



# Global Environment Facility

GEF/LDCF.SCCF.4/5  
March 21, 2008

---

LDCF/SCCF Council Meeting  
April 25, 2008

Agenda Item 8

## ELABORATING A STRATEGIC PROGRAM TO SCALE-UP THE LEVEL OF INVESTMENT IN THE TRANSFER OF ENVIRONMENTALLY- SOUND TECHNOLOGIES

### **Recommended LDCF/SCCF Council Decision(s)**

The LDCF/SCCF Council reviewed the paper, GEF/LDCF.SCCF.4/5 *Elaborating a Strategic Program to Scale-up the Level of Investment in the Transfer of Environmentally-Sound Technologies (ESTs)*, and agreed that the Secretariat should make arrangements for the following immediate actions to be funded under the SCCF Program B on Technology Transfer:

- 1) Provide support for technology needs assessments (TNAs);
- 2) Provide support for a pilot program to: (i) assess TNAs to identify those ESTs with the greatest strategic potential to mitigate climate change; (ii) evaluate the market(s) for these ESTs; (iii) identify critical strategic technology platforms; and (iv) propose activities to be implemented under those platforms
- 3) Prepare a bi-annual report on the transfer of environmentally-sound technologies.

Because the LDCF/SCCF Council also considers it important to begin to pilot concrete technology-sector programs as soon as possible, it requests Secretariat to prepare a program of actions and to raise funds for the implementation of four pilot technology-sector platforms consistent with those described in this proposal, namely, Efficiency Energy-using Devices; Renewable Energy Supply Technologies; Efficiency of Energy-Intensive Industries; and the Efficiency of Fossil-fuel Based Electricity Generation.



# Global Environment Facility

GEF/C.33/7  
March 24, 2008

---

GEF Council  
April 22-25

Agenda Item 13

## ELABORATING A STRATEGIC PROGRAM TO SCALE-UP THE LEVEL OF INVESTMENT IN THE TRANSFER OF ENVIRONMENTALLY- SOUND TECHNOLOGIES

**Recommended Council Decision**

The GEF Council reviewed the paper *Elaborating a Strategic Program to Scale-up Investment in the Transfer of Environmentally-sound Technologies* (GEF/C.33/7) and agreed that the Secretariat should revise the paper based upon Council member comments and forward it to the subsidiary bodies of the UNFCCC for its meeting in June 2008 as requested by the Bali COP in Decision 4/CP.13.

## Table of Contents

Executive Summary .....	i
Introduction.....	1
Technology Transfer and Climate Change .....	2
Proposed Approach for Strategic Technology Program.....	4
Financing for the Implementation of Technology Transfer.....	15
Annex I. GEF Experience on the Transfer of Climate Friendly Technologies .....	26
Annex II. Lessons and Experience on Technology Transfer from the Montreal Protocol.....	31
Annex III. Brief Summary of Status of Technology Needs Assessments (TNAs).....	33
Annex IV. A Strategic Technology Program for Adaptation .....	34

## EXECUTIVE SUMMARY

1. The Thirteenth Meeting of the Conference of Parties to the UNFCCC held in Bali, Indonesia in December 2007 requested the GEF “to elaborate a strategic program to scale-up the level of investment for technology transfer to help developing countries address their needs for environmentally sound technologies” (Decision 4/CP.13). Over the past several months, the GEF Secretariat has consulted with interested Parties, members of the international financial institutions, relevant multilateral entities, and private citizens in the preparation of this paper which responds to the COP decision.

2. There is no question that the financial needs linked to the transfer of environmentally sound technologies (ESTs), as broadly defined by IPCC, will require enormous financial investment flows over the coming years. The recent study of financial flows undertaken by the UNFCCC estimated that additional global investments of \$200-210 billion will be necessary by 2030 to return GHG emissions to current levels. Approximately half of this estimated requirement will need to occur in developing countries. On the adaptation side, the numbers are more difficult to estimate, but it is safe to say that billions of dollars will be required for primary industries, water supply, health, and coastal management alone. Again, much of these financial resources will be needed in developing countries.

3. This paper does not propose a new fund to address these needs, nor does it presume that such large financial requirements can be met from any single source, be it public or private in nature. Rather, the approach described in this paper seeks to begin a process of taking actions to increase investment flows in the specific technologies that hold the greatest potential for mitigation or adaptation and that are of interest to a large number of developing countries. Initially, the program may work with limited additional resources, but as interest in and commitment to climate change grows, the resources devoted to environmentally sound technologies from all possible sources must grow astronomically. This program, therefore, will serve an essential facilitative role to ensure that those resource flows are directed to where they are needed and will have the greatest possible effect.

4. A four-step process to initiate a strategic program to scale-up the investment flows in technology transfer is proposed. The first step will require the identification of those ESTs with the greatest strategic potential to mitigate (or adapt to) climate change. This will be done by examining and re-examining technology needs assessments (TNAs). The second step involves technology market assessments (TMAs) to identify the reasons why these technologies are not already diffusing through the markets. This will include an assessment of market and non-market barriers at the local, national, regional, and international levels. The third step involves aggregating or grouping those promising technologies into categories or “technology-sector platforms” from which actions and best-practices can be proposed, shared and implemented. The fourth step entails concrete actions being taken to implement those approved activities considered to be most effective in leading to the widespread adoption of the environmentally sound technologies. These actions may require greater information flows at the international level; they may necessitate policy or regulatory changes; they may require the facilitation of greater financing for new power plants at the national level; or they may involve the adoption of global energy-efficiency based performance standards. These actions may be implemented at an

appropriate level using resources available from a number of sources, of which the GEF will constitute a small share. One of the goals is to increase the number of financing sources, but also the volume of financing to be devoted to ESTs from international financial institutions, bilateral and multilateral sources, other public sector sources and the private sector.

5. The process proposed in this paper is anticipated to be a medium to longer term approach to the challenge of technology transfer in the climate change focal area. . However, the paper does propose four discrete, but related activities for funding in the next year. These are:

- (a) **Pilot Assessment and Program Formulation:** From TNAs to TMAs to Technology Sector Interventions: This activity is intended to begin with the existing technology needs assessments; identify those technologies of strategic value to a number of countries; assess the markets for those technologies; identify likely technology sector platforms; and propose sets of activities that might be supported under this platform to accelerate the diffusion of ESTs.
- (b) **Funding of Technology Needs Assessment:** Many countries have already received funding for technology needs assessments. For these and other countries that have not, there is a need to update the analysis and utilize a revised methodology that clearly focuses on assessing the markets for key technologies and what can be done to make those markets work more effectively and efficiently.
- (c) **Preparation of Report on the Transfer of Environmentally Sound Technologies:** This report, envisioned as a bi-annual undertaking, will begin a more thorough process of reporting on technology transfer, initially focusing on efforts of ODA but expanding through time to cover transfer of ESTs financed through all sources.
- (d) **Pilot Development of Four Technology-Sector Platforms:** Linked to activity 1 above, it will be important to begin formulating work on technology-sector platforms as soon as possible. Initially, it is proposed to establish four such platforms where previous work indicates widespread need for international cooperation: Energy-Using Devices; Renewable Energy Supply; Energy-Intensive Industries; and Efficient Fossil-Fuel Generation. With a relatively limited additional budget, the goal would be to pilot this approach and see how it can add value to future climate regimes.

6. Because of the clearer link and better understanding between mitigation and technology than between adaptation and technology, the process will initially focus primarily on mitigation technologies. However, a similar approach will be proposed for adaptation once current ongoing assessments have been completed.

## ABBREVIATIONS AND ACRONYMS

APCF	Asia-Pacific Carbon Fund.
CDM	Clean Development Mechanism
CFL	Compact Fluorescent
CIF	Climate Investment Funds
CLASP	Collaborative Labeling and Appliance Standards Program
COP	Conference of the Parties
CSP	Concentrating Solar Power
CTF	Clean Technology Fund
EBRD	European Bank for Reconstruction and Development
EGTT	Expert Group on Technology Transfer
EST	Environmentally Sound Technology
FCB	Fuel-cell Bus
GEF	Global Environment Facility
GHG	Greenhouse Gases
GWP	Global Warming Potential
IDB	Inter-American Development Bank.
IEA	International Energy Agency
IGCC	Integrated Gasification Combined Cycle
IPCC	Intergovernmental Panel on Climate Change
MP	Montreal Protocol
NAPA	National Adaptation Program of Action
NGO	Non-governmental Organization
ODA	Official Development Assistance
ODS	Ozone Depleting Substance
PV	Photovoltaic
RE	Renewable Energy
REN21	Renewable Energy Network for the 21st Century
S&L	Standards and Labeling
SBI	Subsidiary Body on Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCCF	Special Climate Change Fund
SHS	Solar Home System
SME	Small and Medium Enterprises
TMA	Technology Market Assessment
TNA	Technology Needs Assessment
TSPC	Technology sector platform committee
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization



## INTRODUCTION

1. At the Thirteenth Meeting of the Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC) held in Bali, Indonesia in December 2007, the COP reached a decision on the development and transfer of environmentally-sound technologies. The decision reads as follows:

3. Requests the Global Environmental Facility, as an operational entity of the financial mechanism under the Convention, in consultation with interested Parties, international financial institutions, other relevant multilateral institutions and representatives of the private financial community, to elaborate a strategic programme to scale up the level of investment for technology transfer to help developing countries address their needs for environmentally sound technologies, specifically considering how such a strategic programme might be implemented along with its relationship to existing and emerging activities and initiatives regarding technology transfer and to report on its findings to the twenty-eighth session of the Subsidiary Body for Implementation for consideration by Parties” (Decision 4/CP.13).

2. This paper begins the elaboration of a strategic program to facilitate the growth of investment in environmentally-sound technologies (ESTs) in developing countries. In preparing this paper, the GEF Secretariat has consulted with Parties, members of the international financial community, representatives of multilateral agencies, and civil society. The program includes the transfer of both mitigation and adaptation technologies, but focuses more on mitigation technologies as they are currently better understood. A similar process is proposed for technologies of relevance to adaptation to the adverse impacts of climate change, and it will be developed for presentation in the future.

3. The goal of this strategic program for technology transfer is to systematize and scale-up support to the transfer of climate-change related ESTs to developing countries enabling climate change mitigation and adaptation to become truly global in nature. In the past, the GEF has played an important role in piloting and initiating activities to transfer environmentally-sound technologies, especially related to climate change mitigation. However, due to resource limitations and limited international commitment, the results have been positive, but somewhat piecemeal.

