 2008, half-dozen financial proposals have been submitted to the UNFCCC COP15 preparatory process, and more will surely come. These proposals focus almost exclusively on ways of collecting funds and on the volume of resources to be collected. Proposed sources of funding include: establishing country payment quotas in proportion to GDP; pooling a percentage of auctioned carbon emission permits; imposing taxes on international air and maritime transit; applying a global tax on carbon, and more. The volume of funds that could be raised by these different approaches varies from a low of \$2B a year to a high of \$180B a year.

There are many reasons to believe that agreeing on the methods of resource capture for a global climate regime will remain controversial up to COP15. Without endorsing a particular proposal among the ones tabled thus far, WWF has highlighted the UNFCCC principles that should lead the discussion, including:

- Ensuring the adequacy of funds for mitigation needs;
- Guaranteeing the stable, predictable delivery of financial resources; and
- Ensuring that climate finance be new and additional to current international development assistance.<sup>8</sup>

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<sup>8</sup> Find a more detailed discussion of these and related principals in a recent WWF position paper. "Finance from Developed to developing countries A global financial architecture for climate change", WWF December 2008, can be downloaded from [http://assets.panda.org/downloads/wwf\\_finance\\_paper\\_web.pdf](http://assets.panda.org/downloads/wwf_finance_paper_web.pdf)

#### 4.4. Filling the Gap: The Need for a Sector Transformation Fund

Thus far the UNFCCC/COP discussions on the provision of international public funding for climate change mitigation actions under the UNFCCC framework have pursued two approaches. The first approach is based on estimating the global costs of mitigation (e.g. UNFCCC Secretariat estimates or the Stern Report). The second approach focuses on the potential money that could be raised by engaging a variety of funding sources and mechanisms (see section 3.3). Both approaches are important and necessary, but their aggregate and top-down approach risks generating a stand-off between industrialized countries and the rest.

Our proposal advocates for the establishment of a new Sector Transformation Fund (STF) as part of the UNFCCC Global Financial Mechanism. The STF would be capitalized by contributions from industrialized countries, and would provide new and additional funding to developing countries in the form of grants to help them pursue sector transformations that result in significant GHG emissions without jeopardizing their national development goals. We do not believe that currently existing funds will be able to close the gap of needed funds nor provide the necessary incentives to attract the collaboration of complementary funds and mechanisms to support the required sector transformation changes in developing countries. In this section, we explore minimum funding needs that would make the STF an important player in scaling up mitigation activities, and at the same time, make it attractive to donors and recipients alike.

We have based our argument on the cost estimates of financing a portfolio of 100 to 150 country-wide sector transformation plans through the three phases of operation of the Sector Transformation Fund, namely the Preparation, Initiation, and Implementation Phases.

- The Preparation Phase would deliver a transformational plan that maps the priority actions to be undertaken on a sector and strategic basis, the domestic and incremental costs of transforming a sector and implementing a low emissions strategy, and available sources of private and public financing. Such a transformational plan would allow non-Annex I countries to maintain considerable control over each country's respective process, and to decide, in an informed way, on the magnitude, the pace and the scaling-up process of the mitigation commitments they are willing to make. On the other hand, this approach would allow industrialized countries to make initial financial contributions and commit to scale-up their contributions as developing countries' mitigation programs move from the preparation, to the initiation, and then to the Implementation Phase.

Based on similar ongoing experiences (see box 2) we have estimated that the preparation of Sector Transformation Plans (STP) in the context of low emissions strategies could cost an average of \$2M a year, and last from 1 to 5 years depending on the scale and complexity, data availability, technical and human resources, among many other factors. We have budgeted for 100 to 150 sector transformation plans through 20 years of operation of the Sector Transformation Fund. Even assuming that all preparatory costs would be paid in full by the STF, the funding requirements are modest, averaging some \$100M a year for the first 10 years and tapering off thereafter. The bottom line here is that the STF can jump-start an important transformation process with relatively modest resources.

- The Initiation and Implementation Phases will be much more costly. In our case studies of large sectors in large countries (China, India), costs can be on the order of hundreds of millions, or even billion of dollars per year and per sector. However, it must be kept in mind that during these phases an increasing portion of the funding for mitigation can come from a variety of sources, including (a) other international funds; (b) national funds; (c) carbon markets; and (d) private investors. In our exercise, we have capped the STF contribution at 25% of estimated initiation costs and 15% of estimated implementation costs. These are average figures that would allow the Sector Transformation Fund to pay for a large percentage - or even one hundred percent - of the incremental costs of mitigation in a less developed countries, while contributing a much smaller percentage to a basket of funding sources for mitigation investment in middle-income countries.

Based in our case studies, we have estimated that average costs of Initiation Phases can go from \$4M to \$40M a year (for 3- to 5- year programs) and the average costs of Implementation Phases can go from \$50M to \$1B a year (for 4 to 6 years programs).

In conclusion, with the above mentioned 25% and 15% average of grant funding provided by the Sector Transformation Fund, moving a portfolio of 100 to 150 Sector Transformation Plans first to the initiation and then to the Implementation Phase, would require the STF to disburse funds that would average \$2B annually during the first 5 years where most, but not all, sector transformation plans are in the Preparatory Phase, and up to \$10B annually in later years when those plans will be under full implementation.

**Box 6. The Minimum Money Requirements for a UNFCCC Sector Transformation Fund**

To come up with an answer to the “How much money?” question, the Sector Transformation Fund proposal has gone through several steps, including:

- (a) Estimating costs from real case studies and ongoing mitigation activities;
- (b) Estimating costs for three phases of mitigation initiatives: a Preparatory Phase, an Initiation Phase, and an Implementation Phase;
- (c) Acknowledging that the Sector Transformation Fund cannot and should not be the sole source of funding, and proposing a sliding STF funding as follows: up to 100% of preparation costs; 25% of initiation costs and 15% of implementation costs. These are averages and can be compatible with funding a larger portion of less developed countries’ costs and a smaller portion of middle income countries’ costs;
- (d) Estimating funding requirements for a STF to support some 100 to 150 sector transformation plans over a 20-year period.
- (e) Including fees for fund operation and management (based in international standards)

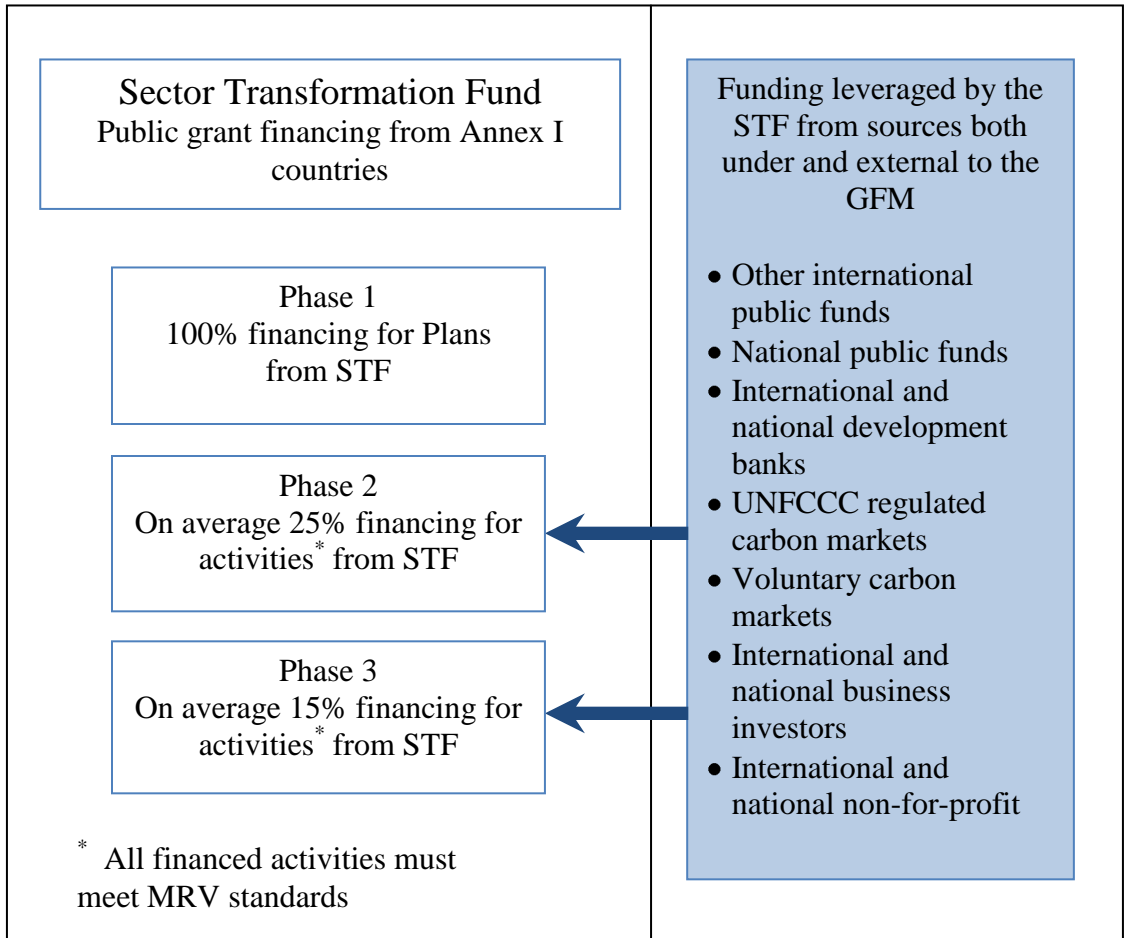
To make the establishment of the Sector Transformation Fund a viable option, it would require a start-up commitment from industrialized countries in the order of \$10B for the first 5 years of operation, growing to \$35B in the following 5-year period. The details are shown in the table below.

