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CLIN 2: Institutional Strengthening of the Financial Sector

Subtask 2.D Finish Providing TA for the Remaining Three Selected Bank Portfolios

Greenhouse Gas Pollution Prevention Project - Climate Change Supplement

A Program of the:
United States Agency for International Development / India Mission

Implemented by:
The Louis Berger Group, Inc.
Global Environment Team

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Portfolio Review of Indian Financial Institutions: *Strengthening GHG Assessment and Analysis*

Washington D. C.
New Delhi · Mumbai · Bangalore
July 29 - August 14, 2002

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Phase I.

Portfolio Review of Indian Financial Institutions: *Strengthening GHG Assessment and Analysis*

Washington, DC
July 29 - August 2, 2002

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I. EXECUTIVE SUMMARY

The impact of global climate change contains no boundaries and continues to attract international attention while being defined as the "21st century conundrum". Corporate environmental responsibility programs and the development of institutional consortiums have emerged in an effort to address climate change as a long-term issue. These forward thinking institutions and companies are working towards defining optimal approaches that can be employed to mitigate the growing threat. It is anticipated that these extensive emission reduction approaches will provide advantageous to the social "bottomline" in the long-term and will provide above-average returns to companies. These interventions have and will continue to catalyze a new offspring of technological and research endeavors to address these issues.

> *A better understanding of the investment applications can only be a positive value for pension funds, other institutional investors and their beneficiaries*
>
> - Peter Moon
> Chief Investment Officer, USS

Financial intermediary institutions across the world recognize that these emerging issues could translate into immediate and near-term risks. As the international climate change negotiations evolve and define how the world will address issues, it is uncertain if there will be threats to businesses from drastic short-term policy changes raised or disintegration. It is felt that these uncertainties and ongoing challenges will create opportunities which the FI community has a key role to play.

Over the course of the past two years, the LBG/GEP-CCS project has been working closely with forward-thinking Indian financial institutions in building their institutional capacity to understand the emergence of climate change issues as well as highlighting the Greenhouse Gas (GHG) emission mitigation potential of the projects. This understanding will assist FIs to explore new to structure projects for financing under conventional and hybrid investment vehicles. LBG/GEP-CCS continues to build upon earlier outreach activities by providing technical assistance to FIs to conduct extensive portfolio reviews the purpose of which is to analyze the greenhouse gas reduction potential of specific energy related projects and examine the risk exposure.

In support of these activities, LBG/GEP-CCS designed the second portfolio review analysis activity with three leading India FIs. The second Portfolio Review was designed in two phases to a review of the FIs project portfolio documentation and structured interaction with leading US and international institutions models on GHG/Environment analysis and structuring. The objective of the Phase I. portion entitled ***Strengthening GHG Assessment and Analysis*** was to gain a better understanding of initiatives undertaken by institutions to thoroughly evaluate their GHG impact, footprint and potential mitigation schemes. A further objective was to equip the FI representatives with appropriate analytical and cutting-edge tools that could be utilized to assess GHG emissions and also to serve as pre-screening and evaluation tools.

The Phase I. segment was held from July 29 - August 2, 2002 with meetings organized in Washington D.C. The delegation was comprised of representatives from IL&FS, IDECK, and IREDA. LBG/GEP-CCS also invited a senior representative from IDFC, who had participated in the first portfolio review. The senior representative from IDFC is preparing a comprehensive climate change strategy for IDFC, and this visit would assist in providing substantial inputs and partnerships to their strategy.

The meetings were organized to showcase a range of models that illustrate the process and of how FIs manage risk and position themselves and clientele to reap the benefits of emerging GHG opportunities.

These models included: Tracking GHG's in selected project portfolios; Managing and Structuring Carbon Risk; Developing GHG Reduction "Incentive Based" Programs. Establishing Carbon Finance and Funding Mechanisms/Facilities.

An initial measure, that LBG/GEP-CCS has supported and that also reflects the status quo for forward-thinking institutions, is to track and measure the level of GHG emissions intensity of portfolio projects. Understanding the depth of emissions will indicate potential vulnerability, and impact and will lay the groundwork for devising interventions that can shape long-term institutional review practices. The Overseas Private Investment Corporation (OPIC) and the U.S. Export-Import Bank (Ex-Im) have institutionalized the practice of tracking and reporting CO_2 emissions for specific portfolio projects. OPICs emissions tracking is focused exclusively on power projects which comprise of 45% of their project portfolio and are inherently large emitters of GHGs. Ex-Im 's reporting focuses on power projects, as well as those industrial energy intensive sectors. A systematic data collection of GHG emissions can provide valuable information to the FIs for devising programs to structure inherent risk and /or position projects for emerging international opportunities. The Ex-Im model is a prime example of the success of this tracking program. This model led to the development of a new innovative program that will provide exclusive "special incentives" for projects that reduce GHG's according to Bank benchmark standards. These types of incentives are fostering a balanced approach that is a "win-win" situation for managing latent risk.

Aon Risk Services, Ltd. has been on the forefront of managing risk from GHG emissions and has designed a full-service *Carbon Risk Management* program within the overall risk management services. Aon provides a blend of financial, risk and insurance solutions to enhance the environmental structuring of a project and that will alleviate the bottomline project risk. These managerial risk solutions will be exceedingly useful for improving overall project strength and ability to obtain and access preferential financing. These measures also will ensure that project development efforts are stymied by the trepidation hinders many environmental projects..

Rising GHG opportunities have cultivated existence of the creation of special carbon facilities and funds by the IFC and the World Bank to purchase project certified emissions reductions, demonstrating these types of models are beneficial to an FI as they lay the ground work for the development of FI "carbon bank" schemes. As the search for solid projects continue Indian FIs could play an integral role for these funding/facilities as "pre-screening clearinghouse".

The Lawrence Berkeley National Lab's ProForm software is an invaluable tool that FI's can utilize when evaluating energy projects. The ProForm software can be considered a "pre-screening" tool for appreciation, as projects are review. The software can also be used as the core for a fee-for-service model or a project sponsor requirement at the time of finance.

LBG/GEP-CCS was encouraged by the strong engagement and interaction of the Phase I. delegation. The participants expressed that these models will establish the foundation toward designing tailored programs for their institutions. LBG/GEP-CCS will continue to work with the institutions in facilitating partnerships initiated during the visit. Lawrence Berkley National Lab's ProForm software will be an excellent tool for these institutions to use and provide the necessary "know how" in understanding the technical intricacies of climate change mitigation projects. Overall, the delegation concluded that an integrated FI strategy will serve as the cornerstone for developing "finance friendly" initiatives that will further support climate change mitigation measures while simultaneously properly structuring and managing institutional risk.

> *IDFC is in the process of completing a comprehensive climate change strategy that will chart the course for our institutions future*
>
> Ms. Bhavna Solanki
> IDFC

II. BACKGROUND ON PHASE I. METHODOLOGY

The Phase I. segment of the Portfolio Review introduced the delegation to leading models and tools that would assist them in evaluating and structuring climate change mitigation projects. To support this process, LBG/GEP-CCS organized a U.S. visit (Phase I.) that brought representatives of four leading Indian financial institutions to Washington D.C. The delegation's visit was designed to provide an opportunity to meet with a range of U.S. institutions and associations who employ and promote GHG and Environmental criteria during the analysis and approval process of projects. Models of carbon risk structuring and GHG assessment tools were also showcased.

It was envisioned that the U.S. segment of the review would work toward establishing the foundation of designing preliminary criteria and processes for introducing GHG and environmental analysis into the respective lending and rating criteria. The long-term goal is to enable the Indian FIs to develop strategies that focus on assisting clients in developing emissions trading solutions to mitigate their exposure to potential greenhouse gas emissions limitations. This will enable them to manage portfolios of low-cost carbon offsets and conventional air pollutant instruments and to originate deal flow for renewable energy and carbon offset assets.

III. OBJECTIVES

- To identify and address the key technical, accounting challenges associated with GHG mitigation projects
- To understand and differentiate existing approaches and methodologies for evaluating individual projects and portfolios
- Demonstrate models and prepare for Phase II. document review

IV. OUTCOMES

- Project Portfolios identified and organized to leverage potential opportunities and/or structure for risk sensivity
- Developed support toward establishing and enhancing credible and systematic GHG emission project criteria/guidelines relevant to all types of projects in India
- Partnerships facilitated with leading U.S. institutions with whom participants can form informal netwroks on related climate change issues

V. PARTICIPATING INDIAN INSTITUTIONS

The visiting delegation was comprised of one senior representative from each institution that would be participating in the extensive Phase II. document review. The delegation included:

- **Mr. Sivagamu Pappu Reddi**
  Deputy General Manager
  Financial Services
  Indian Renewable Energy Development Agency (IREDA)

- **Mr. Santosh Shidhaye**
  Assistant Vice President
  Environmental and Social Management Group
  EcoSmart India (a subsidiary of the Infrastructure Leasing and Financial Services)

- **Ms. Bharti Solanky**
  Assistant Vice President
  Social Development
  Infrastructure Development Finance Corporation (IDFC)

- **Mr. Raghu Rama Swamy**
  Senior Associate
  Environment and Energy
  Industrial Development Corporation of Karnataka (IDECK)

VI. KEY PARTICIPATING U.S. INSTITUTIONS

The Phase I. visit was designed to introduce the delegation to those leading institutions who are on the forefront of incorporating GHG and Climate Change elements into their operational practices, and have developed GHG risk structuring and assessment processes. These institutions included:

- International Finance Corporation (IFC) - *Environment Programs: IFC-Netherlands Carbon Facility*
- Overseas Private Investment Corporation – *Environment and Climate Change Programs Division*
- U.S. Export-Import Bank – *Environment and Strategic Programs*
- Aon Risk Services – *Carbon Risk Management Division*
- Lawrence Berkeley National Lab (a U.S. Dept. of Energy Lab) – *ProForm Software*
- The World Bank Group – *ProtoType Carbon Fund*
- Environmental Resources Trust – *GHG Registry and Project Development Services*

Note: Names and Contact Information for these institutions can be found in Annex A

VII. EXAMINING U.S. AND INT'L MODELS FOR GHG/ENVIRONMENTAL ANALYSIS

The Phase I. segment of the Portfolio Review was organized to provide value-added assistance to the FIs by designing a "hands-on" opportunity to examine best practice models from institutions that incorporate carbon/climate change impact calculations into their financial review process (risk avoidance). The cost/benefits that an FI should take into consideration when developing a carbon mitigating project that has "potential" future carbon sale opportunities were examined. The following provides an overview of the following thematic areas.

a. Project Portfolio GHG Tracking and Reporting

In 1998, the **Overseas Private Investment Corporation (OPIC)** became the first bilateral agency to commit to tracking and reporting CO_2 emissions from its power sector projects. The driver for this commitment was strongly influenced by the NGO community, which maintained strong suggestions that OPICs project portfolios were emitting high levels of GHG's. In 2000, OPIC went beyond its annual assessment of projects and prepared a cumulative assessment of the climate implications of its power portfolio. The OPIC report, *Climate Change: Assessing Our Actions*, demonstrated that OPIC's power portfolio is heavily weighted toward less carbon-intensive gas and carbon-free renewable hydroelectric resources. Upon conducting the initial project portfolio review, OPIC found that their activities do not substantially contribute to global CO_2 emissions. As stated in their report, the bulk of OPIC-related GHG emissions are derived from OPIC's power sector projects.

In fiscal year 2001, OPIC began to evaluate the potential for including CO_2 emissions from oil and gas projects as part of its tracking and reporting of CO_2 emissions. The tracking and reporting of emissions is done in conjunction with the stringent environmental and social review guidelines designed by the World Bank Group. However, the measured and anticipated CO_2 emissions from an individual project are not considered determining factors for project approval.

The delegation felt that the OPIC tracking and reporting model could be a feasible model to be undertaken. The delegations expressed that they would be interested in applying a tracking system to a broader project base that would primarily include large infrastructure projects in transportation and municipal solid waste management. Ms. Solanky, IDFC, was keen in introducing the GHG element as an integral element of their review process and felt that this would help IDFC would position themselves and their client companies for potential long-term, emerging regulatory repercussions.

The U.S. Export-Import Bank (Ex-Im) has also taken active measures to manage global greenhouse gas emissions since 1999. Ex-Im is currently tracking the estimated amount of carbon dioxide (CO_2) emissions from all projects it supports in the power sector. To the extent practical, Ex-Im is evaluating the possibility of tracking emissions from projects in other sectors that may cause significant production of CO_2. These figures are then estimated in the annual amount of aggregate greenhouse gases reported in Ex-Im Bank's Annual Report.

Ex-Im also provides enhanced levels of support for a broad range of environmental exports. The program demonstrates Ex-Im Bank's resolve to reach out to small and large exporters of environmental products and services and provides incentives for projects that illustrate a specific reduction in emissions. *Please see Section C.*

Mr. Shidhaye, EcoSmart, mentioned that it seemed as though the inherent first step in this process is to measure the depth and degree of emissions by tracking systematically. This would provide an analysis of the level of potential exposure, Ex-Im's model. These statistics could then form the basis for establishing the criteria for an incentive based program. Mr. Swamy felt that these financial instruments for structuring projects could be augmented by GoI regulatory incentives for project developers, i.e. tax incentives.

b. Carbon Finance and Funding Mechanisms/Facilities

The International Finance Corporation (IFC) is well positioned to support project sponsors participation in the market for reduced or avoided greenhouse gases. The IFC Environment Projects Unit reviews all relevant projects to assess eligibility for carbon credits and looks for ways to integrate "carbon funding" in financing packages for projects. Buyers of carbon credits receive certificates in exchange for the emission reductions associated with the projects. Further, the IFC's Operational Policies require that environmental assessments for each project consider global environmental aspects, including climate change. GHG emissions are assessed for projects with potentially significant emissions, and their results are included in the environmental assessment documents. IFC is monitoring the methodological development of GHG emissions assessment and has provided project sponsors with guidance, including software to estimate the GHG emissions associated with investments being considered by IFC.

IFC has recently structured an innovative financing vehicle entitled the ***IFC-Netherlands Carbon Facility*** to purchase GHG reductions from developing country projects under the Clean Development Mechanism. A second vehicle for Joint Implementation projects in central and eastern European countries is also in progress. Funds would be available to eligible private sector projects in the form of a forward contract, with disbursements to the project company after emission reductions are certified through audits.

The delegation was keenly interested in understanding the terms of a carbon contract and the evolution of a transaction. It was explained that the contract will specify:

- Volume of GHG emissions that are expected to be reduced, measured in metric tones of CO2
- Price agreed per tonne of CO@ equivalent
- Period over which payments will be made, typically over 10-14 years.

The contractual process will entail an initial assessment that will determine the Facilities potential interest in the project. The time required to evaluate, negotiate and finalize the contract is expected to be a few months. However, the time required to validate the design and have it verified by an outside auditor is estimated to be about 6-8 months.

Mr. Reddi was interested in the relationship between a carbon purchase and the conventional finance. It was discussed that the contract will specify a cash flow that will be paid for the certified emission over time, however conventional FIs can choose to consider these flows beneficial or substantial to a project.

The World Bank *ProtoType Carbon Fund* is intended to invest in projects that will produce credible greenhouse gas emission reductions that could be registered with the United Nations Framework Convention on Climate Change (UNFCCC) for the purposes of the Kyoto Protocol. To increase the likelihood that the reductions will be recognized by the Parties to the UNFCCC, independent experts will follow validation, verification and certification procedures that respond to UNFCCC rules as they develop. By transacting the business of reducing emissions, the PCF will, in turn, develop a major knowledge base.

The PCF will maximize the value of its experience by collecting, analyzing, and disseminating information and knowledge to NGOs, governments, private sector interests, and any other stakeholders involved in the climate change negotiations.

It was explained that the World Banks long-term strategy is to leverage in-country institutions to serve in a pre-screening role for the PCF. Ms. Solanky, mentioned that IDFC is currently in discussions with WB on creating a Carbon Bank facilitation center. This partnership would include IDECK which serves as IDFCs project development wing in Karnataka. Mr. Shidhaye, mentioned that Eco-Smarts growing portfolios could be of interest to the fund, and that a better understanding of the technical intricacies of the baseline, monitoring and verification protocols would be required to structure projects accordingly. It was discussed that extensive interaction with the PCF and IREDA would require for MNES to restructure the current lending process to complement the fund criteria and that did not seem immediately feasible.

c. GHG Reduction "Incentive Based" Programs

The U.S. Export-Import Bank (Ex-Im) has established an ***Environmental Exports Program***, which increases the level of support it provides to exporters of environmentally beneficial goods and services, including those goods and services, which result in the reduction of greenhouse gases. The program provides for renewable energy projects, for projects or products that meet environmentally beneficial criteria, and for projects that meet the special "incentive" limits for designated GHG emissions or effluents which levels/limits are identified by the Bank. This program affords exporters a special level of support in conjunction with either Ex-Im Bank's Insurance Program or with Ex-Im Bank's loan and guarantee programs.

Mr. Swamy felt that Ex-Im was on the forefront of designing a financial structuring technique to support the growing renewable energy project development field. Mr. Swamy explained the dilemma that many institutions face in evaluating these types of projects, and the delegation agreed, was understanding appropriate flexibility mechanisms that would be complementary to the project and not jeopardize the success of financial closure.

d. Carbon Risk Structuring and Management

Aon Risk Services provides a blend of financial advisory, risk management and insurance solutions to manage and minimize project risk potential. Aon has recently created a new product service entitled ***Carbon Risk Management*** that will work toward structuring deals and enhancing the financial viability of projects using carbon offsets. These strategies will capitalize on the potential to improve project finance terms, credit enhance environmental derivatives and structure capital market instruments. GHG emissions related risks can impact a business in a number of ways - not exclusively through trading in carbon credits.

The evolution of international energy market structures and the introduction of new technologies create an unpredictable operating environment. Aon's proprietary qualitative and quantitative risk analysis process has been used successfully on renewable energy projects to assist contractors, developers and investors in mapping construction and operational risks linked directly to risk transfer and insurance solutions to optimize retained risk profiles, improve terms and access to finance. It is also helping clients reduce political and policy risks which affect the viability.

Ms. Solanky was interested in understanding how to optimize on these risk management solutions. It was discussed that a systematic risk evaluation would lend for an adaptation-extension optimization of existing or proposed insurance coverage and would address the new carbon challenges.

Carbon Risk Management can also be identified through systematic evaluation of project GHG emissions, through a baseline and monitoring exercise. This information will prove instrumental in entering into an international carbon market. One example of this is the Environmental Resources Trust GHG Registry which records validated greenhouse gas ("GHG") emissions profiles to help create a market that will enable efficient emissions reductions. Working with private and public entities, ERT is developing a common currency in tradable GHG emissions reductions, supported by standardized measurement and verification protocols; the GHG Registry℠ provides an independent verification and tracking service that enables market participants to track and trade emissions reductions with confidence. ERT believes that the emissions trading system its GHG Registry is enabling will be a powerful tool in reducing global greenhouse gas emissions without crippling economic growth and development

The delegation felt that the technical intricacies of the monitoring and verification process of projects would determine the "critical path" for identifying potential project value. It was discussed that template processes and checklist could be designed by the FI, and submitted by clientele during the project application process.

e. Cutting-Edge GHG Assessment Tools

The Lawrence Berkeley National Lab has developed innovative software called ProForm to conduct environmental and financial assessment of renewable energy and energy efficiency projects. The software was created to serve as a tool to establish a common framework to conduct an assessment of a clean energy projects. Further, the software provides an evaluation of the carbon revenue stream, which is a requirement under alternative climate mitigation funding mechanisms.

The delegation appreciated the notion that the tool was designed to be a hands-on, user-friendly resource to assist small entrepreneurs, businesses, FIs and local developers. The delegation gave several inputs to the ProForm beta version by incorporating cash flow analysis and debt services equity (DSE) indicators into the results section. The DSE would serve as an escrow account for the carbon finance component of the project.

LBG/GEP-CCS will supply LBNL with the India default values for energy projects based on CLIN 3 analysis and Dr. Mittal, Ohio State University, USAID funded report. Each of the institutions will continue to work with the software during the Phase II. review and a revised software package will be sent to all institutions. The delegation felt that the tool could be used as a pre-screening device for projects and would be supplemented by a more thorough technical engineering review of the statistics.

Annex 1 A.

Key U.S. Institution Contact Information

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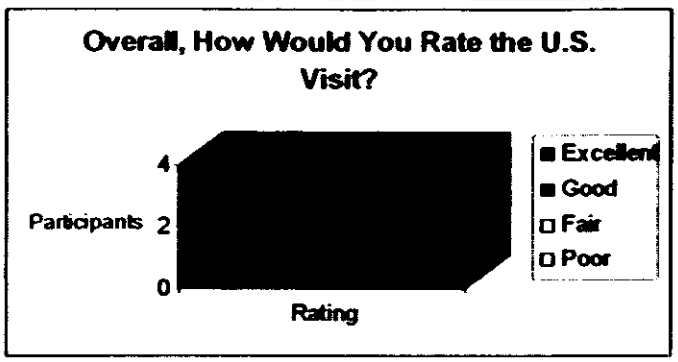
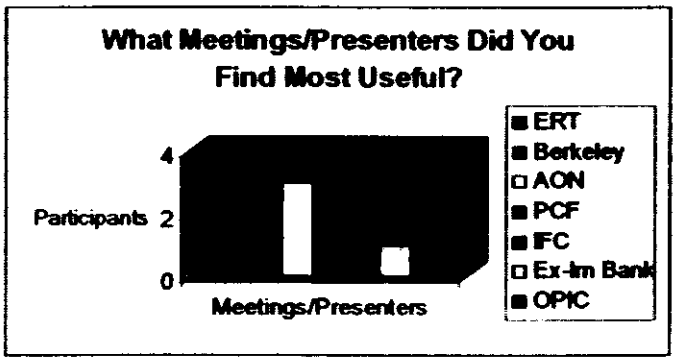
Mr. Chandra Shekhar Sinha Portfolio Manager Prototype Carbon Fund Carbon Finance Business Unit The World Bank Group 1818 Pennsylvania Ave Washington, D.C. 20006	


Overall, How Would You Rate the U.S. Visit?
Participants
4
2
0
Rating
Excellent
Good
Fair
Poor


What Meetings/Presenters Did You Find Most Useful?
Participants
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2
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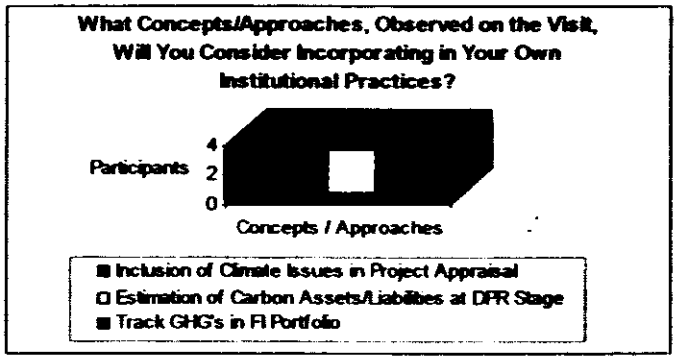
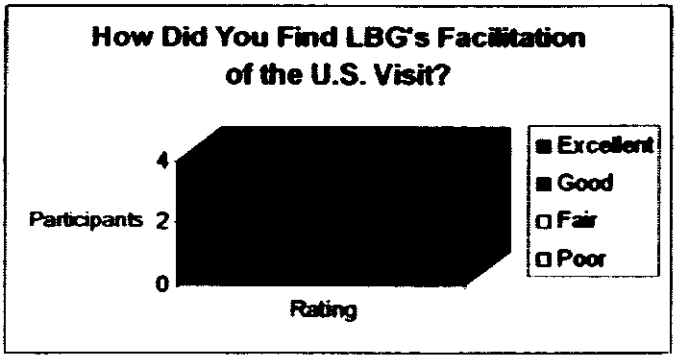
Meetings/Presenters
ERT
Berkeley
AON
PCF
IFC
Ex-Im Bank
OPIC


What Concepts/Approaches, Observed on the Visit, Will You Consider Incorporating in Your Own Institutional Practices?
Participants
4
2
0
Concepts / Approaches
Inclusion of Climate Issues in Project Appraisal
Estimation of Carbon Assets/Liabilities at DPR Stage
Track GHG's in FI Portfolio


How Did You Find LBG's Facilitation of the U.S. Visit?
Participants
4
2
0
Rating
Excellent
Good
Fair
Poor

Phase II.

Portfolio Review of Indian Financial Institutions: Strengthening GHG Assessment and Analysis

NEW DELHI · MUMBAI · BANGALORE
August 9- 14, 2002

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I. EXECUTIVE SUMMARY

The Portfolio Review activity under the *Institutional Strengthening of the Financial Sector* task of GEP-CCS was conducted in two phases. The Phase I segment of the activity was followed by an in-depth review of specific project portfolios at three institutions: the Indian Renewable Energy Development Agency Ltd., the Infrastructure Leasing & Financial Services Ltd. Group (Ecosmart India Ltd.) and the Infrastructure Development Corporation (Karnataka) Ltd. These reviews took place at the offices of the respective institutions during August 9 - 14, 2002.

The main purpose of the review was to enable the financial institutions to make more informed policy decisions on future investments and to assess the environmental risk and opportunities existing in their current portfolios. The review demonstrated the importance of undertaking a GHG assessment of an FI's project portfolios to identify and assess the impact of GHG emissions on the FI's investments, particularly those investments in large infrastructure or energy projects.

The Phase I presentations focused on presenting various GHG assessment models and tools, as well as hands-on familiarization with the review process and analysis tools that would be used in the Phase II portion of the activity of the model. Live cases from respective portfolios and the portfolio of projects to which GEP-CCS provided TA were employed in the Phase I demonstration and "train the trainer" activity. Through LBG's collaborative partnership with Lawrence Berkeley National Lab, an exclusive version of the ProForm Software was developed, demonstrated and identified as a valuable tool for pre-screening GHG mitigation projects. The FI delegates who participated in the Phase I visits took a lead role in the portfolio review process and shared the experiences and applied the lessons learned from the US visits during the Phase II review meetings.

Upon the conclusion of the Portfolio Review process, all of the FIs expressed keen interest in adopting procedures for the GHG assessment of their projects. This interest was driven in a large part by the FI's recognition that by doing so, they would be in a better position to take advantage of the potential to monetize carbon offsets generated by projects in their portfolios..

II. BACKGROUND OF PHASE II: PORTFOLIO REVIEW

The Phase II of the portfolio review was conducted as a follow on to the Phase I wherein designated representatives of the Indian FIs met with counterparts from US based institutions. These U.S institutions were selected as best practice examples of institutions who have taken proactive measures in introducing environmental assessments in their regular investment decisions or have conducted extensive GHG assessment exercises. These institutions included: the International Finance Corporation, the Prototype Carbon Fund (of the World Bank Group), the Overseas Private Investment Corporation (OPIC), Ex-Im Bank, AON Risk Capital, the Environment Resources Trust and the Lawrence Berkeley National Lab. Visits to these institutions provided an international perspective for the Phase II process by highlighting the importance of GHG assessments in a global context and how other institutions are proceeding. The Phase I of the Portfolio Review activity also demonstrated how FIs in the US and around the world are using screening and analysis tools and reviews to identify and quantify the value of potential offsets in a project and use that information in financial structuring for projects. Building upon the information and activities in Phase I, the Phase II portfolio review provided

further on-site training methodologies for the GHG review and assessment of individual institutional portfolios.

III. OBJECTIVES OF THE PORTFOLIO REVIEW

The objective of the portfolio review was to build awareness of the GHG assets and liabilities in the FI's project portfolio and provide pre-screening, review and analysis tools, training and best practice models for the financial institutions to use as they continue to review their portfolios. FIs are the usually the largest financial stakeholders in energy, infrastructure, and large industrial projects in India. As with any business sector, financial institutions try to limit and/or avoid risk exposure while maximizing revenue opportunities. Periodic reviews can provide checkpoints for the FIs in reviewing the environmental performance and the risk profile of their portfolios. Further, the results of these reviews can provide a basis for formulating institutional investment strategies and guiding the decision-making process. The banking sector is also in a position to play an active role in the growth and sustainable development of India by financing projects that have an environmental as well as an economic benefit (i.e. renewable energy projects or industrial projects which employ 'clean' technologies).

IV. APPROACH USED FOR THE PORTFOLIO REVIEW & SELECTION OF PARTICIPATING INSTITUTIONS

The Portfolio Review under GEP-CCS was targeted at analyzing the selected institutions' portfolios of assisted projects and categorizing the projects into two groups: projects that adopt better than 'Business-As-Usual' (BAU) technologies or have GHG Assets, and those projects which rely on BAU or have GHG Liabilities. The review further identified the GHG mitigation potential of current projects and demonstrated how the data gathered on baseline information could be employed to assist the FI to benefit from the GHG offset potential in future projects.

A number of multilateral development banks have devised extensive environment assessment methodologies for reviewing projects. These institutions include: the World Bank Group, EBRD, ADB, international bodies like United Nations Environment Program's Financial Institutions Initiative (UNEP FII) and the Environment Bankers' Association. US Government funded agencies like the Export–Import Bank (Ex-Im) and the Overseas Private Investment Corporation (OPIC) also employ environmental criteria to screen and review projects. The World Business Council on Sustainable Development (WBCSD) and World Resources Institute (WRI) have developed a GHG Protocol Initiative which enables corporate GHG estimation and accounting. One GEP-CCS project objective is to facilitate the dissemination and exchange of information between US organizations with their Indian counterparts.

To maximize the exchange and portfolio review process the portfolio review activity was designed in two phases. The Phase I involved visits from July 29 to August 3, 2002 to key US based organizations to learn and share experiences on environmental and GHG assessments of projects. Phase I. had a "train-the-trainer" orientation with the Phase II segment focus on a GHG review of portfolios on site at participating institutions during August 9 – 14, 2002.

Based on the interest and the proactive approach the FIs demonstrated during earlier training programs and interactions, and the ongoing initiatives in the urban transport and municipal waste sectors, GEP-CCS identified five FIs for possible participation in the review program, of which three were then selected for the on-site portfolio review.

The five were:

- Infrastructure Leasing & Financial Services Ltd. (IL&FS)
- Indian Renewable Energy Development Agency Ltd. (IREDA)
- Small Industrial Development Bank of India (SIDBI)
- Bank of Baroda (BOB) and
- Infrastructure Development Corporation (Karnataka) Ltd. (IDECK)

IREDA, IL&FS and IDECK viewed the Portfolio Review as a major opportunity to prepare for future needs and to re-strategize. Accordingly, these three institutions made solid commitments of their official time and resources for the activity. In case of IREDA, which is promoted by Ministry of Non Conventional Energy Sources (MNES), there was interest at all levels. MNES was hesitant, however, for IREDA to share data with outside agencies, so LBG resolved the issue by offering the portfolio of projects developed under GEP-CCS, which included several renewable energy projects, to be used as case examples. During the discussions with SIDBI and BOB, however, it became apparent that although there was interest in learning more on environmental assessment of projects, they were not quite ready to make the necessary institutional commitment to undertake a portfolio review. The portfolio review, therefore, proceeded with IREDA, IL&FS and IDECK.

PHASE II: PORTFOLIO REVIEW AT THREE FIS

The portfolio review process involved the following steps as indicated below.

Figure 1: Steps in Portfolio Review

The selection of projects was made based on energy intensiveness and savings potential or the sector addressed by the project. Each of the FIs has its own MIS that categorizes the projects or promoters. The Portfolio GHG Assessment can be focused based on specific parameters, contingent upon specific FI criteria that could include the industry sector, geographic area or type of project.

The GHG mitigation or emissions assessment was based on a model prepared by GEP-CCS that examines two distinct areas: industrial and infrastructure projects and urban sector projects. The first area addresses the GHG asset potential and liability type of projects. The second area of analysis was designed to look at urban infrastructure projects such as urban transport and municipal solid waste (MSW) projects. The model is based on the IPCC methodology for calculating the GHG offsets generation for the Indian power sector. A snapshot each of the industry and urban GHG assessment model is shown below in Figures 2, 3, 4 and 5.