4. This paper first discusses technology transfer in the context of climate change, building upon the work of the Intergovernmental Panel on Climate Change (IPCC); the UNFCCC’s Expert Group on Technology Transfer (EGTT); the GEF; and the Montreal Protocol and its Multilateral Fund. It then proposes a process of identifying strategic opportunities for technology transfer from the results of technology needs assessments (TNAs); analyzing why the markets do or do not disseminate the technologies; aggregating global responses to the needs of these markets through so-called technology platforms; and expanding the range of global responses to the strategic opportunities for technology transfer. The paper proposes beginning an analytical process to encompass a wide range of technologies while initiating concrete

activities in cases where a specific technology and the relevant opportunities in particular sectors are already well known.

## **TECHNOLOGY TRANSFER AND CLIMATE CHANGE**

### **Intergovernmental Panel on Climate Change Special Report**

5. Technology transfer is seen to play a critical role in the global response to the challenge of climate change. In the Special Report of the IPCC Working Group III, “Methodological and Technical Issues in Technology Transfer”, the IPCC defined the term “technology transfer” as:

... a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, NGOs and research/education institutions. Therefore, the treatment of technology transfer in this Report is much broader than that in the UNFCCC or of any particular Article of that Convention. The broad and inclusive term “transfer” encompasses diffusion of technologies and technology cooperation across and within countries. It covers technology transfer processes between developed countries, developing countries and countries with economies in transition, amongst developed countries, amongst developing countries, and amongst countries with economies in transition. It comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose and adapt to local conditions and integrate it with indigenous technologies.<sup>1</sup>

6. This definition includes a wide range of activities and extends to a broad range of institutions. It also provides the basis for much of the current understanding of technology transfer. Technology flows are frequently traced through investment flows, as the latter serves as a surrogate indicator for technology transfer in general. Foreign direct investment, official development assistance (ODA), commercial lending and equity investment are all important channels through which technology transfer is financed. However, financial flows alone are insufficient to ensure adequate transfer of climate-friendly technology. The IPCC describes three major dimensions necessary to ensure the effectiveness of technology transfer: capacity building; enabling environments; and mechanisms for technology transfer. Barriers to the smooth working of the market for a specific technology—either in the form of limited capacity; an unsuitable policy environment; or a lack of financing mechanism—will limit the diffusion of the technology.

---

<sup>1</sup> Metz, Gert; O. Davidson; J.W. Martens; S. N. M. Van Rooijen; and L. V. W. McGrory. 2001. Methodological and Technological Issues in Technology Transfer. Cambridge, UK: Cambridge University Press for the IPCC.

## The UNFCCC Technology Transfer Framework

7. The COP established the EGTT under the Subsidiary Body for Scientific and Technological Advice (SBSTA) through Decision 4/CP.7.<sup>2</sup> Decision 4/CP.7 also requested the GEF to provide financial support for the technology transfer framework through both the climate change focal area and the Special Climate Change Fund (SCCF).

8. The Annex to Decision 4/CP.7 defined a framework for meaningful and effective actions to increase and improve the transfer of and access to ESTs and know-how.<sup>3</sup> The framework defined five key elements for meaningful and effective actions to transfer technology. The first element is the area of technology needs and needs assessments, defined as a set of country-driven activities to determine technology priorities through a widespread stakeholder consultation process. The second element is that of technology information. The third element is that of enabling environments, defined as government actions, including the removal of technical, legal and administrative barriers to technology transfer, sound economic policy and regulatory frameworks to create a conducive environment for private and public sector investment in technology transfer. The fourth element of the framework is capacity building, which is considered to be a process seeking to build, develop, strengthen, enhance and improve existing scientific and technical skills, capabilities and institutions in developing country Parties to enable them to assess, adapt, manage and develop ESTs. The fifth element is that of mechanisms to facilitate the support of financial, institutional and methodological activities to enhance coordination among stakeholders; to engage stakeholders in cooperative efforts to accelerate the development and diffusion of ESTs; and to facilitate the development of projects and programs to support these ends.

9. The Bali Action Plan confirmed the technology transfer framework as being valid, renewed the mandate of the EGTT for another five years, and requested the EGTT to undertake an analysis of the financial resources available for technology transfer with a view to identifying any gaps or unmet needs.<sup>4</sup> The EGTT has already begun implementing its work program in response to this decision.

### *GEF and Technology Transfer*

10. At the core of the GEF's work on the mitigation of climate change lies the concept of technology transfer. Article 11.1 of the UNFCCC begins with the phrase "A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined." During the GEF's Pilot Phase (1991-1994), projects focused largely on demonstrating as wide a range as possible of technologies that would be useful in stabilizing the level of GHG concentrations in the atmosphere. After the restructuring of the GEF in 1994, the Council approved an operational strategy that identified three operational programs to support climate change mitigation. All of these focused primarily on mitigation through the use of newly commercialized or nearly-commercialized technologies that either

---

<sup>2</sup> FCCC/CP/2001/13.

<sup>3</sup> FCCC/CP/2001/13/Add.1.

<sup>4</sup> Decision 3/CP.13.

improved the efficiency of energy use or the generation of energy from renewable sources. However, they allowed for a distinction between technologies on the basis of their maturity and commercial availability. In the time it has existed, the GEF has financed the incremental costs of climate change mitigation projects supporting the transfer of at least 34 different ESTs (see Annex I).

11. Based upon experiences with the GEF portfolio, a number of conclusions with respect to technology transfer can be drawn for future operations. Many of these lessons are consistent with the framework proposed by the UNFCCC COP, forming part of the technology transfer framework. First, technology is transferred primarily through markets: barriers to the efficient operation of those markets need to be removed systematically. Second, technology transfer is not a single activity, but a long-term engagement. Partnerships and cooperation are mandatory for successful development, transfer and dissemination of new technologies and they often require time to develop and mature. Third, technology transfer requires a comprehensive approach incorporating capacity building at all relevant levels. In particular, GEF experience demonstrates that all five elements are essential to successful transfer of technologies:

- (a) Policy frameworks: Government plays an essential role in setting the ground-rules that are favorable to the adoption of ESTs.
- (b) Technology: The technology itself needs to be robust and operational. The more mature a technology is, the easier it will be to transfer.
- (c) Awareness and information: National stakeholders, especially market participants, need to be aware of the technology and have information on its costs, uses, and niches.
- (d) Business and delivery models: As technology transfer occurs through markets, businesses and institutions need to be in place to deliver and service the markets.
- (e) Availability of financing: Financing needs to be available for the technology, but financing itself is insufficient to ensure the uptake of the EST.

12. These principles or lessons have informed the approach embodied in the GEF-4 Revised Programming Strategy in the climate change focal area.

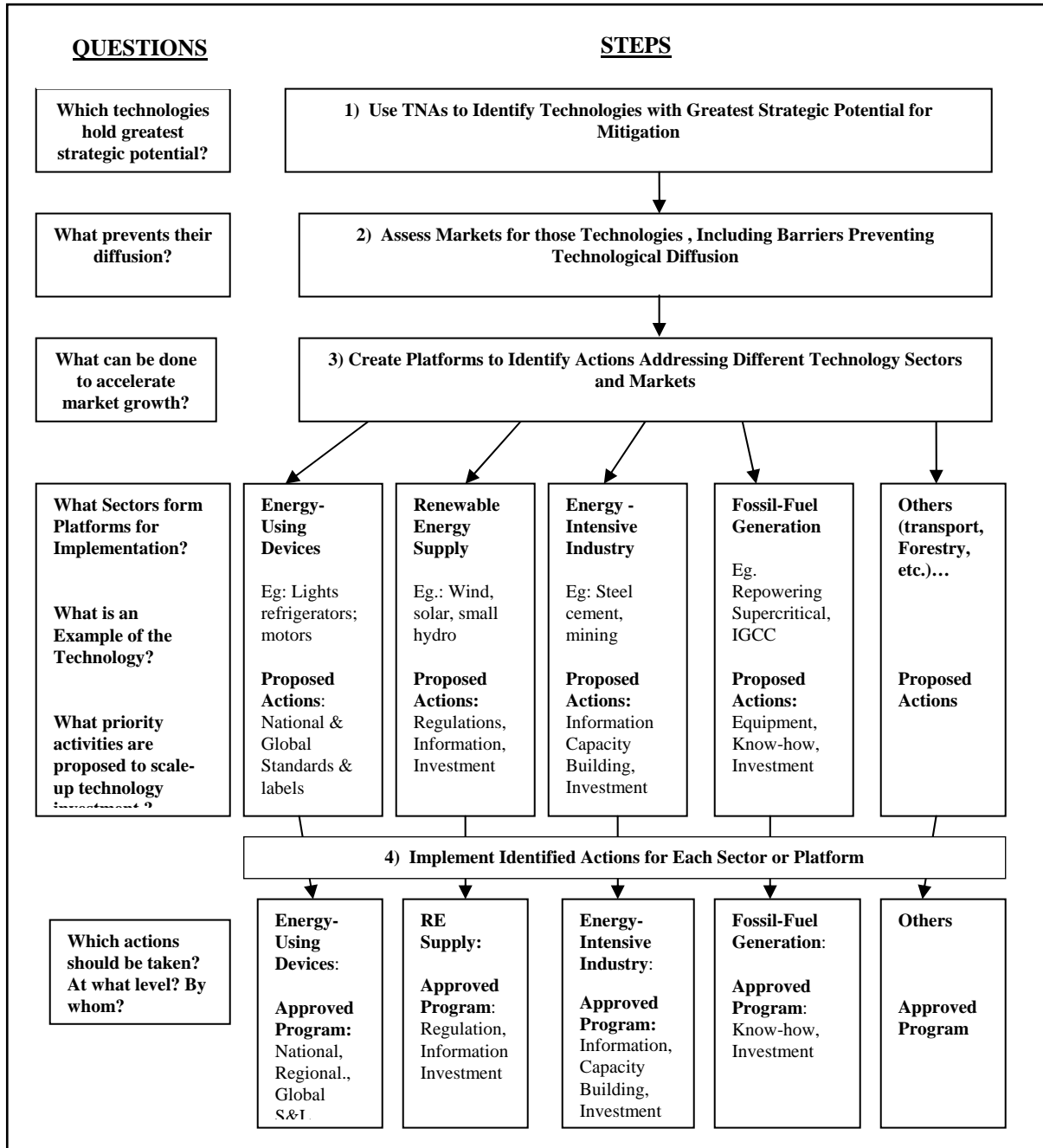
#### **PROPOSED APPROACH FOR STRATEGIC TECHNOLOGY PROGRAM**

13. This paper proposes a strategic program to scale-up investments in ESTs of relevance to the goals and objectives of the climate change convention. As summarized in Figure 1, the approach being proposed involves four steps in response to four sets of questions. These steps incorporate the five key elements for successful technology transfer enumerated in Decisions 4/CP.7. First, developing countries' technology needs assessments (TNAs) serve as an input to the analytical process, whereby those technologies with the greatest strategic potential for mitigation (or adaptation) will be identified. Strategic potential will be determined on the basis of cost-effectiveness (unit abatement costs), the magnitude of mitigation potential, and the needs

that are expressed for the technology by a number of countries in their TNAs. Second, the markets for these technologies will be analyzed to pinpoint their shortcomings; that is, why are they not now achieving the desired diffusion of these technologies. Third, an effort will be made to group these technologies into categories based upon common market characteristics. The categorization will facilitate the delineation of common approaches, policies and key institutions that will need to be strengthened in order to enable greater diffusion of these ESTs. To assist in these latter two endeavors, technology sector platforms will be established and Technology Sector Platform Committees (TSPCs) will be created made up of experts from governments, industry, and civil society. These committees, which will include selected representatives from UNFCCC Parties, will oversee and systematize the response to these strategic opportunities. Fourth, the TSPCs will serve as a resource to the GEF and its Agencies, making recommendations on the range of tools, activities, and mechanisms that are considered most appropriate in scaling-up the diffusion of those technologies with the greatest potential.