Years	STF (billion dollar a year 2005 prices)	Leverage from other sources (billion dollar a year 2005 prices)	Total funding (billion dollar a year 2005 prices)
2010 – 2014	2	2	4
2015 – 2019	7	20	27
2020 – 2024	8	40	46
2025 – 2029	10	57	67

Several important clarifications should be made regarding the above figures:

- The STF is intended to be neither the only mitigation fund, nor the mother of all mitigation funds. It is intended to be the mitigation fund under the aegis of the UNFCCC, providing the identified lack of grant resources large enough to have a substantial impact on its own and to leverage other sources of financing for mitigation that would be provided by mitigation funds and mechanisms inside and outside the UNFCCC framework.
- By the same token, the STF should not be viewed as the only source of money that industrialized countries should contribute to support mitigation activities in developing countries. Industrialized countries should contribute significantly more. In the short-term, the STF is viewed as a central initial commitment on which industrialized countries will build complementary funding windows. In the long term we expect that the UNFCCC parties may want to bring all or certainly the majority of these funding windows under the aegis of Convention and its Global Financial Mechanism.

**Figure 6: The Sector Transformation Fund and Leveraged Funding**



Lastly it should be emphasized that the estimates for funding requirements of the Sector Transformation Fund may vary either with the tightening of the world mitigation goals, the costs associated with of sector changes or the percentage of the costs that the STF is expected to fund in each phase of operation.

## 5. Case Studies

To help develop the Global Financial Mechanism and Sector Transformation Fund proposals, we commissioned a dozen short supporting studies. Findings of finished studies have already informed the drafting of this document. Below we have listed all of these supporting studies, with a brief description of their purpose. We have included in this document summaries of three country case studies: China's cement industry; China's Iron and Steel industry; and Tunisia's renewable energy options. In a subsequent publication, we plan to include the final versions of the twelve supporting studies.

### 5.1. The Country Case Studies

The goal of the country case studies is to facilitate a more informed discussion of what is needed to shift high carbon sectors of developing countries to low carbon trajectories and how a funding mechanism in the framework of the UNFCCC could help achieve these changes. The list of country cases appears in Table 4 below.

**Table 4. The Country Case Studies**

Country	Sector / technology	Function /Focus
China	<ul style="list-style-type: none"><li>• Cement</li><li>• Iron and steel</li></ul>	Technology dissemination Technology dissemination
India	<ul style="list-style-type: none"><li>• Alternatives to coal based power generation</li></ul>	Technology dissemination Technology development and dissemination
Mexico	<ul style="list-style-type: none"><li>• Cement,</li><li>• Iron and steel</li></ul>	Technology dissemination Technology dissemination
Tunisia	<ul style="list-style-type: none"><li>• Renewable energy: Concentrated solar thermal energy and wind power</li></ul>	Technology development, transfer and dissemination

### 5.2. Technical Reviews

The goal of the technical reviews is to take stock of recent developments regarding financing for climate change mitigation, both in practice and in the discussions in the run up to COP15. The list of technical studies and a brief description of each one appears in Table 5 below.

**Table 5. The Technical Reviews**

Technical Reviews
<p><b>New Finance for Climate and the Environment:</b> This review, completed by WWF and the Heinrich Böll Foundation in July 2008, analyze 14 climate change related funds and funding mechanisms recently created outside the UNFCCC framework; including, among others, the World Bank’s Strategic Climate Fund and Clean Technology Fund, the European Commission’s Global Climate Change Alliance, and the Norwegian Rainforest Initiative.</p>
<p><b>A Review of the CDM and Other Existing and Proposed Financial Mechanisms to Fund Mitigation and Adaptation in Developing Countries:</b> This study reviews the operation of (a) current funds and financial mechanisms in the framework of the UNFCCC, including the CDM, the Adaptation Fund, the Special Climate Change Fund, the Least Developing Countries Fund, and others; (b) it summarizes other environment related international funds, as the Montreal Protocol Fund and the Global Energy Efficiency Fund; and (c) it also reviews major funds and financial mechanisms proposals tabled by UNFCCC Parties up to COP14.</p>
<p><b>Ready for Climate Change Mitigation? Country Readiness Plans as Strategic Planning Tools:</b> To help design the “Preparation Phase” of GFM proposal, this study reviews similar experiences with other financial mechanisms, particularly the work of the Readiness Mechanism of the World Bank’s Forest Carbon Partnership Facility.</p>
<p><b>Financing REDD: A review of selected policy proposals:</b> This study takes stock of the forest carbon proposals tabled by the UNFCCC parties up to COP14 (Poznan, December 2008)</p>
<p><b>A Review of Sectoral Mitigation Proposals.</b> Sector approaches to mitigation in developing countries have been proposed by UNFCCC parties and by technical groups. Some of them have found strong opposition among developing countries. This study reviews the main sector proposals tabled up to COP14.</p>
<p><b>Options for financing for technology cooperation under the UNFCCC, and their relation with mitigation financing:</b> This study explores the complementarities between financing for mitigation and financing for mitigation-related technology cooperation.</p>

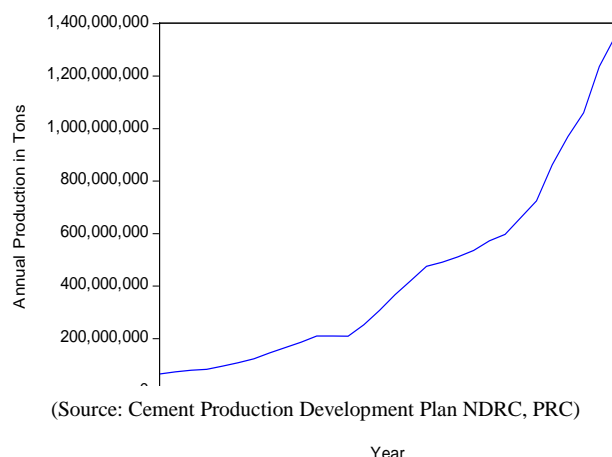
### **5.3. The Threshold-21 Model (T-21)**

The Threshold-21 model was designed to assess countrywide impacts of different development strategies, with a particular focus on incorporating economic, social, and environmental interactions into a single, coherent framework. To use the T-21 model in this project, WWF has retained the Millennium Institute --creator of T-21-- to expand their existing T-21 China model, adding detailed information on the cement and iron & steel sectors, including use of different technologies and their costs, inputs, employment, and emissions associated with each technology choice. The T-21 model will then allow us to see how changes in these two sectors ripple through the national economy, affecting emissions, employment, investment, GDP, and more.