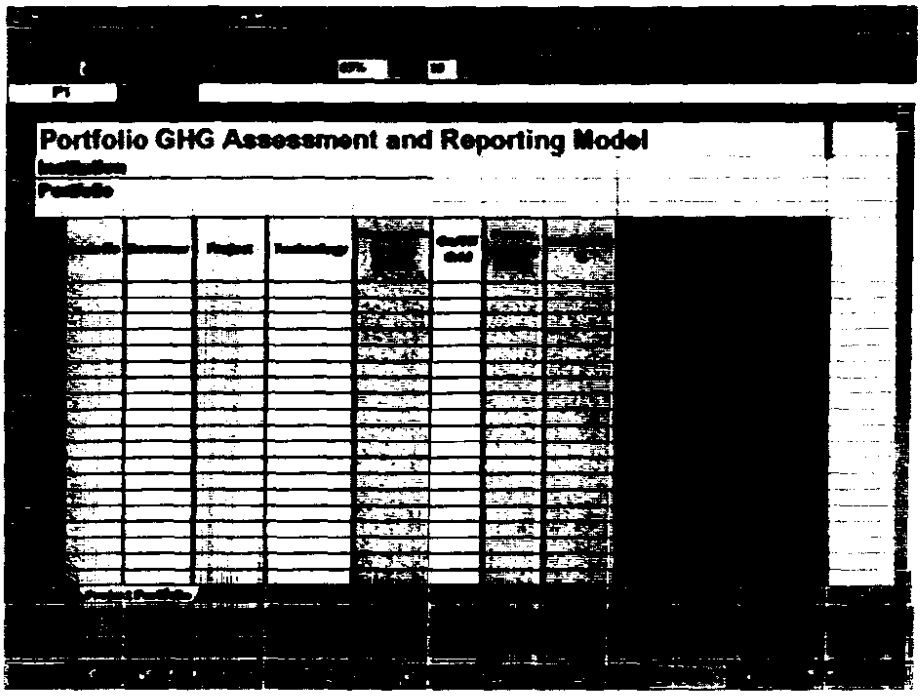

Figure 2: GHG Mitigation Potential Assessment of Industry/Infrastructure Projects

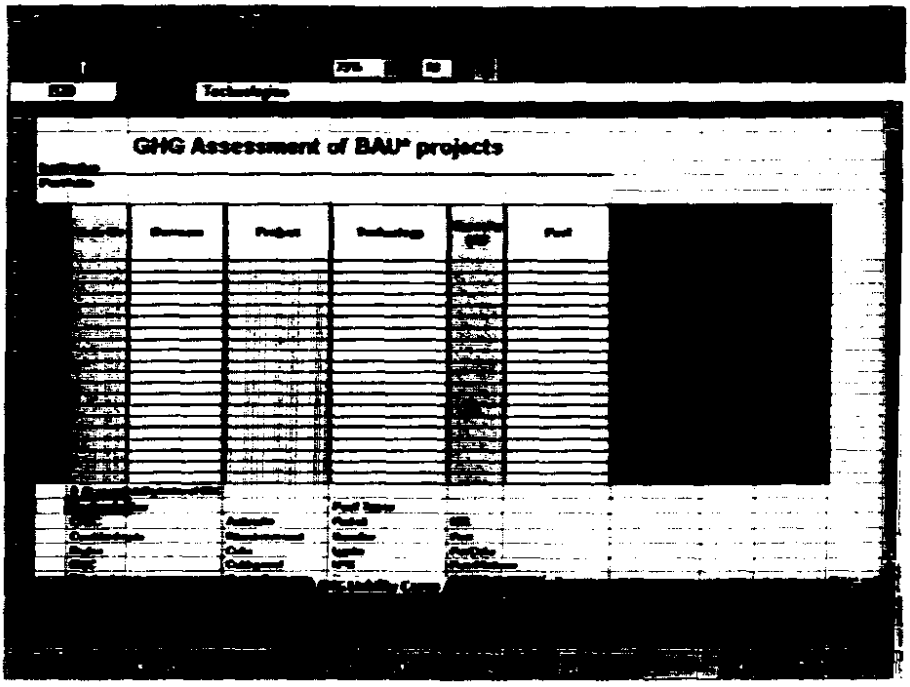

Figure 3: Model for GHG Assessment of Business-as-usual projects

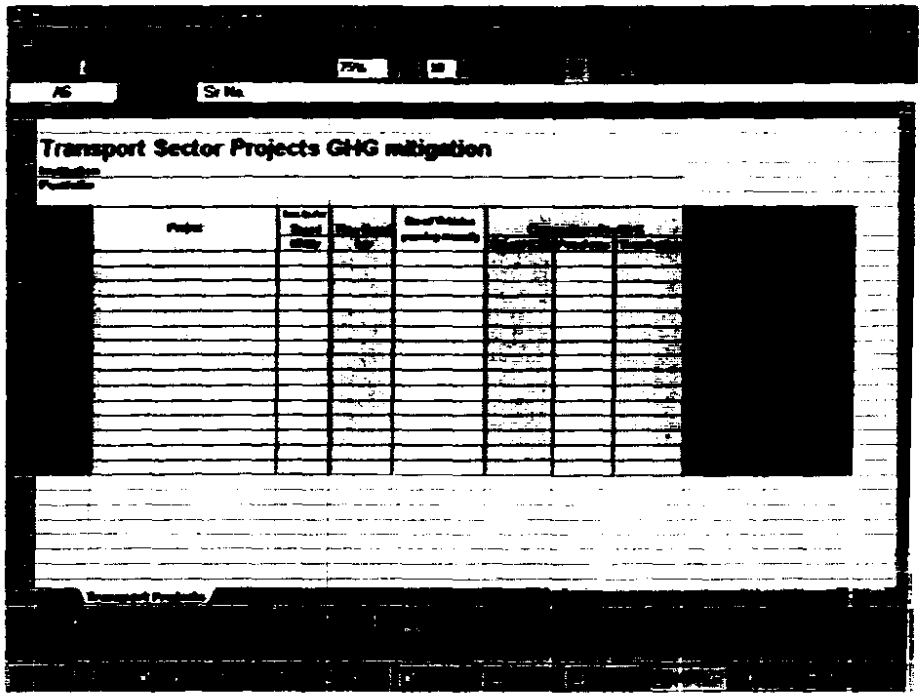

Figure 4: Transport Sector Projects GHG Assessment Model

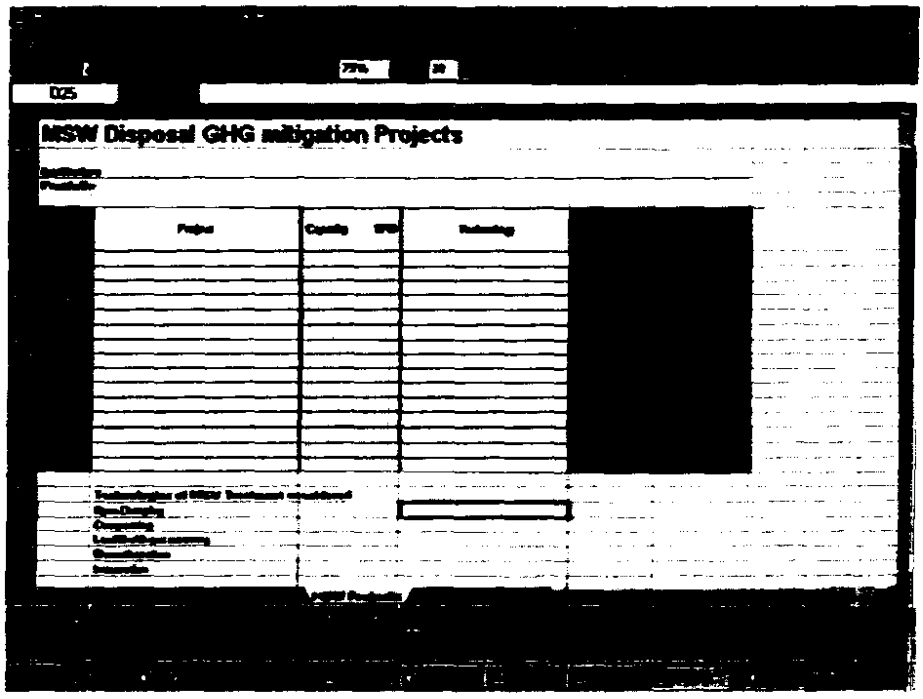

Figure 5: MSW Disposal Projects GHG Assessment Model

As part of the Phase I segment, the Indian FIs met with the Lawrence Berkeley National Lab (LBNL) to gain a better understanding of the ProForm software. Inputs like the State specific default values for India provided by GEP-CCS and critical suggestions and comments by FIs were expressly incorporated into the software by the developers after this meeting, and an improved version was rushed to GEP-CCS so that it could be demonstrated during the Phase II meetings. GEP-CCS prepared a separate program book for these Phase I visits, which provided the overall outline of the ProForm software.

V. OUTCOMES & GENERAL PORTFOLIO REVIEW FINDINGS

The Phase II Portfolio Review meetings were deemed extremely instructive (and therefore successful) by the participants and the GEP-CCS technical assistance and tools was well received. At all three institutions, the interactive presentations were followed with intensive discussions as the FI officials raised questions arising from their day-to-day operating experience. The FIs were keenly interested in understanding the role that bank relationship staff can play, in terms of GHG opportunities, with a project promoter/developer. The FIs were equally interested in understanding the project cycle and process that they may have to follow for structuring the GHG mitigation projects to benefit from the market in offsets. Finally, they found the portfolio review tools to be user friendly. It is believed that most of the FIs will use them for the assessment of GHG reduction potential of the clean energy projects under consideration, and as they evaluate infrastructure and large energy intensive projects in the future.

VI. INSTITUTION SPECIFIC FINDINGS

The individual portfolio reviews are discussed briefly below:

IREDA

The portfolio review was held on August 9, 2002 at the IREDA office in New Delhi. Representatives of all the sectoral groups at IREDA attended the program. Created 14 years ago by the Government of India who took an early progressive stance in recognizing the need for renewable energy technologies, IREDA, a government funded entity that specializes in financing renewable energy projects, is a truly singular institution. As of today, IREDA has already provided more than Rs. 53 billion in financial assistance to 1,570 projects. These projects range from solar thermal projects to photovoltaics, wind, small hydro, biomass, bagasse based cogeneration, and energy efficiency projects.

Mr. Debashish Majumdar, Director (Technical), IREDA expressed a distinct interest in the portfolio review process and mentioned that since IREDA assists only renewable energy and energy efficiency sectors, all the projects in their portfolios have the potential for carbon finance opportunities. IREDA officers raised several important issues that could affect GHG mitigation project structuring. A few of these were:

- What is the likely price that carbon offsets could bring in the market?
- Since IREDA's project sizes are small, would it be remunerative for the project developers to avail of carbon finance? Are there any mechanisms in place for small projects?

- Would the MNES subsidies be affected in any way by the possible flow of carbon finance?
- Can IREDA benefit from its clients availing themselves of carbon finance opportunities? What role can it play in facilitating the flows?

Some of the questions raised at IREDA had also been discussed in the Phase I meetings so that the presentation team was in a position to be able to supply answers based on the best practices observed and what other institutions are planning to deal with the uncertainties. (e.g. Small projects are being 'grouped' so that the total emission offsets can be more marketable.) IREDA was not able share its project database for the GHG assessment as its promoter, MNES, had not given them permission to do so. IREDA officials were, however, able to participate in the GHG review process and assessment model with the help of the portfolio of mainly renewable projects for which GEP-CCS had provided TA.

IL&FS

The portfolio review at IL&FS was held on August 12 and 13, 2002 at their office in Mumbai. The IL&FS team included officers from the parent organization and from Ecosmart India Ltd., its wholly owned subsidiary. IL&FS is a multifunctional institution, one that not only provides finance to infrastructure projects, but also acts as a financial intermediary and project developer on behalf of its clients. EcoSmart is an extension of its environment and social group, which is entrusted with conducting environmental and social due diligence. In addition, EcoSmart also implements independent consultancy assignments to develop eco-friendly industrial and infrastructure projects.

The IL&FS group portfolio included a number of projects from the power sector including, bagasse based cogeneration, waste heat recovery based power plants, and other renewable projects like wind and mini hydro electric projects. IL&FS also assists urban sector projects, primarily those in road transportation and solid waste management and disposal. Senior Managers at IL&FS have recognized the importance of including the urban sector projects along with the power and renewable energy projects in looking at GHG emissions. In direct response to IL&FS's progressive posture, GEP-CCS developed the urban modules of the GHG assessment model. IL&FS appreciated the effort and has expressed continued interest in developing additional modules especially for the transport sector projects. IL&FS also found the discussion on GHG mitigation project structuring very useful. IL&FS raised many pertinent issues, among which were:

- Whether there was any standard methodology for establishing baselines especially for the small size projects?
- Whether the methodology followed in the GHG assessment models have international acceptance?
- IL&FS wanted to know whether there are any examples wherein investment policy was altered as an outcome of the portfolio review exercise?
- In case of transport sector projects, IL&FS suggested the addition of modules to cover flyover projects that save idling time of vehicles at the intersections.

IL&FS considers environmental factors very important in their investment decisions. They propose to conduct GHG assessments of all energy related projects that are presented for their financial assistance. IL&FS found great value in the ProForm software of LBNL that was demonstrated at the meetings. They have expressed a desire to obtain the final version and would

List of Participants at the Phase II Portfolio Review Meetings

Organization: Indian Renewable Energy Development Agency Limited
Date: 9 August, 2002
Venue: IREDA Board Room

S.No.	Name of the Participant	Designation
1	Mr. D. Majumdar	Director (Tech))
2	Mr.T.Prabhakaran	Director (F)
3	Mr. R.V.Vimal	Manager (TS)
4	Mr.V.T.Valavan	Senior Manager
5	Mr.P.R. Reddy	Asst. Manager
6	Mr. A Chandrashekhar	DM (PTS)
7	Mr. S. Bhaskaran	SM (TS)
8	Mr. Shanker Lal	DM (PTS)
9	Mr. K Gopalkrishna	DM (BD-TS)
10	Mr. P.K. Pandey	Manager
11	Mr. B.V.Rao	DGM
12	Mr. A.A Khatana	GM
13	Mr.S.P.Reddi	DGM
14	Mr.K.B.K Reddy	DM (TS)

Organization: Ecosmart India Limited (Promoted by IL&FS)
Dates: 12-13 August, 2002
Venue: IL&FS Financial Centre Conference Room

S.No.	Name of the Participant	Designation
1	Mr.Hari Shankar	Executive Director
2	Mr. Santosh Shidhaye	Asst Vice President
3	Ms. Shaivali Parikh	Asst Vice President
4	Mr. Subhash Mathurvaishya	Chief Engr. (Power)

Organization: Infrastructure Development Corporation (Karnataka) Limited
Date: 14 August, 2002
Venue: IDECK Board Room

S.No.	Name of the Participant	Designation
1	Mr. Cherian Thomas	Director
2	Mr. Anil Shenoy	Chief Financial Officer (Urban)
3	Mr. V. Sathyanarayana	Head Admin & Liaison (Urban)
4	Mr. Sumeet Shukhla	Associate (Urban)
5	Dr. S. Vasudevan	Associate (Transport)
6	Mr. Sarvanan	Management Trainee (Tourism)
7	Mr. K. Jayakishan	Sr. Associate (Transport)
8	Mr. Natesh Holla	Manager (Legal)
9	Mr. D.T.V.Raghu Rama Swamy	Sr. Associate (Urban)

ANNEX 2B.

Phase II Program Book

Portfolio Review of Indian Financial Institutions

Strengthening GHG Assessment and Analysis

Phase II : August 9 - 2[illegible], 2002

Greenhouse Gas Pollution Prevention Project-Climate Change Supplement

Implemented by:

The Louis Berger Group, Inc.
The Global Environment Team

A program of the:

United States Agency for International Development / India Mission

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PROJECT PORTFOLIO REVIEW OF INDIAN FINANCIAL INSTITUTIONS
Strengthening GHG Assessment and Analysis

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED FI PORTFOLIOS

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Section I. Overview and Background

Section II. Detailed Schedule for the Portfolio Reviews

Section III. Presentations at the main sessions

A. Current Trends in International Climate Change Dialogue
Mr. Subrata Mazumder, India GET Manager, The Louis Berger Group, Inc

B. Overview of Bank Portfolio Review Process
Mr. Vinay Deodhar, Project Finance Specialist, LBG/GEP-CCS

C. Clean Energy Project Structuring Elements
Vinay Deodhar, Project Finance Specialist, LBG/GEP-CCS

Section IV. Computational Tool for GHG Analysis

Approach of the model and Datasheets for various type of projects

Section V. Selected Reports, Articles and Background Information

A. Environmental Bankers Association Report – *Your Financial Institution and the Environment*

B. Environmental Management in Financial Institutions – Swiss Bankers Association report for UNEP – FI Initiative

C. OPIC Report – *Climate Change: Assessing Our Actions*

D. Ex-Im Bank Environmental Procedures

E. UNEP Finance Initiatives Climate Change Working Group Position Paper November 2001

F. Environments in Transition – Extracts from the Environmental Bulletin of EBRD

G. Lawrence Berkeley National Lab Report – Role of Development Banks in Promoting Industrial Energy Efficiency; India Case Studies

H. IFC-Netherlands Carbon Facility (INCaF) – IFC Facility to Purchase GHG Emission Reductions

I. The GEF Solar PV Portfolio: Emerging Experience and Lessons, August 2000

J. GEF Climate Change Program Study Synthesis Report

PORTFOLIO REVIEW AT THE PARTICIPATING BANKS

Conducted by The Louis Berger Group, Inc. under the USAID/India GEP-CCS Program

August 8 – 17, 2002

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED PORTFOLIO

SECTION I: OVERVIEW & BACKGROUND

C-6/7, Safdarjung Development Area, New Delhi – 110 016 Tel.. 91-11-653 2024,653 2025, 653 2026 Fax 91-11- 651 8507

GREENHOUSE GAS POLLUTION PREVENTION PROJECT-
CLIMATE CHANGE SUPPLEMENT

Portfolio Review of
Indian Financial Institutions:
Strengthening GHG Assessment and Analysis

Washington, DC • New Delhi, India

July 29 - August 20, 2002

A program of the United States Agency for International Development/India Mission and implemented by The Louis Berger Group, Inc. Global Environment Team

I. GEP-CCS PROJECT BACKGROUND

The Louis Berger Group, Inc. (LBG) Global Environment Team is currently implementing the *"Greenhouse Gas Pollution Prevention Project - Climate Change Supplement (GEP-CCS)"*, a program of the United States Agency for International Development/India Mission (USAID). The program aims to build local capacity and create a forum to foster dialogue and cooperation on widespread clean energy issues between U.S. and Indian government, financial, private, and non-government stakeholders. These initiatives will, in due course, lead to an integrated assessment and subsequent implementation of actions that reduce the rate of growth of greenhouse gas emissions (GHG).

II. TECHNICAL ASSISTANCE TO THE INDIAN FINANCIAL COMMUNITY

The LBG/GEP-CCS project assists in building the institutional capacity of industry, key Government of India (GOI) officials, leading Indian financial institutions (FIs), and banks. It also supports the clean energy project development process by highlighting the Greenhouse Gas (GHG) emission mitigation potential of the projects, and illustrating ways to promote these projects for possible funding under conventional and hybrid financial mechanisms. Under the financial sector capacity building activity, LBG/GEP-CCS conducts training programs and portfolio reviews for Indian financial sector institutions to increase their awareness about the use of potential greenhouse gas reduction analysis for the evaluation of specific projects. The financial sector is a major stakeholder in financing projects and is therefore exposed to major risk if a project is delayed due to environmental factors. Financial Institutions around the world have begun analyzing their portfolios to assess the potential environmental risks, including GHG risks. It is, therefore, essential to equip the Indian bank loan officers with appropriate analytical tools to assess the GHG emissions component.

III. PORTFOLIO REVIEW METHODOLOGY

The FI Portfolio Review, under LBG/GEP-CCS, will provide value-added assistance to the FIs by looking at representative carbon emission producing projects in their portfolios. The review will highlight the importance of incorporating carbon/climate change impact calculations into their financial review process (risk avoidance). Similarly, what cost/benefits should the FI take into consideration when developing a carbon mitigating project that has "potential" future carbon sale opportunities.

IV. OBJECTIVES

- To identify risks that may impact the performance of assets in their portfolio enhancing the value of the project activity.
- To enhance the technical capacity of the officials to be able to advise industrial clients in ways to improve the technical-economic feasibility of projects, thereby reducing investment risk.

V. ANTICIPATED OUTCOMES

- Appreciation of the significance and magnitude of the environmental and GHG risks of projects, and recognition of the true opportunity cost by the bank officer.

- Increased ability to better apprise and advise the project promoters in a manner that enhances the project's value.

VI. APPROACH

The LBG/GEP-CCS team has designed this activity in two discrete phases, which will provide an overall comprehensive and thorough review:

- Phase I. Examining U.S. and Int'l FI Models for GHG/Environmental Analysis: Strengthening CCMP Project Review and Appraisal for Pre-Qualification (U.S.)
- Phase II. FI Portfolio Document Review (India)

Phase I. Examining U.S. and Int'l FI Models for GHG/Environmental Analysis: Strengthening CCMP Project Review and Appraisal for Pre-Qualification (U.S.)

The Phase I. portion of the Portfolio Review will provide and introduce leading models and tools to assist the participating Indian FIs to pre-qualify projects in their portfolios before the Phase II Document Review.

To support this process, LBG/GEP-CCS is organizing a "mini-study tour visit" that will bring an Indian delegation to the U.S. The delegation will be comprised of representatives of the three participating FIs in the current portfolio review, and one additional delegate from an institution, which had participated in the July-August 2001 review, e.g. IDFC. The delegation will have the opportunity to meet with a variety of U.S. institutions, and associations who employ and promote GHG and Environmental criteria during the analysis and approval process of projects. It is envisioned that the U.S. segment of the review will work toward establishing the foundation of designing preliminary criteria for introducing GHG and environmental analysis into the respective lending and rating criteria.

LBG/GEP-CCS envisions the U.S. visit to be a "hands-on" learning experience where the Indian delegates can investigate, at a practical level of detail, the above relevant issues in partnership with the U.S. institutions.

Participating Financial Institutions and the Visiting U.S. Delegation

Participating Financial Institutions

The Portfolio Review will include those Financial Institutions who have expressed interest and play a key role in financing clean energy projects. The review will include the following institutions:

- Infrastructure Leasing, Financing and Structuring (IL&FS)
- Infrastructure Development Corporation of Karnataka (IDECK)
- Indian Renewable Energy Development Agency (IREDA)

U.S. Visiting Delegation

The delegation visiting the U.S. comprised of three senior-level officials, one representing each financial institution participating in the Portfolio Review (see participating institutions above).

Phase II. FI Portfolio Document Review (India)

Under Phase II, the first task will be to incorporate applicable models and tools observed and introduced during Phase I into the process accordingly. LBG/GEP-CCS will conduct a detailed review of the FI's portfolio projects and determine, based on the project characteristics, whether they would be classified as a: I) GHG Asset; II) Liability; or an III) Business-As-Usual (BAU) projects. Upon categorizing portfolio projects, those considered GHG Assets (projects with a better GHG profile than BAU) would undergo further analysis. These GHG Asset projects would be subjected to further review to estimate the GHG reduction potential from the clean energy projects.

These analyses will be discussed in detail with the banks and will be captured in a customized MS Excel model. The following provides an outline of the Phase II. Exercise:

- Identify/select and review a portfolio of projects for preeminent carbon mitigating projects = possible future carbon sales.
- Identify portfolio projects with higher GHG emissions = higher future risks.
- For the GHG Asset projects, illustrate the calculation of GHG emission reductions and indicate possible structuring with GHG offsets revenue.
- Update the FI on the status of international equity buyers of carbon reducing projects.

VII. PORTFOLIO REVIEW SCHEDULE

Below, is the schedule for the entire portfolio review. These are illustrative dates and are naturally subject to change based on availability and scheduling of Indian FIs and visiting organizations in the U.S.:

Phase I. Examining U.S. and Int'l FI Models for GHG/Environmental Analysis: Strengthening CCMP Project Review and Appraisal for Pre-Qualification (U.S.)

	[illegible]					
Sunday	[illegible]	[illegible]	[illegible]	[illegible]	Friday	[illegible]
28	29 Exchange Visit Washington D.C.	30 Exchange Visit Washington D.C.	31 Exchange Visit Washington D.C.	1 Exchange Visit Washington D.C.	2 Exchange Visit Washington D.C.	3

Phase II. FI Portfolio Document Review (India)

August 2002						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
4	5	6	7	8 IREDA* *Interactive Meet*	9 IREDA* *Interactive Meet*	10
11	12 IL&FS *PF Review*	13 IL&FS *PF Review*	14 IDECK *PF Review*	15 Indian Independence Day	16 IDECK *PF Review*	17
18	19 IDECK *PF Review (Alternate Dates)*	20 IDECK *PF Review (Alternate Dates)*	21	22	23	24

* On one of the dates August 8th or 9th to be confirmed

VIII. GEP-CCS WASHINGTON D.C. CONTACT INFORMATION

Mr. Erik Brejla of The Louis Berger Group, Inc., and the U.S. based representative for the GEP-CCS program, will lead the delegations visit. Mr. Brejla's contact information is as follows:

Mr. Erik T. Brejla
U.S. Program Manager
Greenhouse Gas Pollution Prevention Project-Climate Change Supplement
Global Environment Team
The Louis Berger Group, Inc.
1819 H Street, N.W.
Washington, D.C. 2006
Tel: (202) 331-7775 ex. 602
Fax: (202) 331-1058
E-mail: ebrejla@louisberger.com
www.climatechangeindia.com
www.louisberger.com

PORTFOLIO REVIEW AT THE PARTICIPATING BANKS

Conducted by The Louis Berger Group, Inc. under the USAID/India GEP-CCS Program

August 8 – 17, 2002

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED PORTFOLIO

SECTION II: DETAILED SCHEDULE OF REVIEW

C-6/7, Safdarjung Development Area, New Delhi – 110 016 Tel.: 91-11-653 2024,653 2025, 653 2026 Fax: 91-11- 651 8807

PHASE II THE PORTFOLIO REVIEW AT THE PARTICIPATING BANKS
DRAFT SCHEDULE

Conducted by The Louis Berger Group, Inc. under the USAID/India GEP-CCS Program
August 8 – 16, 2002

Day 1

10:00 Welcome by Senior Executive of the Institution & Introduction

10:30 Presentation on GEP-CCS and LBG Role (Subrata Mazumder, India GET Manager, The Louis Berger Group, Inc.)

10:45 Portfolio Review Objective (Vinay Deodhar, Project Finance Specialist, LBG)

11:00 Learning from Phase I Visits to US based FIs – by participant* from respective Institutions: (Institutions visited and observations on discussions)

11:30 Tea/Coffee break

11:45 Presentation on International Climate Change progress (Subrata Mazumder) (Covering developments in Climate Change discussions, UNFCCC, India's position, status, GEP-CCS and activities with FIs and project development to date, upcoming events of importance)

12:15 Overview of Portfolio Review Process – Computational Tools, GHG Accounting/Inventory Protocols, brief discussion on proposed model (Vinay Deodhar)

13:00 Lunch

14:00 Formation of Portfolio GHG Assessment Team (PGAT)

14:15 Identification of Projects for review – i.e. Portfolio (these could be from one department but preferably should be from different sectors, Categorization into GHG Assets and Liabilities

15:30 Tea/Coffee break

16:00 Data identification and collection

17:00 Recap of Day 1

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Day 2

10:00 Feeding of data in the Model, and discussion on the GHG Offset potential of the projects in the identified portfolio (PGAT)

11:30 Tea/Coffee break

11:45 Additional Analysis for CCMPs, Structuring elements to possible monetization of GHG offsets generated (Vinay Deodhar)

12:30 Group Discussion on Risks in GHG Liability projects and their Mitigation (Entire Group)

13:00 Wrap up and closing remarks

13:30 Lunch

Schedule of Reviews:

Aug 8 or 9, 2002	*IREDA New Delhi*	*Mr. S. P. Reddy, DGM (FS)*
Aug 12-13, 2002	*IL&FS Mumbai*	*Mr. Santosh Shidhaye, AVP*
Aug 14-16, 2002	*IDECK Bangalore*	*Mr. D. T. V. Raghu Rama Swamy, Sr. Associate*

PORTFOLIO REVIEW AT THE PARTICIPATING BANKS

Conducted by The Louis Berger Group, Inc under the USAID/India GEP-CCS Program

August 8 – 17, 2002

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED PORTFOLIO

SECTION III: PRESENTATIONS AT MAIN SESSIONS

C-6/7, Safdarjung Development Area, New Delhi – 110 016 Tel : 91-11-653 2024,653 2025, 653 2026 Fax 91-11- 651 8807

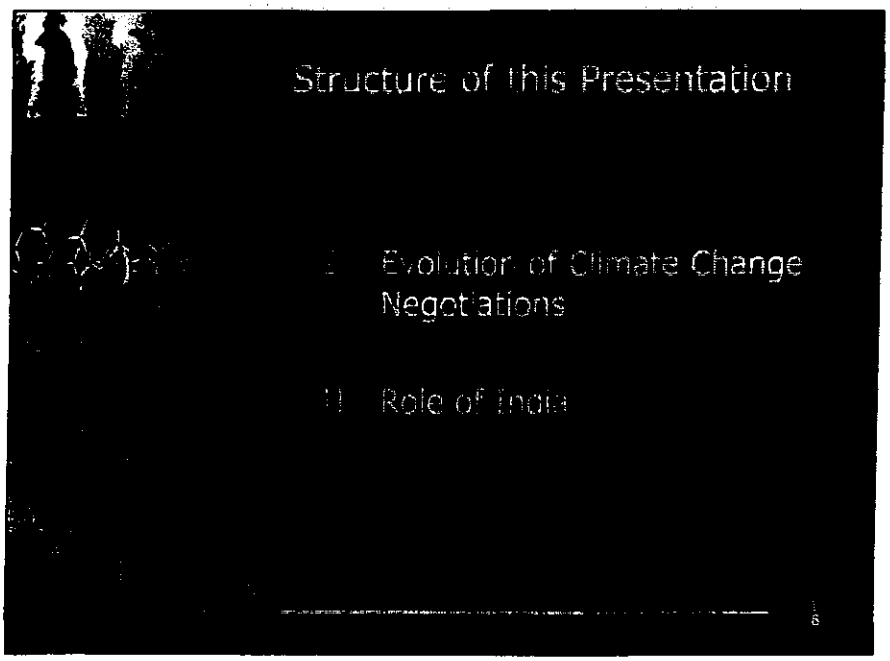
Greenhouse Gas Pollution Prevention Project

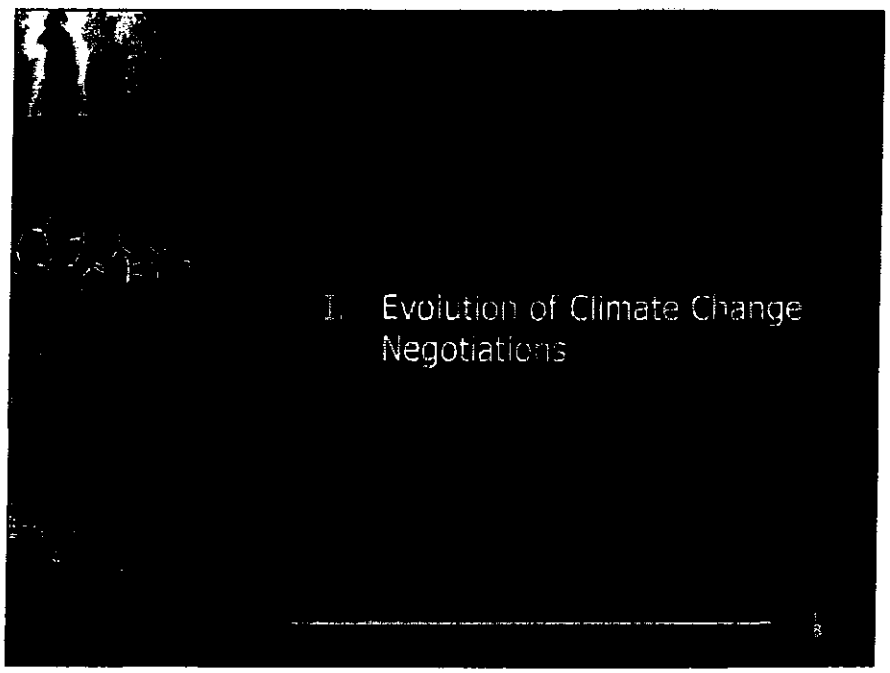
Current Trends in International Climate Change Dialogue

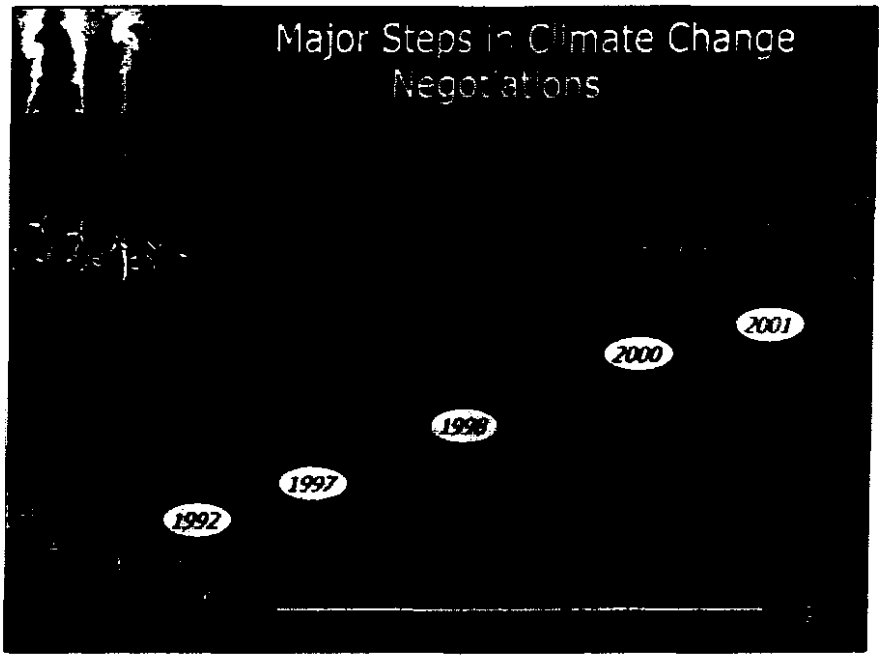
Suprata Manumaer
The Louis Berger Group, Inc.