14. The following section describes the proposed process in more detail, using early results from a TNA to provide an example of how it might work in practice. The discussion focuses on mitigation. For future deliberation, a similar diagram is presented for adaptation in Annex IV.

**Figure 1: Formulation of a Strategic Technology Program: Mitigation**



**Step 1: Which Technologies Hold Greatest Strategic Potential? Use TNAs to Identify Technologies with Strategic Potential for Mitigation**

15. Step 1 in the process involves identifying the specific technologies to serve as the focus for the program. Because limited resources constrain the ability of the international community

to respond to all technological needs at once, any strategic approach to technology transfer must begin by selecting those technologies which should serve as the strategic heart of the program. Comparison of TNAs can provide a key to the identification of climate friendly technologies of interest to a number of countries. Indeed, the TNAs prepared to date make clear that a limited number of high-value, low-cost areas can be worked on immediately. However, as more work needs to be done to delineate a larger range of options, one of the first steps in the program will include a review of the TNAs to determine those technologies cited in the TNAs of great interest to a number of countries.

16. However, as noted above, interest cannot be the only factor, and further analytical work is needed to determine whether a technology cited in a TNA is really of strategic value. What determines the strategic value of a technology? Three conditions are proposed for the determination of the strategic value of a mitigation technology:

- First, it must be considered an expressed need for a significant number of the countries whose TNAs are being considered globally or within a specific region. Any technology of interest to a single country or a very small number of countries may be better addressed through individual country programs and not through a global strategic effort.
- Second, the technology must hold considerable promise for reducing GHG emissions from those countries. Technologies holding only a very small potential to reduce GHG emissions would not lead to significant achievements.
- Third, the program should begin by focusing on those technologies that are already cost-effective and commercialized, or nearly so. A very large number of cost-effective ESTs are not being adequately disseminated around the world.

17. Focusing initially on those cost-effective options will ensure that the program's results are both economically and environmentally beneficial to developing countries. This last criterion would ensure that successful outcomes are all "win-win" by nature.<sup>5</sup>

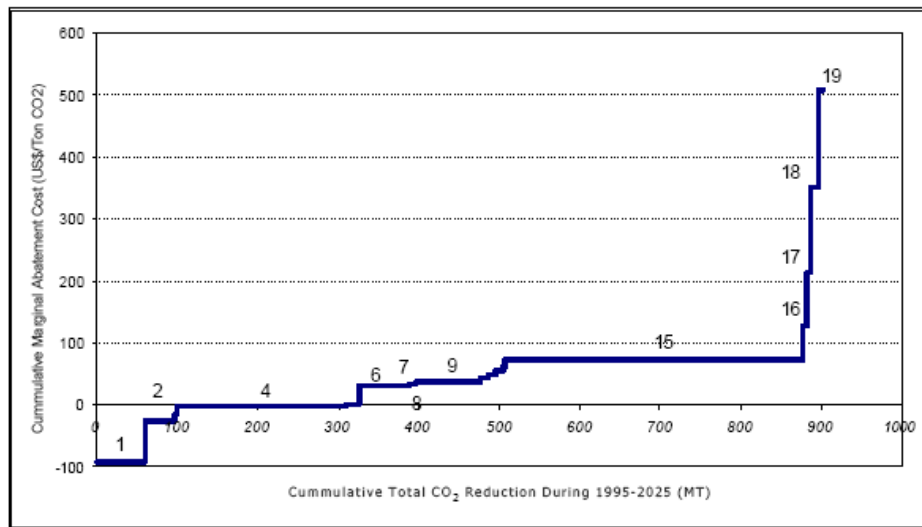
18. For explanatory purposes, Figure 2 displays an abatement curve highlighting the role of specific technologies of interest to Country X, which included this graph as part of its TNA. The graph lists a number of technologies with the potential to reduce greenhouse gas (GHG) emissions, with the most cost-effective technologies on the left-hand side of the graph and the least cost-effective technological options on the right-hand side of the graph (measured in dollars per ton of CO<sub>2</sub> avoided). The analysis should begin with such a list of technologies from a specific country and compare them with similar assessments from other countries to identify those technologies which still require attention to be adequately diffused throughout the relevant markets. In this case, the four most cost-effective technologies featured in the analysis are: 1) Cogeneration; 2) Electric Motors; 3) Solar Thermal; and 4) Compact Fluorescent Lamps.

---

<sup>5</sup> The IEA estimates that there are nearly 15 gigatonnes of greenhouse gases (GHG's) that can be cost-effectively reduced at a negative incremental cost.

Although three of these technologies reduce significant GHG emissions at a near zero cost,<sup>6</sup> the other one—solar thermal heating—does not demonstrate significant potential to reduce GHG emissions under the conditions found in this analysis. Therefore, the three technologies with significant mitigation potential should be identified as promising technologies for Country X. The other one—in this case, solar thermal—should not be included for Country X as it demonstrates very limited potential for GHG abatement. If other countries list similar technologies with significant potential, then the three technologies with significant mitigation potential should serve as the basis for more concerted international action.

**Figure 2. Prioritized Technological Options to Reduce GHGs Emissions: Marginal Abatement Cost Versus Total of CO2 Reduction**



source: Boedoyo, et.al. (2001)

Note:

- |                          |                                |                         |
|--------------------------|--------------------------------|-------------------------|
| 1 : Cogeneration         | 8: New Hydro                   | 14: New Gas Gas Turbine |
| 2: Motor Electric        | 9: Gas Combined Cycle          | 15: Geothermal          |
| 3: Solar Thermal         | 10: ACFL Lamp                  | 16: New HSD Gas Turbine |
| 4: CF Lamp               | 11: Compact Refrigerator       | 17: New Coal PP600 MW   |
| 5: Advanced Refrigerator | 12: Compact Panel Refrigerator | 18: New Coal PP 400 MW  |
| 6: Hitech Refrigerator   | 13: New Biomass                | 19: SFL Lamp            |
| 7. New Mini Hydro        |                                |                         |

## Step 2: Why do Technologies not Disseminate on their own? From Understanding Technology Needs to Understanding Technology Markets

19. The EGTT’s technology transfer framework and the GEF experience to date have highlighted the necessity of both understanding barriers to the efficient operation of markets for ESTs and removing those barriers in a systematic way to accelerate the growth of the markets

<sup>6</sup> Any analysis using the results of TNAs will have to both update the technology information and the cost information as well as verify that they are roughly valid. The curve used here is taken from an actual TNA that is several years old. But the general shape of the curve resembles that found in recent analyses of the IEA (2006); McKinsey (2007); Vattenfall (2007); and IPCC (2007). The idea is to begin working on the most promising options to reduce GHG emissions at no economic cost to the country.



concerned. Both market barriers (such as market failures and inappropriate taxes or duties) and non-market barriers (limited local capacity, weak protection of intellectual property rights) provide important impediments to the dissemination of ESTs through market mechanisms. The purpose of this second step in the process is to assess the market for these technologies through technology market assessments (TMAs). Such market assessments are needed to understand clearly not only the potential that can be achieved through systematic removal of those barriers at the national level, but also how countries experiencing similar technological needs might be able to collaborate and avail themselves more effectively of support from the international community to grow the markets for the climate-friendly technologies. A clear understanding of the markets, their viability, their operations, the industrial structure, and whether existing avenues and directions of foreign investment are changing the markets are essential to directing global efforts to increase growth in the markets for these technologies.

20. Some TNAs have done a good job of evaluating the nature of the markets for the technologies needed to reduce GHG emissions and to adapt to climate change. Others have not. One criticism of many of the existing TNAs is that they have spent too little effort identifying the market potential and the barriers to achieving that market potential in the cases of the most-pressing technologies. Future TNAs should undertake more detailed market assessments in order to begin involving industry in identifying solutions to stimulate the markets for these ESTs.

21. Returning to the example presented in Figure 2 of Country X, co-generation or the production of both process heat and electricity by industry has become a generally accepted practice in many parts of the world. But it requires a regulatory system that allows the sale of excess electricity to the grid, thereby rewarding the use of waste heat, know-how and investment capital. Activities designed to improve the regulatory environment, increase knowledge and know-how, and encourage the availability of investment capital would surely help this market reach its untapped potential. In the case of CFLs and efficient motors, limited awareness of life-cycle costing and the benefits of the technology, high initial costs, and uneven product quality serve as barriers. These also are cases where regulations favoring the newer, ESTs can accelerate the growth of these markets. Excessive import duties on the new technologies might also play a role in hindering the local demand for the technologies. Understanding these barriers in a systematic manner is a prerequisite for formulating solutions.

### **Step 3: What Can be Done to Accelerate Market Growth? Create Platforms for Action Addressing Different Technology Sectors and Markets**

22. The third step will build upon the identification of technology groups, comprised of technologies with both technological and market similarities in a specific sector. It proposes establishing technology sector platforms of activities that would accelerate growth of the technological markets in question. Activities under each such platform would provide “best-practice” guidelines and develop, through pilot studies, practical examples to all participants. Related platform committees could also alert the GEF Agencies or the Secretariat to funding possibilities, and they would be able to propose additional activities for funding that, in its view, would have the greatest impact to scale-up investment in the technology at an international level.

National teams can then implement national-level activities using international best-practice guidelines regarding the technology, making use of the resources available to them at the national and international levels.

23. Many of the actions will be of a policy or regulatory nature; others will support local capacity building; some may entail international efforts to adopt standards; others may provide greater access to information and still others may secure project financing from public or private sources. Taxes may be examined and revised to ensure the desired policy outcomes. For stimulating investments in new technologies, advanced market commitments or technology prizes might be considered. Different technology sector platforms will require different emphases and combinations of actions to be taken to most effectively scale-up investments in the technology. For example, the availability of widely-used standards for technological performance are recognized as an important tool that can be utilized to stimulate the markets for clean energy technologies in developing countries.