## 5.4. A Summary of China's Cement Industry Case Study<sup>9</sup>

**Figure 7: China- Annual Cement Production in Tons**



### 5.4.1. The Facts

Cement production in China has been growing at 10% a year over the past two decades: today making China the world's largest producer--1.3 billion tons in 2007--representing 50% of the world's production. For comparison, the second largest producer, India, has an installed capacity of less than 200 million tons a year and the third, the United States, less than 100 million tons a year.

Worldwide cement production accounts for roughly 5% of global CO<sub>2</sub> emissions. In China, the sector accounts for somewhere between 15% and 25% of the country's CO<sub>2</sub> emissions. This is due in part to the sheer size of China's cement industry, but also to the fact that China's emissions of CO<sub>2</sub> per ton of cement are high. The reasons are obvious, almost all

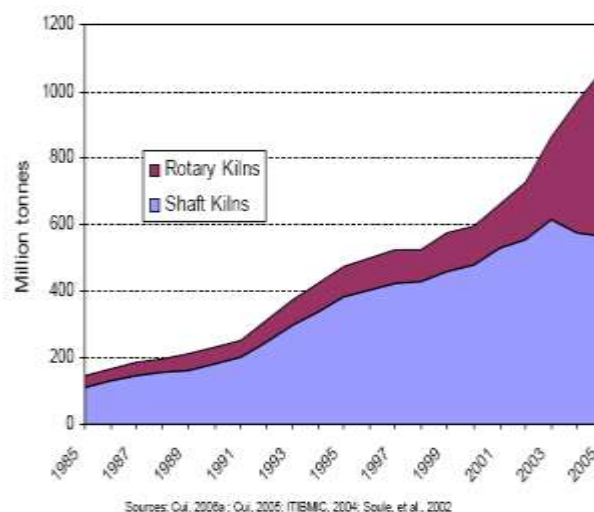
of the industry is fueled by coal, and a good part of it is technologically obsolete and energy inefficient. Paradoxically, while China's cement industry boasts some of the most technologically advanced plants in the world, approximately 50% of cement is still produced by highly inefficient and highly polluting, small-scale vertical shaft kilns.

### 5.4.2. The Opportunities

If China were to shift production to modern, dry rotary kilns and adopt an aggressive alternative raw materials and fuel program (burning waste products rather than fossil fuels) the emissions of CO<sub>2</sub> could fall by 45%. Assuming that cement production levels off at about 1 billion tons per year, that shift would result in 450 millions of CO<sub>2</sub> annual emission reductions. A short review of the forces at play can shed light on how this shift to lower CO<sub>2</sub> could happen, and how a Transformational Funding Mechanism in the framework of the UNFCCC could help it happen.

**Favorable policies are in place:** Since 1990 the Chinese government has had a program to close old vertical shaft kiln plants and replace them, where appropriate, with modern units. The aim of this

**Figure 8: China Cement Production: Share of Shaft and Rotary Kilns**



<sup>9</sup> This is a summary of a longer case study commissioned for this project: Michael Rock (2008) "Using External Finance to Foster a Technology Transfer-Based CO<sub>2</sub> Reduction Strategy in the Cement and Iron and Steel Industries in China"

policy is to rationalize the size distribution of firms by closing small firms, encouraging the consolidation of a smaller number of very large firms, and pushing the remaining firms to the technological frontier. This industrial development strategy offers real and substantial opportunities for putting China cement sector on a substantially lower CO<sub>2</sub> emissions trajectory.

**The market is pushing in the same direction:** The restructuring of China's cement industry is also driven -- some would argue mostly driven-- by market forces. On the demand side large buyers request high quality cement that only modern plants can provide and, on the supply side, many firms have found that larger, modern kilns are more efficient and more profitable.

**Technologies are at hand:** Cutting by half China's cement CO<sub>2</sub> emissions can be achieved with today's available technologies, including: (1) retrofitting existing kilns, (2) replacing all or part of old vertical kilns with larger, more efficient kilns, (3) upgrading performance of existing rotary kilns; (4) decreasing electricity use in raw materials preparation and in the grinding of clinker, (5) shifting to blended cement, and (6) using alternative (waste) fuels in kilns. China's more advanced cement plants already use several of these technologies, and while most modern equipment is still imported, China already manufactures large rotary kilns. The table below lists several of these technological improvements with their energy /CO<sub>2</sub> savings per ton of cement.

**But modernization costs would be high:** Table 2 presents a summary of the investment costs that would be necessary to reduce China's cement industry emissions by approximately 45%. Total costs are large, in the order of \$43B, three quarters of which are the costs of switching most of the production to new rotary kilns with pre-heaters and pre-calciners. Marginal investment costs vary significantly. The first 50 million tons of CO<sub>2</sub> reductions could come very inexpensively, but costs climb steeply thereafter, first to \$ 20 per ton, and then to \$30 per ton (see Figure 8).

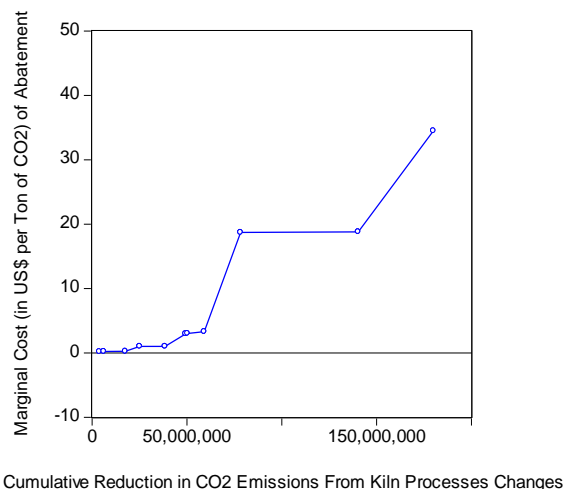
**Table 6: Technological improvements and energy and emissions gains in the cement industry**

Intervention	Fuel Savings (GJ/Ton)	Electricity Savings (kWH/Ton)	CO <sub>2</sub> Savings (KgC/Ton)
<b>Retrofitting all kiln types</b>			
Kiln shell heat loss	.4-.6		10.3-15.5
Energy management/process control	.1-.2	1.5-3.2	2.9-5.9
Adjustable speed kiln fan			
<b>Replacing vertical shaft kiln with rotary kilns with pre-heaters and pre-calciners</b>	2.4		62
<b>Upgrade rotary kilns by adding</b>			
Pre-calciner to kiln with pre-heater	.16-.7		4.1-18.1
Pre-heater and pre-calciner	1.4		36
Multi-stage pre-heater	.9		23
Reciprocating grate cooler	.27		6.3
Improved kiln combustion system	.1-.5		2.6-12.9
Optimize heat recovery/upgrade clinker cooler	.05-.16		.8-3.7
Heat recovery for power		20-35	4.6-8.1
Low pressure drop cyclone		.7-4.4	.16-10
<b>Energy savings in raw material processing</b>			
Efficient transport system		3.4	.78
Raw meal blending		1.7-4.3	.4-1.0
Process control vertical mill		1.4-1.7	.3-.4
High efficiency roller mill		10.2-11.9	2.3-2.7
High efficiency classifiers		4.8-6.3	1.1-1.4
Slurry blending and homogenizing		.5-.9	.1-.2
Wash mills with closed circuit classifier		8.5-11.9	2.0-2.7
Roller mills for fuel preparation		.7-1.1	.2-.3
<i>Source: Worrell et al. (2008) World best practice energy intensity values for selected industrial sectors. Lawrence Berkeley National Laboratory. University of California. Paper No. LBNL-62806.</i>			

**Table 7. Direct Cost of Reducing China's Cement Sector CO<sub>2</sub> Emissions by 45% for an Industry with 1 billion tons a year of Capacity**