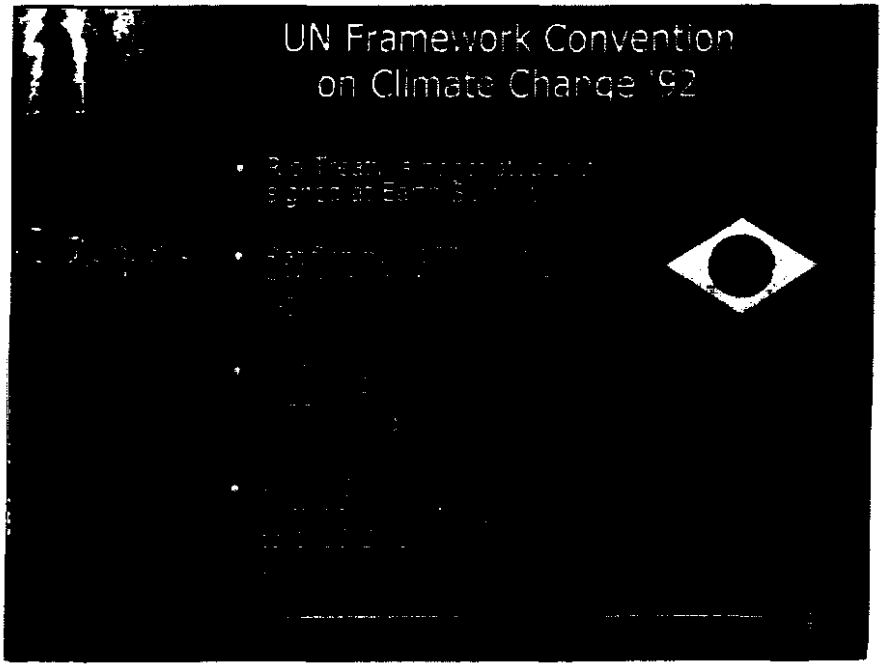
The Louis Berger Group

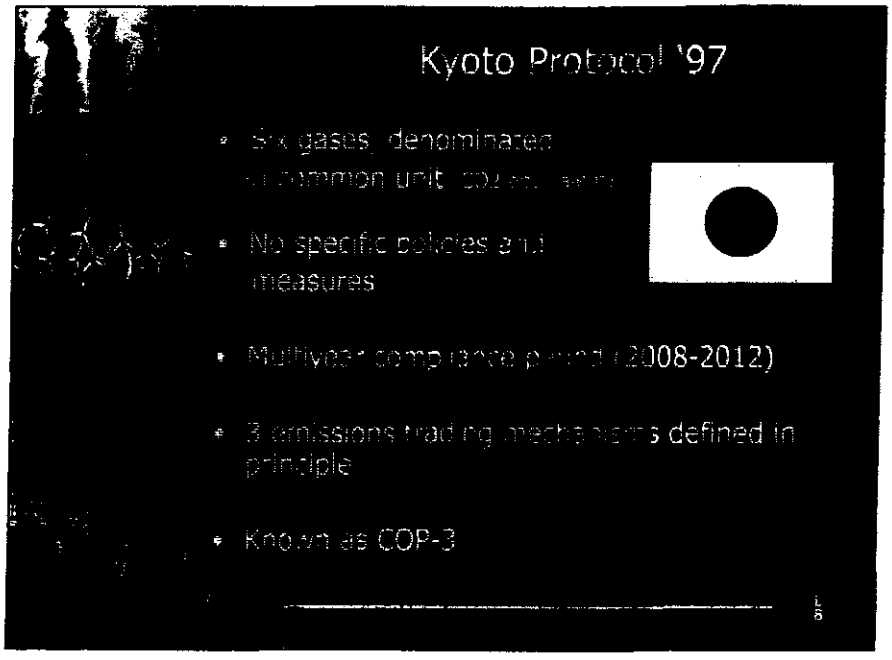
Portions of the Materials Presented are Courtesy of Natsource, LLC Strategic Advisory Services Division a GEP-CCS Project Financial Service Partner

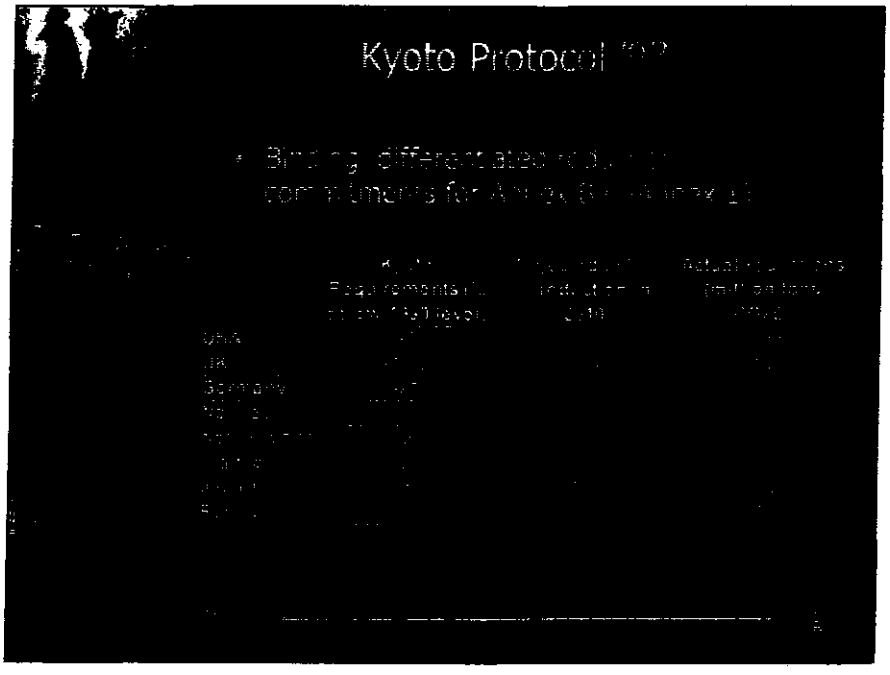

Structure of this Presentation
I. Evolution of Climate Change Negotiations
II. Role of India


I. Evolution of Climate Change Negotiations


Major Steps in Climate Change Negotiations
1992
1997
1998
2000
2001


UN Framework Convention on Climate Change '92


Kyoto Protocol '97
Six gases, denominated
No specific policies and
measures
Multiyear compliance period (2008-2012)
3 emissions trading mechanisms defined in
principle
Known as COP-3

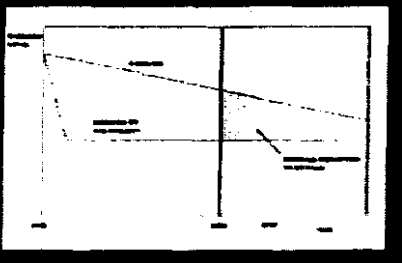

Kyoto Protocol

Kyoto Protocol Mechanisms:
International Emissions Trading

- Between Annex B countries
- Transfers of Assigned Amount Units (AAUs) or pieces of national cap
- No longer [illegible]

Kyoto Protocol Mechanisms:
Joint Implementation

- [illegible]
- [illegible]
- [illegible]



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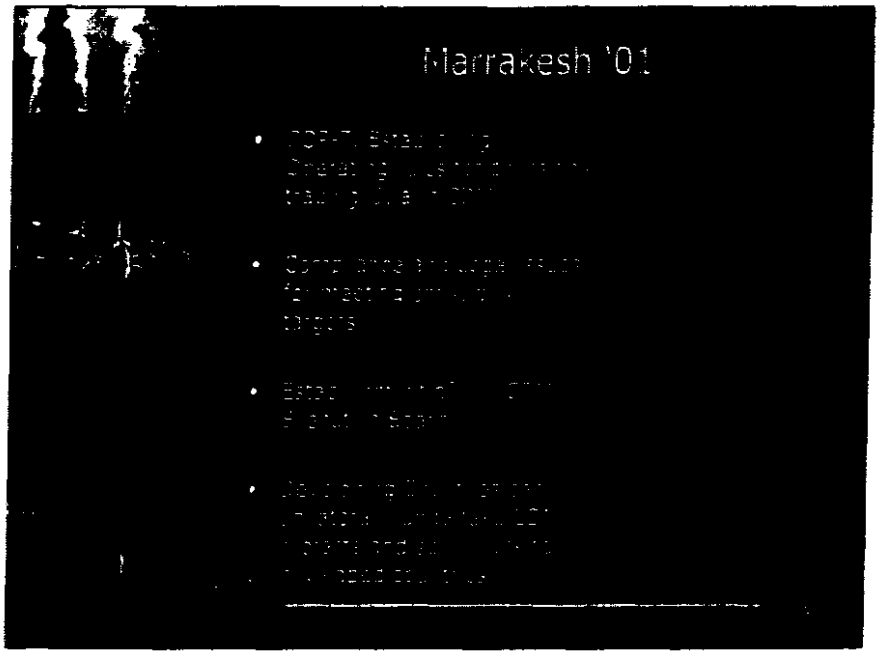
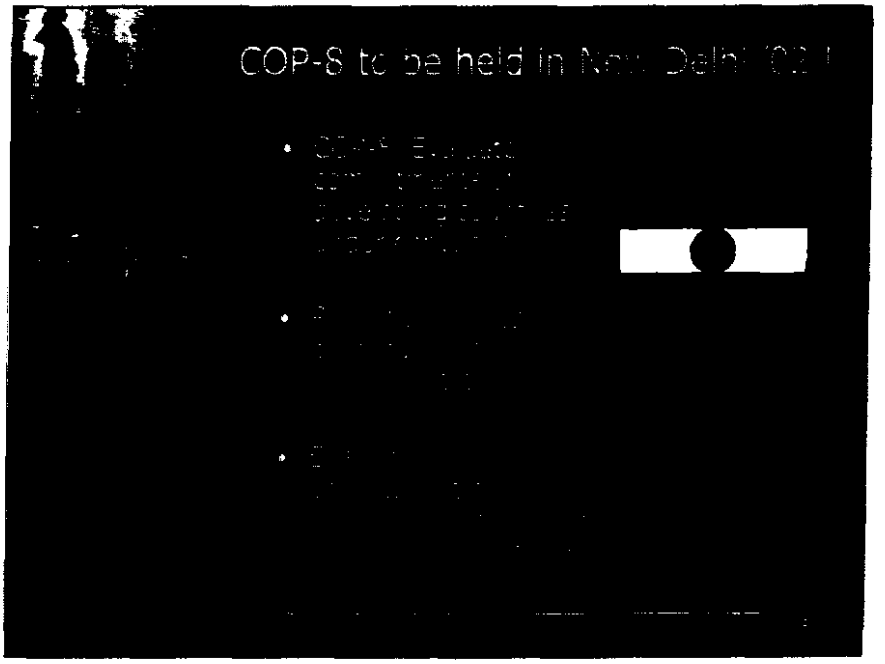
Kyoto Protocol Mechanisms:
Clean Development Mechanism

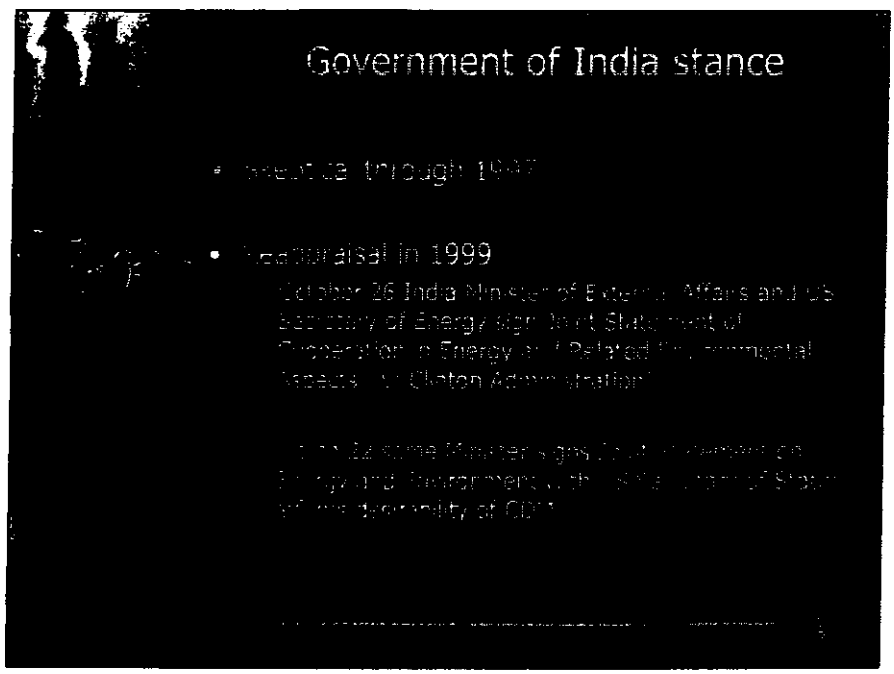
- Project based, [illegible] Annex B countries and developing [illegible]
- Purposes:
  - meet Annex B [illegible]
  - [illegible]
- [illegible]
- Produces Certified [illegible] Reductions (CERs), [illegible] Annex B national caps

The Hague '00

- COP-6 - high expectations
- Major issues:
  - supplementarity
  - compliance
  - adaptation
  - role of sinks
  - project eligibility
  - CDM [illegible]
  - bilateral [illegible]


Marrakesh '01


COP-8 to be held in New Delhi



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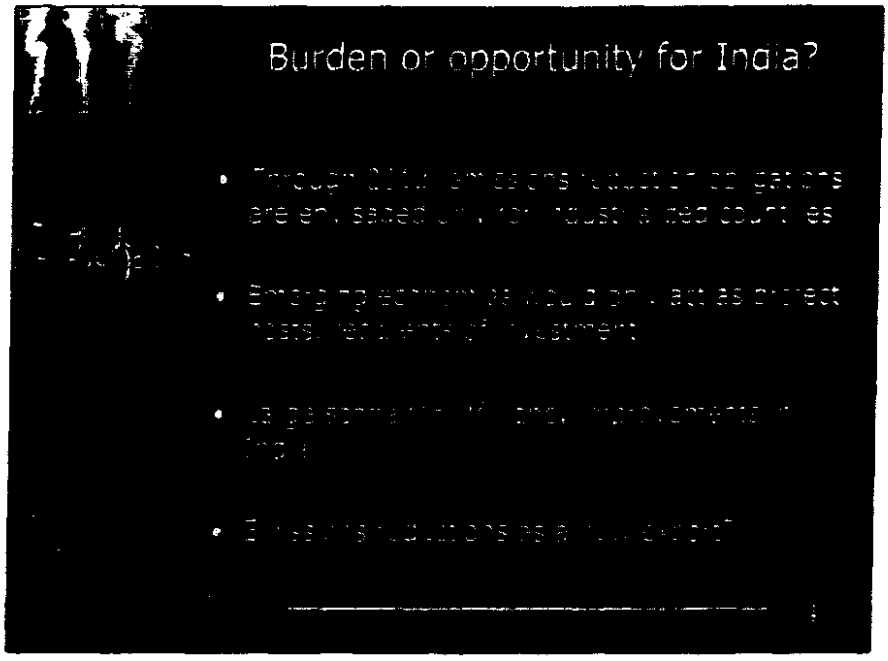
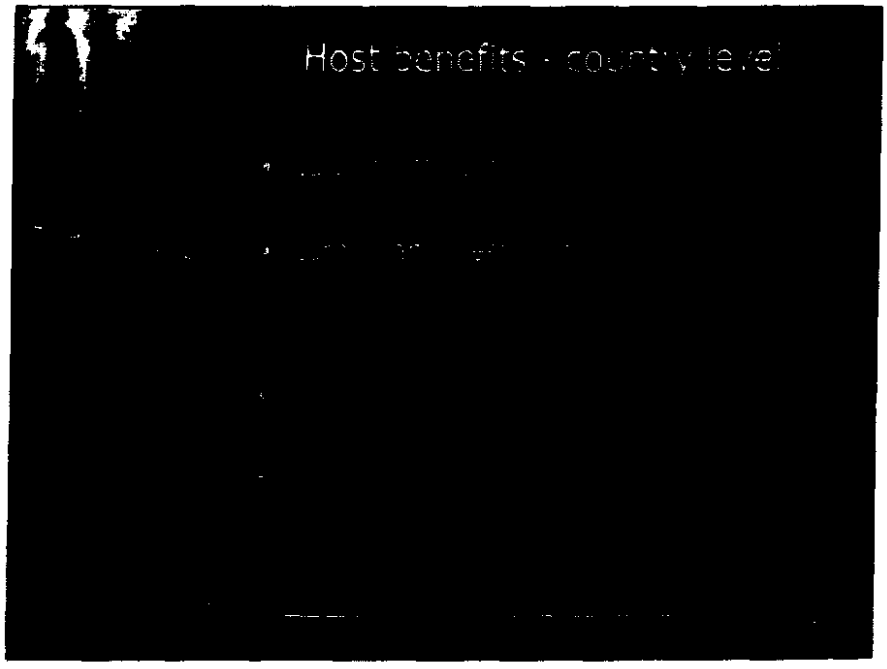
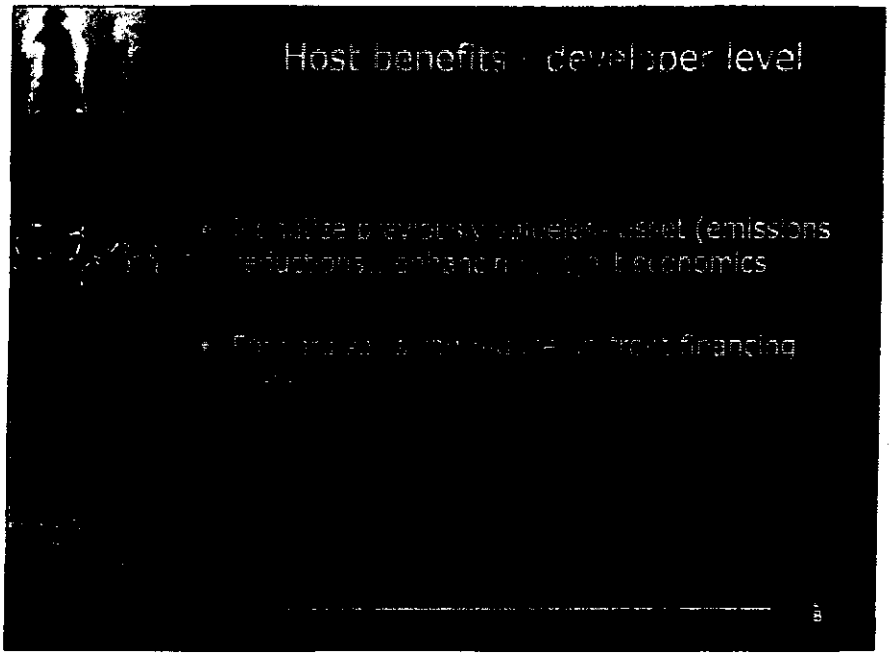
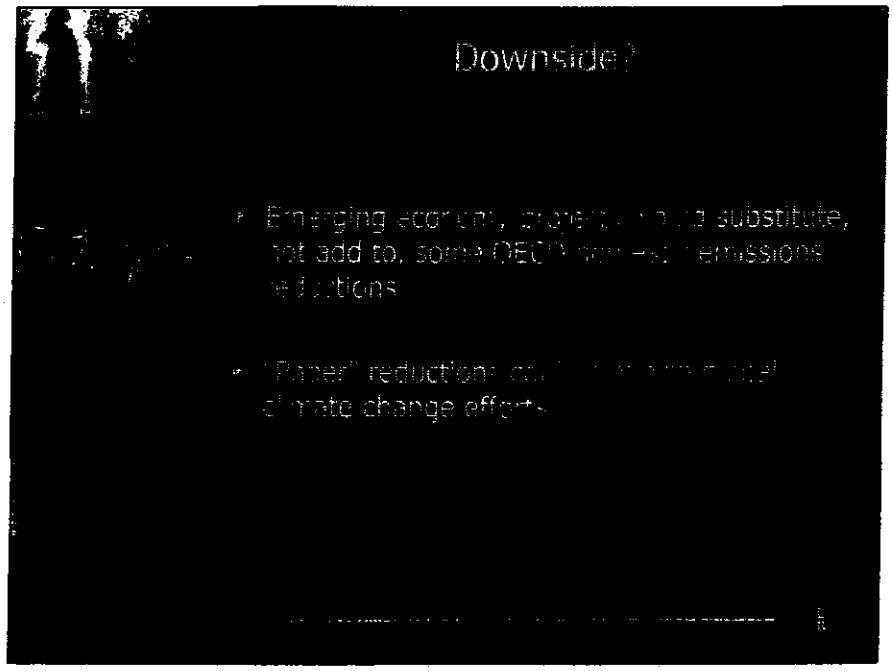

Burden or opportunity for India?


Host benefits - country level





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Summary - Negotiations

- International negotiations [illegible] fits and starts
- Some national governments moving ahead with regulations, incentives
- For foreseeable future, India [illegible] have an opportunity to be [illegible]
- Demand for reductions is on the rise

Summary - Role of India

- India Hosting COP-8 [illegible] October - November 2002
- [illegible]

Greenhouse Gas Pollution Prevention Project

Overview of Bank Portfolio Review Process

Vinay Deshpande
Project Finance Specialist
GEP-CCS Project

Portfolio Review

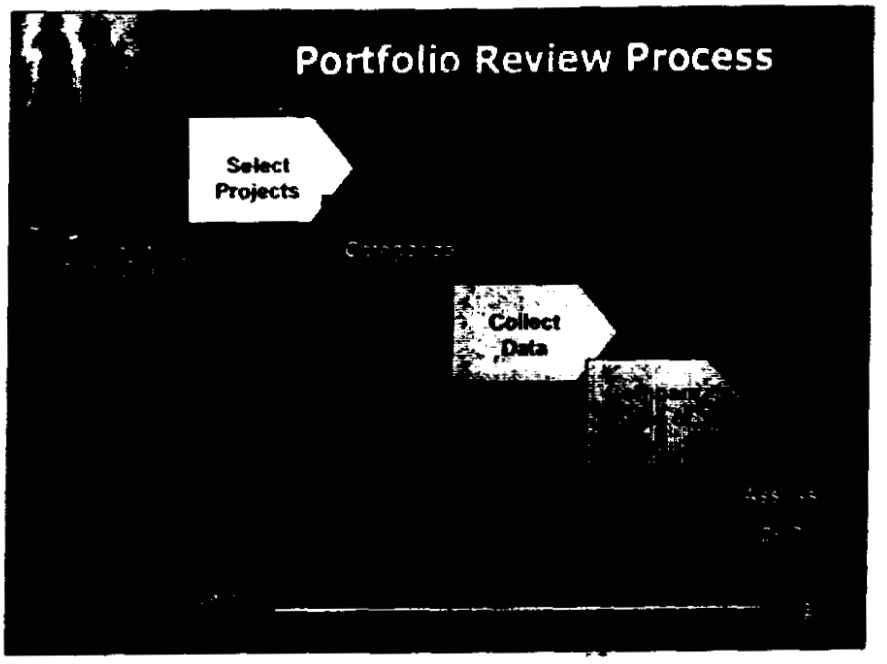
- What is it?
- Why to Review the Portfolio?
- What is involved in the Review?
- What are the Quantitative Objectives?
- [illegible]
- [illegible]

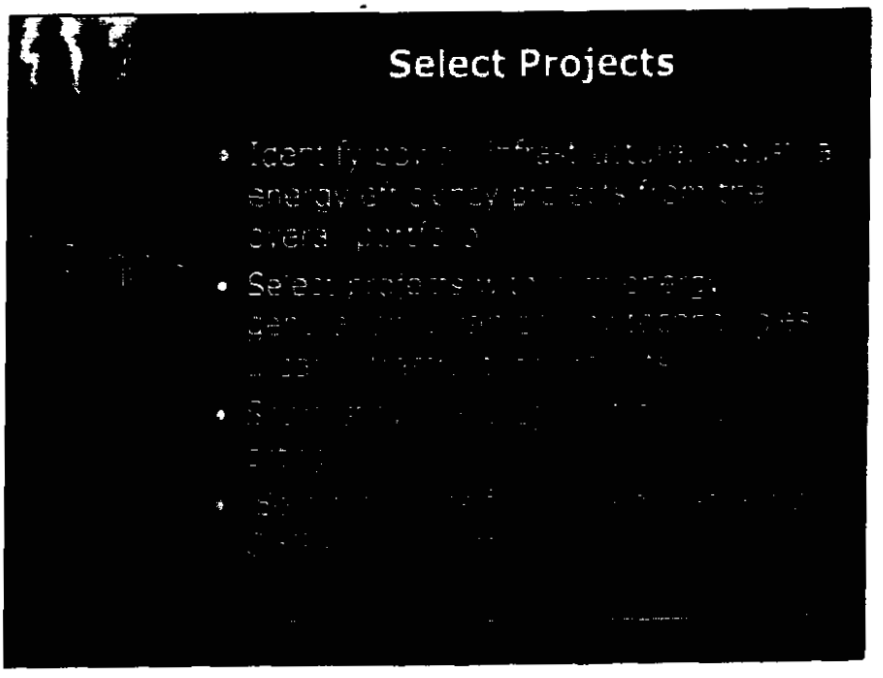
What is Portfolio Review?

- To categorize projects [illegible] terms of their energy intensiveness
- To review what are the technologies employed and how they compare with "Best Practices" in that sector
- Conduct GHG assessment to judge whether the project uses better than normally practiced [illegible] technologies or is business as usual type
- Assess how your portfolio helps in bettering environment

Why to Review the portfolio?

- Assessing our own actions
- Banking Sector – Biggest investor in power and infrastructure Projects
- Therefore, Lending institutions are in a position
  - To promote clean energy projects leading to Climate Change Mitigation
  - To promote emission intensive projects leading to damage to environment
- Portfolio Review provides the institution a check point to devise/alter investment policies
- It would also help in assessing risks faced by the institution – some of which may risk the institution's investment


Portfolio Review Process
Select Projects
Collect Data


Select Projects

Categorize

- Categorize the identified projects into different classes based on in-house MIS categorization or by sector, type or geographical area
- The categories would largely depend on the nature or focus of the FI's business

Collect Data

- Identify data elements necessary for the type of project
- Use Data Sheets designed for the purpose of data Collection
- Sources of data on the project include documents like DPR of the promoter, appraisal note, sector analysis etc.
- Additional data may be necessary in specific projects

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Compare with State of Art

- Compare the technology employed by project with Best Practices in that category to decide the nature of the project
- GHG Asset (Advanced or Better than BAU technology)
- GHG Liability (BAU project

Conduct GHG Assessment

- Feed the data [illegible] run the model
- Conduct also a qualitative assessment of the project [illegible]
- [illegible]

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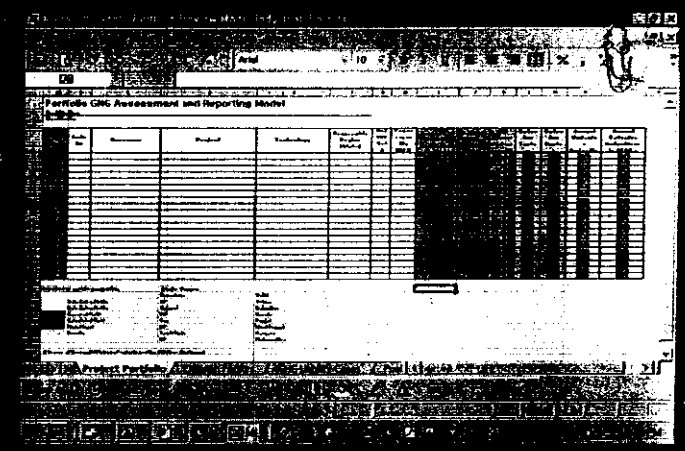
A snapshot of the Model



Outcomes of PF Review

- Provides a general idea of GHG emissions intensity of the Institution's portfolio
- In case of the GHG Assets cases there is a possibility of packaging the projects so as to market the GHG Offsets from them to interested voluntary or other investors with emission caps
- Enables framing of policy for funding projects in future
- Enables undertaking risk mitigation measures in case of severe GHG Liability projects

International Experience

- UNEP has promoted a Financial Institutions Initiative that promotes environment policy by FIs worldwide
- Multilateral FIs like World Bank, IFC, EBRD, ADB and FIs like OPIC, Exim Bank conduct review and incorporates environmental assessment in project appraisal
- Environmental Bankers Association has provided a platform to the FIs worldwide to implement environment friendly investment policy
- WBCSD/WRI developed a GHG protocol to assess Corporate GHG emissions from operations and is developing a project based tool

Benefits of PF GHG Review

- You will be able to identify projects with higher GHG risks and suggest suitable mitigation measures to the promoters so as to minimize the impact
- You will be in a better position to advise [illegible] GHG mitigating projects [illegible] GHG reduction [illegible]
- This as [illegible] project implementation

Greenhouse Gas Pollution Prevention Project

Clean Energy Project Development – Structuring Elements

Mr. Vinay Deodhar
Project Development Specialist
The Louis Berger Group, Inc.

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Outline

- Elements of a GHG mitigation project
- Traditional aspects + GHG Mitigation aspects
- Differentiation of Climate Change Mitigation Project (CCMP) and Business as Usual Scenario through identifying appropriate baseline and estimating its emission intensity
- Estimating the "Additionality" environmental, financial, technological & Social
- Valuing the Carbon Offsets, i.e. betterment over baseline and incorporating it in project financials to enable decision making
- Explained in the context of an Indian project case

Why Carbon Finance?

- Provide additional revenues sources only available to climate change projects
- Sector is underdeveloped with many potential low-cost, quick return projects
- Generation of carbon premium
- Project fits the regulatory framework on carbon trading

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Carbon Revenue Stream

- Non-recourse financing means reduce debt cash flows as primary security
- Any cash flow can be a security
- Carbon sales can be a major financing gap

CEP Project Analysis

- CEP assessments will be based on the carbon due to the [illegible] and the [illegible]
- [illegible]

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The Lock Box Concept

- Guarantees repayment in the form of collateral or other securitized assets
  - [illegible] revenue streams
    - [illegible] carbon price, other [illegible]
- Reduces risk by linking specific investments with specific revenue streams (transparency)
  - Investor returns are [illegible] from other project risks
  - [illegible] project sponsor or parent company
- Called the "lock box" because it effectively locks in the inputs (revenue stream) and the outputs (payment stream)

Case Study on Carbon Finance Model

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Project Particulars

- Project L: A plant for [illegible] of municipal solid waste (MSW) to capture methane gas and use it to generate power for export
- Promoter: SPV formed by an engineering firm [illegible] pollution treatment plants
- Project data based on a Non Recourse basis with revenue generation from power, [illegible] and manure sales

Needs Prior to GHG Analysis

- [illegible]

Steps in Project Analysis

1. Review the Check-list to see if carbon finance is right for the project
2. Review the project to insure that: a) it can be realistically implemented, b) reduces GHG emissions, and c) can assist India in achieving sustainable development
3. Choose a business model: the traditional corporation vs. the special purpose vehicle
4. Valuing of the project
5. Complete a basic projected Income Statement for the project
6. Estimate the discount or hurdle rate
7. Calculate the Net Present Value
8. Calculate the Levelized Cost of the Project

Steps in Project Analysis

9. Identify Project Risk Factors
10. Distinguish between qualitative and quantitative risk
11. Develop a Risk Matrix
12. Decide the appropriate level of Debt the project
13. Decide the company's investment hurdle rate (or Cost of Capital)
14. Recalculate the project's net present value (NPV)
15. Decide the appropriate level of Debt for the project
16. Decide the best risk mitigation procedures for the project

Nature of GHG Mitigation

- [illegible]
- [illegible]
- [illegible]

GOI Perspective

- [illegible]
- [illegible]
- [illegible]

Thus the project exhibits...

- Environmental Additionality - Better than Business as usual scenario
- Technological Additionality - Advanced technology being provided Investment Additionality - Need for additional funding to sustain GHG mitigation benefits & no diversion of ODA
- Social Additionality - through improving the health and hygiene in the city and also providing additional employment

Hence We may proceed with further analysis...

- Baseline Analysis
- GHG Mitigation Potential Estimation
- Monitoring & Verification System
- Validation and Integration into Financial Analysis
- Risk Assessment & Mitigation

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What is a Baseline?