24. While an effort will be made in the strategy to systematize an overall strategic vision and to strengthen frameworks that will be necessary to assist markets across technologies, it is recognized that the mix of interventions for each technology sector will, in the end, have to be uniquely designed based upon the nature of the technology, the markets for that technology, and the range of appropriate tools, mechanisms, and resources available to countries seeking access to the technologies. Some interventions will be appropriate for some, but not all, countries.

25. As noted above, a number of technology sectors can be identified based upon the needs expressed in TNAs; however, the purpose of the program must be to sort out which provide the greatest promise for immediate action at a given level. Returning to the case of Country X from Figure 2; co-generation, CFL use, and energy-efficient motors are considered to be promising technologies. Assuming that these were also identified in other TNAs, the characteristics of the market for each technology would be evaluated in Step 2. As part of Step 3, these technologies would be grouped together according to similarities and differences. Co-generation might be considered as an action appropriate to sectoral activities linked to energy-intensive industries. Best practice activities and global activities, where appropriate, could then be delegated to the group responsible for that platform. In the case of CFLs and energy-efficient motors, both are energy-using devices where the tools associated with standards and labeling can help transform the markets. These two technologies could be grouped into an energy-consuming device or appliance platform for action.<sup>7</sup>

26. Based upon preliminary assessments of TNAs and past GEF programming experience, it is possible to suggest what four of these platforms could look like so that pilot activities could be designed for early implementation. Four possible technology sector platforms from the energy-sector mitigation side are briefly described below to provide a clearer understanding of how the technology-sector platforms might work and what they might accomplish:

---

<sup>7</sup> As electric motors are primarily used in industrial applications, the corresponding response may be tailored differently than for consumer products.

- (a) **Efficient Energy-using Devices:** The markets for these technologies can be effectively guided using standards and labels (S&L) at little or no cost beyond those involved with developing the standards, testing the equipment, and enforcing the regulations. More ambitious programs may require marketing campaigns, buy-back schemes or mass procurement to jump-start the market. Examples of the technologies lending themselves to this type of intervention are energy-efficient light bulbs, energy-efficient refrigerators, and energy-efficient motors. Not only does the GEF have an active program in many countries to “phase-in” the use of the S&L nationally, but as this program increases in reach, the discussion of universal minimum energy performance standards will eventually become unavoidable. As more energy-efficient technologies are developed and utilized in developed countries, developing countries will need to adopt standards in order to avoid becoming the target for the “dumping” of sub-standard products and to avoid locking-in higher GHG emitting technologies in the future. Developing and least-developed countries can begin to adopt and to enforce these standards progressively, given their own economic and environmental status.<sup>8</sup> Consideration must be given to enforcing such standards on the importation of new as well as used products.

Over sixty countries have some form of energy-efficiency standards for appliances. At present, many countries favor adopting their own standards, despite the obvious benefits of a global or regional standard of performance for energy-consuming devices. But as more countries become interested in phasing-in more efficient appliances in order to reduce GHG emissions and conserve electricity, interest in uniform global standards for appliances that could be progressively adopted by developed, developing, and least developed countries will grow.<sup>9</sup> Working toward more effective S&L is an activity that should be considered a priority under this platform. In addition to the regulatory approach of S&L, in countries that are major producers of these appliances, engaging the private sector and the manufacturers is also considered essential in bringing about successful transformation of the market.

- (b) **Renewable Energy Supply Technologies:** The markets for renewable energy technologies have grown rapidly in recent years. Some developing countries have benefited from this growth, others have not. Through their TNAs, a large number of countries have expressed a need for greater access to clean, renewable energy generation. All of the elements of the technology transfer framework will prove relevant here as there are many situations in which policy, human capacity, institutional frameworks, information or financing will serve as barriers. But each country and each technology may face a different set of challenges to increasing the scale of renewable energy generation.

---

<sup>8</sup> The creation of universal energy efficient standards for common household appliances was one of the recommendations made by IEA to the recent G8 summit.

<sup>9</sup> Motivations will include not only reducing GHG emissions, but also reducing energy costs, forestalling the need for electrical capacity expansion, and improving energy security.

Experience has demonstrated that the adoption of clear, regulatory guidelines favoring renewable energy have the greatest impact on the uptake of renewable energy. In particular, the “feed-in” tariff is the single most effective tool to stimulate investment in renewable energy technology. However, regulatory frameworks are necessary, but not wholly sufficient to stimulate investments in the market for these technologies. Each technology may face a set of unique barriers or challenges. For example, a number of countries list geothermal energy as a technology in which they have no experience of the technology even when they are in active tectonic zones.<sup>10</sup> Past GEF support to geothermal technology has identified the resource confirmation stage as being a near absolute bottleneck in geothermal development, even once regulatory obstacles have been removed. In response, the GEF has established several funds using contingent grants or loans to facilitate the resource confirmation stage.

- (c) **Efficiency of Energy-Intensive Industry:** Many national TNAs have not been able to specify more than the energy-intensive sector requiring efficiency enhancements. Very specialized knowledge is required to pinpoint the precise technology or the suite of specific technologies that can be utilized to improve the efficiency of energy use in a particular energy-intensive industry, such as steel or aluminum processing, cement or brick production, or mining. The GEF has experience working with the brick industry, agro-processing industries, steel industry and several others and has supported several processes to improve access to newer technologies for these energy-intensive industries. But access to these newer technologies is especially challenging for small and medium enterprises (SMEs) in developing countries, as they may have limited access to information, specialized expertise, and financial capital.

In such cases, programs focusing on sharing information on sectoral “best practices” and “best technologies” may be of considerable use to assist local industries to identify their preferred options for their product and scale of operation. This might lead to specific sectoral benchmarking and voluntary agreements regarding technological processes in the target sector. The facilitation of investment finance through public or private sources would also be essential to help these industries move beyond older, inherited technology toward more efficient, cleaner, and lower GHG emitting production processes. The driving forces behind the adoption of the latter technologies tend to be reduction of operating costs, improvement of production efficiency and product quality, and enhancement of overall competitiveness.

- (d) **Efficiency of Fossil-fuel Based Electricity Generation:** Many countries have identified fossil-fuel electricity generation as a major source of GHG emissions

---

<sup>10</sup> In the case of Figure 2, geothermal energy is shown to have a great potential to reduce GHG emissions. However, for purposes of the discussion, the unit abatement costs for geothermal are very high on this graph, meaning that it is not a “win-win” priority. A review and updating of these costs might alter this view and place geothermal energy as a key strategic sector for this country.

and, therefore, a major need for technology transfer. Frequently, existing plants operate using sub-standard methods and therefore consume more fuel and emit more GHGs than necessary. Unless clean technology is provided, many developing countries will build the power plants required to meet their energy development needs using older, relatively inefficient fossil-fuel based technologies. This issue requires interventions of a policy/regulatory/information nature and of a capacity/investment/technological nature. Many new fossil-fuel technologies are available commercially, but are not yet being put to widespread use. Others will require greater research, development, and demonstration support before they become commercially available. All of these fossil-fuel based energy technologies could be addressed under this technology sector or platform.

27. The above list of technology sectors is only indicative of what might be identified as a set of initial platforms for action under the proposed strategic technology program. The above cases are drawn from the energy sector, which is probably the best understood component in mitigation analysis. Clearly, similar technology sectors and platforms could be identified for the industrial, forestry and agricultural sector mitigation technologies. On the adaptation side of the equation, a similar approach would be adopted, but focusing initially on the sectoral level (i.e., agriculture, coastal zone management, etc.) drawing upon priorities identified in National Adaptation Programs of Action (NAPAs) and information in national communications (see Annex IV).

#### **Step 4: Which Actions Should be Taken? At What level? By Whom? Implementing the Solutions Identified for Each Platform**

28. The fourth step of the program will involve the implementation of the solutions identified through the above process through available tools and mechanisms. These solutions will draw upon existing and new mechanisms for implementing technology transfer, including those contained in paragraph 2 of Decision 4/CP.13. These tools and mechanisms are discussed below in the context of GEF programming, and they include the development of joint research programs, demonstration projects, creation of enabling environments, provision of private-sector incentives, North-South and South-South cooperation, strengthening endogenous capacity and technologies, the provision of licenses, where appropriate, and the use of venture capital approaches and funding.

29. Depending upon the specifics of the technology and markets involved, a number of activities may apply:

- (a) National policy or tax changes to accelerate market growth;
- (b) Capacity-building efforts to increase local implementation capacity;
- (c) Local incentives or investment projects from public or private sources to stimulate investments; and

(d) Global standards, such as minimum energy-performance standards.

30. But the programs being implemented would have to be specific to the technologies and markets under consideration; there is no one-size-fits-all solution.

31. In order to coordinate and oversee the implementation of the solutions for each technology sector platform, it is proposed that a Technology Sector Platform Committee (TSPC) be established to oversee the work of each platform. This committee will be comprised of experts from governments in both Annex I and non-Annex I countries (including designated representatives from UNFCCC parties), from industry, including the financial sector, and from civil society. It will consult with relevant experts from other institutions, such as IEA, IPCC, REN21 or other institutions with technically relevant expertise. The TSPC for each platform will serve a key support function for activities to be implemented relevant to the technology sector platform. It will also make recommendations to the GEF Secretariat and GEF Agencies which may, in turn, make proposals to utilize additional funds earmarked for the platform to support activities not being supported through other sources. As the response is to be truly global in nature, funding for investments under each platform will be drawn from wide-ranging sources, as appropriate: the GEF, multilateral development banks, bilateral ODA sources, multilateral ODA sources, private equity and debt finance, corporate finance, vendor finance and so on. The Clean Development Mechanism (CDM) can also play an important role in leveraging private investment into ESTs: a recent evaluation of the CDM found that over 30% of its projects were expected to play a role in transferring technologies.<sup>11</sup> But each tool and financing source has its own niche to play, and that niche may vary according to the technology, market, and country being addressed.

32. Taking the example found in Figure 2 to the next stage, two platforms were established that would be relevant to the needs of Country X: Energy Efficiency in Energy-intensive Industries and Energy-efficient Appliances and Devices. The TSPC for Energy Efficiency in Energy-intensive Industries might be comprised of governments from both Annex I and non-Annex I; representatives of steel, cement, brick, and other relevant industries; and the financial sector. Industry groups should be included as appropriate. The GEF Secretariat would play a convening role and UNIDO, which has a comparative advantage with respect to industrial technology, might be considered as the lead Agency for the TSPC.