Intervention	Cost per Ton of Clinker	Million Tons of Clinker	Total Cost in Millions of US \$
<b>Vertical Shaft Kilns</b>			
Kiln shell heat loss	\$.25	100	\$25
Improved energy management/process control	\$1.00	100	\$100
Adjustable speed drive for kiln fan	\$.23	100	\$23
<b>Rotary Kilns</b>			
Kiln shell heat loss	\$.25	170	\$42.5
Improved energy management/process control	\$1.00	170	\$170
Adjustable speed drive for kiln fan	\$.23	170	\$39.1
Add pre-calciner to kilns with pre-heaters	\$18.70	170	\$3,179
Add pre-heater and pre-calciner	\$34.50	170	\$5,865
Convert to reciprocating grate cooler	\$2.95	170	\$501.5
Kiln combustion improvement system	\$1	170	\$170
Indirect firing	\$7.40	170	\$1258
Optimize heat recovery/upgrade clinker cooler	\$.20	170	\$34
High temperature heat recovery for power	\$3.3	170	\$561
Low pressure drop cyclone	\$3	170	\$510
New rotary kilns with pre-heaters and pre-calciners	\$41	730	\$29,930
Shift to blended cement	\$.70	500	\$350
Adopt aggressive alternative fuels program	\$3.70	200	\$740
Total cost			\$43,350
<i>Sources and assumptions in M. Rock (2008)</i>			

**Figure 9: Marginal Cost (US \$ per Ton) of Abating CO<sub>2</sub> from Kiln Process Change through 2020**



Most of these costs could be repaid by the efficiency gains accompanying the modernization process. For example, retrofitting existing vertical and rotary shaft kilns could pay back in as little as three years. Still, few cement plants in China are investing in retrofitting. On one hand, the small local companies with antiquated vertical kilns are usually cash strapped, and would not be able to invest in technological innovations, even if they wanted. On the other hand, some medium size firms with rotary kilns do invest in retrofitting, but most do not, due to lack of technological foresight, a phenomena well studied in the literature on technology diffusion. The bottom line is that strong incentives may still be required (e.g. favorable loans, regulations, training and capacity building, etc) to push a significant part of China cement sector towards a low CO<sub>2</sub> emission path.

**And there may be important social and institutional indirect costs too:** Since the late nineties, China's drive to restructure the cement sector has progressed much more slowly than anticipated. That delay is attributable to the fact that many of the smaller firms and kilns are owned by local governments that use them to prop up production and employment within their jurisdictions. These governments are averse to closing them down and seeing production and employment shift to larger plants located elsewhere. China's strong decentralization process shields local governments from central government pressures. In addition, given the potential social disruption associated with the closing of many of these small-scale production units, the central government is reluctant to move too quickly for fear of increasing social unrest. The bottom line is that accelerating the cement sector restructuring may require investing in alternative economic activities, labor training and safety nets in the thousands of localities affected by the closer of old cement plants<sup>10</sup>.

<sup>10</sup> In its China chapter, a recent world-wide review of the cement sector commissioned by WWF International, discusses the same emission reduction opportunities of our study and put forward two more that we have omitted in this summary:: opportunities for carbon capture and sequestration in the cement sector, and demand management (to reduce the demand for cement). On the other hand that study does not address the indirect economic and social costs that our study highlights as one of the barriers to the modernization of China's cement sector (see, ECOFYS, 2008 "How to turn around the trend of cement related emissions in the developing world? A background report prepared for the WWF-Lafarge Conservation Partnership, Nuremberg, Germany).

### 5.4.3. What role for a UNFCCC Sector Transformation Fund?

The above summary discussion illustrates some of the main opportunities and challenges that China would face in trying to move a large industrial sector towards a low GHG emission trajectory. The summary also illustrates the role of a UNFCCC Sector Transformation Fund, including:

- Replacing old plants with state of the art rotary kilns may require as much as \$30B in investment. The largest part of these investments is justified in strict business terms and is in line with China's own restructuring program. Yet, the additional mitigation costs, the ones that Annex II countries may be called to fund, can amount to several billion dollars. On the technology side, China has the option of either importing most of the new equipment and know-how or, alternatively, investing in the development of already existing but incipient country capacity to design and build high end cement equipment. In both cases, this may also require international support.
- Improving GHG emission performance of existing modern plants also entails significant investments estimated at approximately \$13B. In addition to covering these investment costs, reaching agreement to invest in modernization and innovation is equally challenging, as reflected in the large disparity in companies' willingness to improve productivity and efficiency. Thus, beyond the issue of paying for modernization costs, international funding in the framework of the UNFCCC could support a strategic public - private collaboration focused on accelerating technological learning among firms and providing financial incentives to overcome information externalities (costs of sector-wide information and know how dissemination) and coordination failures (where a number of firms need to adopt a new technology in a coordinated way in order to make it economically attractive).
- A strong capacity building effort may be needed to promote investment on emission abatement among medium size firms; both to gain managers' interest, and to train the staff that would design and operate the improvements. There are firms in China that have already mastered this knowledge, but they may be reluctant to share for free the actual source of their competitive advantage, or they may request a fair compensation to do so. Hence an important role for the STF could be to support China government capacity building efforts with the goals of (a) accelerating the spread of knowledge regarding emission reduction options among firms; (b) helping China address the required legal or regulatory frameworks and public staff training needs, and (c) where necessary, facilitate international level exchanges regarding technology information, capacity building, and the brokerage of cooperation activities.<sup>11</sup>
- Indirect costs, to provide alternative economic activities, labor training and safety nets to the thousands of localities associated with the closure of old cement plants, may be the exclusive responsibility of the Chinese government. However, these costs may need to be factored into a sector-wide GHG emissions reduction strategy. In addition, it may be possible for China to pursue these investments in a "Sustainable Development Policies and Measures" framework that would qualify for support in the framework of the UNFCCC.

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<sup>11</sup> The importance of capacity building, even in the relatively advanced context of China's cement industry, was brought to our attention by the work of WWF China staff

The overall conclusion that we draw from this summary is that moving China's cement sector to a lower CO<sub>2</sub> emission trajectory is possible, and would result in large GHG emission reductions. But it is a multi-year endeavor that will demand a multi-tiered emissions reduction strategy, capable of mobilizing private and public, national and international interest and resources.

Helping China (and other countries in a similar situation) refine such strategies could be the initial contribution of a UNFCCC funding mechanism –the preparatory phase-- to be followed by a steady provision of financial and technical support, and a networking effort to mobilize a variety of international and national funding sources to support the initiation and implementation of the emission reduction strategy.

## 5.5. A Summary of China's Iron & Steel Industry Case Study<sup>12</sup>

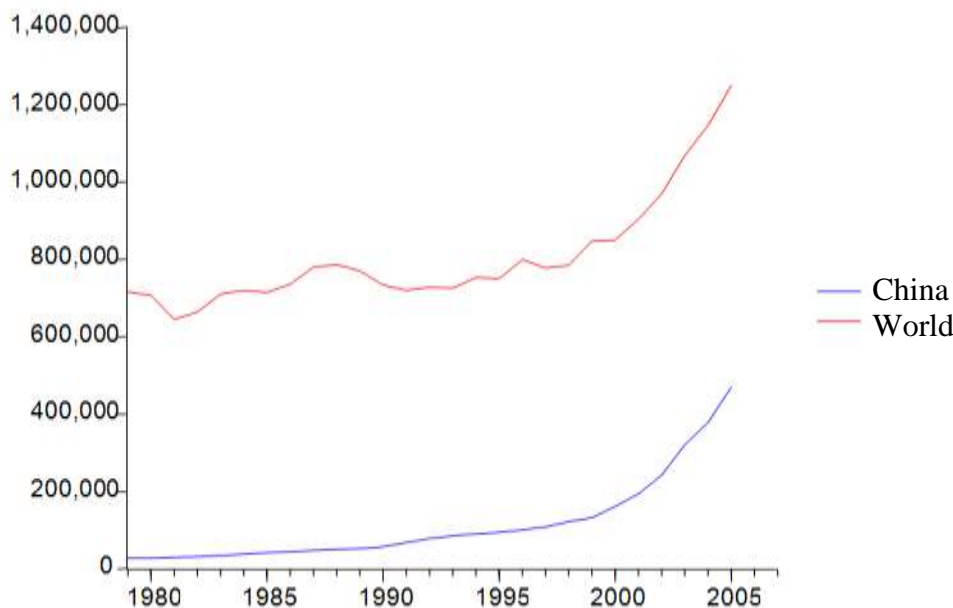
### 5.5.1. Iron and Steel (I&S) Production in China: a contrasting story

Following the Sino-Soviet split of the 1950s and the isolation of China from the global economy, policy-makers in China set out to disburse iron and steel making away from its coasts and large urban areas. The government also set out to promote local self-sufficiency in steel production. Not surprisingly, this policy promoted the proliferation of low efficiency, highly polluting, small-scale plants throughout China.