- [illegible]
- [illegible] demand a [illegible] base[illegible] of [illegible]
- [illegible]
- [illegible] GHG [illegible]

Steps in Establishing Baseline

[illegible]

63

GHG Reduction Objectives of the Case Project

- Clean Technology Nature
  - [illegible] of the host technology [illegible] MSW treatment and methane abatement
  - [illegible] emphasis on three [illegible]
- SD Objectives Aspects
  - Direct and indirect [illegible] local operation
  - Value & loss [illegible] advantages [illegible]
  - [illegible]
- Host Country Objectives
  - Meets objectives of MOEF [illegible]
  - [illegible] technology Demonstration [illegible] of MNES

Project Boundary

- The Project treats MSW, feeds power & generates organic manure
- Correspondingly, there are [illegible] project boundaries that include proposed plant & extend to
  1. [illegible] limits from [illegible] transportation to the plant
  2. [illegible] and frequent [illegible]
  3. Disposal [illegible]

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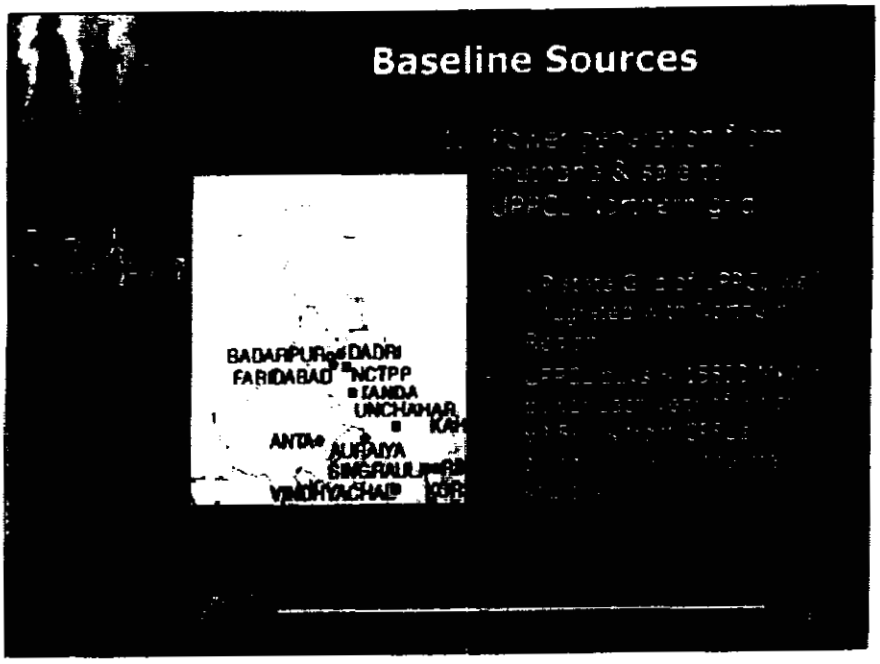
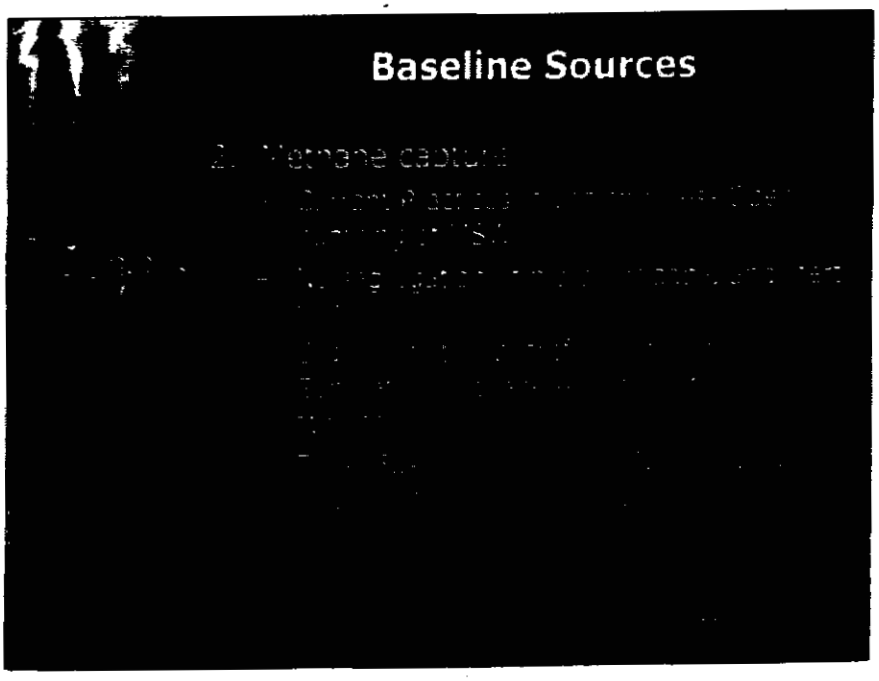

Baseline Sources
BADARPUR
DADRI
FARIDABAD
NCTPP
TANDA
UNCHAHAR
ANTA
AURAIYA
SINGRAULI
VINDHYACHAL


Baseline Sources

Baseline Sources

Data Collection Sources

1. Electric Power Sector

- CEA statistics
- Planning Commission Annual Report on Working of SEBs and EDs
- Reports of National Council of Power Utilities, Central Board of Irrigation & Power, NMEB, NDP etc.
- Report of World Bank
- Meetings with state and regional utility officials

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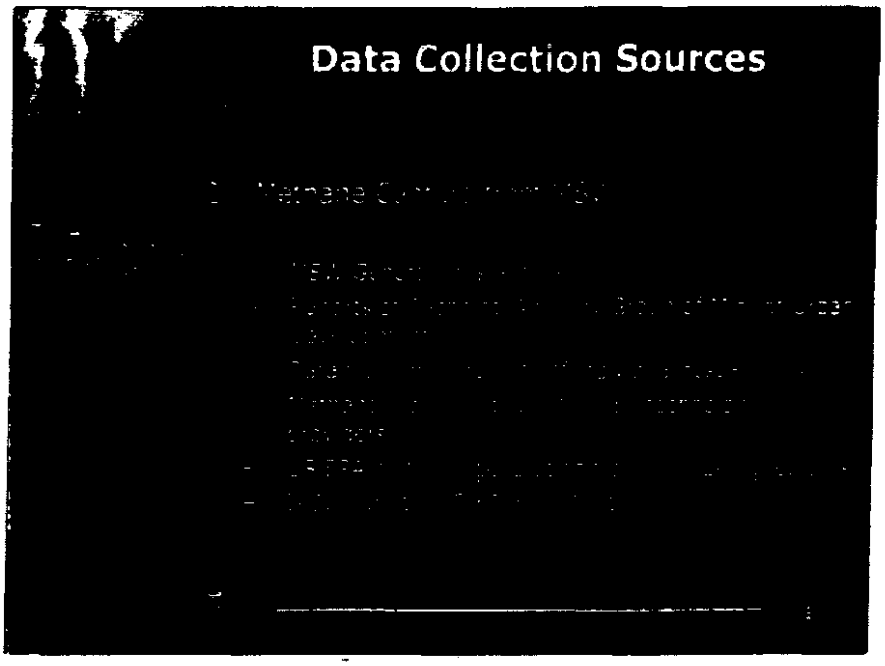

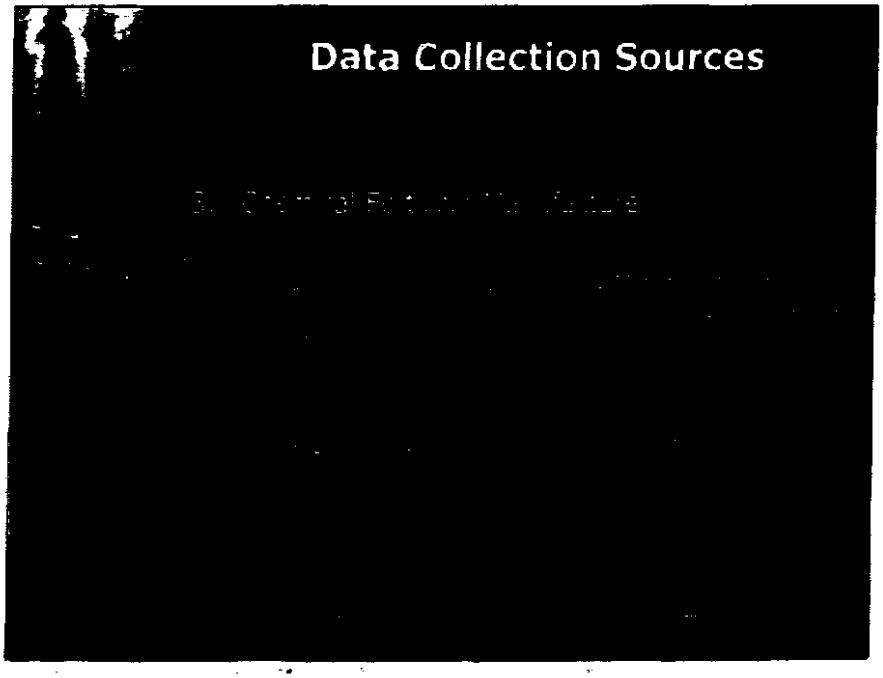

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Electric Power Capacity

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4542	75	4102	[illegible]	[illegible]	79	[illegible]	[illegible]	75
[illegible]	1533	25	1533	[illegible]	[illegible]	21	[illegible]	[illegible]	25
[illegible]	6075	[illegible]	[illegible]	[illegible]	14887	100	15265	[illegible]	100

Electric Power Generation

	2000		2001		2002		2003	
[illegible]	19096	[illegible]	19471	[illegible]	[illegible]	[illegible]	21086	[illegible]
[illegible]	5292	[illegible]	5291	[illegible]	[illegible]	[illegible]	10007	[illegible]
Total	24388	100	24765	100	[illegible]	100	31593	100

Revelations!!

- [illegible]
- [illegible]
- [illegible]

GHG Reduction from Sale of Power

- [illegible]
- [illegible]
- [illegible]

61

Methane avoided from MSW Dumping

GHG Reduction due to Organic Manure

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Summary of Carbon Reductions

Methane capture from MSW	Power generation and sale to grid	Substitution of chem. fertilizers by manure
118,169	40,375	33,587

Total emission reductions 192,130

Integration of Emission Revenues with Project Financials

Pricing of Emission reductions

- Two possible approaches for pricing in non-established markets
  1. [Cost of Production between project and a similar project with traditional technology] / tons of emission reductions
  2. Total amount required to make the project IRR cross the Hurdle rate/tons of emission reductions
- Proposed project provides heterogeneous services that cannot be provided by traditional technology
  - Bottom line is Second Approach

Results

- IRR on Equity with unchanging price of manure at Rs. 2,200/- and power tariff as specified in PPA- 22.85% and a hurdle rate of 25%
- Price of emission reductions from recent issues is $ 3 per ton CO2e
- At this price Project's IRR on equity is 27.12%
- Reasons for higher IRR - MNES tariff & grant, and relatively higher price of manure

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Sensitivity Analysis

- IRR is sensitive to manure price
  - @ Rs. 1,500/ton IRR w/o carbon = 20.19% & with carbon 24.63%
- MNES subsidy and special tariffs help the project largely
- If MNES grant was replaced by Loan from existing lenders and tariffs were fixed as per new UPERC ruling [Rs. 2.25/kWh in 1999-00] IRR on equity w/o carbon 18.19% and with carbon 22.8%
- If the price of manure is fixed at Rs. 1,500 per ton IRR w/o carbon 16.09% & with carbon 20.86%

Sensitivity Analysis Results

Conditions & constant Manure price Rs/Ton	IRR without Emission Reductions	IRR with Emission Reductions
MNES grant & Tariff [illegible]	22.55%	27.12%
MNES grant & Tariff 1500	20.19%	24.63%
[illegible] UPERC Tariff [illegible]	18.19%	22.8%
[illegible] UPERC Tariff [illegible]	16.09%	20.86%

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PORTFOLIO REVIEW AT THE PARTICIPATING BANKS

Conducted by The Louis Berger Group, Inc. under the USAID/India GEP-CCS Program

August 8 – 17, 2002

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED PORTFOLIO

COMPUTATIONAL TOOL FOR GHG ANALYSIS

GEP-CCS has been providing Technical Assistance to key stakeholders involved in GHG mitigation project development. These include, industrial promoters, financial institutions and the GOI officials. Financial Institutions provide a major share of finance to clean energy and GHG Mitigation projects. As such, they have a sizeable repository of projects in their portfolio, which could have earned investments from carbon investors. With a view to enable the FIs take advantage and to make use of these "Opportunities" in future, GEP-CCS provided technical assistance to two major FIs. This has enabled the FIs to understand the possibilities and also helped them in preparing suitable strategies for identifying suitable criteria for considering such projects and incorporating necessary design elements so as to enable their structuring as GHG mitigation projects.

GEP-CCS conducted a more detailed GHG assessment for two of the ten projects to which it provided the TA. This was based on current understanding of the developments in the climate change arena and the IPCC methodology for assessing GHG reduction potential. GEP-CCS also helped in development of a five-part Computational Toolkit to address various structuring elements of a GHG mitigation project. Based on these tools and interactions with several international emission brokers, consultants and researchers, GEP-CCS has developed a simple MS Excel based tool to review portfolio through identification of projects, categorizing them and applying the IPCC methodology to assess GHG mitigation potential of cleaner projects and GHG emissions from *business-as-usual* (BAU) projects. This would be demonstrated in a 1½ day portfolio review program at three Indian FIs during August 2002. In addition to the industrial and power sector projects, GEP-CCS also looks at the linkage between urban development and climate change through two major activities in transport and municipal solid waste sectors. Consequently, GEP-CCS ahs also developed additional modules to assess the GHG abatement potential of projects financed by FIs in these sectors. These modules look at projects like bypasses, over bridges or any other projects that reduce the running time of a large number of vehicles and also increases their average speed, thereby resulting in reduction of emissions and various alternative MSW treatment technologies that help in mitigating methane emissions from open dumping of municipal solid waste.

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SECTION IV: COMPUTATIONAL TOOL FOR GHG ANALYSIS

C-6/7, Safdarjung Development Area, New Delhi – 110 016 Tel.: 91-11-653 2024,653 2025, 653 2026 Fax: 91-11- 651 8807

Portfolio GHG Assessment and Reporting Model

Institution
Portfolio

	Code No	Borrower	Project	Technology	Geographic Region (State)	On/Off Grid	Power capacity MW@

At 85% PLF and 90% Availability

Data Entry Fields
Data Entry Fields
Comment Field
Calculated Field
Model Input
Results

State Names

Karnataka
AP
Gujarat
MP
Goa
HP
Tamil Nadu
UP
Delhi
Orissa
Rajasthan
Kerala
Punjab
West Bengal
Haryana
Maharashtra

@ In case of Energy Efficiency Projects mention MkWh or Kcal saved

GHG Assessment of BAU* projects

Institution

Portfolio

Code No	Borrower	Project	Technology	Capacity MW	Fuel

Technologies

CFBC
Combined cycle
Engine
IGCC
PC simple cycle
Steam turbine

Anthracite
Bituminous coal
Coke
Coking coal
Crude oil
Diesel oil

Fuel Types

Fuel oil
Gasoline
Lignite
LPG
Naptha
Natural Gas

NGL
Peat
Pet Coke
Pure Methane
Sub-bituminous coal

* Project with conventional technology, fuels

Transport Sector Projects GHG mitigation

Institution

Portfolio

Project	Inc. in Av Speed	Time Saved	No of Vehicles passing annually	Composition of traffic %		
	KM/hr	hrs		Diesel HCVs	Petrol cars	Two wheelers

MSW Disposal GHG mitigation Projects

Institution

Portfolio

Project	Capacity TPD	Technology

Technologies of MSW Treatment considered

Open Dumping
Composting
Landfill with gas recovery
Biomethanation
Incineration

PORTFOLIO REVIEW AT THE PARTICIPATING BANKS

Conducted by The Louis Berger Group, Inc. under the USAID/India GEP-CCS Program

August 8 – 17, 2002

PHASE II: GHG ASSESSMENT & ANALYSIS OF SELECTED PORTFOLIO

SECTION V: SELECTED REPORTS, ARTICLES AND BACKGROUND INFORMATION

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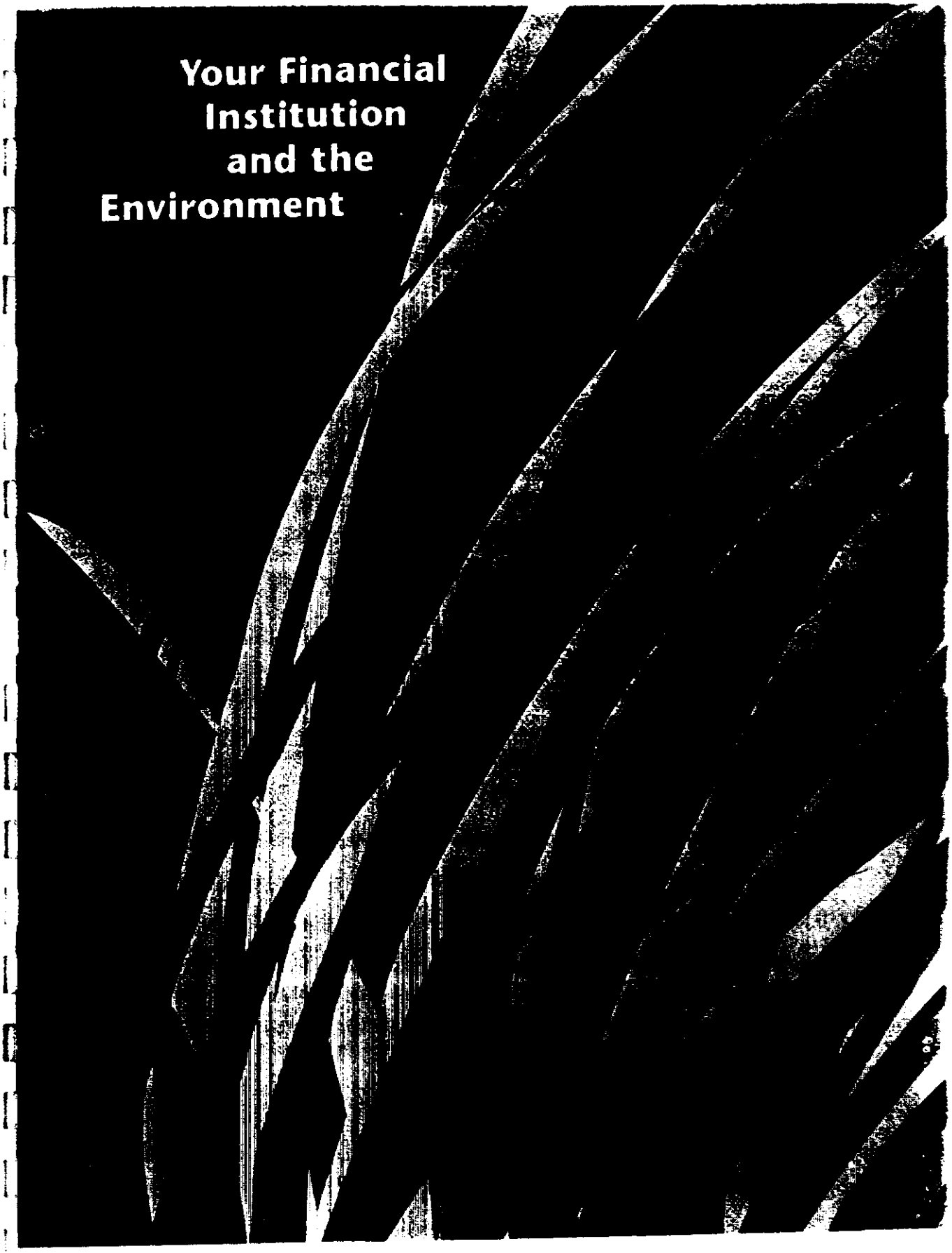
Your Financial Institution and the Environment



Your Financial Institution and the Environment

INTRODUCTION

We live in an era where the environment is recognized as an important part of virtually everything we do. Nowhere is the direct impact felt more than in the business community. Whether it is mining, manufacturing, transportation or energy, the business community can be targeted as the primary cause of pollution and other negative impacts on our air, water, open space, and natural resources. There is a strong connection between finance and the environment. The environmental risks that confront a financial institution's clients such as violation of laws, responsibility for cleaning up contamination or loss of franchise and brand reputation have an impact on their bottom line and, in turn, can pose risks to your institution. On the other hand, these same environmental issues can also present opportunities to finance new products, to learn how to build environmentally-based efficiencies into your own operations and to enhance the reputation of your institution.

The Environmental Bankers Association (EBA) has provided the forum for financial institutions to address environmental issues for the past decade. One of the founding principles of the EBA is that the environment should not be a factor in financial transaction competition. We believe that a healthy environment is one key to a strong economy and that we all benefit far more from a collective strong economy than by individually cutting corners at the expense of the environment. In this spirit we have prepared this booklet. EBA believes strongly in proactively addressing environmental issues, especially environmental risks to the bottom line of our respective financial institutions. This booklet provides you with an introduction to the approaches we've developed from our years of experience and draws on what we have learned in collaboration with other groups including the United Nations Environment Programme Financial Institutions Initiative (UNEP FII).

WHAT DOES ENVIRONMENT MEAN TO A BANK?

The word "environment" can bring many images to the mind of a banker - some that are critical to the profitability of the services and products of the bank, some that are helpful for expense control, and some that may seem more discretionary, but are nevertheless beneficial to the bank and the environment in less tangible ways. In general, we identify six categories that make up a total definition of environment for a bank. These are:

Risk Management

The environmental problems of borrowers and equity investments can have serious impacts on the ability to repay debt or realize a gain on investment and, increasingly, negative public opinion on the financing of environmentally high profile projects is impacting the reputations of financial institutions.

Infrastructure Finance

Financing of environmental infrastructure such as clean water supply and wastewater treatment as well as solid and hazardous waste disposal are examples of environmental financing.

Internal Operations

Most corporations recognize the benefits of the wide variety of internal environmentally beneficial actions that contribute to bottom line savings and other corporate benefits. These may include energy efficiency programs, recycling, source reduction and waste minimization, and programs to educate and engage employees, suppliers and clients.

Community Responsibility

Financial institutions have a responsibility to the communities in which they operate which can include involvement in environmentally relevant issues through activities such as corporate grant-making, public policy participation, and community volunteering.

Marketing

Banks can use environmental causes for marketing their services to consumers that are interested in doing business with environmentally proactive companies or by participation in cause-related marketing.

Sustainable Product Finance

The environmental products and services industry is often in need of financing, particularly for new technologies that can help solve environmental problems. Proactive financial institutions can play a major part in their successful development. In addition, banks can have a major impact through financing the redevelopment of contaminated properties (brownfields) and promotion of smart growth methods of greenfield development. Stand-alone investment products allow a financial institution to offer issue-specific products for customers that wish to make investments aligned with their values.

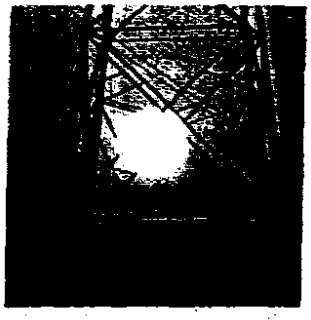
A comprehensive environmental approach for a financial institution would involve an appropriate combination of all of these elements. However, these initiatives may not all have the same impact, and hence, priority. For EBA members, our initial focus has been on risk management as it is viewed as having the potential for the biggest and most tangible impact to the bottom line success of our member institutions. Risk management provides a good starting place to build a relevant corporate environmental program at any financial institution, regardless of its size, products, or domestic or global market.

GLOBAL FOCUS

Risk management, infrastructure finance, internal operations, community responsibility, marketing and sustainable product finance pertain to financial institutions worldwide. It is especially important to communicate with all stakeholders at a local and global level.

Collaboration and involvement with The United Nations Environment Programme Financial Institutions Initiative (UNEP FII) provides a voice for financial institutions on important global issues. UNEP FII provides its signatories, which include several EBA members, with access to a high visibility partnership with the United Nations and with other financial institutions worldwide. UNEP FII develops cutting edge research and management tools.

In addition, UNEP's Finance Initiatives group provides a powerful voice for its signatories at international policy negotiations such as the World Summit for Sustainable Development in Johannesburg, the United Nations Financing for Development Conference and climate change treaty negotiations. UNEP FII also opens up a valuable global network of finance and sustainable development contacts, information and networking services as well as collaboration with other leaders in the field including the Forge-Group, Sustainability Performance Indicators (SPI) Finance, and the Global Reporting Initiative. Some projects currently underway include guidelines for environmental management and reporting; solutions to mainstreaming sustainable asset management; the Innovative Financing for Sustainability report series; an Inventory of Sustainable Energy Funds, and a professional development program for industry executives.

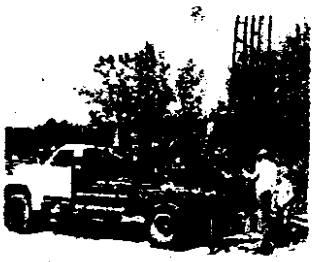


ENVIRONMENTAL RISKS

The financial industry is a complex web of organizations offering a wide variety of services including retail, commercial, investment and development banking and insurance to international markets, controlling billions of dollars in cash and assets. The sheer size and complexity of the business makes it inevitable that the activities of financial institutions will affect or be affected by some aspect of the environment. We think of environmental risks as being either direct, meaning that the actions of the financial institution itself create the environmental problem (real or perceived) or indirect, meaning that the financial institution is affected by the actions of another party such as a borrower or an investment.

Indirect risks generally are associated with monetary loss related to the extension of credit or investment. Borrowers can face legal liability for violations of law, have financial responsibility for cleaning up contamination, and can suffer damage to their franchise and brand reputation. For instance, a borrower may contaminate their real estate collateral that, in turn, creates potential for loss to their lender. The lender is not directly responsible for the actual contamination but indirectly faces the financial consequences, nonetheless.

Examples of direct environmental risks may include causing environmental contamination at your own facilities that you have to clean up, or publicly supporting an unpopular public policy position that impacts reputation. For instance, the United States experience has shown us that excessive involvement in a borrower's environmentally sensitive activities, specifically being involved in the operational decisions of the borrower's business, can result in the institution being directly liable for the cleanup of what was thought to be the borrower's environmental problem. Similarly, if care is not taken to understand and adhere to corporate legal structures, it is also possible for a parent corporation (the bank or its borrowers) to be held liable for the environmental activities of its subsidiaries. Identifying and managing these liability risks is particularly important for financial institutions operating in multiple international jurisdictions, where corporate and lender liability rules may differ.



Risks also exist for financial institutions involved in investment research and asset management. Increasingly, financial institutions and investors should be aware of and respond to market data or perceptions that link positive environmental performance to positive impact on shareholder value. At the very least, the environmental problems of equity investments clearly can affect the ability to realize a gain on investment. In the future, financial institutions that fail to consider market demand for environmentally focused investment products could be perceived as being remiss in their fiduciary responsibility.

Finally, your financial institution's own operations have environmental risks. Activities such as disposal of used electronic equipment, management of wastes from printing operations, and recycling of office wastes are subject to environmental laws in many jurisdictions. Failure to comply with these requirements can result in liability or loss in asset value. In addition, financial institutions involved in the insurance industry have a direct stake in the frequency and severity of claims relating to environmental matters.

Growing concerns about the environment have contributed to a major shift in public expectations about the role of corporations and financial institutions in society. A financial institution's particular reputation risks will depend on the activities and statements of the institution, and the institution's existing reputation, which has been developed over time among the relevant stakeholders. If subjected to specific scrutiny, a financial institution's reputation will be judged using criteria such as:

- **Credit** - involvement in financing environmentally controversial projects and the degree to which the projects are subjected to some sort of screening (which can, in fact, be the basis for their core environmental credit risk management program).
- **Investment** - incorporation of environmental aspects in the institution's investment advice and availability of environmentally responsible investment products.
- **Internal Operations** – level of environmental management practices, such as waste prevention, recycling and energy conservation and the magnitude of charitable environmental giving programs.

RISK MANAGEMENT

The discipline of risk management was first introduced to business by the insurance industry over fifty years ago. Financial institutions first applied systematic risk management methods to environmental risks in the United States during the late 1980s in response to the unique legal precedents of the "Superfund" laws. This liability led to lenders initiating environmental risk programs and due diligence policies, procedures and practices in order to avoid direct environmental liability as well as the indirect financial losses associated with borrowers' liability.

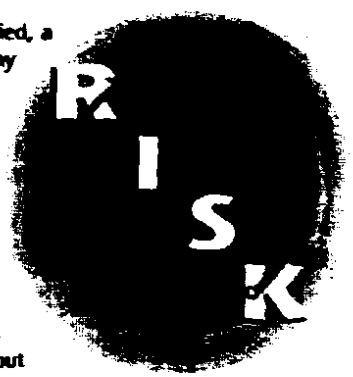
Virtually all of the environmental credit risk management programs used by EBA members include the basic building blocks of risk management - identification, assessment, control, mitigation and monitoring. Each of these can be successively integrated with conventional credit risk underwriting using the 5 C's of credit cash flow, collateral, character, capacity and conditions specific to considering environmental risk.

Identification

Risk identification may be completed prior to making a new loan or during the life of the loan. Identifying environmental risks is critical since environmental issues can impact a borrower's cash flow and value of the collateral. These impacts may affect the ability of the customer to service debt.

Appraisal

Once there is a perception of risk or risks are identified, a lender should try to establish the impact the risk may have on the specific transaction or overall line of business. EBA institutions consider the many due diligence tools available for assessing and characterizing the environmental risks. The environmental impact to the financial transaction must be adequately characterized using available information or new investigations.



Control

Risk control measures are designed to prevent losses from occurring not just for the financial institution, but more importantly for the customer. EBA institutions tackle these potential losses by considering the legal, technical and business tools available to minimize the risk. Some of these tools include loan documentation and covenants that require the customer to mitigate risks and evaluate environmental conditions during the life of the loan.

Mitigation

Environmental risks may be mitigated either prior to or during the life of the loan. One of the tools that may be used by the financial institution involves the transfer of risk to another party, either through contractual documents or insurance. Banks should consider whether or not they will manage these internally (self-insure) or transfer the risks through environmental insurance mechanisms. Protecting bank assets and net income from environmental risk can also be achieved with risk financing techniques through the employment of environmental indemnifications, holdbacks/escrows, or letters of credit.

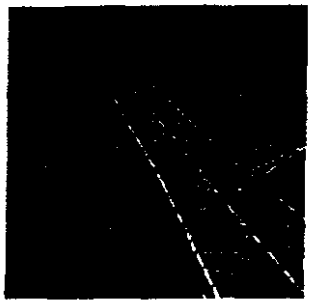
Monitoring

Monitoring should be an integral part of any financial institution's risk management system. With risk monitoring, the systems for tracking the loan or loan portfolio life cycle that are already implemented for traditional risk management can also be used to monitor the environmental conditions at a site.

ENVIRONMENTAL OPPORTUNITIES

There are opportunities for financial service companies both large and small to take part in practices that are sustainable and contribute to the bottom line. In reality, most financial service companies are already involved with these practices but may not realize how they contribute to sustainability.

Facility Management



Financial institutions operate real estate portfolios that range from one or two buildings to vast numbers of retail branches and large high-rise operation centers. Energy efficiency issues are at the core of cost savings and the need to ensure maximum resource use. Power consumption including heating and cooling, transportation, waste management and source reduction all provide opportunities for eco-efficiency. For instance, financial institutions consume significant volumes of paper. We have the ability to manage paper production and consumption from forest to mill to desk and back to the mill for recycling, resulting in efficiency that directly contributes to the bottom line and shareholder value. The logical next step is to understand that environmentally focused property management practices all are contributors to the making of an environmentally sustainable financial institution.

Products

There are market-based solutions that encourage sustainable development and provide positive solutions for environmental challenges. Many financial institutions have found an under-served market niche created by the desire of the investor to act as a responsible global citizen through the power of their investments. Issue specific investment products including socially responsible investment strategies, eco funds and green investments allow financial institutions to tap new markets, provide customers with sustainable investment choices and generate revenue. Other markets are created from new products and services such as the demand for recycled material or components associated with energy efficient products such as photovoltaic cells, geothermal and fuel cell technologies. In addition, larger infrastructure projects associated with clean water supply, wastewater management or solid waste disposal demand specific knowledge and financial expertise. As an example, a small 20-employee US based company may supply a developing country in Asia with a specific component for a wind turbine. The global market fosters this type of trade and financial institutions take advantage of this kind of environmental market niche as an opportunity to create a dynamic new line of business.

Community

We can benefit our communities and, in turn, our standing in our communities through actions such as public policy participation , employee volunteering, and promotion of positive community reinvestment. Brownfield lending is an example of how financial services directly benefit under-served communities. Brownfield sites are typically located in urban areas; these often idle or abandoned properties represent sites that were once economically strong centers of commerce and business. Using their expertise and specific knowledge related to contaminated real estate redevelopment, EBA institutions have financed hundreds of millions of dollars in brownfields redevelopment, resulting in cleanup of contaminated real estate, providing business access to under-served urban markets and creating jobs.

Marketing

Many environmentally beneficial organizations and causes raise funds for their activities through partnerships with businesses including financial institutions. Examples include cause-related marketing associated with credit cards or other retail banking services where the company gets the visibility and public relations benefits of the partnership and some portion of the revenues go to the environmental cause. Even without such partnerships, promotion of the environmental actions of the financial institution, whether related to core business or internal greening, can result in marketing advantage to the growing base of environmentally conscious clientele.

CORPORATE INTEGRATION

A growing number of financial institutions have recognized the benefits of integrating environmental issues into company strategy and developing an organizational commitment to conducting business in an environmentally responsible manner. While this process is relatively new for many, there are existing mechanisms and best practices available which may assist banks in making their commitment to the environment operational. A starting point is a corporate environmental policy statement.

Corporate Statements and Policies

Many manufacturing and retailing industries companies have had environmental policy statements for the past decade or so. More recently, financial service institutions are getting on board. Statements serve to transparently affirm a corporation's dedication to environmental stewardship. They deliver a message for both employees and external stakeholders, and can be general or specific depending on how far along an institution is in articulating and acting on its environmental commitment.

Industry Initiatives

There are numerous industry initiatives underway dedicated to corporate environmental leadership and sustainable development. By participating in these initiatives, banks can gain and share knowledge and experience with their peers. The following is just a sampling of the many initiatives that exist.

- **United Nation's Environment Programme's (UNEP) Financial Institutions Initiative (FII) on the Environment** – FII was founded in 1992 to engage financial institutions in dialogue on sustainable development and currently has more than 180 bank signatories worldwide. Signatories to the initiative's Statement By Financial Institutions on the Environment and Sustainable Development recognize that "sustainable development is the collective responsibility of government, business, and individuals" and "are committed to working cooperatively with these sectors within the framework of market mechanisms toward common environmental goals". A number of signatories use the principles within the Statement as a framework for identifying and managing risks, particularly in their lending and underwriting business.

UNEP Finance Initiatives
Innovative financing for sustainability

- **Coalition for Environmentally Responsible Economies (CERES)** – The CERES Coalition is a network of over 70 organizations, including environmental advocates, investors, advisors and analysts, representing over $300 billion in invested capital. Companies, including several EBA members, that join CERES have committed to continuous environmental improvement by endorsing a ten-point code of environmental conduct. The principles include: Protection of the Biosphere; Sustainable Use of Natural Resources; Reduction and Disposal of Wastes; Energy Conservation; Risk Reduction; Safe Products and Services; Environmental Restoration; Informing the Public; Management Commitment; and Audits and Reports.

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- **The World Business Council for Sustainable Development (WBCSD)** – The WBCSD is a coalition of more than 160 international companies committed to sustainable development via the three pillars of economic growth, ecological balance and social progress. Members come from more than 30 countries and 20 major industrial sectors. The WBCSD is a member-led organization and is governed by a Council composed of the Chief Executive Officers of its member companies, or other top-level executives of equivalent rank. The WBCSD aims to show that businesses which make efforts to promote sustainable development experience improved competitiveness. WBCSD members state that they have benefited greatly from pursuing strategies such as eco-efficiency and corporate social responsibility.