33. In the case of Energy-efficient Appliances and Devices, participating governments, appliance manufacturer representatives and financial sector representatives might be involved in the TSPC. The IEA and the Collaborative Labelling and Appliance Standards Program (CLASP) might provide resource people and UNEP might serve as the lead Agency. In a similar examples, a TSPC might be established for the other platforms, making use of the World Bank as the lead agency for the Efficient Fossil-Fuel Platform. But the TSPC would provide recommendations on how fast and in which direction the activities of their respective platform groups should move, and how much of the limited resources under the platform's control should

---

<sup>11</sup> Haites, E.; M. Duan; and S. Seres. 2006. "Technology Transfer by CDM Projects" Margaree Consultants, Inc. and Tsinghua University (August, 2006).

be devoted to each activity, given that the goal is to accelerate the uptake of the ESTs relevant to the sector.

## **FINANCING FOR THE IMPLEMENTATION OF TECHNOLOGY TRANSFER**

34. The GEF has considerable experience in working with programs to transfer ESTs. Virtually all GEF projects support elements of the technology transfer framework. The purpose of this program is to improve the utilization of resources for support to the transfer of ESTs and to make the deployment of these resources more responsive to the needs of countries. Because responding to the climate change challenge is a truly global undertaking, more resources that are currently available will be required, but they must be utilized efficiently and effectively to achieve the desired results. The design of each platform and each country program should draw upon the tools and investment resources available, and where needed, make use of newly available funding sources.

### **Tools and Mechanisms**

35. Decision 4/CP13 provides a list of points or approaches that are considered important tools and mechanisms for funding technology transfer activities through new or existing funding sources. Paragraph 2 of the decision lists the following as important elements for technology transfer:

- (a) The implementation of technology needs assessments;
- (b) Joint research and development programmes and activities in the development of new technologies;
- (c) Demonstration projects;
- (d) Enabling environments for technology transfer;
- (e) Incentives for the private sector;
- (f) North–South and South–South cooperation;
- (g) Endogenous capacities and technologies;
- (h) Issues associated with meeting the agreed full incremental costs;
- (i) Licenses to support the access to and transfer of low-carbon technologies and know-how; and
- (j) A window for, inter alia, a venture capital fund related to, or possibly located in, a multilateral financial institution.

36. The following section discusses each of these elements in turn, both drawing upon past GEF experiences and suggesting potential future avenues of pursuit that might be utilized under the strategic technology program.

### **Technology Needs Assessments**

37. TNAs will form the basis of the strategic technology program. Not only will work begin immediately on utilizing existing TNAs to identify technologies around which interventions can be designed and implemented, but a new round of updated TNAs will be funded by the GEF. EGTT has been mandated to make suggestions for the improvement of TNAs, and these recommendations should be followed. TNA teams should spend more time identifying the market characteristics for specific technologies, including their weaknesses and any barriers that prevent these markets from reaching maturity.

### **Joint Research and Development Programs**

38. With respect to joint research and development programs for new technologies, GEF experience particularly with concentrating solar power investments has indicated that for the not-yet commercialized technologies, such programs would prove very helpful in sharing knowledge and experience and in developing new technologies in partnership with other countries. Existing bilateral sources of funding for technology agreements have already been used to establish such partnerships. As the list of technologies expands from the already-commercial to the not-yet-commercial, such an approach will prove increasingly helpful. Additional support may be required to expand the scope and coverage of these joint R&D efforts.

### **Demonstration Projects**

39. Demonstration projects have always been an important part of the GEF repertoire of activities. Removing barriers to the broader dissemination of clean energy technologies frequently requires a demonstration of the technology “ice-breaker” for the market. Early demonstrations, or pilot activities, can be extremely effective in helping stimulate interest in promising, new technologies. Experience has shown that such demonstrations are more effective when they highlight not only the successful operation of the equipment, but also the enabling conditions that will make the technology itself widely adoptable and commercially viable. Once GEF support has been provided to demonstrate a new technology, other funding sources, such as the international financial institutions, the CDM and the private sector, often become more interested in the technology and are more willing to replicate the activities piloted by the GEF. Future demonstration efforts will need to report on these efforts to the COP more consistently and will also need to communicate more effectively the lessons and best practices identified.

### **Supportive Enabling Environments**

40. Establishing supportive enabling environments has always been essential for technology transfer. Much of the GEF support over the years has focused not just on the transfer of the equipment, but on the creation of the enabling environment that will make the uptake and



adoption of the technology successful. This need extends to conditions for attracting local and foreign private sector investment and establishing proper regulatory frameworks that are critical to the successful adoption of ESTs. The approach suggested in this paper will involve conditioning the market through investments to build supporting enabling environments.

### **Incentives for the Private Sector**

41. The GEF portfolio contains numerous examples of projects providing incentives for the greater engagement of the private sector. Apart from support to pilots and demonstration activities, GEF support has been provided in the form of risk-sharing mechanisms to encourage greater private investment, reducing the financial risks, thereby enabling greater financial resources to flow. Other GEF projects have also helped train private sector technicians and transfer new business models—such as that of performance-based contracting—to private sector entities in program countries. The CDM has proved to be an important tool for bring private sector resources to bear on climate change mitigation in developing countries. But new avenues for engaging the private sector in the global climate change arena are needed and require greater exploration.

### **North-South and South-South Cooperation:**

42. As the world has become increasingly globalized, there is little difference between effective examples of North-South and South-South cooperation. The Strategic Technology Program will seek to encourage and build upon successes of both. Past GEF financing has supported all types of technology transfer: whether transferring Indian biomass gasification units to Latin American and African countries or European small-scale coal boilers to China. Information flows must be increased to share the successful cases of such technology transfer, so that the good models can be more easily replicated.

43. The GEF has supported a number of projects to encourage North-South and South-South cooperation. One GEF-UNEP sponsored project entitled “*Technology Transfer Networks, I and II*” provided support to cleaner production centers in Brazil, India, Nicaragua, Peru and Tanzania. The project provided support to the creation of the SANet (Sustainable Alternatives Network) web-site, focused on clean and sustainable technologies. The project utilized the worldwide web to provide improved communications, training, and information to enable decision-makers in developing countries to make more informed decisions regarding investments in clean technologies. The lessons from this and other similar projects supported by the GEF will be utilized to enhance the quality of future technological cooperation.

### **Endogenous Capacities and Technologies**

44. The Strategic Technology Program will enhance endogenous capacities and technologies by first assessing capabilities and limitations of endogenous technologies and their role in mitigation and adaptation. It will disseminate and replicate good practices on development and deployment of endogenous technologies. All GEF projects currently provide support to building capacity to assess and transfer mitigation technologies with the intention of those technologies

then being further adapted for local use. Future additional support can be provided not only to enhancing endogenous capacities but also to disseminating best practices achieved in other contexts.

### **Agreed Full Incremental Costs**

45. The approach proposed for this strategic program begins by focusing on those technologies which may already be commercial or nearly commercial in some contexts, but which are not broadly adopted in others. Through a series of strategic interventions, the approach seeks to expand these latter markets. In such situations, the incremental costs of the program activities are simply the programmatic costs of removing the barriers so that the markets will become established and operate more efficiently. However, as the program moves from more commercial to less commercial technologies, the incremental investment needs will rise and the risks will increase. In the past, these resources have been provided by the GEF. In the future implementation of this program, resources will have to be sought from the GEF and other sources to help meet the full incremental costs of the investments. Reverse auctions, where the winner is the proponent requiring the smallest subsidy or demonstrating the greatest leverage, may be used to help minimize these incremental costs and to utilize most effectively the limited resources available.

### **Licenses for Technologies**

46. Licenses to sell and operate a particular technology provide an important tool to protect the intellectual property rights of those developing the new technologies. Paying for the costs of these licenses may be needed to support access to and transfer of some low-carbon technologies. The best known case of GEF facilitating access to a patent design is the case of the *China Small-scale Coal Boilers Projects*. In this case, the World Bank facilitated the sharing of the design of more efficient small-scale boilers from European producers with Chinese manufacturers. The result was a transformed market for small-scale coal boilers built around the more efficient design. In this case, the provision of a license was important to technological adoption.

47. In many cases, the licensing fees and the intellectual property elements are minimal, but the true value lies in the technological know-how from the company selling or operating the technology. A recent review of three clean energy technologies (photovoltaics, biofuels, and wind) has shown that there are few concerns with the intellectual property of these technologies, and even where such protection exists, the royalty costs embodied in license fees may be as low as one percent of the cost of the investment. The author points out that import tariffs typically constitute a larger fraction of the cost of the technology than do license fees or patent fees.<sup>12</sup> Licensing fees may constitute a barrier to the adoption of new technologies, which can be negotiated in individual cases. But when placed in the context of the overall cost of the technology being transferred, these fees tend to be minimal.

---

<sup>12</sup> John. H. Barton. "Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel, and Wind Technologies," October 2007. International Centre for Trade and Sustainable Development Issue Paper No. 2. Geneva: ICSTD.

## **Window for Venture Capital and Other Creative Financing**

48. Venture capital plays an important role in the private-sector development of new technologies. This past year has seen a flood of venture-capital money flow into the clean-energy technology field. Venture capital serves to stimulate investments in new technology by putting financial resources into “high-risk, high-return” undertakings. These are types of investments rarely made knowingly in either the ODA or multilateral world. A window for a venture capital fund related to a multilateral financing institution might assist in the rapid penetration of new technologies into developing country markets.

49. The GEF has recently created a Public-Private-Partnership Initiative (the “Earth Fund”) to engage more effectively the private sector in programs providing global environmental benefits. GEF has already allocated \$50,000,000 to the Earth Fund and will create a new platform within the Earth Fund for technology transfer. This platform will seek to leverage venture capital funding for new clean technologies through both the private sector and multilateral financing sources using a variety of tools. Future GEF work will make greater use of this innovative window and will report publicly on its deployment.

## **Evolution of the GEF Strategy**

50. The first sources of resources to be considered for utilization under this strategic technology program are those of the GEF, whose mandate fully conforms to the approach proposed for the Strategic Technology Program. The GEF’s Operational Strategy stated the goal as being to “support sustainable measures that minimize climate change damage by reducing the risk, or the adverse effects, of climate change. The GEF will finance agreed and eligible enabling, mitigation, and adaptation activities in eligible recipient countries.”<sup>13</sup> About \$2.2 billion has been allocated to projects in the climate change focal area, funding which has leveraged an additional \$14 billion, and resulted in the reduction of hundreds of millions of tons of GHG emissions. GEF funding has focused on supporting innovative approaches and technologies to benefit the global environment. As part of the GEF-4 replenishment process, the Operational Strategy for mitigation in the GEF was revised to focus primarily on six Strategic Programs in the mitigation area: Promoting Energy Efficiency in the Built Environment; Promoting Energy Efficiency in the Industrial Sector; Promoting Market-based Approaches for Renewable Energy; Promoting Sustainable Energy Production from Biomass; Promoting Sustainable Innovative Systems for Urban Transport; and Management of Land-use, Land-Use Change and Forestry (LULUCF) as a Means to Protect Carbon Stocks and Reduce GHG Emissions. Support under all of these programs is consistent with the goals and objectives of the strategic program for technology transfer, and countries should feel free to utilize their allocations under the GEF Trust Fund to support the implementation of projects and activities supporting the acceleration of the growth of ESTs.