After 1978, with the liberalization of the Chinese economy, public policies reversed and focused on rationalization and structural adjustment of the industry. Main elements of the new policy included closing older open hearth furnaces, shifting production toward larger and more efficient plant sizes, and reducing the number of firms by promoting the emergence of several very large iron and steel conglomerates that could compete in the world economy.

This change of policies, coupled with China's two digit economic growth, resulted in the explosive growth of the I&S industry. Crude steel production grew 8.1% per year between 1980 and 1995 and 17.8% per year between 1996 and 2006. As a result, China has become the largest producer of crude steel, with 36% of the world production in 2007.

**Figure 10: Crude steel production for China and the World (thousands of tons)**



<sup>12</sup> This is a summary of a longer case study commissioned for this project: Michael Rock (2008) "Using External Finance to Foster a Technology Transfer-Based CO<sub>2</sub> Reduction Strategy in the Cement and Iron and Steel Industries in China" All the figures quoted in this summary are from Wang et al (2007) 'Scenario Analysis of CO<sub>2</sub> emissions reduction potential in China's iron and steel industry' *Energy Policy* 2320-2335.

As a result of the different forces at play, the I&S sector in China still presents today a contrasting picture. On the one hand, China has a small number of medium and large scale, state of the art, energy efficient steel mills. On the other hand, a large number of small, inefficient plants linger (see table 1 below).

**Table 8. Iron & Steel production in China a mix of large/modern and small/outdated plants**

Process	Percentage of Production Capacity (circa 2004)
Iron, pig iron blast furnaces <ul style="list-style-type: none"> <li>• large furnaces (more than 1000 m<sup>3</sup>)</li> <li>• small furnaces</li> </ul>	17% 55%
Steel, basic oxygen furnace (BOF) <ul style="list-style-type: none"> <li>• Large furnaces (more than 300 tons)</li> <li>• Small (less than 100 tons)</li> </ul>	4% 67%
Steel, electric arc furnaces (EAF) <ul style="list-style-type: none"> <li>• Large furnaces (more than 100 tons)</li> <li>• Small furnaces</li> </ul>	30% 70%

Source Wang et al, 2007

### 5.5.2. GHG emissions in the Iron & Steel industry

Worldwide the iron and steel industry is a major source of GHG emissions. In 2002 the sector accounted for 4% of the world CO<sub>2</sub> emissions and 3.2% of the world GHG emissions. In China the I&S industry accounts for 10% of the country's CO<sub>2</sub> emissions and 7% of its GHG emissions.

China I&S industry has made enormous progress in increasing efficiency and reducing CO<sub>2</sub> emissions, and its large modern mills already operate close to international best practice. For example in 2004 average energy consumption in large China's mills was 705 kg of standard coal equivalent per ton of steel, just 7.5% higher than the energy consumption per ton of steel in Japan mills.

On the other hand, the average energy efficiency in China's small mills is 1,045 kg of standard coal equivalent per ton of steel. This is nearly 50% higher than the average of medium and large mills in China and nearly 60% larger than those mills in Japan. Furthermore, due to China's ample supply of iron ore and its limited supply of scrap steel, China is one of the few countries in the world that has been building new integrated primary steel plants that require production of pig iron to make steel. As a consequence, a large share of crude steel (83%) is produced in basic oxygen furnaces, rather than in more energy efficient and less polluting electric arc furnaces.

Because of all the above, large technical opportunities are available to reduce energy and CO<sub>2</sub> intensity of China's S&I industry, particularly through two complementary strategies:

- Closing the large number of small, inefficient and energy intensive mills and replacing them with larger and more energy efficient mills. For example, a shift from small to large blast furnaces could save .28 tons of CO<sub>2</sub> per ton of steel, while a shift from small to large electric arc furnaces could save .16 tons of CO<sub>2</sub> per ton of steel (Wang et al. 2007).



- Even larger savings in CO<sub>2</sub> could be achieved if China were able to shift production away from integrated steel mills that produce pig iron, and increase the share of electric arc furnaces that rely on scrap as the basic raw material for making steel. Such a shift could save .61 tons of CO<sub>2</sub> per ton of steel.<sup>13</sup>

### 5.5.3. Three scenarios of GHG emissions in the Iron & Steel industry

Due to the strong relation between the country's economic growth and growth in the demand for steel, no one expects that I&S total emissions will fall in absolute terms in the near future, but there is ample room to reduce their emission intensity (GHG per ton of steel produced), and eventually arrive to a peak and subsequent reduction in total emissions. In a recent paper Wang et al. (2007) show how this could happen. They base their analysis in:

- A projection of China demand for steel that peaks in 2020 at some 660 million tons a year and thereafter contracts slowly.
- Three different scenarios to the year 2030: (a) a status quo scenario; (b) a scenario with intermediate mitigation goals that reflects policy changes that the Chinese government introduced between 2000 and 2005 and further sustainable development policies, and (c) a more ambitious CO<sub>2</sub> mitigation program.
- From one scenario to the next the simulation increases the percentage of China's S&I industry that adopts available international best practice technology (IBPT). In average the percentage of the industry that is working at IBPT by 2030 is 30% in Scenario 1; 40% in scenario 2 and 50% in scenario 3.
- Carbon capture and sequestration (CCS) and other infant technologies have not been considered because there is no data available to include them in the model (e.g. cost per ton of steel produced and per ton CO<sub>2</sub> sequestered)

Figure 10 gives an overview of production and emission trajectories in the 3 scenarios and Table 9 highlights in more detail the CO<sub>2</sub> savings associated with different technology upgrades for the scenario 3 "ambitious mitigation."

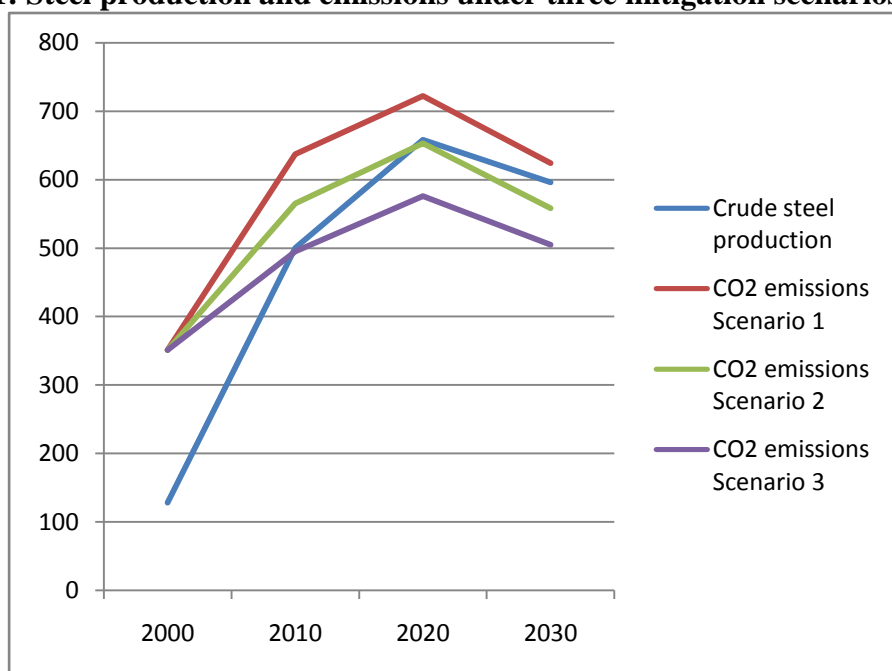
Almost 70% of the emission savings would come from (a) reducing the iron to steel ratio; and (b) shifting to larger and more efficient blast furnaces; and (c) improved smelt reduction technology. If all the twelve proposed measures were adopted, CO<sub>2</sub> emissions from iron and steel could be 140 million tons less per year than in the trend (Scenario 1).