World Business Council for Sustainable Development

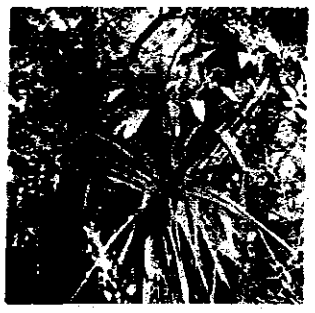
ENVIRONMENTAL REPORTING

Corporate Environmental Reports are used to demonstrate company-wide, integrated environmental management systems, corporate responsibility and the implementation of voluntary initiatives and codes of conduct as stated above. Obtaining information for a corporate environmental report may be a challenging task. However, the process itself encourages a financial institution to think about its information management system and realize how much it is already doing regarding environmental stewardship. Reporting is a good way for a company to track its own progress and identify internal strengths and weaknesses. By initiating environmental reporting, a bank may put into place processes and systems that can help gather information and make the firm more efficient.

Facts often covered in corporate environmental reports include:

- environmental policies and systems
- indicators of environmental/social/economic performance
- financial implications of environmental/social/economic actions
- relationships with stakeholders
- sustainable development business opportunities
- business initiatives that support environmental/social/economic development

Producing an environmental report may lead to internal and external benefits for a financial services institution. Internally, employees are often pleased to learn that the bank they work for is environmentally engaged and the report serves to boost company morale. Senior management is better able to learn and speak knowledgeably about the company's environmental program, including its many benefits to the corporation.



Externally, many individuals and organizations are increasingly asking banks to provide environmental reports and they may find that reporting is a good way to respond to environmental criticism. Furthermore, reporting gives a bank the opportunity to demonstrate environmental leadership.

Environmental Bankers Association

Mission:

To protect and preserve bank net income and assets from environmental exposure and liability resulting from lending and trust activities through the employment of environmental risk management in the United States and worldwide.

The Environmental Bankers Association is a non-profit trade association that represents the financial services industry, including bank and non-bank financial institutions, insurers, asset management firms and those who provide services to them. Its members include lending institutions, property & casualty and life insurers, the environmental consulting and appraisal community, and attorneys. The EBA was established in 1994 in response to heightened sensitivity to environmental risk issues, and the need for environmental risk management and due diligence policies and procedures in financial institutions.

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United Nations Environment Programme Finance Initiatives

UNEP **Finance Initiatives**
Innovative financing for sustainability

Mission

To identify, promote, and realize the adoption of best environmental and sustainability practice at all levels of financial institution operations.

The United Nations Environment Programme Finance Initiatives (UNEP FI) is a unique global partnership between UNEP, the Financial Institutions Initiative (FII), and the Insurance Industry Initiative (III). These three partners work together to achieve UNEP FI's mission. Signatories to the UNEP Statement by Financial Institutions on the Environment and Sustainable Development commit to the integration of environmental considerations into their operations and services. Created in April 2001, the North American Task Force (NATF) is a member-driven and UNEP-supported initiative that works to support and expand sustainable financial practices in North America. The top priority of the NATF is the creation of a critical mass of North American signatories that are able to exchange ideas and best practices as well as learn about worldwide developments in the field via a UNEP FI facilitated network.

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Environmental Management in Financial Institutions

Swiss Bankers Association

«Environmental protection is an important subject, of course, but what has it got to do with our banking business?» This is the question that Swiss banks also asked themselves at the beginning of the nineties.

Environmental and economic issues are very often linked with each other, also in banks. Envirenmental factors, however, often have an economic effect in the future. Some Swiss banks have already started to record and assess possible risks and strategic opportunities in both their lending and investment business.

What we want to do in these **guidelines** is to present our findings and experience to other banks and to a wider public. We want to encourage you to take an active part in combining ecology and economy in your own bank.

For those in management, these guidelines contain important questions to be asked and describe the steps towards the introduction of environmental management.

For employees and those in charge of departments of the bank, it provides clear examples and aids in solving the tasks facing them.

Dr. Georg F. Krayer
President of the
Swiss Bankers Association

The UNEP Financial Institutions Initiative on the Environment wishes to express its sincere appreciation and gratitude to the Swiss Bankers Association for making these guidelines available to banks across the world through the Initiative's web site.

One of the major thrusts of the Initiative is the development

Environmental management concerns all areas of banking. Our guidelines have therefore been designed for the following heads of department and areas of concern:

- For the management
- For everyone: corporate ecology
- For the professionals in loans
- For the professionals in investments
- For communication
- Towards systematic action
- For further reference

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of a global network to enable the sharing of best practices among members, who represent over 33 countries, and to facilitate member access to management tools and other resources for taking concrete environmental actions in all functional areas of their business.

Both UNEP and the Initiative's Steering Committee are convinced that these guidelines will serve as an excellent framework for any bank or financial institution, regardless of size or type, to use in developing and implementing environmentally sound policies and programs. Your willingness to make these available to the financial sector at large will significantly enhance our efforts to promote environmental responsibility throughout the financial services sector globally.

Linda Descano
Chair of the Steering Committee to the UNEP Financial Initiative

Deborah Vorhies
Coordinator of the UNEP Financial Initiative

For best presentation set browsers default font size between 10 and 12 point. PDF-Files have to be opened with Acrobat Reader.

For the professionals in investments

- **Environmental issues in asset management**

  New aspects in investments (Grafic 177kb)

- Choosing stock according to environmental criteria
- A market for environmental investment funds

Environmental issues in asset management

A possible real-life scenario

«A and B, two industrial groups listed on the stock exchange, wished to overcome problems of structural change through engaging in a merger.

In the context of a due diligence investigation, it is revealed that considerable site contamination has been found on the premises of firm B and that numerous environmental regulations have not been adhered to.

A estimates the additional investment needed for the clean-up of the damage will be about U.S. $ 34 million and expresses doubts about the merger agreement. The stock markets react immediately: B's stock capitalization decreases by about U.S. $ 40 million.»

«We will reinforce the attention given to environmental risks in our core activities. These activities include risk management, loss prevention, product design, claims handling and asset management.»

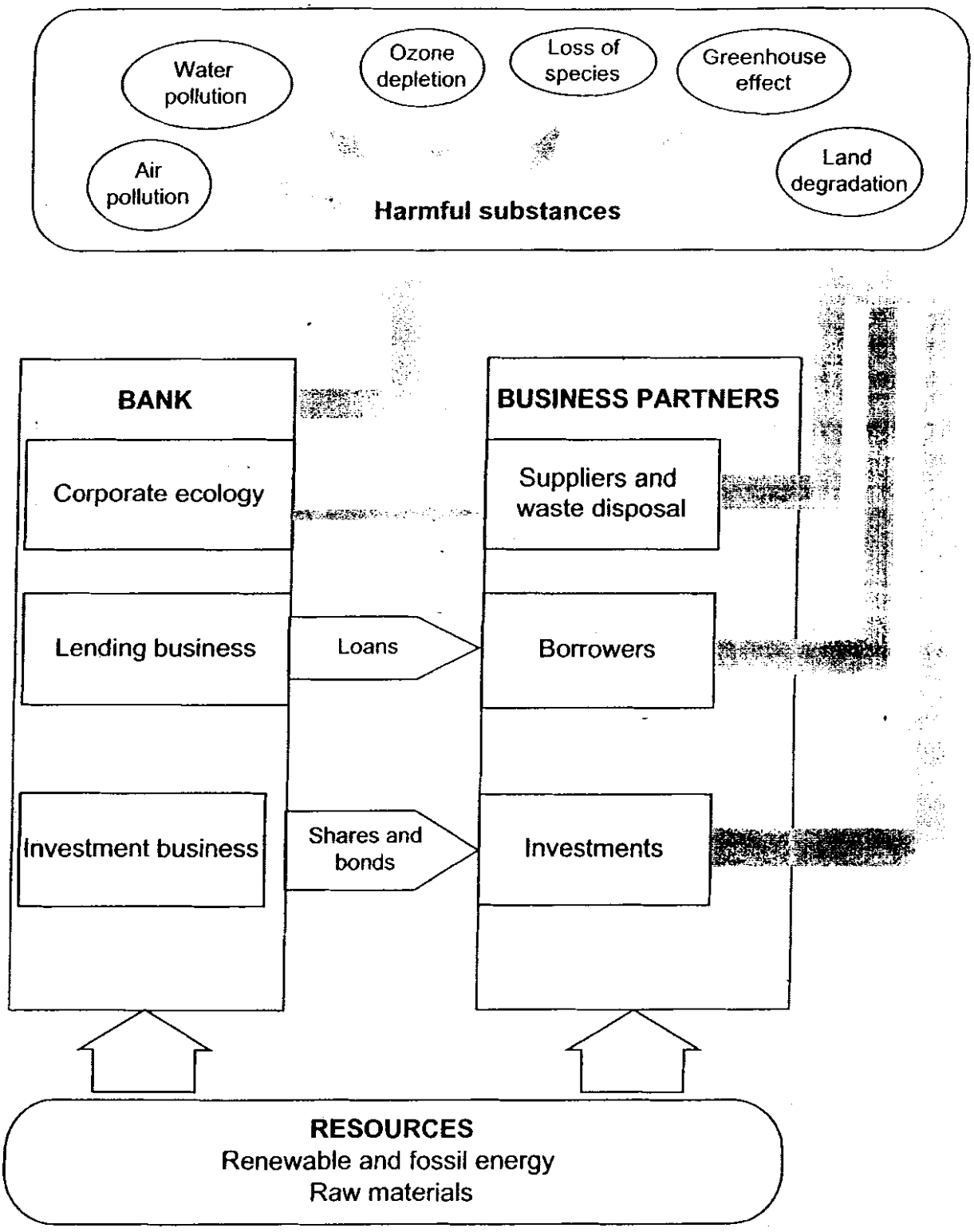
A new market develops

Environmental issues have so far played only a minor role in the investment business but there are ever more signs of change under way. By signing the UNEP statement, over seventy insurance companies have already declared their future intention of taking environmental issues into account in asset management.

The interests of the investors ...

Up to now, it has only been investors with a particular interest in ecology who have been prepared to follow up their principles when considering investments. They wish to contribute to environmental improvement by investing in pioneer businesses.

What have banks to do with ecology



New aspects in investments

The interest of the investors

Contribution to environmental improvement

Contribution to shareholder value

- Investing on the basis of *personal convictions*
- Promoting pioneering businesses
- Reduction of financial risks caused by environmental issues
- Awareness of opportunities due to environmental issues

How the banks are reacting

Supplementing stock analysis

- Developing means of assessment
- Building up in-house specialized know-how
- Training in investment consulting

Individual investment consulting

- Encouraging awareness towards importance of environmental factors
- Personal portfolio management according to environmental criteria

Development of environmental investment funds

- Investment in:
  - Environmental technologies
  - Pioneering businesses
  - Best in class companies

Now that there is increased recognition that the environmental achievements of companies have an economic effect, traditional investors are also weighing up the consequences of these factors for their shareholder value.

... and how the banks are reacting

The first step is to include environmental factors in stock analysis (see «Choosing stocks according to environmental criteria»). Check-lists and questionnaires, similar to those used by the credit department, need to be developed in order to assess recommended stock according to financially-relevant environmental criteria. In order to give clients sound advice, investment consultants need to have appropriate training and specialized knowledge.

Environmentally-oriented clients can then be offered an individual portfolio management supplemented with environmental criteria.

Some banks have introduced so-called environmental investment funds with a range of investment goals (see «Environmental investment funds»).

New aspects in investments

(Graphic - This file can be either downloaded as a PDF-File 14kb, as a PowerPoint-Document 19kb or opened in a new browser window.)

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For the professionals in investments

- Environmental issues in asset management
- **Choosing stock according to environmental criteria**
  - Assess stock according to environmental criteria (Grafic 195kb)
- A market for environmental investment funds

Choosing stock according to environmental criteria

Finding the right criteria

How can stock with a particular environmental potential be identified? What criteria should be selected in evaluating the environmental performance of a company?

The basis of each stock recommendation is a positive financial rating, the criteria for which are generally accepted, but for environmental aspects there is as yet no standardized approach. However, as environmental management has been standardized, important qualitative and quantitative criteria have emerged.

Does an environmental strategy exist?

An environmental policy forms the basis of an environmentally-oriented business strategy which, together with the key projects of its implementation, is usually made public through an environmental report.

Scrutinizing the system

An assessment of a corporate environmental management system will reveal to what degree an environmental approach forms part of daily management procedures. The establishment of eco-controlling will guarantee the achievement of environmental aims. Certification of the environmental management according to international standards provides a further sign of the continuing efforts of a business to improve its environmental performance.

Assessing the production processes

In many industries, the production process causes the most environmental pollution. Forward-looking businesses will be able to identify important data:

- What financial reserves are there for environmental risks?
- What are the costs of energy consumption or waste disposal?
- What pollutant emissions are generated by production?
- What improvements have been achieved?

Potential for environmental success

The environmental quality of products is significant for the future success of a company:

- What share of the turnover and the market do eco-products have?
- What standards are demanded of suppliers?
- How large is the proportion of recycled materials?
- How energy-efficient are the products?

The result is a performance analysis with the addition of environmental factors, which increases the quality of stock recommendations for the benefit of customers, banks and the environment.

A working group of the Swiss Bankers Association has developed a catalog of financially-relevant environmental indicators

Assess stock according to environmental criteria

(Graphic - This file can be either downloaded as a PDF-File 12kb, as a PowerPoint-Document 19kb or opened in a new browser window.)

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For the professionals in investments

- Environmental issues in asset management
- Choosing stock according to environmental criteria
- **A market for environmental investment funds**

Investment funds for the environment (Grafic 198kb)

A market for environmental investment funds

Investment funds for the environmentally committed

Investment funds with a background of environmental, social or ethical issues have a long tradition in the USA. For over 20 years, there have been proposals for potential investments which guarantee that certain ethical criteria are adhered to. At the end of the 1980s, after the environmental movement had begun, special environmental investment funds were launched for environmentally-interested investors, particularly in Europe.

A product not only for a niche in the market

Whereas in the USA, approximately $ 640 billion, or 9 % of all investments are made according to ethical or environmental criteria, investment in the German-speaking countries up to now lies at $ 350 million or at less than 1 % of the market, but is increasing. Recently launched products reflect the growing interest in these type of investments.

Transparency is a major factor of success for environmental-ethical investments. The criteria for assessment of corporate environmental contributions must be communicated clearly.
Some critics maintain that an ethical-environmental selection of stocks which is not oriented towards contribution to shareholder value is unlikely to divert capital flow into environmentally meaningful investments. For this reason, some new environmental investment funds focus on measurable contribution to sustainable development and shareholder value.

Decision-making criteria

The tradition of ethical investments has produced some negative criteria which exclude certain industrial sectors, such as the weapons industry, nuclear power or the tobacco industry.

Positive criteria imply an informed selection of particularly environmentally sound industrial sectors, such as renewable sources of energy, recycling, organic farming or

Assess stock according to environmental criteria

Financial corporate analysis

- Financial indicators
- Balance sheet structure
- Returns on capital
- Assessment of management
- Sector analysis
- Country analysis

Environmental corporate analysis

Qualitative criteria

Environmental strategy

- Environmental policy statement formulated?
- Environmental program prepared?
-
- Environmental organization established?
- Environmental communications plan available?
- Environmental report published?

Environmental management system

- Internal comunication supplemented by eco-factors?
- Eco-controlling prepared?
- Legal compliance checked?
- Insurance cover for environmental risks?
- Environmental management directed at certification?

Qualitative and quantitative criteria

Production processes

- Criteria for suppliers?
- Risk management?
  - Investment to reduce environmental risks
  - Finanical reserves for risks
- Investment in eco-friendly technologies?
- Energy management?
- Environmental data?
  - Pollutant emissions
  - Energy consumption
  - Amounts of waste products and waste water

Products

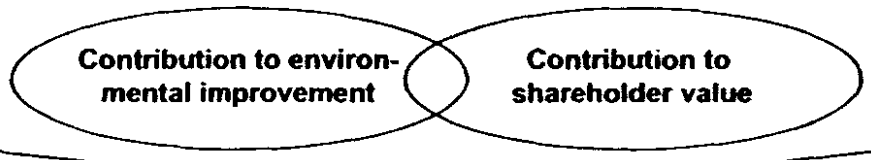
- Materials?
  - Environmental relevance
  - Material costs
- Customer information?
  - Market share of eco-products
- Environmental labels?
- Criteria for suppliers?
- Offers to recycle and dispose of products?

Corporate analysis including environmental factors

- Integration into stock analysis
- Individual asset management
- Development of environmental investment funds

Investment funds for the environment

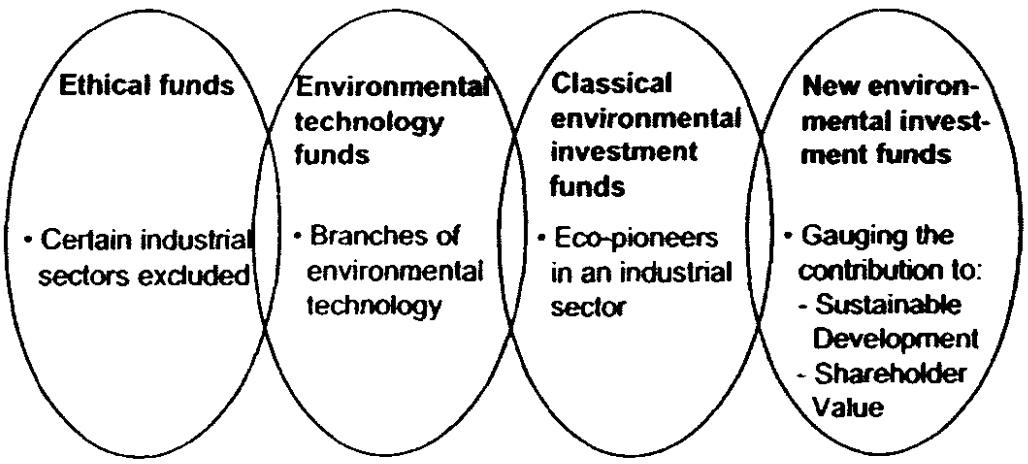
Interests of the investor



Decision making criteria

Negative criteria	Positive criteria	Environmental corporate analysis
• Armaments • Fossil fuels • Nuclear power • Destruction of rainforests • Animal experiments • Other ethical criteria •	• Environmentally sound transport system • Organic farming • Renewable sources of energy • Pollutant reduction • Environmental technologies	Qualitative and quantitative assesment of environmental performance: • Environmental strategy • Environmental management system • Production processes • Products •

Range of investment funds



environmental technologies.

Some more recent approaches also include corporate environmental analysis which includes qualitative and quantitative environmental factors in its assessment. The aim is to substantiate the contribution to sustainable development of these funds.

The range of environmental investment funds

Since most of the investment funds on offer apply a mixture of the criteria already mentioned, a definite categorization is not possible. However, four basic trends are discernible:

- ethical investment funds
- environmental technology funds
- classical environmental investment funds directed at pioneering companies
- new environmental investment funds with the intention of offering a measurable contribution to sustainable development and shareholder value.

See the current list of environmentally-oriented funds.

Investment funds for the environment

(Graphic - This file can be either downloaded as a PDF-File 12kb, as a PowerPoint-Document 20kb or opened in a new browser window.)

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Environmental investment funds

(This checklist can also be downloaded as a MS-Word-document 36kb)

The following list shows the environmental investment funds issued and managed in German speaking countries as of January 1998:

Name of funds	Investment minimum in DEM	Positive criteria	Negative criteria
Luxinvest SecuraRent	10 000	• Private housing, communication technology • Investments in the social, health and educational sectors • Technologies which aim to conserve natural resources or to employ alternative forms of energy • Conservation of clean water, air and soil • Avoidance, reduction, re-utilisation or removal of harmful substances and waste products • Promotion of rail traffic	• Weapons • Violations of human rights • Production of environmentally harmful substances
Credit Suisse Equity Fund (Lux) Eco Efficiency	No minimum	• Evaluation of eco-efficient enterprises through Sustainable Asset Management (SAM) • Active management: risk-adjusted overperformance in comparison with the benchmark • Options in this sector extend beyond local and regional boundaries	• None

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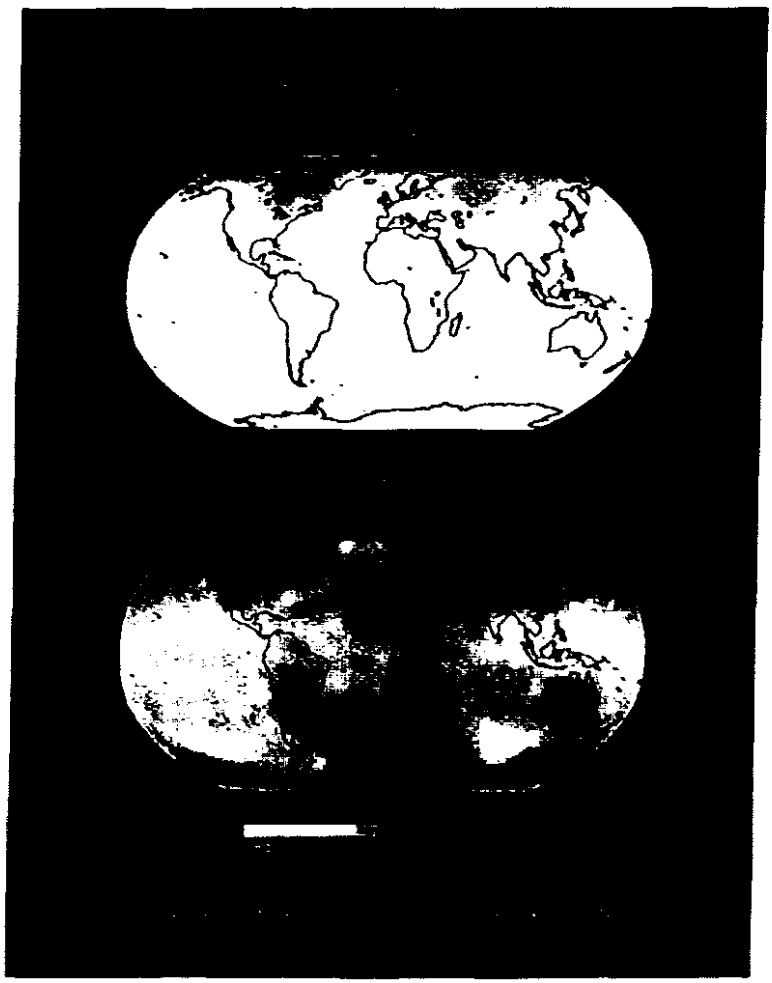
		• Well-balanced mixture of large and mid caps	
Sustainable Performance Group (SPG)	1 unit (the issue price is based on the daily net asset value)	• Investment in all sectors possible • Diversified portfolio having regard to sustainability	• None
Focus Umwelt-Technologiefonds (environmental technology funds)	5 000	• Technological improvements with positive effects on the environment • Development, production or marketing of products or services in the field of environmental technology, with a share in turnover in excess of 51%.	• None
SBC Eco Performance Portfolio	1 unit (the issue price is based on the daily net asset value)	• Stocks of companies which are of leading economical as well as ecological significance within their sector and which display an ongoing commitment to improving their attitude to environmental issues.A differentiation is made into leaders (blue chips with high environmental performance) and innovators (smaller companies with eco-efficient products and services).	• None
Hypo Eco Tech	None	• Environmentally friendly products or technologies • Attainment of a cleaner and healthier environment in local sectors; control of air pollution, geothermic energy, recycling,	• None

Climate Change:
Assessing Our Actions



Overseas Private Investment Corporation
October 2000

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A MESSAGE FROM THE OPIC PRESIDENT

Preserving the environment and building economies need no longer be seen as competing goals. Increasingly, new technologies are beginning to harness sustainable energies in ways that both protect the global environment and expand economic opportunity for global citizens. Indeed, if we are to endow future generations with the environment *and* the economic opportunity they deserve and require, this trend must continue. As a step in that direction, the Overseas Private Investment Corporation (OPIC) is issuing the enclosed report, *Climate Change: Assessing Our Actions*.

The report found that OPIC's power portfolio is driven predominantly by clean-burning, low-carbon natural gas (45 percent) and carbon-free hydro- and geothermal energy (27 percent). It concludes that OPIC-supported projects "are *not* a major contributor to global greenhouse gas emissions or climate change." Current carbon dioxide emissions from OPIC-supported projects represent 0.24 percent of global CO_2 emissions. In addition, OPIC projects tend to utilize highly efficient advanced technologies, more than 45 percent of them making use of combined cycle technology – the most efficient electricity-generating technology available.

For OPIC, the report is satisfying on several counts. First, it affirms our leadership role among bilateral investment finance and export credit agencies in assessing the environmental impact of the projects we support. Rather than calculating only the annual aggregate emissions of CO_2 from OPIC's thermoelectric power projects, the report takes into account the *cumulative* impacts of OPIC's *entire* thermoelectric portfolio.

Secondly, a third party verifier reviewed OPIC's methodology – the same methodology applied by the World Bank and other leading international financial organizations to make their calculations – and confirmed the validity of the results. Independent verification is the best support for OPIC's effort to undertake responsible environmental protection.

Lastly, the report represents OPIC's progress down a road less travelled. Since 1985, when Congress gave OPIC a specific environmental mandate, OPIC has evaluated the environmental consequences of each and every prospective project. Not only will OPIC reject support for projects that pose major or unreasonable adverse environmental impacts, but we actively look for opportunities to make a *positive environmental difference* through the projects we support.

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In 1998, OPIC began to calculate and report on annual aggregate emissions of carbon dioxide from its thermoelectric power projects, responding to the need for responsible environmental stewardship in the face of the growing importance of transboundary and global environmental impacts. And, throughout, OPIC has carefully monitored the projects in its portfolio to ensure ongoing compliance with World Bank-level standards.

In that context, *Climate Change: Assessing Our Actions* represents the latest and most advanced OPIC measure to track the environmental impacts of the projects it supports. We at OPIC see our commitment to natural gas as part of our role in helping the developing world make a transition to less carbon-intensive fuels. Without question, that is the single greatest contribution OPIC can make to the trend toward weaving together environmental and economic needs.

Yet this report is one of only many steps OPIC intends to take in that process. More needs to be done to harness and support renewable energy sources such as wind and solar power. OPIC looks forward to working with the renewable energy industry to develop innovative financing mechanisms which will help lead newer technologies into the marketplace.

In the meantime, we are issuing *Climate Change: Assessing Our Actions* as a demonstration of OPIC's commitment to the principle that economic development and environmental protection can go hand in hand.

Sincerely,

George Muñoz
President and Chief Executive Officer
Overseas Private Investment Corporation

Independent Review

OPIC is to be congratulated for its forthright effort to assess the global warming and other environmental impacts of the power projects that it finances and insures. The greatest growth in electric power is expected in developing countries and Eastern Europe, and so the greatest opportunity for avoiding the locking in of carbon dioxide, methane and air pollution emissions over the next half-century lies in the investments now being made there.

Before I begin, I have just two caveats. My analysis is based solely upon the report itself, and I did not independently examine the raw data, nor did I verify the types of projects that OPIC has supported.

First, the methodology used by OPIC for the analysis of its projects is a standard and generally accepted method for estimating CO_2 emissions from power plants. A rough estimate shows that the reported figures are of the right scale. The only additional related greenhouse gas emissions that might be significant are from methane. Methane is a much more potent greenhouse gas than CO_2 and is associated with leaks from aging gas pipelines, from coal mining, and oil and gas production. However, OPIC is either not invested at all (e.g. coal mining) or is not heavily invested in these sectors compared to thermoelectric power.

The report appropriately calculates CO_2 emissions three ways: total tons, as a percentage of global and of developing country emissions, and as an index of tons of carbon dioxide per Gigawatt of OPIC supported power capacity. The total tons provides a measure of the total contribution of OPIC projects to global warming, while the percentages place that in an overall context. The figure of 0.24% of world emissions, projected to grow to 0.43% by 2015 may seem small, but still represents a measurable contribution and should not be ignored. The third intensity measure may be the most useful in determining how OPIC projects compare with other investments. From the high efficiency and the mix of projects supported to date, OPIC projects have lower GHG emissions than the average constructed in the regions, but in the future this comparison should be quantified. OPIC might also utilize this index as a criterion and as a measure of progress for future projects. The relevant question is what will be OPIC's greenhouse gas policies towards future projects; should it consider adopting an incentive program for lowering emissions from future projects? As stated, the potential for emissions growth in developing countries justifies OPIC's efforts to support lower emitting power projects. OPIC might also wish to take more credit for the co-benefits of clean air that accompany their projects as well as the CO_2 reductions.

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The proposal to develop a workshop for renewable supply options in the near future is commendable, and builds upon two ongoing trends. The first is the high success demonstrated by the Danish government in promoting Danish built wind turbines in countries such as India. The second is the emerging potential of some sort of a Clean Development Mechanism for low carbon energy projects in developing countries that will be decided at a meeting in the Hague this November.

The proposal to "reach out to the renewables industry" has real potential for identifying low carbon options for future OPIC projects. For example, wind turbines are the fastest growing source of energy supply on a percentage basis, and world installed capacity now exceeds 15,000 MW – nearly equaling OPIC's total installed capacity of 16,775 MW. The potential for OPIC to finance low carbon emitting options in the power sector could lower their projected increase in carbon dioxide emissions, and help establish a standard for others to follow. The pessimistic forecast of EIA and DOE for renewables could be correct for the US, but may not apply to the opportunities in developing countries that lack the extensive transmission and distribution system of the US. Also, the opportunities for renewables in deregulated markets is largely untested, and projections of their potential, even in the US, vary widely.

The US Senate position on the participation of developing countries in meaningful reductions must be seen in the following context: the UNFCCC and the Berlin Mandate both clearly state that developing countries have "differentiated responsibilities" and that industrial countries must be the first to proceed with reductions. That said, OPIC, whose sole focus is on the developing world, has the unique opportunity to play an important role facilitating the participation of the developing countries critical to the resolution of the climate problem.

Prof. William R. Moomaw
Director, International Environment and Resource Policy Program
The Fletcher School of Law and Diplomacy, Tufts University, Medford, MA

Executive Summary

- OPIC has undertaken a review of the cumulative annual greenhouse gas (GHG) emissions and climate implications of all OPIC finance and political risk insurance projects since 1990. This review is consistent with OPIC's long-standing commitment to the environment and sustainable development. OPIC's review concludes that the cumulative annual GHG emissions from OPIC-supported projects do not substantially contribute to global GHG emissions and associated climate change impacts. Current CO_2 emissions from OPIC-supported projects represent approximately 0.24% of global CO_2 emissions.

- OPIC attributes its conclusions to the fact that its 16,775 MW power portfolio relies primarily on less carbon-intensive natural gas and carbon-free renewable hydroelectric and geothermal rather than carbon-intensive coal and oil. OPIC-supported power projects, on a capacity basis, are approximately 45% gas-fired, 24% hydroelectric, and 3% geothermal, while coal- and oil-fired projects make up approximately 21% and 7%, respectively. In addition, OPIC-supported power projects tend to use highly efficient advanced technologies that emit fewer GHGs per unit of electrical output. For example, more than 43% of OPIC-supported fossil fuel-fired power projects incorporate combined cycle technology, the most efficient fossil-based electricity generating technology.

- Although OPIC-supported projects are not in themselves a substantial contributor to climate change, OPIC recognizes that renewables, such as wind and solar power, have a potentially important role to play in reducing global reliance on fossil fuels and their concomitant GHG emissions. Therefore, OPIC will seek to support these emerging power sources through better outreach to the renewable energy industry and by providing innovative financing.

- OPIC's methodology and conclusions have been independently validated by a noted climate change expert.

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I. OPIC and Climate Change

Summary: OPIC is a bilateral development agency and a major source of financing and support for the development of U.S. private sector participation in a wide range of investments, including many independent power projects, in developing countries and emerging economies. OPIC-supported power projects serve a critical development objective and bring considerable economic and social benefits to developing regions. However, the power sector is a major source of the anthropogenic greenhouse gas (GHG) emissions that threaten the stability of the global climate system. OPIC understands the serious implications of GHG emissions and climate change and was the first bilateral finance, investment insurance or export credit agency to commit to tracking and reporting annual CO_2 emissions. This report, however, goes beyond OPIC's annual GHG assessments, to evaluate the cumulative climate implications of all OPIC finance and political risk insurance projects since 1990. The results of this report demonstrate that OPIC is not a substantial contributor to global GHG emissions or to climate change. Annual CO_2 emissions from OPIC-supported power projects represent less than 0.24% of global CO_2 emissions. Although OPIC activities are not in themselves a substantial contributor to climate change, OPIC recognizes that renewables, such as wind and solar power, have a potentially important role to play in reducing global reliance on fossil fuels and their concomitant GHG emissions. Therefore OPIC will seek to support these emerging power sources through better outreach to the renewable energy industry and by providing innovative financing for such projects.

OPIC is an independent government agency whose mission is to mobilize and facilitate the participation of United States private capital and skills in the economic and social development of less developed countries and areas, and countries in transition from nonmarket to market economies. In carrying out this mission, OPIC's finance and political risk insurance programs support a wide range of investments in some 140 developing countries. All OPIC projects support the U.S. economy, contribute to the economic and social development of the host country, protect the rights of workers, and safeguard the environment. All OPIC projects meet World Bank environmental, health and safety standards, and OPIC carefully monitors projects in its portfolio to ensure ongoing compliance with these standards.

Developmental Benefits of Power

The power sector represents 30% of the OPIC project portfolio. OPIC-supported power projects serve a critical development objective and bring considerable economic and social benefits to developing regions. Access to energy supply is fundamental to eradicating poverty and improving standards of living around the world, where nearly two billion people live below the poverty line without access to modern forms of energy, such as electricity. The availability of energy to provide water supply and sanitation or

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refrigerators for vaccines, for example, has a great impact on health. Freeing rural people, usually women and children, from the daily routine of collecting fuelwood or carrying drinking water over long distances makes them available for more productive work or for education, both of which are primary development objectives and lead to future income opportunities and increased standards of living.