51. As the GEF moves from its Fourth to its Fifth Replenishment Period, the strategy will be refined and revised to incorporate responses to emerging needs and new frontiers. Projects

---

<sup>13</sup> GEF Secretariat, 1995, GEF Operational Strategy, p 31.

supporting the removal of barriers to the expansion of markets for ESTs will continue to serve as the mainstay of the GEF portfolio—helping countries adopt those technologies which they feel are already cost-effective but are not disseminating rapidly enough is an essential task for the GEF. GEF resources can be used to remove barriers and stimulate market growth, as well as to invest in the pilot and demonstration activities that are of importance to its program countries. In the past, the GEF has demonstrated and piloted innovative approaches and activities that are then replicated through investments made by other sources, such as international financial institutions, the private sector, government finance, and carbon finance. The GEF's role as a funder of innovative, pilot activities is expected to continue: when integrated gasification combined cycle (IGCC) or carbon capture and storage (CCS) become ready for demonstration activities in developing countries, it is fully anticipated that GEF resources should be available to support these activities.

52. As a network institution, the GEF works through a number of other institutions in the multilateral system. It will continue to work through these institutions, to leverage resources and expertise from them, and to lay the foundation for more substantial work of relevance to the global environmental conventions, for which the GEF serves as financial mechanism.

### **Collaboration with the World Bank and Other International Financial Institutions**

53. The World Bank has always been, and will continue to be, the strongest implementing partner of the GEF. Over the years of GEF's existence, nearly \$1.6 billion or 64% of the GEF's funding in the climate change focal area has flowed via projects being implemented by the World Bank. The World Bank's initiatives in the energy efficiency and renewable energy portfolios have continued to grow, with the total funding committed to renewable energy, hydro-electricity, and energy efficiency comprising \$1.4 billion, or 40% of total energy sector commitments.<sup>14</sup> GEF funding made up \$128 million of this total. The World Bank also hosts ten different carbon funds to support CDM projects. During 2007, nearly 10% of the Bank's clean energy portfolio (\$140 million) was made up of carbon finance operations.

54. The World Bank is placing renewed emphasis on climate change and the key role that it must play in shaping future global development. In consultation with the regional development banks, the World Bank is seeking to establish a portfolio of strategic Climate Investment Funds (CIF). This family of funds is expected to include a Strategic Climate Fund, a Clean Technology Fund (CTF), a Forest Investment Fund, and a Climate Resilience Pilot Program. The CTF will focus on financing clean technologies that are part of the near to medium-term investment needs of countries with significant GHG emissions that are seeking to deploy low-carbon technologies. It will provide support for renewable energy projects, energy efficiency projects, and clean fossil-fuel projects required for transformation to a low-carbon growth path.

55. The activities under the CTF are largely consistent with those of the Strategic Technology Program being outlined in this paper, and all efforts will be made to ensure that the efforts of this program and those of the World Bank under these new funds remain

---

<sup>14</sup> World Bank. 2007. *Catalyzing Private Investment for a Low-Carbon Economy: World Bank Group Progress on Renewable energy and Energy Efficiency in Fiscal 2007*. Washington, DC: World Bank.

complementary. Because of these efforts, the World Bank may play a leading role in future work on clean fossil fuels and renewable energy. As both the CIF and this strategic program for technology move forward, continued close collaboration between the GEF and the World Bank will be essential to ensure that resources are effectively and efficiently utilized to meet country's needs.

56. In addition to the initiatives of the World Bank, the other multilateral development banks have established specialized funding instruments to address climate change. The Asian Development Bank is supporting clean energy projects through the Asia-Pacific Carbon Fund (APCF). The EBRD is supporting low-carbon projects through both the Sustainable Energy Initiative and the Multilateral Carbon Credit Fund. The IDB is utilizing its own capital to support both sustainable infrastructure projects through its Infra-fund and sustainable energy projects through its Sustainable Energy and Climate Change Initiative.

57. The work being supported under all of these funds is largely consistent with the formulation of the Strategic Technology Program presented in this document. As all of these MDBs are now GEF Agencies, the technology program will strive to work in close collaboration with these other initiatives.

### **Private Sector Financing**

58. Private sector investments represent the primary investment flow to address climate change worldwide, and they must at least triple between 2000 and 2030 in order to continue the world's economic growth pattern.<sup>15</sup> Private sector financial flows represent nearly 86% of financial flows to address climate change at a global level. At present, only 25% of these private sector investment flows occur in developing countries. In order to return GHG emissions to current levels by the year 2030, additional financial flows of between \$200 and 210 billion will be required. Approximately 46% of these flows will be required in developing countries. Clearly, directing private sector investment in new infrastructure and technologies is essential to meeting the challenges posed by climate change.

59. Carbon finance, made up of support to projects under the flexible mechanisms of the Kyoto Protocol, including the CDM and Joint Implementation, represents a significant new flow of resources into environmentally sound technologies. Projects in the CDM pipeline in 2006 are anticipated to generate about \$25 billion over their lifetimes and nearly 90% of this is anticipated to represent investments in renewable energy and energy efficiency.<sup>16</sup> Nearly half of this flow of investment resources represents unilateral CDM—investments by host-country project proponents in clean energy projects in their base country of operations. A recent review of CDM projects estimated that roughly 39% of all CDM projects contained elements focusing on technology transfer. These projects are expected to account for 64% of the total emissions projected from the CDM.

---

<sup>15</sup> United Nations Framework Convention on Climate Change. 2007. *Investment and Financial Flows To Address Climate Change*. Bonn: UNFCCC.

<sup>16</sup> UNFCCC. 2007. *op cit*.

60. The GEF has continually focused its efforts on setting the conditions for successful private sector investment and the replication of investments in ESTs by the private sector, international financial institutions and other public-sector investors, including host governments. The GEF will continue to focus on creating the enabling environment for successful investment in GHG mitigation in its program countries. Recently, the GEF has begun to provide programmatic support to investments that will be replicated through the CDM and carbon finance. The work proposed under this strategic technology program will engage the GEF further in supporting private sector investments in ESTs worldwide.

### **For Immediate Implementation**

61. The purpose of this initiative is not to create new sources of funding or funds. Nor is it to put resources into making R&D investments that traditionally have been the responsibility of the private sector and governments. Rather, its intent is to elaborate a program to accelerate the development of markets for ESTs of strategic relevance to the climate change convention, beginning with technologies that are needed and that already pose profitable investment opportunities for the users. With increased commitment to addressing the challenge of climate change mitigation, more resources will have to be devoted and utilized to meet the enormous scale of the challenge.

62. The first two activities proposed below are meant for immediate implementation. The third and fourth activities will require immediate attention, but must begin within the next year. The activities proposed below are intended to be either foundational—to lay the foundation for future activities—or demonstrative—to pilot how such a strategic program would work. The expectation is that the required investments will not come from the direct costs of the program, but will be leveraged by the program from other available sources through the softer measures seeking to improve market operations.

### **Pilot Project: From TNAs to TMAs to Technology Interventions (\$2 million on a matching basis; \$4million total)**

63. In order to shape the architecture of the entire strategic program and its platforms, it is proposed that this pilot activity begin to involve countries that have already prepared TNAs. The Pilot will begin by examining TNAs, aggregating their results, and analyzing them to determine which technologies will be considered to be of strategic importance will be determined in reference to a technology's interest to a number of countries; its aggregate importance in reducing GHGs; and its status as "win-win" technologies that is not yet widely adopted in developing countries. This pilot will also lead the way in developing and utilizing a revised methodology for TNAs that can help countries look further into the operation of the relevant markets for the technologies under consideration. Rather than focusing exclusively on assessing technological needs, the relevant actors need to focus also on the markets for the technologies, and their functioning. Based upon these market assessments and relevant work from other agencies and institutions (such as IPCC, IEA, etc.), it will then design implementation programs for technology sector platforms to stimulate the markets for the technologies, using the available tools, mechanisms and resources available. These programs will vary by technology

type and will consider using all of the available tools and resources, as appropriate. For example, for many energy-consuming devices, the universal adoption of minimum energy-efficiency performance standards would make sense. For other technologies, regulatory and policy solutions may be appropriate. The activities proposed for each technology will include activities at the local, national and global levels, where appropriate, and countries may choose to implement the relevant activities using their GEF resources or any other resources available to them.

64. The expected cost of a two-year pilot activity to undertake an initial assessment of the TNAs is expected to be US\$4 million. Beyond the initial two-year period, the costs are expected to continue as the range of countries, technologies, and activities increases. This pilot will be implemented through UNEP. The pilot assessment will begin in June of 2008 and is expected to require 18 months to complete.

#### **Funding of Technology Needs Assessments (\$6.5 million)**

65. As indicated earlier, the GEF has already funded TNAs for over 90 countries. However, less than 30 TNAs have been identified and posted on the UNFCCC web-site. These TNAs will provide the basis for the initial design work of the Strategic Technology Program. Some countries have presented information on technology needs as part of their national communications, bringing the total number of countries for which this information is available to nearly 40. This information will be used in the above activities. However, if TNAs are to provide the foundation for future global cooperation under the Convention, there is a need to ensure that all countries have assessed their technology needs; have understood the nature of the markets for those technologies; and have begun to participate in activities to expand the markets for these ESTs.

66. This activity will involve funding a round of TNAs for countries that require them to carry out these activities. The countries will use the existing guidelines but should also accept suggestions being made by the EGTT and other informed entities (including those developed through the pilot assessment) to update and strengthen the methodology and its focus on specific markets. For example, identifying specific mitigation technologies in the energy sector and coming to grips with the barriers to the growth of the markets for these technologies provide an essential step in designing programs of activities to accelerate the dissemination of these technologies.

67. This activity will be implemented through UNEP and UNDP. The process of funding the new TNAs will begin in June of 2008.