Due to the pace of growth of steel production, in all three scenarios total emissions would keep growing up to 2020 and fall thereafter.

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<sup>13</sup> But this shift assumes that China could significantly increase the use of scrap iron and steel. Available evidence suggests that scrap iron and scrap steel are in short supply in China and in the world. This may well constrain China's ability to save CO<sub>2</sub> by shifting to electric arc furnaces.

**Figure 11: Steel production and emissions under three mitigation scenarios (millions of tons)**



Source: Based in Wang et al, 2007

**Table 9. Annual Potential Reduction in CO<sub>2</sub> Emissions from an Ambitious Emissions Reduction Program in the Iron and Steel Industry** (difference between Scenario 1 and Scenario 3)

CO <sub>2</sub> Savings Intervention	Annual Reductions by 2010 (Millions of CO <sub>2</sub> )	Annual Reductions By 2015 (Millions of CO <sub>2</sub> )	Annual Reductions by 2020 (Millions of CO <sub>2</sub> )
Energy management center	6.75	5.99	3.64
Powder coal injection	4.67	.71	--
Advanced continuous casting	4.14	.85	--
Advanced blast furnace	34.51	31.24	24.63
Reduce ratio of iron to steel	33.13	40.46	43.55
Dry coke quenching	8.28	8.52	3.52
Advanced coke oven	12.42	11.36	9.07
Advanced sintering machine	11.73	11.40	10.78
Advanced direct steel rolling	1.92	4.17	4.43
Advanced converter	10.72	7.71	7.59
Advanced EAF	1.75	4.45	5.68
Smelt reduction technology	8.01	15.02	25.63
<b>Total CO<sub>2</sub> Saved</b>	<b>138.03</b>	<b>141.98</b>	<b>138.52</b>

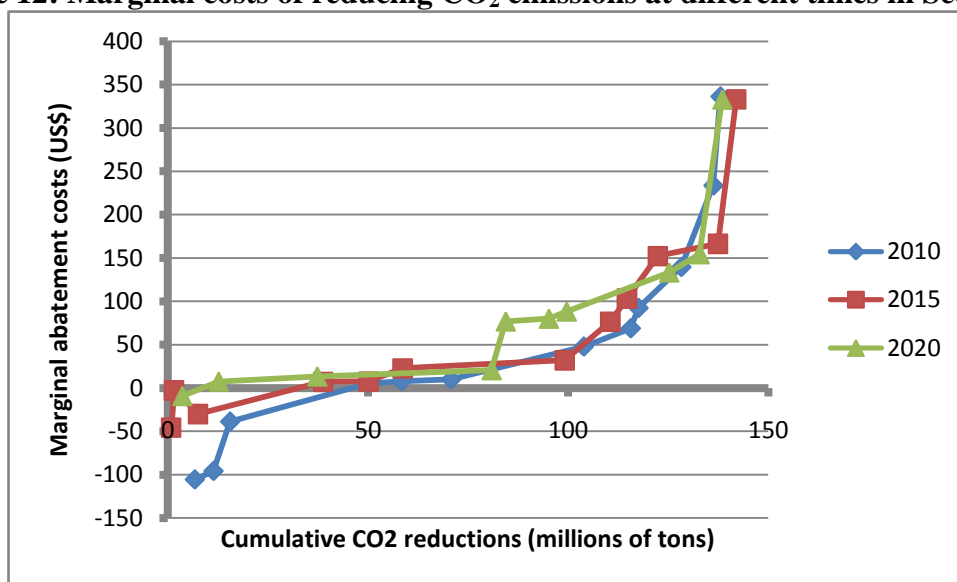
Source: Wang et al. (2007)

#### 5.5.4. The costs of mitigation

Overall moving from the trend to Scenario 2, has a total incremental costs of \$9.34B through 2030. Scenario 2 can be associated with the deployment of sustainable policies and measures, not directly focused on climate change but still having substantial mitigation benefits. In the 20 years from 2010 to 2030 it could save approximately 1 billion tons of CO<sub>2</sub>.

Scenario 3, if fully implemented could save three times as much, 3 billion tons of CO<sub>2</sub> emissions in the 30 years from 2010 -2030. But the price tag would be \$80.95 billion dollars of incremental costs. With such stiff price tag Scenario 3 may look unrealistic, so it is important to underline that moving down the emission ladder has different costs. Initial steps and the initial years may actually have negative costs, that is, net savings. For example in 2010 half of the emission savings of scenario 3 can be achieved at negative costs, and still in 2020 as much as 60% of the emission reductions of scenario 3 can be achieved at an average cost of \$16/ton CO<sub>2</sub>. But costs can escalate fast, and emissions savings from advanced converters, smelt reduction technology and advanced EAF can come with a price tag between \$ 140 and \$333 per ton of CO<sub>2</sub> saved (see figure 3)

**Figure 12: Marginal costs of reducing CO<sub>2</sub> emissions at different times in Scenario 3**



Source Wan et al 2007

#### 5.5.5. What role for a UNFCCC Sector Transformation Fund?

To a large extent, the discussion of how a STF could support China's cement sector transition to a lower carbon trajectory holds true for the iron and steel industry. It includes, among other activities, support for:

- Capacity building and training to promote investment on emission abatement among medium size firms; both to gain managers' interest, and to train the staff that would design and operate the improvements;
- Policy and institutional reform to support the industry move towards low carbon paths;
- Development of strategic public - private collaborations focused on accelerating technological learning among firms and providing financial incentives to overcome information externalities
- Support for mitigation-related incremental costs of replacing of old plants;
- Support for the selection and acquisition of mitigation technologies.

The previous discussion also suggests three areas that may be of particular interest for China's iron and steel industry

- **Technology** The rapid growth of marginal costs of mitigation with currently available technologies almost ensure that, after a 40% reduction in CO<sub>2</sub> intensity (emissions per ton of iron), further progress will stall in the absence of new technology breakthroughs that can significantly reduce the cost of further mitigation. The STF could help China partner with industry and research centers around the world to foster these technological developments and ensure their fast deployment.
- **International sector coordination:** Steel is a world commodity and the industry is highly globalized, hence the STF could help China partner with other manufacturers and providers around the world to accelerate low carbon changes. For example, modest increases in the world's supply of scrap could have a dramatic impact in China ability to reduce emissions.
- **Demand management and sustainable policies and measures:** Even factoring in significant reductions in emission intensity, China's CO<sub>2</sub> emissions from its iron and steel industry will keep growing through 2020 if demand grows as fast as predicted. Here the STF could help China devise demand management strategies and sustainable policies and measures that tame China's demand for steel without affecting consumer satisfaction or economic development.

## 5.6. A Summary of Tunisia's Renewable Energy Case Study<sup>14</sup>

### 5.6.1 Why Tunisia?

Tunisia is a small middle-income country in Northern Africa. Considering countries' total GHG emissions Tunisia is number 100, and in per capita GHG emissions it is number 125. So, why focus on a small middle-income country with a modest GHG footprint? Why go beyond the 20 largest emitters? The answer is that Tunisia is an example of a large number of developing countries that are small players on their own, but as a group they are a significant source of GHG emissions and an important component of any global climate deal (see table 10).