CO_2 Emissions from Power Projects

However, while power projects have considerable economic and social developmental benefits, they are also responsible for a significant share of the anthropogenic emissions of greenhouse gases (GHG) that threaten the stability of the global climate system. The consumption of fossil fuels, which provides electricity, heat and steam to the industrial, commercial and residential sectors, and fuel to the transportation sector, is by far the largest contributor to global carbon dioxide (CO_2) emissions. Approximately 38% of total global energy consumption goes to supply power plants which are the largest emitters of CO_2, accounting for nearly 32% of total global CO_2 production.

Power plants produce electricity by converting chemical energy stored in fossil fuels into electrical energy. During the energy conversion process, fuel-bound carbon is oxidized to CO_2 and released to the atmosphere. Fossil fuels like natural gas, that have relatively high chemical energy contents and low carbon contents, produce the lowest emissions of CO_2, while coal generally produces the greatest CO_2 emissions. In addition, some power generation technologies, like combined-cycle plants, are more efficient at converting chemical energy into electrical energy and produce fewer CO_2 emissions per unit of electrical output. As a result, fuel and technology choices have a significant impact on the level of CO_2 emissions produced by power generation facilities, with natural gas and high efficiency combined cycle plants producing significantly lower CO_2 emissions than other fossil fuel-based plants. Renewable energy projects generally produce little or no CO_2.

Climate Change

Carbon dioxide and other atmospheric greenhouse gases have long been known to absorb infrared radiation and create a natural greenhouse effect that warms the Earth. The natural greenhouse warming of the atmosphere keeps the Earth approximately 60°F warmer than it would be without an atmosphere. However, humans have been emitting increasing quantities of these greenhouse gases since the advent of the fossil fuel-driven industrial age and now emit 25 billion tons of CO_2 annually. As a result, atmospheric CO_2 concentrations are now at their highest levels in more than 160,000 years and global mean temperature has increased approximately 1°F over the past century. There is a strong and growing scientific consensus that these steady additions of GHGs have tipped a delicate balance and begun to impact our climate and may be the dominant force driving recent warming trends. *(For more information on climate change, see Chapter III: An Introduction to Climate Change.)*

Given the link between GHG emissions and development, industrialized countries are responsible for the bulk of past GHG emissions. However, the rapid economic and population growth forecast for the coming decades, particularly in the developing world, is expected to substantially increase demand for energy and global GHG emissions. Global CO_2 emissions are projected to increase from 22.6 billion metric tons in 1997 to 29.9 billion metric tons in 2010 and 36.7 billion metric tons in 2020 (not taking into account the potential impact of the Kyoto Protocol, as discussed below). Developing countries as a group are expected to account for as much as 70% of this increase. Current forecasts suggest that growth in GHG emissions could double atmospheric concentrations of CO_2 by 2060 with a resulting temperature increase of as much as 2° to 6.5°F over the next century. Even the low end of such a temperature increase would be an unprecedented rate of warming and may alter patterns of precipitation and evaporation and lead to more severe weather, rising sea levels, and potentially adverse economic, ecological and human health impacts. *(For more information on GHGs, see Chapter IV: Global Production of Greenhouse Gas Emissions.)*

International Response to Climate Change

The potential adverse effects of "enhanced" greenhouse warming and climate change have been the focus of much international debate. Power plants and other major energy systems in particular have been the focus of attention from the Intergovernmental Panel on Climate Change (IPCC), the international organization tasked with assessing the risk of human induced climate change. International efforts to reduce GHG emissions and stabilize atmospheric GHG concentrations culminated in 1997 with the Kyoto Protocol to the UN Framework Convention on Climate Change (UNFCCC), which commits industrialized countries to legally-binding GHG emissions reduction targets. Although 83 countries have signed the Protocol, only 16 countries have ratified it to date. Given the critical role of energy in development and in improving living standards, the goal of the Protocol is not to limit access to energy, but to provide energy that is less carbon intensive. As different approaches to achieve emissions reductions are carefully evaluated and international negotiations continue, most countries have implemented programs similar to those in the U.S. that promote research, tracking and reporting of carbon emissions, voluntary mitigation measures, energy efficiency and renewable energy technologies. For the most part, governments and international organizations continue to support fossil fuel power plants. The U.S. government does not currently regulate CO_2 domestically and the EPA has not promulgated emission limits for CO_2. *(For more information on the international response to climate change, see Chapter V: International Response to Climate Change.)*

OPIC and Climate Change

OPIC has a longstanding commitment to the environment and sustainable development and recognizes the serious implications of climate change and the need to stabilize atmospheric GHG concentrations. OPIC continually strives to make its portfolio more climate friendly

by proactively seeking renewable energy projects and by seeking to harmonize its approach to climate change issues with that of other U.S. Government entities. OPIC's actions with respect to climate change are generally consistent with the international response to climate change and clearly ahead of its foreign bilateral counterparts. In February 1998, in an effort to support global GHG management efforts, OPIC became the first bilateral finance, investment insurance or export credit agency to commit to tracking and reporting annual CO_2 emissions. OPIC's most recent annual GHG assessment demonstrates that OPIC-supported power projects continue to be heavily weighted toward climate-friendly natural gas and that these projects contribute only small amounts to global GHG emissions. *(For more information on OPIC's environmental polices, procedures and recent initiatives, see Chapter VI: OPIC and the Environment.)*

This report goes beyond OPIC's annual Greenhouse Gas Assessment Reports, to evaluate the cumulative (CO_2) climate implications of all OPIC finance and political risk insurance projects since 1990. OPIC conducted this analysis of its role in GHG production in accordance with prescribed methods of assessing GHG emissions. As will be seen in the following section, the results of the analysis demonstrate that OPIC is not a substantial contributor to global CO_2 emissions or climate change. Annual CO_2 emissions from OPIC-supported power projects, which produce the bulk of OPIC-related GHG emissions, represent approximately 0.24% of global GHG emissions. OPIC's power portfolio relies primarily on less carbon-intensive natural gas and carbon-free renewable energy sources rather than carbon-intensive coal and oil. In fact, natural gas (45%) and renewable energy (27%) drive 72% of the OPIC power portfolio. In addition, OPIC projects incorporate advanced technologies that reduce GHG emissions.

Renewable Energy

Although OPIC-supported projects are not in themselves a substantial contributor to climate change, OPIC recognizes that renewables, such as wind and solar power, have a potentially important role to play in reducing global reliance on fossil fuels and their associated GHG emissions. Renewable energy projects, particularly wind and solar, offer compelling environmental advantages when compared to conventional fossil fuel-based power generation, including little or no conventional pollutant and GHG emissions. However, renewable energy projects face serious challenges competing with conventional fossil fuel-fired power projects and have achieved only limited success in the marketplace. In addition to high capital costs, one of the most significant challenges facing renewable energy projects is the subsidy given by many governments to conventional forms of energy.

Another challenge facing renewable energy development is the remote, decentralized nature of many renewable energy projects. Very large conventional power projects, a gigawatt-sized fossil fuel-fired plant for example, can find investment capital at much lower interest rates and longer tenors than can hundreds of thousands of micro-hydro projects or wind installations of a few kW each. Banks and financing agencies are generally ill-equipped to manage myriad micro projects, so aggregation of demand is necessary if a "level playing field" is to be established in financing renewable energy

projects. Such challenges led the U.S. Department of Energy (DOE) to conclude that over the next two decades it is unlikely that renewable energy can compete economically with conventional fossil fuel-based power generation. According to the U.S. DOE, "failing a strong world wide commitment to environmental considerations, such as the limitations and reductions of CO_2 emissions outlined in the Kyoto Climate Change Protocol, it is difficult to foresee significant widespread increases in renewable energy use" in the near to medium term[1].

However, there are indications that the market for renewables may be brighter than the above assessment would indicate. The wind industry, arguably one the biggest renewable energy success story, now has a global installed capacity of 14,000 MW and is growing at 35 to 40% per year. Last year, for the first time, more new wind capacity was brought on line than nuclear power. And the solar photovoltaics industry, which is now a $1 billion industry, is growing a 30% per year. The potential of renewables has not escaped the big conventional energy companies, including BP Amoco, ABB, Enron and others, all of which have made considerable investments in the renewable sector. ABB, for example, has divested much of its conventional power portfolio and announced a new 'Alternative Energy Solutions' program, with a target of $1 billion turnover per year by 2005.

And many developing countries and emerging markets are beginning to make modest commitments to including renewable resources in their energy mix as well. India has a Ministry of Non-Conventional Energy Sources and has developed several policies to promote renewables, including tax incentives, automatic environmental clearances and soft loans for certain renewable energy projects. Brazil has committed to invest substantial sums to increase the number of its non-hydro renewable energy installations. Several African countries have implemented policies to promote renewable energy technologies. In addition, there are specialized, off-grid applications where renewables may be more competitive because the costs associated with transmissions lines and other requirements increase the cost of conventional fossil fuel-fired power projects. These types of policies and projects demonstrate the opportunity for national and international efforts that support investment in these countries that contributes to meeting the climate challenge ahead.

It is in the interest of the U.S. to continue to encourage and assist developing countries in making these commitments to renewables. As an agency whose sole focus is on the developing world, OPIC has the opportunity to play a unique role facilitating the participation of countries whose involvement is critical to the resolution of the climate problem. OPIC routinely is involved in the investment process, working with both host governments and U.S. and foreign investors. However, there is a need to understand more fully both the needs of renewable energy developers and how developing countries determine their energy requirements and establish bid specifications for power projects.

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[1] International Energy Outlook 2000 (Washington, D.C.: Energy Information Administration, 2000) 93.

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Therefore, to further explore the potential to support renewable energy projects, OPIC will organize or co-sponsor a workshop focused on the renewable energy industry in FY2001 to explore and evaluate the impact of innovative financing mechanisms. OPIC's goal will be to determine whether its finance and insurance programs can be more effectively utilized to support renewable energy projects.

II. Greenhouse Gas Emissions from OPIC-Supported Power Projects

Summary: In order to evaluate the cumulative GHG emission and climate implications of its programs, OPIC evaluated every project that received either finance or political risk insurance support since 1990. The results of this evaluation demonstrated that power sector projects produce the bulk of OPIC-related GHG emissions. Since 1990, OPIC has support 52 projects totaling 16,775 MW capacity. Annual CO_2 emissions from these projects are approximately 56.4 million metric tons per year and represent approximately 0.24% of global CO_2 emissions. In addition, OPIC supports a power portfolio that is dominated by less carbon-intensive natural gas (44%) and carbon-free renewable energy (28%) resources, while carbon-intensive coal (21%) and oil (7%) make up a smaller portion of the portfolio. In all, approximately 72% of OPIC's power portfolio is either less carbon-intensive natural gas or zero-carbon renewable, and 43% incorporates combined cycle technology – the most efficient fossil-based electricity generating technology. Even in 2015, when OPIC's portfolio is likely to peak in size and emissions, it will only contribute 0.43% to global CO_2 emissions. As a result, OPIC activities are not a substantial contributor to global CO_2 emissions

In order to assess the cumulative GHG and climate implications of its investment activities, OPIC evaluated the number and types of projects that have received finance or political risk insurance support since 1990. OPIC supports a wide variety of projects; as seen in Figure 2.1 the power and financial services sectors each account for approximately 30% of the OPIC portfolio. While the oil & gas sector makes up 10% of the OPIC portfolio, including production, processing and transportation activities, these projects generally result in only relatively minor GHG emissions. For example, OPIC has supported two new gas pipeline projects and two investments in large, pre-existing gas pipeline systems since 1990. While estimates of methane leakage from gas pipelines range from 0.5% to over 5% of throughput, the high quality flanges, valves and compressors incorporated into new pipeline projects and upgrades to existing pipeline systems can reduce these emissions by as much as 60% - 80%. As a result, GHG emissions from OPIC-supported gas pipeline projects are expected to be very small, especially when compared to power sector emissions. In addition, while hydrocarbon stocks are commodities that may be seen in terms of potential future emissions, IPCC guidance clearly indicates that GHG inventories are to include emissions – not potential future emissions. Therefore oil & gas projects were not included in the OPIC assessment. OPIC's portfolio contains no significant transportation projects and, for the most part, OPIC-supported industrial projects are only minor GHG emitters compared to a single large power plant. As a result, the bulk of OPIC-related GHG emissions are derived from its power sector projects.

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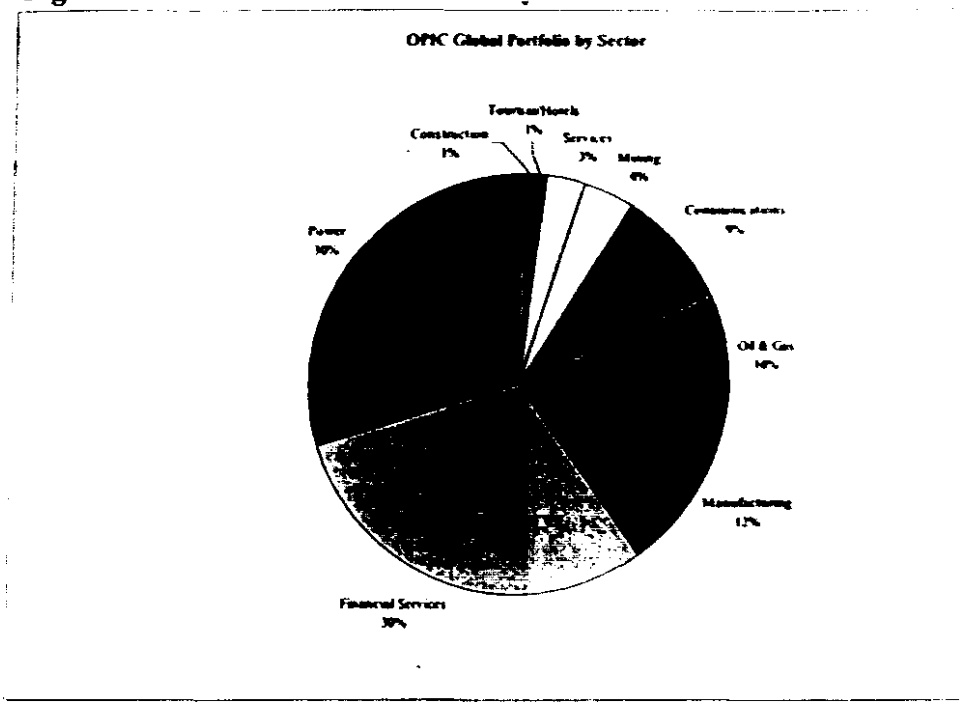
Figure 2.1: OPIC Global Portfolio by Sector



Source: OPIC Annual Report, 1999

Methodology

Estimates of power plant CO_2 emissions involve a fairly simple mass balance equation based primarily on the quantity and type of fuel consumed and the heat rate (efficiency) of the generating technology. The World Bank, IPCC, and other organizations have published various methodologies to assess GHG emissions from power generation facilities. The methodology used in this assessment is adapted from the World Bank's *Greenhouse Gas Assessment Handbook: A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions*[2].

The equation used to calculate CO_2 emissions for each power project is presented in Table 2.1 below. The variables in the equation are: plant size (A), plant heat rate (B), and a fuel-related emission factor (C). The constant (D) incorporates a plant capacity factor and converts the emissions into units of tonnes of CO_2 per year.

[2] World Bank, Global Environment Division, Greenhouse Gas Assessment Handbook: A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions (Washington, D.C.: The World Bank, September 1998) 19.

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Table 2.1: Equation Used to Calculate Power Sector CO_2 Emissions

CO_2 emissions (tonnes/year) =   *A (MW) * B (Btu/Kwh) * C (g/GJ) * D (tonnes/g * GJ/Btu * kW/MW * hrs/yr)*

Plant-specific fuel consumption data was not used in this assessment. Conservative fuel consumption is built into the equation based on the plant size (A), heat rate and an assumed plant capacity factor of 85%. The capacity factor is simply the ratio of the amount of electricity a plant produces to the maximum amount of electricity a plant could produce if it were operated at full capacity for the entire 8,760 hours of the year. For this report, it was assumed that all plants operate at full capacity 85% of the year.

Each type of plant (generating technology) was assigned a heat rate (B). Plant heat rate is the total fuel heat input expressed in Btu divided by the net power leaving the power plant expressed in kWh. Heat rate is a measure of the generating technology's efficiency at converting chemical energy in the fuel into electrical energy and typically varies with plant load. The heat rates used in this report are presented in Table 2.2 below. The lower heat rate (higher efficiency) of combined cycle technology means that less fuel is required to produce a unit of electrical output and therefore less CO_2 emissions are produced.

Table 2.2: Heat Rates by Generating Technology

Generation Technology	Efficiency, (%)	Heat Rate, (Btu/KWh)
Combined-Cycle	0.47	7,266
Simple-Cycle	0.35	9,757
Engine	0.45	7,588
Steam Turbine	0.33	10,348

Each type of fuel was assigned an emission factor (C). The emission factor determines the amount of CO_2 that is produced per unit of energy content of the fuel consumed. The emission factors used in this assessment are presented in the Table 2.3 below. The factors demonstrate that natural gas combustion releases significantly less CO_2 than other fossil fuels and hydro and geothermal do not directly release CO_2.

Table 2.3: Emission Factors by Fuel Type

Fuel Type	Emission Factor, (g CO_2/G. Joule)
Coal	94,600
Residual Fuel Oil	77,350
Diesel Oil	74,050
Natural Gas	56,100
Hydro	0
Geothermal	0

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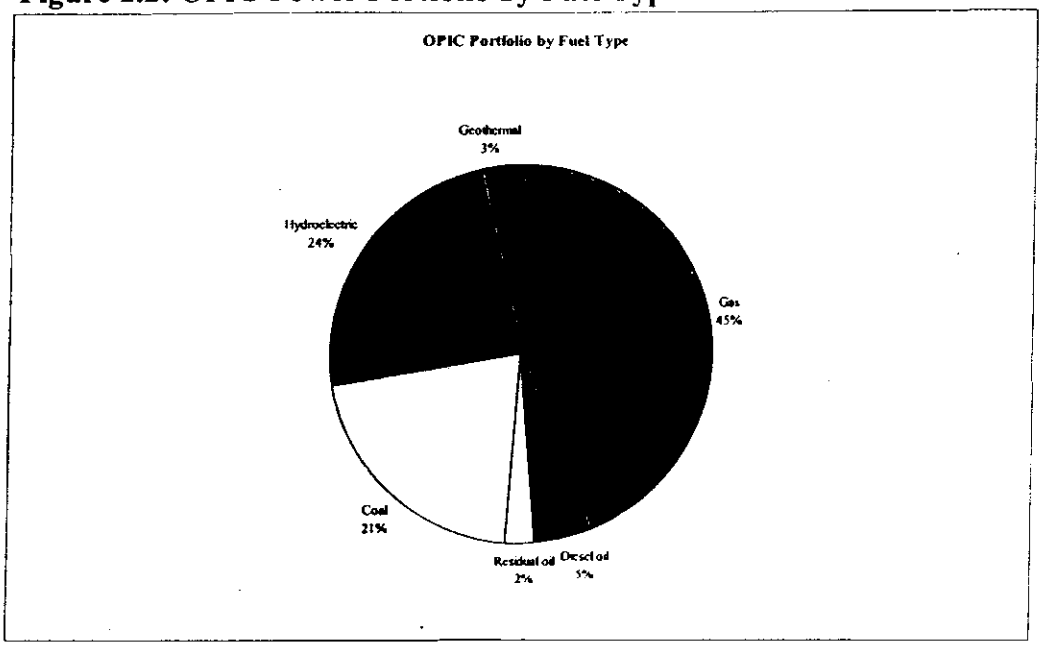
In accordance with the *Greenhouse Gas Assessment Handbook* methodology, plant size and the appropriate emission factor and heat rate were inserted into the above equation to calculate CO_2 emissions from each plant. Because quantities of other GHGs emitted by power plants (e.g. NO_2 and CO) are significantly less in comparison to CO_2, their contributions were not factored into the analysis. This methodology was used to calculate CO_2 emissions from each power project that has received OPIC support since 1990. Here, "OPIC support" refers to the making of a loan or the issuance of an insurance contract. Projects for which a commitment did not result in a loan or an insurance contract were not included in this assessment. *(For a complete list of OPIC-supported power projects, see Appendix I: OPIC-Supported Power Projects.)*

OPIC Power Portfolio

OPIC supported 52 power projects with a total capacity of 16,775 MW between 1990 and 2000. As seen in the Figure 2.2, 19 gas projects with a total capacity of 7,363 MW account for 44% of OPIC's power portfolio based on capacity. Renewable energy projects, including 11 hydroelectric (4,080 MW) (for the most part all preexisting or run-of-river facilities) and 4 geothermal projects (585 MW), make up the second largest group at 4,665 MW, accounting for 28% of the power portfolio. Thus, the preponderance of OPIC-supported power projects, 72% by capacity, are fueled either by natural gas or renewable energy sources. The remainder of the portfolio consists of 4 coal-fired (3,534 MW) and 9 oil-fueled power plants (1,214 MW), representing 21% and 7% of capacity, respectively. In addition, approximately 43% (by capacity) of OPIC-supported fossil fuel-fired plants utilize combined-cycle technology, the most energy efficient type of fossil fuel-based power plant. Prior to 1990, OPIC supported only one power project involving the upgrade of a powerhouse at a preexisting hydroelectric facility.

Figure 2.2: OPIC Power Portfolio by Fuel Type



OPIC Power Portfolio CO_2 Emissions

Cumulative annual CO_2 emissions from these projects are approximately 56.4 million tonnes. Gas- and coal-fired plants release the bulk of these CO_2 emissions, with emissions of approximately 24.8 and 26.1 million tonnes, respectively. The remaining emissions are from oil-fired plants and total approximately 5.5 million tonnes per year. As percentages, CO_2 emissions from the OPIC portfolio are as follows: 56.2% coal-derived, 43.9% gas-derived and 9.7% oil-derived.

Carbon dioxide emissions from OPIC-supported power projects contribute relatively small amounts to existing CO_2 emissions in the developing countries where these projects are located or to global CO_2 emissions. As can be seen in Figure 2.3, annual CO_2 emissions from these projects represent only 0.63% of annual CO_2 emissions from developing countries, which total 9.0 billion tonnes, and less than 0.24% of annual global CO_2 emissions which total 23.7 billion tonnes[3].

[3] Pia Hartman at the U.S. Department of Energy's Energy Information Administration, correspondence with author, July 21, 2000.

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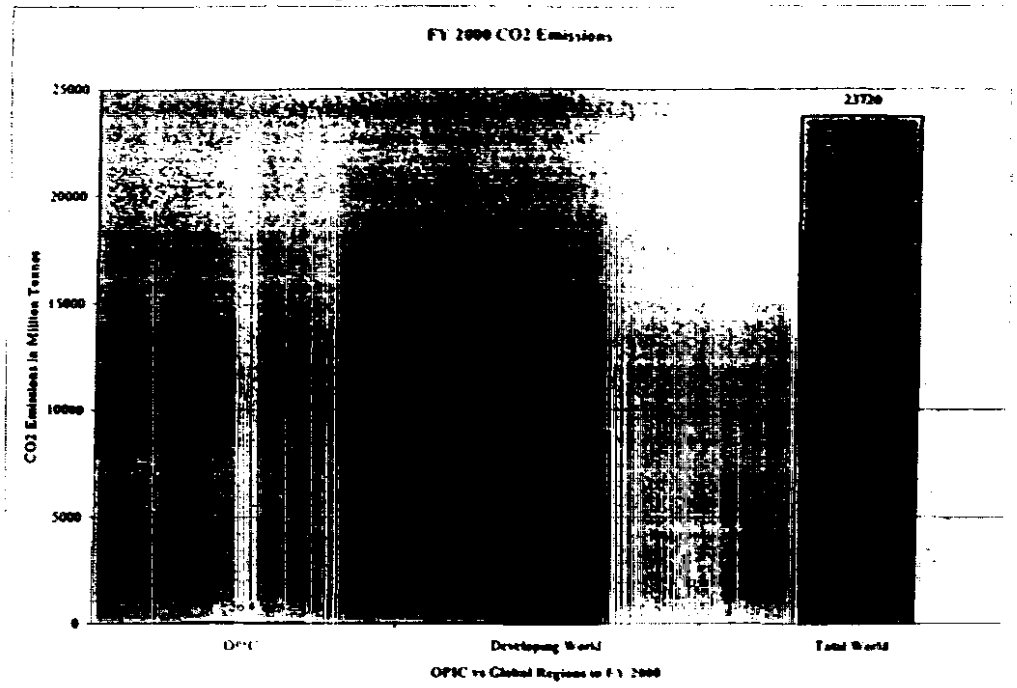
Figure 2.3: CO_2 Emissions from OPIC-Supported Power Projects vs CO_2 Emissions from Developing Countries and the World



In addition to relatively minor CO_2 emissions, the fuel mix of the OPIC power portfolio is largely weighted toward gas and renewable projects. As seen in the Figure 2.4, OPIC's fuel mix consists of significantly more gas (43% vs. 13.6% and 17%) and renewables (28% vs. 26% and 21%), and less coal (21% vs. 43.1% and 36%) and oil (7% vs. 13.6% and 9.3%) than the prevailing fuel mix of the developing world or the global electricity sector. **As a result, when compared with the current power sector fuel mix in these regions, OPIC's power portfolio may be seen as driving investment in gas and renewable projects - investments that are critical to reducing GHG emissions in these regions.** In fact, in "Natural Gas: Bridge to a Renewable Energy Future", the Renewable Energy Policy Project argues that natural gas can serve as a bridge to a renewable energy future[4].

[4] Serchuk, Adam and Means, Robert, Natural Gas: "Bridge to a Renewable Energy Future," (Washington, D.C.: Renewable Energy Policy Project, May 1997.)

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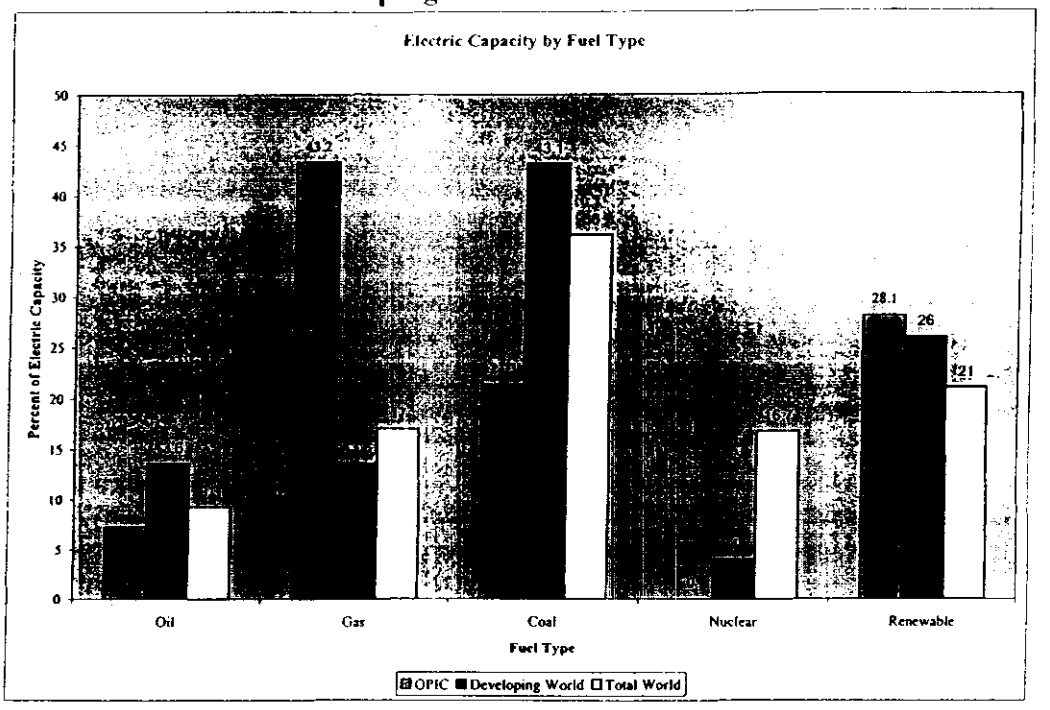
Figure 2.4: OPIC Portfolio by Fuel Type Compared with the Power Sector Fuel Mix in Developing Countries and the World



Future OPIC Portfolio Emissions

Predicting future growth rates and fuel mix trends of OPIC's portfolio is somewhat difficult. Increased electricity demand in the developing world might increase the growth rate of OPIC's power portfolio. On the other hand, economic upheaval or the implementation of international actions to mitigate climate change might significantly slow the growth of the portfolio. With respect to fuel mix trends, the enactment of international efforts to limit CO_2 emissions could significantly affect fuel mix away from carbon-intensive fuels and towards renewable projects.

If we assume that the growth rate and fuel mix of the portfolio remains constant and that each power plant will operate for 25 years, the size of OPIC's portfolio would peak at 42,000 MW by 2015. After 2015, for each unit of power capacity added to the portfolio, a 25-year old unit of capacity would be taken out of commission. CO_2 emissions would peak in 2015 at approximately 141 million tonnes per year. By that time, CO_2 emissions from developing regions and globally are expected to have increased to about 15 and 32.6 billion tonnes per year, respectively. Therefore, as presented in Figure 2.5, peak future emissions from OPIC's power portfolio would account for approximately 0.94% and 0.43% of CO_2 emissions from these regions.

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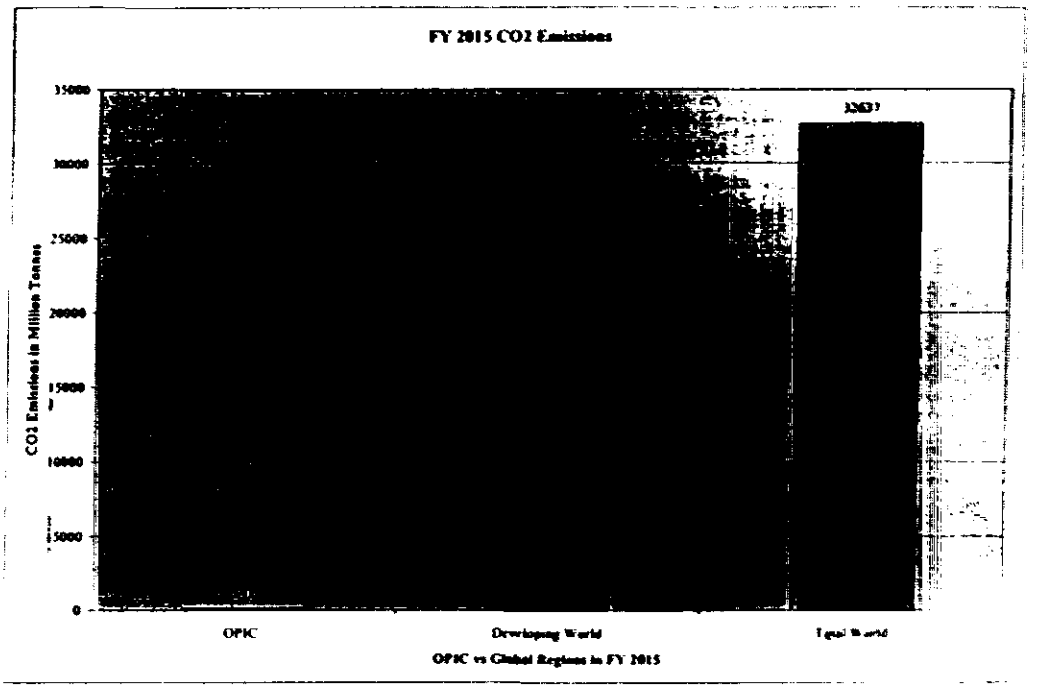
Figure 2.5: Anticipated CO_2 Emissions from OPIC-Supported Power Projects vs. Total CO_2 Emissions from Developing Countries and the World in 2015



Given the size of the contribution of CO_2 emissions from OPIC's power portfolio to global CO_2 emissions both now (0.24%) and in the future (0.43%) and the implications of the portfolio fuel mix, OPIC's power sector activity is not a substantial contributor to global GHG emissions and global climate change. In addition, because the power sector is responsible for the vast majority of OPIC-related GHG emissions, it can be concluded that OPIC programs in general are not a substantial contributor to global climate change.

In many respects, this GHG assessment involves assumptions that tend to make its results conservative. For example, in providing project financing, OPIC typically participates in only up to 50% of the total costs of a new power project, while a somewhat higher participation may be considered in the case of the privatization or expansion of an existing plant. In addition, the term of OPIC involvement in the power sector is typically limited to loan terms of 12-15 years and insurance contracts of up to 20 years. And finally, OPIC often supports the privatization of power projects - and the privatization of existing power projects does not generally result in net incremental increases in emissions and often involve efficiency improvements or fuel-switching that result in net emissions reductions. Yet in this assessment, OPIC takes full responsibility for the projects' 25-year lifetime CO_2 emissions.

It is also important to consider that OPIC power sector activities generally achieve significant supplementary benefits for the environment when compared to other sources of finance or insurance. OPIC projects are required to meet high environmental performance standards that generally exceed host country environmental requirements. OPIC requires annual monitoring reports and third party independent compliance audits and conducts site visits to ensure ongoing compliance with all its environmental requirements. In addition, OPIC often is involved in the privatization of existing power plants. Such projects typically involve significant environmental performance improvements – often through the installation of expensive environmental control technologies like electrostatic precipitators or flue gas desulfurization units. **As a result, OPIC-supported power projects are generally among the cleanest, most efficient projects in the developing world.**

Although OPIC activities are not in themselves a substantial contributor to climate change, OPIC understands the serious implications of GHG emissions and climate change. OPIC recognizes that renewables, such as wind and solar power, have a potentially important role to play in reducing global reliance on fossil fuels and their associated GHG emissions. Renewable energy projects generally offer compelling environmental advantages when compared to conventional fossil fuel-based power generation, including little or no conventional pollutant and GHG emissions. However, renewable energy projects face serious challenges competing with conventional fossil fuel-fired power projects and have achieved only limited success in the marketplace. OPIC will seek to support these emerging power sources through better outreach to the renewable energy industry and innovative financing mechanisms.