**Pilot Development of Four Technology-Sector Platforms: Minimum Performance Standards for Energy-Using Devices; Renewable Energy Supply; Energy Efficiency of Energy-Intensive Industries; and Improving the Efficiency of Fossil Fuel Electricity Generation (\$5 million each; \$20m total, plus preparation costs)**

68. In order to gain early experience in the implementation of these technology sector platforms, the strategic opportunity presents itself to begin initiating three or four of the technology-sector programs immediately, in cases where the activity is a clear-cut priority and where the actions are relatively well understood. Under these pilot activities, four technology-sector platforms could be proposed for support and could be initiated on a trial basis. A program of action could be designed immediately and a TSPC established to begin to oversee the work under these programs. The budget for these TSPCs would pay the costs of the TSPC meetings, the development of best practices, and the costs related to agreed recommendations regarding those additional activities that the TSPC feels are the most cost-effective way to achieve the goals of the widespread dissemination of the technologies falling under the platforms. Such activities might include payment for sector-specific national programs and program teams; convening international meetings; consulting costs; monitoring and evaluation expenses; and other activities consistent with the objectives of the platform, but not paid for by other sources.

69. The possible design for each of the four platforms discussed should be considered as part of this pilot activity. With respect to the efficiency of energy-using devices, S&L may present one of the most cost-effective opportunities to reduce present and future GHG emissions. Even though a more efficient appliance may initially cost slightly more than an inefficient competitor, over the life of the appliance it typically is much cheaper, as it consumes less energy in operation. Because it consumes less energy, it accounts for significantly fewer GHG emissions. Yet a “first-cost” bias frequently leads consumers to select inferior technology—another market failure. The IEA recommended the universal adoption of energy efficient codes and labels to the G8 meeting in Heiligendamm, Germany in 2007.<sup>17</sup> The development and adoption of universal minimum performance standards would provide an opportunity for developing and developed countries to cooperate in the transfer of technology that provide a least-cost option for reducing GHG gases. Countries may choose to adopt the standards progressively, in keeping with their own priorities and markets.

70. With respect to renewable energy, worldwide total investment in 2007 exceeded US \$148 billion. While many developing countries are already on the leading edge of this sector, others are not. While a number of preconditions to making use of renewable energy supplies are important, perhaps the two most important factors necessary to take advantage of renewable energy resources are information about resource availability and a favorable electricity sector regulatory framework. Many countries have expressed an interest in increased hydro-electric supplies, wind supplies, solar energy supplies (solar water heating, PV and CSP), small-hydro supplies, increased biomass use for heat and power, and other renewable energy alternatives. Once resources are understood and regulations are in place, the need arises for investment into

---

<sup>17</sup> International Energy Agency. 2007. “IEA Energy Efficiency Policy Recommendations to the G8 2007 Summit, Heiligendamm.”(June). Paris: IEA.



renewable energy supply. Countries that have not already assumed renewable energy targets or portfolio standards may choose to do so to boost renewable energy investment.

71. As indicated earlier, understanding the opportunities for energy-intensive industries will require specialist understanding and sector-specific information about production processes. One of the most effective ways to encourage the transfer of technologies is to provide information about specific processes so that factory owners and operators can find technological alternatives appropriate to their market niche and scale. Financing then becomes essential to enable the new installations to take place. The degree to which global agreements, such as standards and codes, are effective means to phase-in specific technologies or phase-out others in this sector requires further examination. Accordingly, initial activities would likely focus on cement, steel, timber-processing, bricks and other energy-related industries that are becoming increasingly important in the rapidly industrializing economies.

72. Finally, most countries acknowledge the need to obtain greater efficiency in the generation of electricity from fossil fuels as a key to reducing growth in GHG emissions. Activities to be considered and possibly implemented through this platform could extend the entire gamut from policy issues (such as the need for improved energy pricing and policy reform); to better practices (improved preventive maintenance regimes) to investments in installations with newer, more efficient technologies (such as super-critical generation or ultra-supercritical generation or IGCC). Probably more than the other technology platforms mentioned above, this sector will require increased investment to the electric power sector in developing countries. As such, it also is consistent with the goals of the new Climate Change Funds being established by the World Bank.

### **Preparation of Report on the Transfer of Environmentally Sound Technologies (\$1 million)**

73. As part of the Strategic Technology program, it is proposed to develop and prepare a bi-annual report on the transfer of EST's of relevance to climate change. Initially beginning with work supported through the GEF, this activity will result in the publication of a report on activities to transfer environmentally-friendly technologies consistent with the goals of the UNFCCC.

74. The initial report will be prepared by the GEF for delivery to the COP in 2009, and it will encompass not just the work of the GEF, but also of other related bodies supporting work on the transfer of technologies of relevance to the mitigation of GHG emission or adaptation to the adverse impacts of climate change. The GEF Secretariat will implement this activity in collaboration with UNEP.

## ANNEX I

### GEF EXPERIENCE ON THE TRANSFER OF CLIMATE FRIENDLY TECHNOLOGIES

1. As part of the development of its Operational Strategy approved in 1994, the GEF designed three Operational Programs to meet the goals of the Convention. The difference between these programs focused both on the sector of the technology and the relative maturity of the technology. Operational Programs (OP) 5 focused on energy efficiency and OP 6 focused on renewable energy technologies that were mature, available on the international market and profitable on paper but were not disseminating because of the existence of a number of barriers of a human, institutional, technological, policy, of financial nature. Projects under these OP's were termed "barrier removal" projects, as they sought to remove these barriers and promote accelerated growth in the adoption of the new technologies and practices. In contrast, OP 7 focused on reducing the long-term costs of low-GHG emitting electricity generating technologies. By definition, the technologies included under this program were not-yet commercially available and very expensive relative to the baseline or conventional alternatives. In these cases, such as concentrating solar power (CSP) plants, fuel-cell buses (FCB's), biomass-integrated-combined-cycle generation (BIG/GT), stationary fuel-cells, and micro-turbines, significant incremental costs still existed. In other words, the technology and its costs formed the barrier to greater dissemination of the technology. When the operational program on sustainable transport (OP 11) was approved in 2000, it contained a combination of approaches, including a focus not only on technologies and practices that were cost-effective but underutilized but also on technologies that were not fully developed.

2. As a result of the GEF's strategy and development, the GEF's work in the climate change focal area has always focused on technology. Virtually all GEF mitigation projects have focused on a technology and the need to expand the capacity for its utilization and reach in the market. As explained below, the approach adopted has conformed closely to the UNFCCC's technology transfer framework. Over the course of the GEF's history, there have been projects focusing on expanding the market for and increasing the use of all of the technologies included in the table below. By this count, the GEF has supported the diffusion and dissemination of 34 different technologies in the course of its history.

## Technologies Supported by GEF: 1991-2008

	Energy Efficiency	Renewable Energy	Emerging Energy Generating Technologies	Transportation
Technologies Supported in GEF Projects	Compact Fluorescent Bulbs Light-emitting diodes Energy-efficient street lights (sodium) Energy Efficient Refrigerators Energy-efficient motors Energy Efficient Building materials (windows, doors, perforated bricks, ) Energy-efficient building design Energy efficient brick kilns Heat recovery for power generation from industrial processes (Co-generation ) Efficient Boilers Energy Efficient Street lights District Heating systems	Off-grid PV's On-grid PV's Wind-turbines Small wind-turbines Geothermal energy Low-temperature geothermal Methane from mixed municipal waste Methane from liquid biological wastes Small hydro power Small hydroelectricity Co-generation (biomass) Biomass boilers (heat) Biomass gasification (electricity)	Concentrating Solar Power Stationary Fuel cells Micro-turbines Building-integrated PV's BIG/GT	Fuel-cells for transport Dedicated Bus lanes Bus rapid Transit Bicycle paths

3. This is not to say that all of the technologies listed above have been fully disseminated or that all countries have access to all of these technologies. As the GEF has had limited resources and responds to the different expressed needs of countries in different ways, it has not been able to provide universal support to the above technologies. However, it does have considerable experience to draw upon in the design of a strategic technology program. This section will highlight some of that experience in the context of GEF experiences with particular technologies.

### Examples from the GEF Portfolio

4. Given the vast experience with technologies, this section will draw upon only four examples that is intended to provide some lessons of experience—both positive and negative—with technology development and transfer under the GEF portfolio.

### Biomethanation in India – Industrial Uses of Liquid Biomass Wastes

5. When this project was proposed in the early 1990's, there was no endogenous capacity in India for adapting and replicating biogas technology for industrial wastes. This led to large amounts of biological wastes from agro-processing and related industries that emitted large amounts of methane to the air and other pollutants to the water. The idea of the project was to produce the methane in a controlled environment, capture it, and used for energy production. When utilized for energy, it is emitted as CO<sub>2</sub>, which has lower global warming potential (GWP) than methane (CH<sub>4</sub>). The methane also provides benefits by substituting for fossil fuels in electricity generation or heat production.

6. The GEF project supported capacity building at five national R&D laboratories and other institutions that were been actively involved in the project as a network. Nine international fellowship programs and 20 out-of-country study tours were conducted with nearly 80 participants. A number of in-house training programs were conducted. In addition, the GEF co-financed more than a dozen demonstration units, in a wide variety of industries, including agro-processing, pulp and paper, tanneries, slaughterhouses, rice mills, and commercial dairies.

7. While the capacity building activities were very successful and sustainable, and the demonstration units clearly indicated which industries could reach the highest levels of GHG abatement, the project also demonstrated very clearly that it is important not to stop after the development of technologies, or their adaptation to the local conditions. Once the suitable technologies have been identified and tested, it is very important to move on to the dissemination stage, and to a systematic integration into national technology policy and the build-up of a national industry to provide the equipment and services needed for a lasting dissemination of the demonstrated successes.

8. In the India case, this is now taken up by the National Bioenergy Board that is also supported by the project. A National Master Plan for the dissemination and broad scale use of biomethanation technologies has been developed to lead to broad-scale implementation. Furthermore, replication is now facilitated through the CDM which already has a number of similar projects in the pipeline. The CDM and GEF therefore complement each other very beneficially in this technology transfer effort, with the GEF removing the initial barriers, and the CDM leading to scale-up.

### **The GEF Photovoltaic (PV) Portfolio**

9. Since its inception, the GEF has been confronted with the question of new renewable technologies for the provision of energy services to the 1.6 billion people without access to electricity. Since these people often live in remote areas experts expect that power grid expansion is not cost effective and affordable to the governments, and their limited energy consumption patterns contribute GHG emissions due to their use of kerosene for lighting and woodfuel for cooking. In response to this need, the GEF funded a number of projects with all agencies that provided access to electricity through the use of Solar Home Systems (SHS). More than 20 of these projects are in Africa. A typical project would begin by assessing the market; examining the affordability of the device; ensuring that the products being sold are of a high quality; providing business infrastructure to the suppliers; bundling demand; and including a financial incentive for the users and suppliers to help defray the incremental costs of the technology.