While it is obvious that all large emitters need to be on board with an agreement and implementing mitigating measures, it may not be forgotten that the large group of currently small emitters also has the power to influence the world's climate with their emissions. As Table 10 shows, the aggregate emissions of the small emitters in 2000 was about 2.5 as much as the total emissions of the EU(27). Tunisia is characteristic for this group in two ways: Like many of these countries it has stable economic growth. In addition, it has a comparatively small contribution of coal in its energy mix. If the growth trend and high oil prices continue, a large-scale switch towards coal in many of these countries is likely and might increase their CO<sub>2</sub> emissions significantly.

Because they are small, these countries might require mitigation strategies and technology cooperation measures that are tailored to their markets and their characteristics. These might include specific multi-country and regional initiatives on top of the local programs required in large countries.

**Table 10. Tunisia in a World Perspective (2005)**

	<b>Tunisia</b>	<b>North Africa Countries*</b>	<b>Medium and Small GHG emitters Developing countries**</b>
<b>Population</b> (millions, 2005)	10.03	152.88	2,130
<b>GDP total</b> (\$ billions, 2000 US\$)	64.63	339.46	8,435
<b>GHG emissions</b> (year 2000)			
<b>Total</b> (MtCO <sub>2</sub> )	36.7	355.44	10,812
<b>% of world total</b>	0.09	1.21	25.46
<b>Per capita</b> (tons CO <sub>2</sub> )	3.8	2.3	5.0
<b>World per capita average</b>	7	7	7

\* Morocco, Algeria, Tunisia, Libya, and Egypt

\*\* World, minus Annex 1 countries, minus any developing countries that emits 1% or more of the world's 2000 total GHG emissions, namely China, Indonesia, Brazil, India, Malaysia, Mexico, South Korea, Myanmar, South Africa and Nigeria.

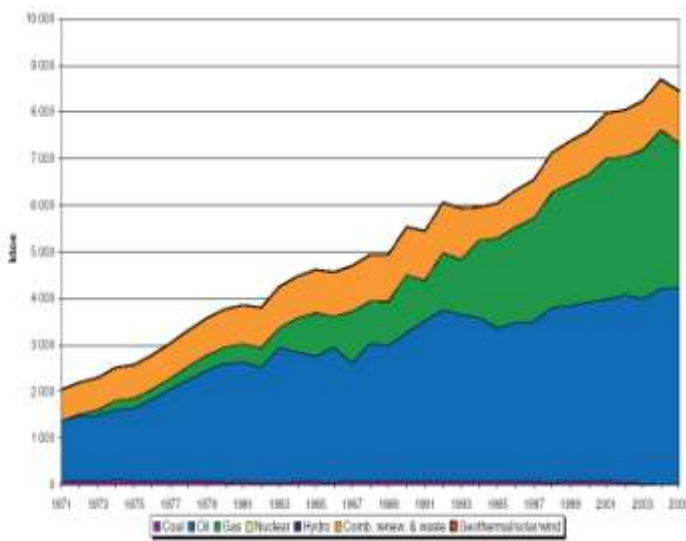
Source: WRI, CAIT website database.

5.6.2. Tunisia’s Energy Sector

Tunisia’s primary energy production is dominated by oil, gas and charcoal (see figure 1). There is a very small component of renewable energy --including hydro but not counting charcoal which could be renewable but currently is not managed to be so-- and no nuclear power. The energy sector is controlled by two public companies, ETAP in charge of oil and gas, and STEG in charge of electricity production. Some large industries (e.g. cement) produce their own electricity, while fire wood collection, charcoal production and mini-hydro are all small-scale activities.

Until recently Tunisia was a minor net exporter of oil and a self-supplier of natural gas, but by the beginning of the century, dwindling oil resources turned the country into a net importer of both. The world oil price became a major factor for Tunisia as here like in many other countries world market price swings are not handed on to the consumer but absorbed in the government’s budget. End user energy services and products from oil and gas (including car fuel and electricity) are highly subsidized in Tunisia. To stave off the hiking costs of oil imports, the Tunisia government launched aggressive programs to substitute oil with natural gas. These programs also encouraged energy savings, energy efficiency and initial investments in renewable energy. As a result of all these measures energy intensity has gone down in the last 10 years, and GHG emission intensity has gone down even faster, due to the switch to natural gas. But fast production and demand growth have overcome these efficiency gains and overall emissions have keep growing (see figure 11 and 12). Compared to a business-as-usual scenario, the energy measures have led to cumulative energy savings of 2 Mt CO<sub>2</sub>eq (about 80 PJ) over the last 20 years. Of this savings 10% came from renewables, but most of it from public awareness campaigns, car checkups and labeling of household appliances.

Figure 13. Primary Energy Consumption



Source IEA

Figure 14. Tunisia CO<sub>2</sub> Emissions



Under the impact of high oil prices of over 100 USD per bbl, the government of Tunisia paid increased attention to the energy sector in the 11<sup>th</sup> Five-Year Plan (2007 – 2011) that put forward a suite of energy efficiency activities expected to reduce energy intensity by 2% per year, for example by allowing industries to self-generate electricity, introducing minimum energy efficiency standards for buildings, supporting solar water heating on large buildings, introducing 2 million energy savings lamps, energy audits and cogeneration of heat and electricity.

Even as energy efficiency has been the center of a national's agency (ANME), important opportunities to abate GHG emissions and reduce the energy dilemma can still be found and leveraged. They range from further improvements in the efficiency of electricity generation to gas flaring and waste-to-energy projects as well as continued demand side activities and the deployment of renewable energy.

### **5.6.3. Tunisia experience with renewable energy**

Since 2005 Tunisia has put in place a lively but modest renewable energy program, investing some \$20M+ a year in activities such as the energy certification of electrical equipment, installation of solar thermal collectors, photovoltaic systems and wind energy<sup>15</sup>.

Regarding renewable energy sources the Tunisia government has emphasized the diffusion of distributed technologies, including solar water heaters, rural electrification with solar photovoltaic, household scale biogas digesters, improved wood burning technologies and wind power for water pumping. The promotion of solar water heaters has been quite successful with 57.000 m<sup>2</sup> of solar collectors installed by 2006 and a target of 740.000 m<sup>2</sup> by 2011.

Thus far Tunisia has looked at renewable power mostly as an option to supply small, isolated rural consumers, not as an alternative for the country main power supply, in spite of the fact that electricity is the largest consumer of primary energy and the largest source of CO<sub>2</sub> emissions. As of 2007 there were only 20 MW of wind power installed and, since STEG (the national utility) is not very open to wind power, the government and UNDP/GEF have supported some large energy-intensive industries to invest in captive wind energy generation, and feed the surplus into the electricity grid. Three wind projects were under development and review for CDM accreditation during 2008, two in the cement sector and the other directly commissioned by STEG. Government plans foresee some 200 MW of wind power installed by 2011. As of late 2008, the country had no experience with concentrated solar power (CSP).

### **5.6.4. Renewable energy as a centerpiece of a Tunisia power scenario**

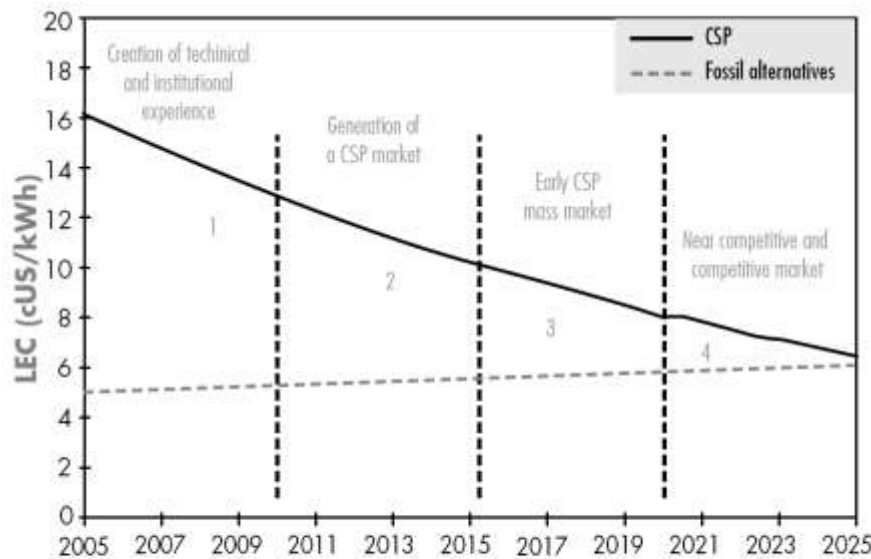
Like many other countries Tunisia has large wind resources that could be tapped for wind power, and it shares with neighboring North Africa countries unique solar radiation conditions for concentrated solar power generation. With the right incentives both, wind power and CSP, may become important sources of power for the country, and even for export. Still, both technologies differ a lot regarding their short and medium term prospects and challenges.