III. An Introduction to Climate Change

Summary: Atmospheric gr[illegible] gases have long been known to absorb infrared radiation and warm the Earth. The natural greenhouse warming of the atmosphere keeps the Earth 60°F warmer than it otherwise would be. However, humans have been emitting increasing quantities of [illegible] greenhouse gases since the advent of the fossil fuel-driven industrial age and now annually emit 25 billion tons of CO_2, the most important anthropogenic GHG. As a result, atmospheric CO_2 concentrations are now at their highest levels in more than 160,000 years. Ice core records and other data demonstrate a strong correlation between atmospheric CO_2 concentrations and global mean temperatures. During the 20th century, global mean temperatures have increased approximately 1°F degree. However, precisely how much of the recent warming is due to human influences and how much is due to natural climate variations is the focus of much current research. In addition, while [illegible] studies indicate that human activities have begun to impact our climate and [illegible] the dominant force driving recent warming trends, the extent and [illegible] temperature changes and their potential impacts remains unclear. Climate models suggest that foreseeable growth in GHG emissions could double atmospheric concentrations of CO_2 in 100 years, with a resulting temperature increase of as much as 6°F over the next century. Even the low end of this estimate would be an unprecedented rate of warming and may alter patterns of precipitation and evaporation, lead to more severe weather, rising sea levels, and potentially adverse economic, ecological and human health impacts.

The Earth is constantly heated by incoming shortwave radiation from the sun. This heating is offset by reflected infrared radiation leaving the planet. A portion of this reflected terrestrial radiation, though, is itself absorbed by gases in the atmosphere. As illustrated in Figure 3.1, the energy from this absorbed terrestrial radiation warms the Earth's surface and atmosphere creating what is known as the natural Greenhouse Effect. This strong infrared absorptivity is extremely robust and can be readily measured in the laboratory and from Earth orbiting satellites. Simply put, the atmosphere is like a "blanket" around the planet. The Earth is 60°F warmer than it would be without an atmosphere.

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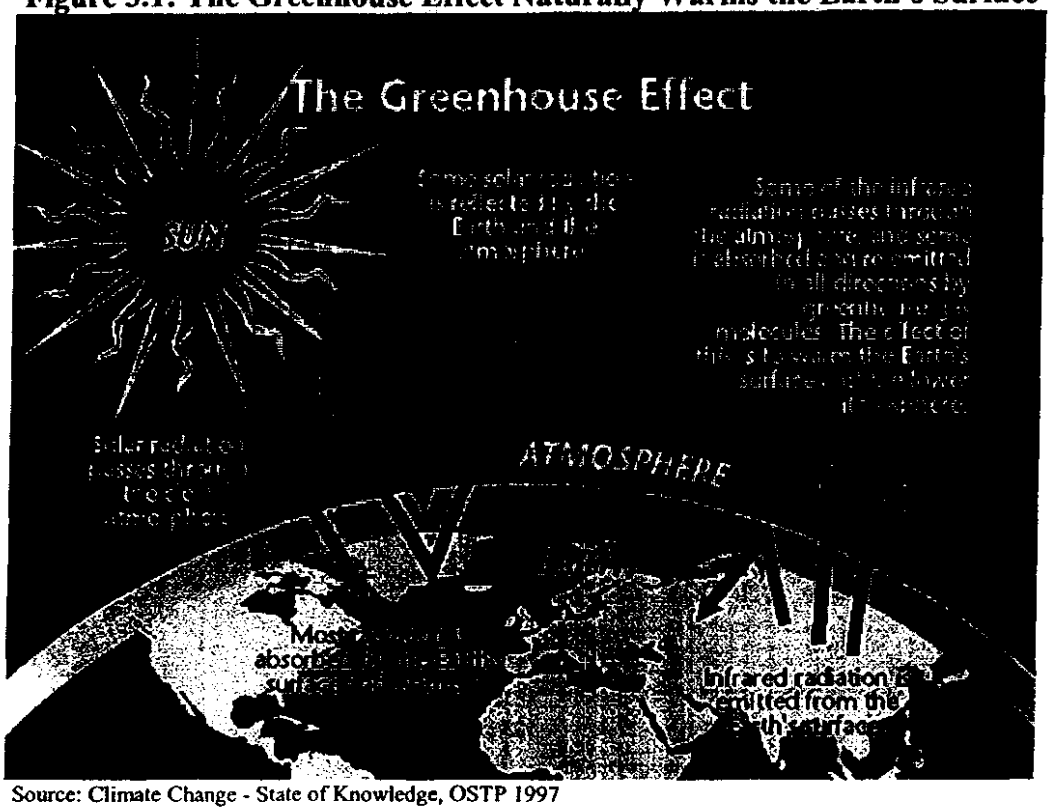
Figure 3.1: The Greenhouse Effect Naturally Warms the Earth's Surface



Source: Climate Change - State of Knowledge, OSTP 1997

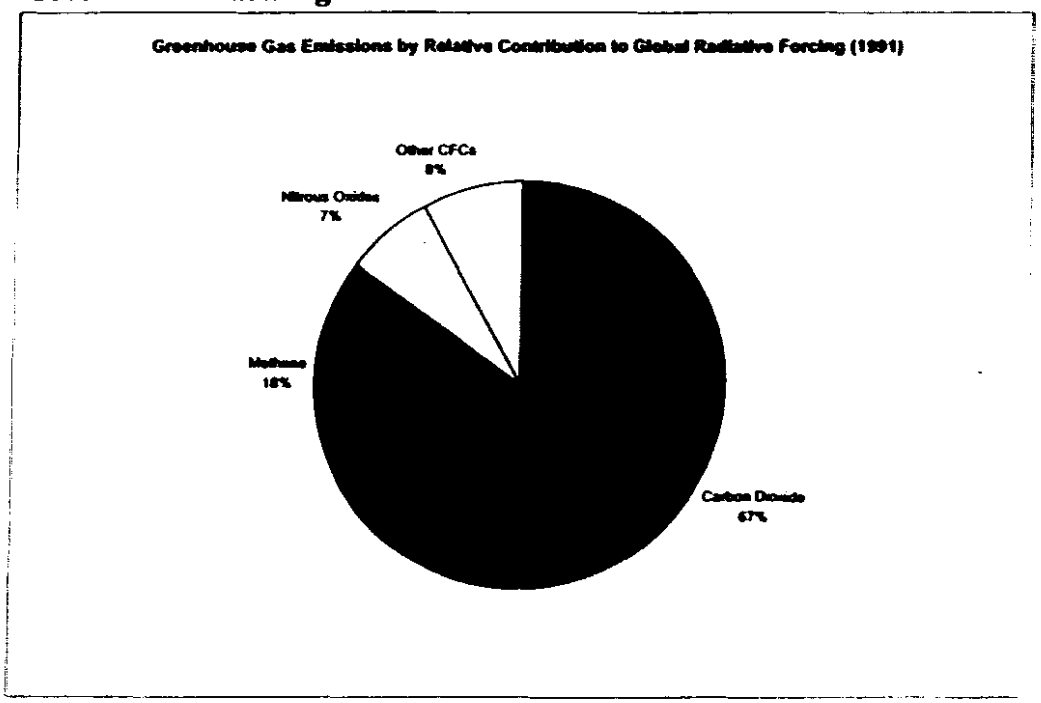
Greenhouse Gases

The gases responsible for the strong atmospheric absorption of infrared radiation are called greenhouse gases (GHGs). Water vapor and CO_2 are the most important GHGs and are responsible for the bulk of greenhouse warming. Both water vapor and CO_2 are naturally occurring as are other greenhouse gases including methane, nitrous oxide, and ozone. Human activities, however, add to the levels of most of these naturally occurring gases, and are the sole source of other powerful classes of GHGs, including chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), among others.

Greenhouse gases generally persist for long periods in the atmosphere. While many conventional air pollutants may persist in the atmosphere for only a matter of hours or days, many important GHGs persist for decades or even hundreds of years. For example, CO_2 has an estimated atmospheric persistence of 120 years and some CFCs may persist for as long as 400 years. As a result, these gases accumulate, become very well mixed in the atmosphere and have a global impact that is mostly independent of where they were emitted. GHG persistence has significant policy implications because the gases we emit today may impact the climate system for hundreds of years.

GHGs differ in their ability to absorb infrared radiation. Among the most infrared radiation-absorbent are the CFCs, HFCs and PFCs. Other powerful GHGs include nitrous oxide and methane. For example, a molecule of CFC-12 is 15,800 times, CFC-11 is 12,400 times, nitrous oxide is 270 times and methane is 21 times as effective in absorbing infrared radiation as a molecule of CO_2[5]. However, because atmospheric concentrations of these compounds are much less than concentrations of CO_2, they play a lesser role in greenhouse warming and climate change. Figure 3.2 depicts the relative contribution to greenhouse warming of various GHGs when both their radiation absorbing characteristics and their relative concentration are considered. As illustrated, CO_2 is the largest contributor to climate change, or radiative forcing, followed by methane and nitrous oxide, which together account for over 90% of total radiative forcing. Water vapor is not included because it is a feedback gas - meaning its concentration is mainly a function of other climate parameters, not emissions.

Figure 3.2: The Contribution of Selected Greenhouse Gases to Greenhouse Warming



Source: Greenhouse Gas Assessment Handbook, World Bank 1998

[5] Robert G. Watts, ed., Engineering Response to Global Climate Change: Planning a Research and Development Agenda, (New York: Lewis Publishers, 1997) 6.

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Increasing Atmospheric GHG Concentrations

The basic story of human-induced greenhouse warming remains simple. With industrialization and population growth, GHG emissions from human activities have continuously increased. These steady additions of GHGs now include more than 23 billion tonnes of CO_2 per year and have begun to tip a delicate balance, significantly increasing atmospheric GHG concentrations and creating an "enhanced" greenhouse effect[6].

Accurate measurements of atmospheric CO_2 concentration began in 1958 at the Mauna Loa Observatory in Hawaii. Information on atmospheric CO_2 concentrations prior to 1958 can be derived from the analysis of ice, and the bubbles of air within it, from various depths in Antarctica. Ice cores have been drilled through the Antarctic ice cap as deep as 3 km, indicating conditions over the past 160,000 years. Figure 3.3 presents results of an analysis of ice core data and more recent data from Mauna Loa and demonstrates that atmospheric concentrations of CO_2 have increased from approximately 280 to 350 parts per million by volume (ppmv), an increase of nearly 30%, since the beginning of the industrial revolution[7]. As a result, atmospheric CO_2 concentrations are now at their highest levels in more than 160,000 years. Other GHGs have increased as well, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15%.

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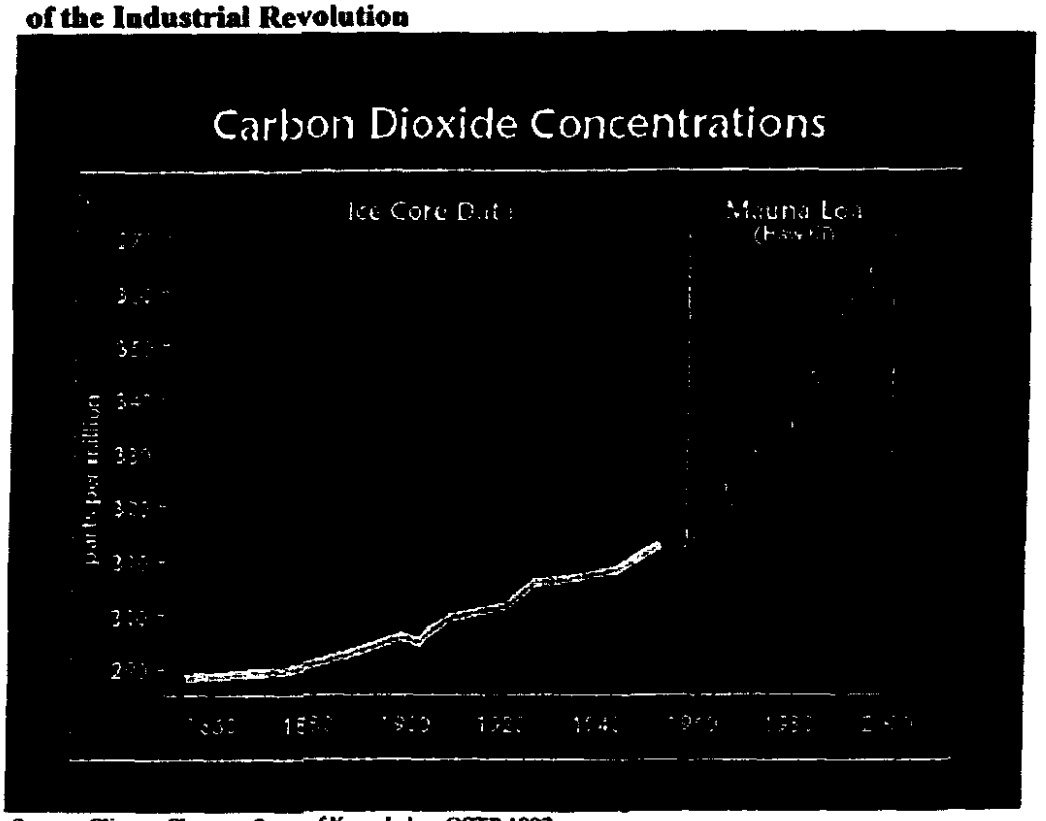
6 International Energy Outlook 2000 (Washington, D.C.: Energy Information Administration, 2000) 179.

7 Executive Office of the President, Office of Science and Technology Policy, Climate Change: State of Knowledge (Washington, D.C.: Office of Science and Technology Policy 1997) 4.

Figure 3.3: Concentration of CO_2 in the Atmosphere Since the Beginning of the Industrial Revolution

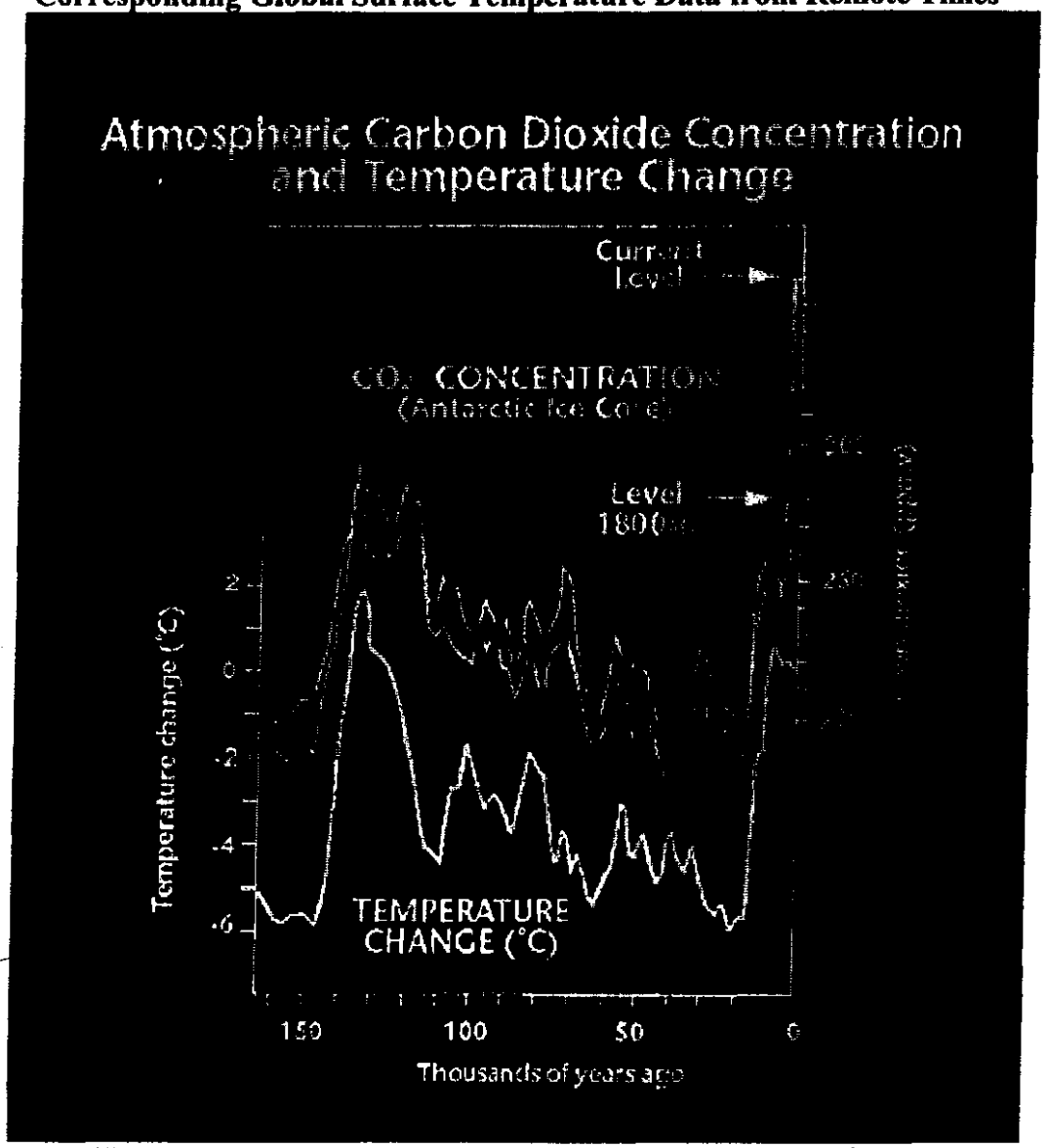


Source: Climate Change - State of Knowledge, OSTP 1997

Carbon Dioxide – Global Temperature Relationship

Information on remotely past climates is obtained by means of considerable ingenuity. Figure 3.4 illustrates the changes in the CO_2 concentration in air bubbles within ice from various depths (i.e., since 160,000 years ago) beneath Vostok, Antarctica along with the temperature during bubble formation. The temperature is estimated from the ratio of the amount of 'heavy' oxygen (with a molecular weight of 18) to that of normal oxygen, with a molecular weight of 16. The ratio depends on the global sea-surface temperature at the time the bubbles were trapped. The figure illustrates how fluctuations in CO_2 concentrations and global average temperatures have roughly mirrored each other over the last 160,000 years.

Figure 3.4: Atmospheric Carbon Dioxide Concentrations and Corresponding Global Surface Temperature Data from Remote Times



Source: Climate Change - State of Knowledge, OSTP 1997

Figure 3.5 illustrates more recent warming trends and demonstrates that global mean surface temperature has increased by as much as 0.6° -1.2°F since the late 19th century. These figures strongly suggest that increasing CO_2 concentrations provide a measurable direct addition to the atmospheric trapping of infrared radiation leaving the surface of our

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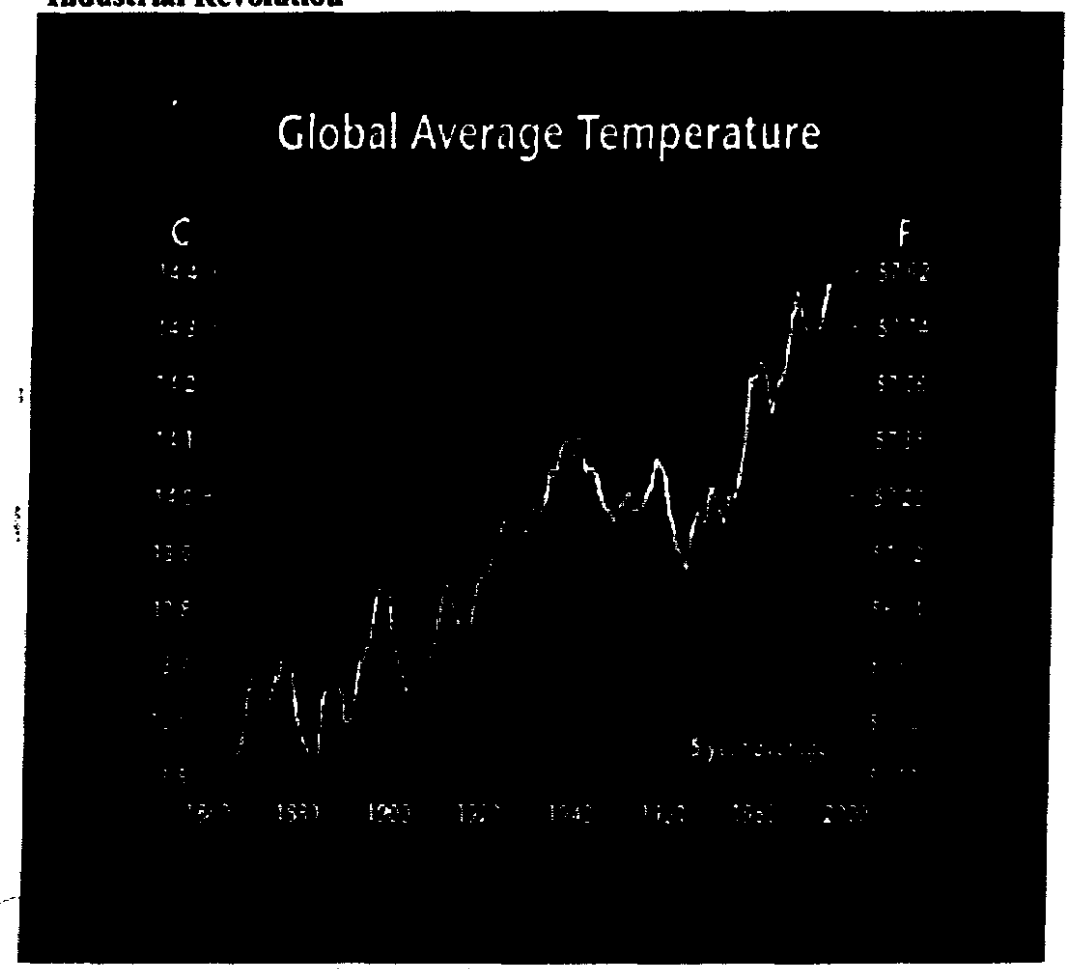
planet and an "enhanced" greenhouse warming. In effect, adding CO_2 and other GHGs to the atmosphere is like adding another "blanket" to the planet.

Figure 3.5: Global Average Temperature Since the Beginning of the Industrial Revolution



Source: Climate Change - State of Knowledge, OSTP 1997

Climate Feedback Mechanisms

The global climate system is complex and involves many positive feedback mechanisms that tend to amplify the warming caused by increasing CO_2 concentrations. As mentioned above, water vapor is by far the most dominant greenhouse gas. However, water vapor enters the climate system mostly as a "feedback" gas. In other words, atmospheric water vapor concentration is largely a function of global temperature and atmospheric holding capacity for water vapor increases exponentially with temperature. As a result, CO_2

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induced warming is augmented by increased water vapor concentrations, creating a powerful positive feedback mechanism.

A smaller positive feedback involves the relationship between ice at the Earth's surface and its reflectivity (albedo) of solar radiation. In essence, if ice or snow cover melts, the surface left exposed (ground, vegetation, or water) is generally less reflective of incoming solar radiation. This leads to more absorption of the solar radiation, thus more warming, less ice, and so on. This "ice-albedo" feedback process further amplifies the calculated warming response of the climate caused by increased concentrations of CO_2 and infrared absorbing gases.

Natural vs. Anthropogenic Effects

While the greenhouse effect and global warming are generally accepted by most of the scientific community, the cause of global warming remains the subject of some debate. Many scientists attribute the current global warming to an "enhanced" greenhouse effect caused by the build up of atmospheric GHG concentrations caused by human activities. Other scientists suggest that natural factors are responsible, including primarily changes in the radiation flowing from the sun, which is thought to follow many complex cycles, and volcanoes, which temporarily cool the Earth by lofting a veil of fine sulfate droplets that reflect sunlight.

Resolving this puzzle – the balance between human and natural influences – has been something of a holy grail in atmospheric science, particularly because the answer could determine whether countries enact plans in coming years to reduce GHG emissions. Few contest the idea that some of the recent climate changes are likely due to natural processes - after all, significant climate changes have occurred since long before human activity is thought to have begun to play a role a century ago. The last two millenia, for example, were marked by relative warmth between 900 –1200 AD (the Medieval Warm Period) and worldwide cooling between about 1450 and 1850 (the Little Ice Age)[8].

However, recent studies have begun to clarify the magnitude of anthrogenic influences on the climate system. A new analysis of the climate of the last 1,000 years suggests that human activity is the dominant force behind the sharp global warming trend seen in the 20th century[9]. The study found that natural factors, like fluctuations in sunshine or volcanic activity, were powerful influences on temperatures in past centuries and when fed into a computer model simulating the flow of energy to and from the Earth, produced temperatures that match most of the ups and downs of the actual climate from the year 1000 to the mid 1800's. But the relationship among sunlight, eruptions and temperature broke down completely in the 20th century, when the study found that natural factors could account for only 25% of the warming since 1900. The only "radiative forcing" that

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8 Linacre, Edward and Geerts, Bart, Climate and Weather Explained: An Introduction From A Southern Perspective (New York: Routledge, 1997) 338-339.

9 Crowley, Thomas J., "Causes of Climate Change over the Past 1000 Years," (Science, July 14, 2000) 270-277.

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remotely matched the jump in temperatures seen in the latter half of the century was the rise in GHG emissions. Although these results will continue to be refined, they demonstrate the significance of human impact on climate change and imply that future actions to address the issue may be required.

Anticipated Impacts

Current forecasts indicate that, unless effective international efforts to reduce CO_2 emissions are adopted, atmospheric CO_2 concentrations could reach twice the preindustrial level by 2060, with an associated average global temperature increase of 2° to 6.5°F by 2100. Even the low end of this range represents an unprecedented rate of change compared to the past 10,000 years. In fact, the difference in temperature from the last ice age to now is about 9°F[10]. By increasing the energy of the climate system, such a temperature increase may lead to more intense rainfall, and thus flooding, in some areas, but more frequent drought-like condition in other areas. Current rates of sea-level rise are expected to increase by a factor of two to five due to both the thermal expansion of the oceans and the partial melting of mountain glaciers and polar ice caps. Changes in precipitation and crop-pest relationships could adversely impact agricultural production. Increased temperatures may extend the range of insect-borne diseases, including malaria and dengue fever and adversely impact human health. And finally, changes in temperature and precipitation can disrupt natural ecosystems, such as forests, rivers, and wetlands.

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[10] Executive Office of the President, Office of Science and Technology Policy, Climate Change: State of Knowledge (Office of Science and Technology Policy 1997) 1.

IV. Global Production of Greenhouse Gases

Summary: Carbon Dioxide is the most important anthropogenic GHG and its production can be used as an indicator for other GHGs. CO_2 results primarily from fossil fuel consumption and land use changes. Industrialized countries are responsible for the bulk of past CO_2 emissions. However, rapid economic and population growth in developing countries is expected to substantially increase demand for energy and significantly increase CO_2 emissions from these countries. As a result, as much as 70% of the growth in global CO_2 emissions over the next two decades will come from the developing world. Electricity generation is the largest source of CO_2 emissions. Fuel and technology choices have a significant impact on the level of CO_2 emissions produced by power generation facilities, with natural gas and high efficiency combined cycle plants producing significantly lower CO_2 emissions than other fossil-based plants and renewable energy projects generally producing little or no CO_2. International efforts to reduce GHG emissions and stabilize atmospheric GHG concentrations culminated in the Kyoto Protocol to the UNFCCC which calls on industrialized countries to reduce GHG emissions in order to stabilize atmospheric concentrations of these gases. However, even if industrialized countries are able to achieve their reduction targets, future GHG emissions will still grow substantially due to rapidly increasing emissions from the developing world. Therefore, any success in stabilizing GHG concentrations will likely require the participation of developing countries and a major commitment to natural gas, renewable energy, energy efficiency and improved land-use management.

The major anthropogenic sources of GHG emissions worldwide are fossil fuel consumption, non-fossil methane emissions and land-use changes[11]. The consumption of fossil fuels, which provides electricity, heat and steam to the industrial, commercial and residential sectors, and fuel to the transportation sector, is by far the largest contributor to GHG emissions and accounts for approximately 73% of global GHG emissions. In fact, fossil-based electric power generation alone accounts for approximately 32% of global CO_2 production[12]. Non-fossil based methane (CH_4) from solid waste, rice production, agriculture and livestock account for approximately 14% of GHG production. And land use changes, principally deforestation, which release the CO_2 stored in forest organic matter and soils, account for approximately 11% of total GHG production. As seen in Figure 4.1, these three sources make up the bulk of GHG emissions and are believed to be largely responsible for the rapid rise in atmospheric concentrations of CO_2 and other GHGs since pre-industrial times.

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[11] World Bank, Global Environment Division, Greenhouse Gas Assessment Handbook: A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions (Washington, D.C.: The World Bank, September 1998) 7.

[12] Pia Hartman at the U.S. Department of Energy's Energy Information Administration, correspondence with author, July 7, 2000.

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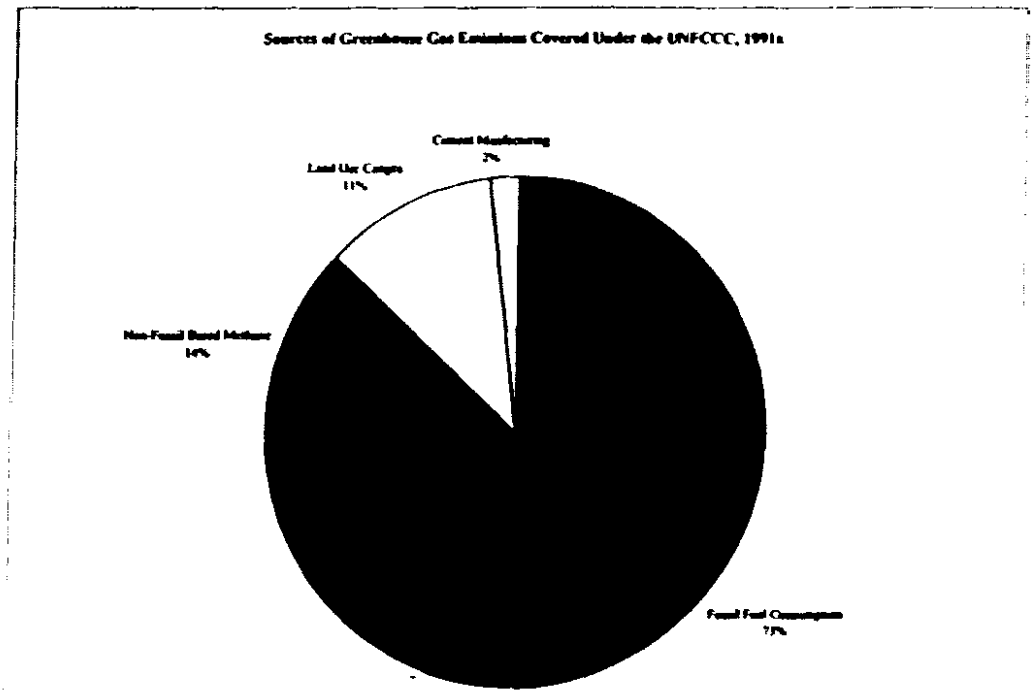
Figure 4.1: Sources of the Greenhouse Gases Covered Under the UNFCCC



Source: Greenhouse Gas Assessment Handbook, World Bank 1998

GHG Emissions and Development

Energy demand is closely associated with both population and economic growth. Because energy supply in most countries is largely based on fossil fuels, carbon emissions tend to grow rapidly with development, particularly among countries with relatively low levels of per capita income. For example, among low-income economies (excluding China), GDP grew at a rate of 2.8% per year between 1980 and 1994, while commercial energy consumption grew at a much higher rate of 4.7% per year[13]. The reasons for this are straightforward - the energy demands of industrial economies are far greater than those of agricultural economies. As developing countries transition from agricultural to industrial economies, fossil fuel consumption tends to increase rapidly. Moreover, with increasing per capita income household energy use grows because of the increased number of

[13] United Nations Development Programme and the World Resources Institute, Promoting Development While Limiting Greenhouse Gas Emissions: Trends & Baselines (New York: United Nations, 1999) 3.

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appliances. Energy consumption for transportation grows as the per capita ownership of private vehicles increases.

Among high-income countries, however, growth in energy consumption becomes increasingly "decoupled" from growth in GDP for a number of reasons. These economies often experience a shift from energy-intensive industrial sectors to less intensive service sectors. Moreover, the levels of energy use in certain sectors, such as households, become saturated as most consumers reach income levels at which further growth in consumption of energy-intensive appliances slows. Finally, technological advances regularly increase energy efficiency, holding down growth in energy demand even with growing economic activity. As a result of these factors, some OECD countries have exhibited stable or declining levels of CO_2 emissions in recent years.

Global CO_2 Emissions

Carbon Dioxide is the most important anthropogenic GHG, and its production can be used as an indicator for the other GHGs. Global CO_2 emissions have grown from 14.0 billion metric tons in 1970 to more than 22.6 billion metric tons in 1997; an increase of nearly 60%. Because fossil fuel consumption, and hence CO_2 emissions, are closely linked to economic output, past emissions of CO_2 and other GHGs were largely from developed economies. In 1990, 72% of the total CO_2 emissions from human activities came from industrialized countries[14]. The United States, with just 4% of the world's population, accounts for 22% of current global emissions.

In the coming decades, economic and population growth rates in developing countries are expected to significantly outpace those in the industrialized world. Over the next two decades, per capita incomes in the developing world are expected to more than double, and the regions' total population is projected to increase by 35%, accounting for 90% of the world's population growth[15]. As a result, per capita energy use for electricity generation and transportation in the developing countries, which is currently only 1/10 to 1/20 of the U.S. level, will increase rapidly[16].