10. In general, the projects supported have not lead to growing healthy markets for SHS's. Affordability remains an issue: GEF's resources are insufficient to provide long-lived subsidies to SHS purchasers, so after the GEF projects are over, there has been a frequent collapse in the market. GEF subsidies have not been sufficient to stimulate sustainable growth of the market even in instances where the SHS technology may be the least cost because it is still largely unaffordable to the largely rural and poor target population. In addition, SHS's have not resulted

in significant reduction of GHG emissions as the quantity of electricity generated and used is very small.<sup>18</sup>

11. However, through the process, the GEF learned a number of lessons.<sup>19</sup> The technical quality of the SHS's and its various components was frequently an issue. In order to stimulate the market, all projects included an element encouraging countries to adopt the latest international standards for SHS's, and their components. Consumers frequently were unaware of the existence of solar home systems and all of the services that they could provide, so most projects included an emphasis on raising awareness of the technology. In order for SHS's to be accessible to those needing them, a business infrastructure including not only sales but also after-sales service and maintenance needed to be provided. Capacity building at the human and institutional level was necessary to enable these businesses to take off. Policy and regulatory environments also frequently have played a role, with clear indications of the areas that will be electrified economically and those that are not. For those areas that cannot be reached with the grid, many governments have provided them with the same level of support available to electrified households to be able to purchase energy services through PV's and SHS's. Finally, there is the issue of financing. GEF investment support was never meant to provide a permanent subsidy for households and businesses for the purchase of PV systems. Rather, it was meant to improve the operation of the market for the technology. But because the cost of the technology has remained high that many subsidies have been required. In some cases, governments have assumed a responsibility for that gap funding. In others, it has not been able to do so. But just because PV's and SHS's may have been the least-cost option to provide electricity to remote homes and households does not mean that they are necessarily affordable to those who need them. In such a case, financing arrangements are needed to match both the customers ability and willingness to pay for the energy services provided.

### **GEF's Concentrating Solar Power (CSP) Portfolio**

12. In the 1980's, a small number of experimental power plants were built that used mirrors to concentrate solar radiation, and generate enough heat to produce power. This technology is called Concentrating Solar Power or CSP. The most extensive installation is in Kramer Junction, California and the plant is still in operation after over 20 years. After the first multi-Megawatt installations had been built and operated for a number of years, it seemed appropriate to have some similar demonstration projects in developing countries, many of which have very suitable solar conditions for this technology.

13. Starting in 1996, the WB and GEF, together with India, Mexico, Morocco, and Egypt, developed a portfolio of 4 demonstration plants in developing countries. The projects were intended to build a solar field, typically of 30 MW, as part of a hybrid gas-turbine plant. The hybridization of the gas turbine and the solar power plant would enable the projects to be able to

---

<sup>18</sup> Martin Krause and S. Nordstroem, ed. 2004. Solar Photovoltaics in Africa: Experiences with Financing and Delivery Models. UNDP Lessons for the Future. Monitoring and Evaluation Report Series Issue 2. New York: UNDP.

<sup>19</sup> International Finance Corporation. 2007. Selling Solar: Lessons from More Than a Decade of IFC's Experience. Washington DC: IFC.

dispatch power at will, making it more economically attractive. After nearly eight years of working on this portfolio, the India project was cancelled. The other projects progressed very slowly indicating that the technology did not meet with the enthusiastic uptake originally anticipated.

14. Not only did the technology not make any progress in developing countries, but it also languished in developed countries during this time period. Until 2004, no other CSP plants have been completed in developed countries, although the Kramer Junction plant has continuously operated under commercial conditions. Only recently have new plants been planned and constructed in developed countries, most notably Spain where they were given generous incentives through a high feed-in tariff for solar energy. Now, together with an increased momentum in spurred by these activities in developed countries, the projects in Egypt, Mexico and Morocco are moving forward.<sup>20</sup>

15. One lesson from this experience is that it is not easy for developing countries to adopt technologies from developed countries that are not yet fully commercialized. The lack of follow-up to the technology in the developed countries damaged its reputation in developing countries. The costs did not fall as anticipated, and in fact, the costs increased while the projects were under development. Not only have the projects imposed additional costs on the countries, but they have also imposed additional risks regarding the likelihood of the projects producing the rated power on a firm basis. In fact, in two of the cases under way, the incremental costs of the project have exceeded those which the GEF has provided leaving both countries to provide significant cash subsidies to the plants to enable them to move forward.

16. For technologies of this type to move forward, a technology partnership between interested participants in developed and developing countries would help the technology move forward more rapidly. As early technology adopters and technology developers around the world collaborate, problems can be resolved through cooperation and lessons adopted and applied more quickly.

---

<sup>20</sup> An expert assessment commissioned by the World Bank recommended that despite the many drawbacks, the remaining 3 CSP projects be allowed to move ahead. World Bank GEF. Assessment of the World Bank Group/GEF Strategy for the Market Development of Concentrating Solar Thermal Power. Washington DC: World Bank and GEF.

## ANNEX II

### LESSONS AND EXPERIENCE ON TECHNOLOGY TRANSFER FROM THE MONTREAL PROTOCOL

1. As the Montreal Protocol (MP) has proven to be successful at promoting new technologies to phase-out the use of substances that deplete the ozone layer, it can also provide useful lessons on the transfer of EST's. Although the nature of the technologies used to phase-out ozone depleting substances (ODS) and the industries where they were deployed are far more limited than in the case of climate change, a concrete approach focusing on specific technologies can provide a useful model for the climate change convention.

2. One recent review of the experience of the Montreal Protocol (MP) with an eye toward lessons for the Climate Change Convention identified ten key lessons that may provide useful in stimulating concrete actions. These are listed briefly below:

- (a) Act now with the best available technologies and existing legal structures;
- (b) Develop visionary technology assessment;
- (c) Encourage leadership by multinational and domestic enterprises;
- (d) Identify and involve all stakeholders and develop local and international partnerships;
- (e) Raise awareness;
- (f) Require country programmes from each developing country, with specific voluntary goals towards green growth;
- (g) Empower the financial mechanism to be a proactive instrument for technology transfer;
- (h) Create focal points and networks;
- (i) Develop and implement training;
- (j) Use regulations and policies to promote technology transfer;
- (k) Remove legal and institutional barriers, and improve systems of governance; and
- (l) Use public procurement to promote alternatives.<sup>21</sup>

3. While some of these lessons might be considered controversial, they are possible to pursue in the context of a strategic technology program.

---

<sup>21</sup> Stephen O. Andersen; K. M. Sarma; and K. N. Taddonio. *Technology Transfer for the Ozone Layer: Lessons for Climate Change*. London: Earthscan.

4. A second recent discussion of technology transfer in the climate change context also has draws four lessons from the successes of the Montreal Protocol. The first lesson identified relates to the fact that governments emerged as major stakeholders in the process and assumed a central role in all responses, including those related to technology transfer. Second, the MP identified a number of promising technologies to phase out substances that deplete the ozone layer. Thirdly, funding was made available to pay for the costs of the phase-out or technology transfer. Finally, the MP provided assistance to provide country needs assessments; training in adapting the new technologies to local conditions; and information exchange prior to the implementation of the investment projects. As a result of this last action, significant capacity was built in the developing countries to work on both existing and future ODS phase-out activities.<sup>22</sup>

5. Similar lessons have been identified by G. Victor Buxton in a paper prepared for UNEP-DTIE.<sup>23</sup>

---

<sup>22</sup> Christian Egenhofer; L. Milford; M. Fujiwara; T. L. Brewer; and M. Alessi. "Low-Carbon Technologies in the Post-Bali Period: Accelerating their Development and Deployment," December 2007. European Climate Platform (ECP) Report No. 4. Brussels: ECP.

<sup>23</sup> G. Victor Buxton. 2007. "Assessing Experience with the Montreal Protocol, Climate Change and Other MEA's: Looking to the Future. February, 2007. Prepared for UNEP-DTIE: Paris.



## ANNEX III

### BRIEF SUMMARY OF STATUS OF TECHNOLOGY NEEDS ASSESSMENTS (TNAs)

1. Decision 2/CP.4 requested the GEF to support Parties to “identify and submit to the Conference of the Parties their prioritized technology needs, specially as concerns key technologies needed in particularly sectors of their national economics conducive to addressing climate change and minimizing its adverse effects”. In response to this decision, the GEF Council approved the “Operational Guidelines for Expedited Financing of Climate Change Enabling Activities: Part II, Expedited Financing for (Interim) Measure for Capacity Building in Priority Areas” in October 1999. Starting in 1999 and continuing until the present, the GEF has funded more than 90 countries to carry out technology needs assessment. In support of the work of the EGTT, the UNFCCC Secretariat established a web-site for sharing information about technology transfer. This web-site, called TT:Clear, provides access to technology-related information from 38 countries and one region (SADC).
2. In April 2006, the UNFCCC Secretariat presented a synthesis paper to the 24th Session of the SBSTA entitled “Synthesis report on technology needs identified by Parties not included in Annex I to the Convention.”<sup>24</sup> The report reviewed the available TNAs and national communications that were available at the time to provide information on the process and priorities expressed in those report. A total of 23 TNAs were reviewed together with technology information from 25 national communications. With respect to mitigation needs, the survey reported that the most commonly assessed sectors were energy, industry, transport, land-use and forestry, waste management and agriculture. Within the energy sector, renewable energy, energy-efficient appliances, combined heat and power, industrial energy efficiency, boilers and green building materials and design were the technologies most frequently cited. On the adaptation front, agriculture, coastal zone management, and water resources received the most attention, but human health, systematic observation, natural disasters, and tourism were also covered by nearly ten percent of the countries. The most commonly cited adaptation technologies were crop management; water recycling and conservation; irrigation; land management; and livestock.
3. Since this review was undertaken, 12 additional TNAs have been posted on the TT:CLEAR website, and the UNFCCC Secretariat is planning to undertake an update on the information provided in the new TNAs that have been provided since 2006.
4. A summary of the discussions was prepared for presentation to the Thirteenth Meeting of the Conference of Parties under the title “Report on the workshop on best practices in conducting technology needs assessments: Note by the Secretariat”.<sup>25</sup> The report identifies best practices in all stages of the TNA process and is meant to serve as a useful guideline for revising the methodology for use in future assessments of ESTs.

---

<sup>24</sup> FCCC/SBSTA/2006/INF.1

<sup>25</sup> FCCC/SBSTA/2007/11.

## ANNEX IV

### A STRATEGIC TECHNOLOGY PROGRAM FOR ADAPTATION

1. Figure 4.1 presents a diagram of how the logic involved in the development of the mitigation technology sector platforms might be utilized to formulate strategic technology programs in the area of the adaptation to the adverse impacts of climate change. This diagram will be further pursued following the completion of work recently commissioned by the GEF Secretariat.

**Figure 4.1 Formulation of a Strategic Technology Program: Adaptation**