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<sup>15</sup> A significant share of the moneys for this program came from foreign aid sources.

- Wind is already one of the most competitive sources of renewable power generation and the last two decades have seen two digits growth of the industry, mostly in Europe (Denmark, Germany and Spain in particular), North America, India and China. Currently demand for turbines outstrips supply and most manufacturers face large order's backlogs. Wind power has limitations too; due to the intermittency of wind and the lack of economic technologies for power storage, a rule of thumb for the contribution of wind power to power supply says that no more than 15% to 20% are simple to integrate into a standard electricity grid although Denmark is close to 25%. But even the lower limit means that Tunisia could increase wind power 30 to 50 times: from the current 20MW to 600- 800 MW.
- Concentrated solar power (CSP) is still in an early stage of commercial application, and experts differ on how long it will take for CSP to become economically competitive; some say as little as 5 years and others as much as 25 years (see figure 13)<sup>16</sup>. If CSP develops, Tunisia may be able to take advantage of the exceptional solar radiation conditions of the country to become a major producer and exporter of electricity. For example a 2005 study of CSP potential in Mediterranean countries, estimated Tunisia CSP potential for 2050 at 9,250 TWh a year. That would be more than the country's electricity consumption and could offer export opportunities to Europe if sufficient transmission capacity is built.

**Figure 15: CSP Technology Development Estimates**



Source: World Bank- GEF (2006) "Assessment of the World Bank/GEF Strategy for the Market Development of Concentrating Solar Thermal Power", World Bank, Washington DC

<sup>16</sup> In an nutshell The CSP consist in optical devices (e.g. mirrors, lenses) that focus sunlight on small receptor devices (e.g. on tubes) so that a heater fluid is heated to high temperatures (between 130 and 1000 °C, depending on the optical technology and overall efficiency of the system) and then can be used to produce electricity in steam turbines.



In table 11 we present the government CO<sub>2</sub> emissions abatement scenario for 2010 – 2020 from the Initial National Communication to the UNFCCC, plus our own scenario of accelerated deployment of wind power and CSP. This latter scenario assumes that, after 2010 Tunisia moves decidedly to increase wind power to some 20% of the country's electricity supply, and begins to develop the technical capacity to manage CSP, although large investments on CSP and integration of larger amounts of wind power are delayed to 2020 and after, when the CSP technology is expected to be competitive and grid technology can accommodate more intermittent power.

**Table 11. Tunisia's Energy Sector, Currently and According to Several Scenarios to 2020**

CO <sub>2</sub> emissions (000 tons)	2005	2010	2020	2030
Reference Scenario	19,290	31,636	48,993	
Government attenuation scenario		24,245	36,151	
<b>A scenario of accelerated deployment of renewable power</b>				
• Wind power				
Additional GW installed	20	60	600	1,600
CO <sub>2</sub> emissions reductions per year *	33	600	1,040	2,770
• CSP				
Additional GW installed				
CO <sub>2</sub> emissions reductions per year **	--		200	3,000
	--		460	6,924
* Assuming 3000 full load hours in 2010 and after and specific CO <sub>2</sub> emissions of 577 kg/MWh.				
* Assuming 4000 full load hours and 577 kgCO <sub>2</sub> /MWh				

Although the targets of the renewable power scenario as well as the CO<sub>2</sub> savings would look modest to a large country (e.g. the wind power capacity proposed for Tunisia for 2030 is 5% of the current wind capacity in Germany at 10 % of the wind energy produced), they are quite ambitious for Tunisia, and they would be globally significant if repeated in 20 or 40 developing countries that face similar opportunities and constraints.

#### 5.6.5. What role for a UNFCCC Sector Transformation Fund?

For small or medium size developing countries scaling up renewable power face them with several challenges, including

- Information and awareness barriers that keep potential buyers (e.g. power companies and large electricity users) away from renewable options.
- Policy framework barriers, including lack of technical standards, grid codes, lack of regulation to allow independent renewable power providers to feed-in the electricity grid, etc.

- Lack of access to the actual technologies.
- Lack of local operation and maintenance capacity.
- Limited financing availability, particularly for demonstrative or initial plants,
- Shortcomings of physical infrastructure (e.g. power grids).

Some of these issues need to be tackled nationally, but others may require or may benefit from an international approach. For instance:

- To scale up wind power, Tunisia would have to (a) in the country, increase power producers and large power consumers' interest in wind power; and develop the country's technical capacity and infrastructure, necessary to operate and maintain a large wind power sector; and (b) internationally, wind power manufacturers would have to be attracted to a market – Tunisia-- which, on its own, may be too small.
- To make CSP a large power generation alternative, Tunisia would require (a) nationally, to build capacity, pilots and infrastructure; and (b) internationally, that the maturation and deployment of the CSP technologies proceed at a pace that meets Tunisia's CSP expectations.

A STF in the framework of the UNFCCC could play a key role in support of such paths. To begin with, our proposed three-phase approach— preparatory, initiation and implementation, fits well with the challenges listed above. Applied to a large-scale energy-system transformation as proposed here, it can also be based on the framework for technology cooperation as agreed upon by the convention. During the first phase, analyses of the natural potential and prefeasibility studies could be fully sponsored by a global financing mechanism, and help attract initial private sector funding. The total cost of these preparatory activities could be in the order of 2 – 3 million dollars and also build the necessary planning and analytical capacities. Building on this could be public-private partnerships, in phase 2 with a larger share of grant funding to build up the relevant capacities for maintenance and operation, and in phase 3 with a smaller share of multilateral funding to fill the remaining capacity gaps. In the case of Tunisia, the success of captive wind power production has already demonstrated that public-private partnership can help significantly to deploy these new technologies, in this case with the help of CDM and GEF funding. Due to the fragmentation of the existing funding schemes, this process was difficult and unreliable for the local stakeholders. The suggested Sector Transformation Fund in contrast offers clear funding structures and a long-term coordinated transition from more to less international grant aid towards a complete mainstreaming of clean technologies.

Of particular interest is the regional or international scale that a Sector Transformation Fund can bring to bear in support of mitigation efforts in small and medium developing countries. Whereas large developing countries --e.g. China, India, Brazil, Mexico-- have the size to make mitigation initiatives totally or mostly a single country endeavor, that is not the case for Tunisia and similar developing countries. A number of important capacities require a minimum market size in order to be built up in a self-sustaining manner.

- Take the case developing industrial capacities for manufacturing, assembling and maintenance of wind power equipment. The Tunisian market on its own is too small to justify a wind power manufacturing plant in the country. On the other hand the right demand size could be achieved if a group of countries move in a coordinated way to add up to a regional market. A Sector Transformation Fund in the framework of the UNFCCC could support regional initiatives and create

the financial incentives and align the technical support to facilitate the emergency of such regional mitigation initiatives.

- Take the case of research and development to bring a renewable technology to maturation. Establishing a new energy technology on the market may take as much as 25 years and cost billions of dollars. This is not a task for Tunisia, or for that matter for any small developing country. On the other hand, an international research, development and commercialization program could include Tunisia as an ideal partner where pilots and demonstrative plants could be built and tested, giving Tunisia an active role in the international R&D efforts, and helping build the country CSP operation and maintenance capacity that will be a necessary piece of a future commercial deployment of CSP. Here, too, a Sector Transformation Fund in the framework of the UNFCCC would be well positioned to offer the financial incentives and broker the required international cooperation agreements, and ultimately work towards technology cooperation as written into the Convention.

Financial and technical support  
provided by:



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