The International Energy Outlook 2000 (IEO2000) presents an assessment by the Energy Information Administration (EIA) of the outlook for international energy markets through 2020. Its projections anticipate various economic scenarios and are displayed according to three basic country groupings: industrialized regions, the developing countries and Eastern European/former Soviet Union (EE/FSU) countries, with additional details provided for each of these three regions. The report includes a "best estimate" reference projection along with high and low economic growth projections that represent possible alternative growth paths for the energy forecast. The EIA projections are generally consistent with other projections, including those by the International Energy Agency, Standard & Poor's

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14 International Energy Outlook 2000 (Washington, D.C.: Energy Information Administration, 2000) 179.

15 International Energy Outlook 2000 (Washington, D.C.: Energy Information Administration, 2000) 160.

16 Executive Office of the President, Office of Science and Technology Policy, Climate Change: State of Knowledge (Office of Science and Technology Policy 1997) page 6.

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Platt's, Petroleum Industry Research Associates, and Petroleum Economics, Ltd. The following discussion is based on EIA2000 reference case projections.

Based on expectations of regional economic growth and energy demand, global CO_2 emissions are projected to increase from 22.6 billion metric tons in 1997 to 29.9 billion metric tons in 2010 and 36.7 billion metric tons in 2020 (not taking into account the potential impact of the Kyoto Protocol). Developing countries as a group are expected to account for approximately 70% of this increase. Emissions from these countries, which accounted for about 28% of the total global emissions in 1990, are projected to make up 44% of the total by 2010 and nearly 50% by 2020. Figure 4.2 illustrates the increasing contribution of carbon emissions from developing countries to global carbon emissions. Emissions from China, which are expected to rise from 2.9 billion metric tons in 1997 to 7.7 billion metric tons in 2020, constitute about 33% of the projected global increase. Emissions from the industrialized world are expected to rise by 3.3 billion metric tons between 1997 and 2020, led by an increase of 2.2 billion metric tons in emission from North America. In total, the industrialized nations account for just 23% of the projected increase in global CO_2 emissions over the two decades, with EE/FSU accounting for the remaining 7%.

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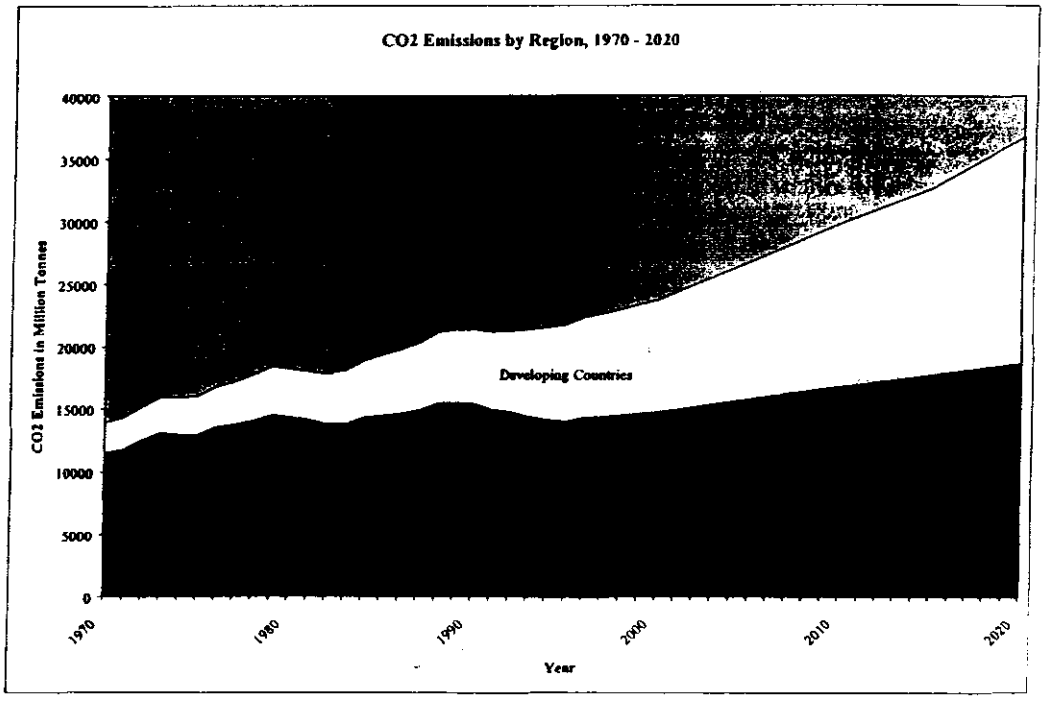
Figure 4.2: World Carbon Emissions by Region, 1970 – 2020



Source: International Energy Outlook 2000, IEA 2000

By 2020, developing countries are expected to surpass the industrialized countries in both energy demand and CO_2 emissions. On a per capita basis, however, CO_2 emissions from the industrialized nations are expected to remain far higher than those from most of the developing countries. Figure 4.3 compares per capita CO_2 emissions of the top ten emitting countries and illustrates that, despite the rapid growth in CO_2 emissions from developing countries, the significant gap between per capita CO_2 emissions in developed and developing countries will persist well beyond 2020.

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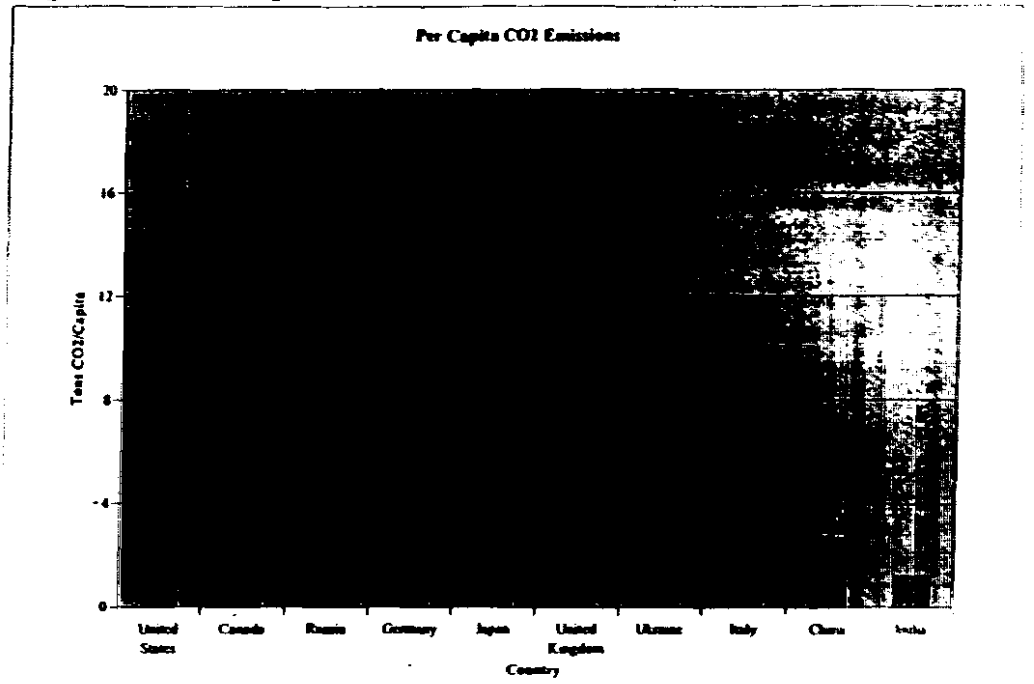
Figure 4.3: Per Capita CO_2 Emissions of the Top Ten Emitting Countries



Source: Stopping the Hot Air, NRDC 2000

There are, of course, forecasts that anticipate significantly different development scenarios and that, as a result, do not predict the same growth rates for fossil fuel consumption and GHG emissions. Forecasts that anticipate a coordinated international effort to reduce GHG emissions generally predict considerably lower fossil consumption and GHG emission growth rates as a result of the rapid deployment of renewable energy technologies, demand side management and energy efficiency improvements.

Electricity Generation

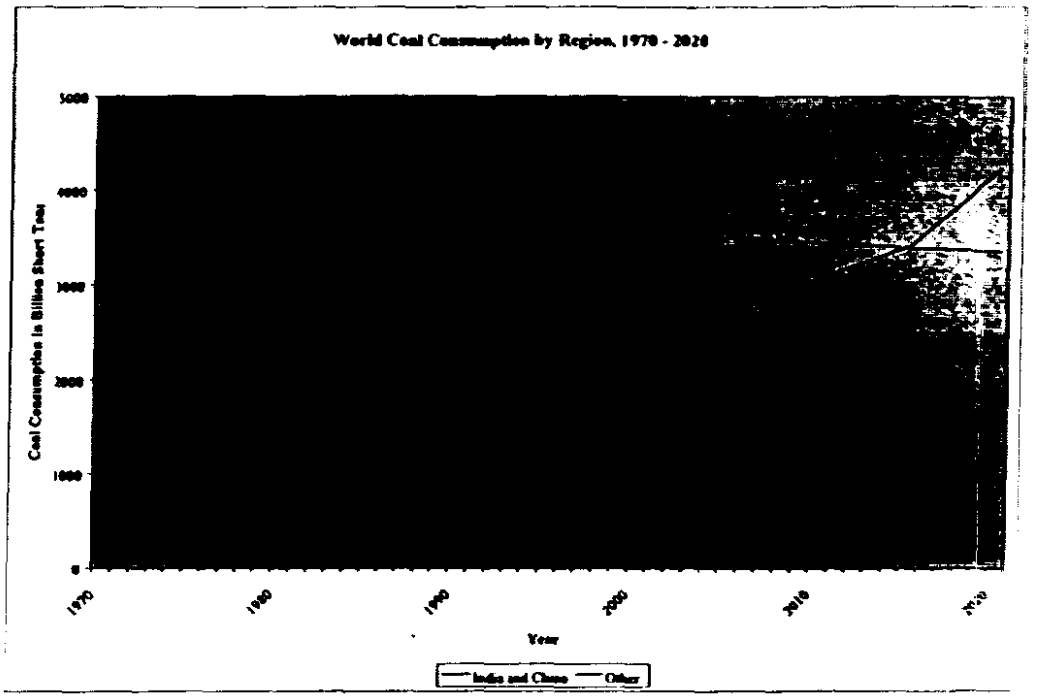
As mentioned above, electric power generation is the largest source of CO_2 emissions. Approximately 38% of total energy consumption goes to supply power plants[17], which account for nearly 32% of total CO_2 production. Power plants produce electricity by converting chemical energy stored in fossil fuels into electrical energy. During the energy conversion process, fuel-bound carbon is oxidized to CO_2 and released to the atmosphere. As a result, fossil fuels like natural gas, that have relatively high chemical energy contents and low carbon contents, produce the lowest emissions of CO_2. While fuels like lignite coal, that have relatively low chemical energy contents and high carbon contents, produce the highest emissions of CO_2.

[17] Pia Hartman at the U.S. Department of Energy's Energy Information Administration, correspondence with the author, July 7, 2000.

In addition, some power generation technologies are more efficient at converting chemical energy into electrical energy. Conventional boiler-based thermal power plants are generally around 33% efficient, while combined-cycle plants are generally around 45-50% efficient. As a result, fuel and technology choices have a significant impact on power plant CO_2 emissions. For example, CO_2 emissions from a gas-fired combined-cycle power plant may be as much as 60% less than emissions from a conventional coal-based power plant. Renewable energy technologies, which generally rely on solar or geothermal energy, produce little or no CO_2.

With worldwide electricity consumption expected to increase by 76% by 2020 compared to 1997 levels, fuel and technology choices will have a major impact on future CO_2 emissions. In the industrialized world, where natural gas is increasingly seen as the fuel of choice for new power plants, nearly 50% of the increase in CO_2 emissions between 1990 and 2020 will be attributed to an increase in natural gas use, while coal use will remain essentially flat. In the developing world, which will account for 61% of the growth in electricity production over the next 20 years, growth in gas consumption will be slower and heavy reliance on coal will continue, particularly in developing Asia. Coal accounts for 41% of the projected increase in CO_2 emissions in the developing world between 1990 and 2020, while oil accounts for 35%, and gas accounts for only 22%. The largest increases in CO_2 emissions are projected for China and India, where coal supplies are plentiful. As seen in Figure 4.4, those two countries alone will account for more than 90% of the projected rise in coal use worldwide over the next two decades.

Figure 4.4: World Coal Consumption by Region, 1970 – 2020

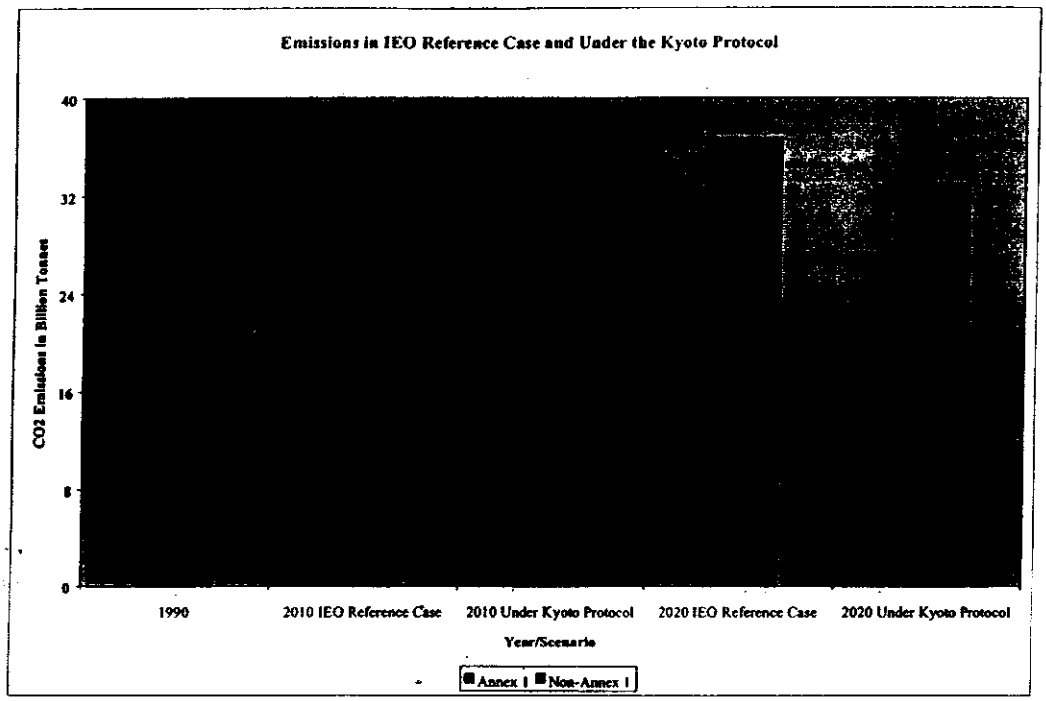


Source: International Energy Outlook 2000, IEA 2000

Implications for the Kyoto Protocol

The projected growth in CO_2 emissions described above has serious implications for implementation of the Kyoto Protocol. Under the Kyoto Protocol, which is intended to stabilize atmospheric GHG concentrations, developed countries (Annex I countries) would be required to limit GHG emissions to approximately 5% below 1990 levels by 2012. Assuming no coordinated Kyoto-like international actions are taken to reduce global CO_2 emissions, as seen in Figure 4.5 below, global CO_2 emissions are expected to exceed their 1990 levels by 40% in 2010 and by 72% in 2020. Given the significant CO_2 emissions increases anticipated from developing countries, even if Annex I countries were able to meet the emission limits or reductions prescribed in the Kyoto Protocol, worldwide CO_2 emissions still would grow by more than 31% and 55%, by 2010 and 2020, respectively. Therefore, the participation of developing nations and a shift to climate-friendly gas and renewable energy, along with major energy efficiency and agricultural and forest management improvements, will be needed to effectively reduce CO_2 and other GHG emissions and stabilize atmospheric concentrations of these gases.

Figure 4.5: World Carbon Emissions in the IEO2000 Reference Case and under the Kyoto Protocol



Source: International Energy Outlook 2000, EIA 2000

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V. International Response to Climate Change

Summary: International efforts to reduce GHG emissions and stabilize atmospheric GHG concentrations culminated in 1997 with the Kyoto Protocol to the UN Framework Convention on Climate Change, which commits industrialized countries to legally-binding GHG emission reduction targets. Many governments (85) have signaled their commitment to addressing climate change by signing the Protocol (although only 16 countries have ratified it to date) and are working with key international institutions to evaluating complex policy options that have potentially significant economic and environmental implications for their countries. Given the critical role of energy in improving and maintaining living standards, the goal of these efforts is not to limit access to energy, but to provide energy that is less carbon intensive. As different approaches to achieving this goal are carefully evaluated and international negotiations continue, most countries have implemented programs similar to those in the U.S. that promote research, [illegible] monitoring of emissions, voluntary mitigation measures, energy efficiency and renewable energy technologies. However, with the exception of [illegible] European countries, [illegible] implemented some form of carbon/energy tax, [illegible] have not [illegible] restrictions on fossil fuels or CO_2 emissions [illegible] with [illegible] climate change appear to be consistent with the [illegible] response to [illegible] but clearly ahead of its foreign bilateral counterparts.

Many governments have signaled their commitment to addressing climate change by signing the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol and are now working with key international institutions to evaluate complex policy options with potentially significant economic and environmental implications for their countries. Access to modern forms of energy is fundamental to development and the eradication of poverty in the developing world, but energy is also responsible for much of the GHG emissions that threaten the stability of the climate system. Therefore the goal of GHG reduction efforts is not to deny people access to energy, but to reduce the carbon intensity of development - which means a less carbon-intensive energy supply, reduced energy demand and improved carbon sinks.

Efforts to reduce the carbon-intensity of the energy supply generally focus on increasing the efficiency of power plants and promoting low-carbon fuels and renewable energy (wind, solar, hydro, geothermal, etc.). Efforts to reduce energy demand typically promote energy efficiency and conservation in the industrial, transport and residential sectors or demand side management. Efforts to encourage improved management of agricultural and forest lands and the protection of forests tend to enhance the Earth's natural capacity to assimilate carbon and mitigate the impact of CO_2 emissions. The Kyoto Protocol includes emissions trading, joint implementation and the clean development mechanisms that are designed to allow countries to work together across their borders to facilitate these

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outcomes. The most effective, economic approach to achieving these outcomes is the focus of the climate debate.

United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 with the goal of stabilizing greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system." Approximately 180 governments, including the U.S. and the European Community, have ratified the Convention, which entered into force in March 1994. The Convention contains the principle of "common but differentiated responsibilities," which designates that those nations contributing most to global warming take the lead in combating its effects. In keeping with this principle, the industrialized countries ("Annex I Parties") agreed to the voluntary aim of returning their emissions to 1990 levels by the year 2000. It also obligated Annex I countries, particularly OECD countries, to provide financial resources and to facilitate technology transfers for climate change initiatives in developing countries and "economies in transition" and established requirements for reporting on climate change policies, programs, and national emissions inventories.

Kyoto Protocol

The Kyoto Protocol to the UNFCCC was adopted in December 1997 after two years of debate and negotiation about the inadequacies of the UNFCCC and its voluntary mechanisms and the need for more meaningful requirements. Much of the inspiration for the Protocol came from the Intergovernmental Panel on Climate Change's Second Assessment Report, which concluded that, "the balance of evidence suggests a discernible human influence on global climate change." The Kyoto Protocol commits developed countries to legally-binding emission reduction targets for six greenhouse gases -- carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride -- to be reached by the period 2008-2012. (CFCs are controlled under the Montreal Protocol.) These targets, which range by country from –5% to +10%, provide for a 5% emissions reduction from 1990 levels in aggregate.

The Protocol is noted for its three flexible, innovate mechanisms – joint implementation, emissions trading, and the clean development mechanism. The primary goal of these mechanisms is to encourage the least costly emissions reduction to be made wherever they are possible. For example, the CDM is intended to promote "win-win" actions in developing countries - that is, actions that enhance development prospects while reducing growth in GHG emissions. The Clean Development Mechanism would allow industrialized countries to finance emissions reduction or avoidance projects in developing countries and credit some or all of the reductions achieved against their own emission limitation targets. The rules governing the CDM have not yet been determined. Depending on how the rules are structured the CDM could be a cost-effective way for industrialized Annex I countries to meet their Kyoto Protocol goals and at the same time aid development prospects of developing countries by stimulating technological "leapfrogging" and generating new investments.

Although 83 countries have signed the Protocol, only 16 countries have ratified it to date. Fifty-five countries, including Annex I Parties accounting for at least 55% of developed country emissions, must ratify the Protocol in order for it to enter into force. Many countries are delaying ratification of the Protocol until operational details are finalized. Others, including the U.S., are upholding ratification until the "meaningful participation" of developing countries is achieved, a prerequisite for U.S. Senate approval as pronounced in the Byrd-Hagel Resolution[18]. The importance of meaningful participation of developing countries was highlighted in the previous section of this report.

Global Environment Facility

The Global Environment Facility (GEF) was launched in 1991 as an experimental facility and restructured after the Earth Summit in Rio de Janeiro, Brazil to provide funds on a grant or concessional loan basis to support projects that address biodiversity loss, climate change, degradation of international waters, and ozone depletion. The GEF is implemented jointly by the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank. UNDP provides technical support and is responsible for the development and management of capacity-building programs and manages the GEF Small Grants Program. UNEP is responsible for scientific and technical analysis, manages the Scientific and Technical Advisory Panel, and catalyses global, regional, and national environmental assessment and policy frameworks. The World Bank, the repository of the Trust Fund, manages investment activities, mobilizes private sector resources, and manages its own GEF project portfolio.

As the financial mechanism for the UNFCCC, the GEF helps developing countries implement the Convention. Specifically, the GEF supports projects that: (i) remove barriers to energy efficiency and energy conservation; (ii) promote the adoption of renewable energy by removing barriers and reducing transaction costs; (iii) reduce the long-term costs of low greenhouse gas emitting energy technologies; and (iv) support the development of sustainable transport. Since its inception in 1991, the GEF has provided access to over $2 billion in funding and has attracted additional funding for projects by helping them to overcome initial investment costs and reducing risks for investors. Around 40% of GEF funds have supported climate change activities.

World Bank Group

The World Bank Group (WBG) is a development institution whose goal is to reduce poverty by promoting sustainable economic growth in its client countries. WBG consists of five closely associated institutions: the International Bank for Reconstruction and Development (IBRD); International Development Association (IDA); International Finance Corporation (IFC); Multilateral Investment Guarantee Agency (MIGA); and the International Centre for Settlement of Investment Disputes (ICSID). The World Bank supports the implementation of the UNFCCC and the Kyoto Protocol through various policies and programs and through their role as an implementing agency of the GEF.

[18] Senate Resolution 98. U.S. Senate, June 12, 1997.

The energy sector has always been an important area of the World Bank's activities. Loan commitments in this sector totaled $2.54 billion in FY 1998 (IDA, IBRD, and IFC) and typically represent between 18 - 20% of total annual commitments of the WBG. Bank renewable energy and energy efficiency loans are often supported by GEF grants. To date WBG loans for renewable energy total $547 million and energy efficiently initiatives, once only component parts of power sector loans, are now addressed in their own right in lending operations. In addition, as an implementing partner of the GEF, the WBG also manages its own portfolio of GEF projects, including over $500 million in support of climate change projects.

In addition to lending and GEF activities, the WBG has a number of programs and initiatives addressing climate change and promoting renewable energy, energy efficiency and providing technical assistance. The longest established program is the Energy Sector Management Assistance Program, which provides technical assistance for the energy sector in six priority areas: energy and the environment; rural and household energy; renewable energy technologies; energy sector reform; energy efficiency; and international energy trade. Other programs include: the Prototype Carbon Fund; the Activities Implemented Jointly Program; the Solar Development Corporation; the Renewable Energy and Energy Efficiency Fund; the Small and Medium Scale Enterprise Program; the Asia Alternative Energy Group; and the Global Carbon Initiative, among many others.

Organization for Economic Co-operation and Development

The Organization for Economic Co-operation and Development (OECD) comprises 29 member countries, including the U.S., that work together to improve economic and social policy. The OECD considers global climate change to be a major challenge, with serious economic and environmental implications. The OECD is working to integrate climate policy objectives into transport, energy, and agriculture sector policies. Key contributions of the OECD include the Climate Technology Initiative, coordination of an annual Forum on Climate Change, analysis of the Kyoto Protocol, and inputs to the Conferences of the Parties. By helping member countries assess domestic and international policies to reduce greenhouse gas emissions, the OECD contributes to the effective implementation of the UN Framework Convention on Climate Change and the Kyoto Protocol.

The OECD has reported that, for the most part, current domestic policies in member countries are inadequate for meeting the targets of the Kyoto Protocol.[19] Several countries (Germany, Italy, Austria, Norway, Sweden, Finland, Denmark, and the Netherlands) have introduced some form of energy/carbon tax, while others are planning or considering such as tax. Although there is talk of domestic tradeable permit systems for CO_2, no such system is currently in use. Other measures employed or considered by member countries include voluntary agreements to reduce emissions, regulatory policies for materials,

[19] Organization for Economic Co-operation and Development, "OECD Perspectives on Climate Change Policies," (OECD, October 26, 1999.)

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buildings and products, green government procurement approaches, research, information and public awareness programs.

U.S. Government

The Climate Change Action Plan (CCAP) was launched in 1993 and was intended to satisfy U.S. commitments under the UNFCCC. The CCAP involves nearly 50 programs and initiatives aimed at reducing GHG emissions. These programs and initiatives generally involve win-win voluntary partnerships, are non-regulatory and address all sectors of the economy, from energy production to forestry initiatives.

Examples of the voluntary programs established by the U.S. government under the CCAP[20] include the DOE's Climate Challenge, which encourages major electric utilities to pledge to reduce their greenhouse gas emissions. The joint DOE/EPA Climate Wise program encourages firms to respond to the challenge of reducing greenhouse gas emissions by setting bottom-line emission targets that they can attain using the most cost-effective means available. The DOE Motor Challenge encourages motor system manufacturers, industrial motor users, and utilities to begin an aggressive program to install the most energy-efficient motor systems in industrial applications. Although the CCAP has achieved considerable success, "these voluntary programs alone are not capable of producing the reductions necessary to return U.S. emissions to 1990 levels."[21]

In anticipation of the December 1997 approval of the Kyoto Protocol, the U.S. announced a renewed effort to address climate change. The plan sets timetables and targets for reaching the 1990 emission levels by the period of 2008 to 2012, anticipates a review of U.S. progress and an evaluation of next steps beginning around 2004 and the implementation of a domestic emissions trading program beginning in 2008. The highlight of the plan is the 5-year, $6.3 billion Climate Change Technology Initiative (CCTI). The CCTI is a package of tax incentives and R&D investments designed to encourage energy efficiency and to help develop low-carbon energy sources and to reduce greenhouse gas emissions.

Complementing its domestic efforts, The United States Agency for International Development (USAID) is responsible for the management of U.S. overseas development assistance. USAID's energy sector strategy addresses climate concerns by promoting the use of renewables, energy efficiency, and clean energy technologies. Activities in the energy sector have been supported by around $180 million annually.

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[20] Nordhaus, Robert R. and Fotis, Stephen, "U.S. Implementation of Voluntary Actions and Programs," Analysis of Early Action Crediting Proposals (Pew Center on Global Climate Change, October 1, 1998.)

[21] Nordhaus, Robert R. and Fotis, Stephen, 14.

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VI. OPIC and the Environment

Summary: OPIC's environmental policies and procedures have long been among the most stringent of any [illegible] investment insurance or export credit agency. [illegible] thorough environmental assessment and post-completion environmental compliance monitoring. The release of the new OPIC Environmental Handbook last year demonstrates a continued commitment to improve environmental policies and procedures, strengthen environmental performance and expand public participation. World Resources Institute has rated OPIC public consultation and disclosure policies the best among our foreign bilateral counterparts. OPIC has taken a lead role in efforts to promote common environmental [illegible] counterpart agencies overseas and has created partnerships with [illegible] agencies and non-governmental organizations (NGOs) to promote [illegible] and development. In response to the threat of climate change, OPIC [illegible] agency to commit to tracking and reporting CO_2 emissions [illegible] power sector projects and to pledge support to projects that reduce [illegible] particular those certified by the U.S. Initiative for Joint Implementation.

OPIC has a long standing commitment to the environment. Since 1985, OPIC has been required by statute to assess the environmental impacts of prospective projects and to decline assistance to projects posing a "major or unreasonable hazard to the environment, health or safety" or resulting in the "significant degradation of a national park or similar protected area." OPIC is required to operate its programs in accordance with the intent of sections 117, 118 and 119 of the Foreign Assistance Act relating to environmental impact assessment, tropical forests, biological diversity and endangered species.

OPIC strongly supports these principles and is committed to ensuring that the projects it supports meet the highest level of environmental performance. All prospective projects receive a thorough environmental assessment and OPIC declines support to projects involving infrastructure or raw material extraction in primary tropical forests and other protected or ecologically fragile areas. In determining whether a project will pose an unreasonable or major environmental, health or safety hazard, OPIC generally relies on guidelines and standards adopted by international organizations such as the World Bank. All prospective projects having potentially significant environmental impacts must submit an EIA, undergo a 60-day public comment period, submit annual environmental monitoring reports and undergo at least one independent compliance audit within the first three years of project operation. And finally, OPIC monitors project compliance with contractual conditions throughout the term of the OPIC loan agreement or insurance contract. *(For a complete description of OPIC's environmental assessment procedures, please see the OPIC Environmental Handbook, at www.opic.gov.)*

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Environmental Handbook

While OPIC's environmental policies and procedures have long been among the most stringent of any bilateral finance, investment insurance or export credit agency, in April 1999, following intensive discussions with its stakeholders, including U.S. businesses and environmental NGOs, OPIC adopted and issued in final form its Environmental Handbook. The handbook codifies OPIC's environmental standards and procedures as they have evolved since 1985, including strengthened environmental requirements, particularly with respect to transparency and public participation.

Public Consultation and Disclosure

OPIC is unique among its foreign bilateral counterparts in its comprehensive procedures for environmental information disclosure. In fact, according to a recent report of the World Resources Institute[22], OPIC is one of only two "leading ECAs" (the U.S. Export Import Bank is the other) to satisfy seven key environmental disclosure criteria. That is, OPIC publishes environmental guidelines, discloses screening criteria, publishes environmental assessment rules, releases project environmental assessments, solicits public comments, discloses projects approved, and reports on CO_2 emissions.

OPIC's public consultation and disclosure process involves posting on OPIC's web site a 60-day notice of environmentally sensitive projects for which OPIC is considering providing support. A list of such postings is maintained on the OPIC web site and members of the public may subscribe to OPIC's Environmental List Server to be automatically notified when OPIC posts a new prospective project. Members of the public may request copies of EIAs and submit comments for any posted projects. All public comments received by OPIC are considered in the assessment of posted projects. OPIC also strongly encourages investors to consult with locally affected people in the host country through the entire duration of their investment projects, and particularly in the preparation of environmental impact assessments and other planning documents.

In addition, OPIC reports annually to Congress and the public regarding its implementation of and compliance with internal, national, and international environmental policies, laws, treaties, and agreements to which its programs are subject. OPIC's Annual Environmental Report (AER) is a voluntary report, and is part of a package of OPIC environmental initiatives proposed by President Clinton at the United Nations General Assembly Special Session (UNGASS) on Sustainable Development in June 1997. The first part of the report summarizes the implementation of the policy changes that OPIC made to fulfill the initiatives announced at UNGASS. The second part reports on the environmental implications of the projects to which OPIC committed its support during the fiscal year, including CO_2 emissions from power projects. The third part describes OPIC's efforts to promote the development of common environmental standards among its counterpart organizations overseas and among private political risk insurers.

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[22] Maurer, Crescencia and Bhandariu, Ruchi, "The Climate of Export Credit Agencies, " Climate Notes (Washington, D.C.: World Resources Institute, 2000) 1-16.

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Common Environmental Standards

OPIC has taken a lead role in efforts to harmonize environmental standards among bilateral finance, investment insurance and export credit agencies. OPIC has encouraged its foreign bilateral agency counterparts, as well as its private sector partners, to recognize the importance of the environment to the long-term viability of the projects they support and to integrate environmental considerations into their investment decision-making. Over the last year, OPIC continued its ongoing efforts to promote harmonization of environmental standards through meetings with our foreign bilateral counterparts in Germany, The German Investment and Development Company (DEG) and Kreditanstalt fur Wiederaufbau (KfW), as well as with representatives of the Japanese Export Import Bank (JEXIM) and the Export Development Corporation of Canada.

OPIC also took a leading role in the International Finance Corporation's review of environmental and social requirements among international financial institutions (IFIs) in private sector development projects. This effort entails collection of data on environmental, occupational health and safety, and social matters, public consultation and disclosure practices and their implementation by about 50 IFIs. This process will provide a baseline for further effective dialogue with OECD counterparts. The benefits of common environmental standards are widely recognized among OPIC's various stakeholders. OPIC looks forward to continuing its close collaboration with U.S. business, NGOs, Congress and the Administration, as it continues to address these and other environmental challenges.

Partnerships for the Environment

As part of its continuing efforts to promote environmentally friendly private investment in projects in developing countries, OPIC has established partnerships with U.S. government agencies and NGOs to enhance its ability to support environmentally friendly projects, including eco-tourism, low cost housing, and renewable energy.

As part of this effort, OPIC entered into a partnership with U.S. AID to complete OPIC's first loan commitment to a non-governmental organization, Washington, D.C.-based Counterpart International, Inc. and World Women in Defense of the Environment. Counterpart International, Inc. will use the $1 million in financing to establish a facility to on-lend OPIC funds to environmentally friendly projects and existing businesses to promote environmentally focused small-and medium-sized enterprises in the Philippines. The facility will be comprised of up to $750,000 in a direct loan from OPIC and up to $250,000 in grant monies from USAID that will be administered by OPIC. Proceeds of the OPIC loan will be used for investments in business ventures in the Philippines that meet OPIC's environmental and other policy criteria. Up to five investments are anticipated, involving activities such as organic fertilizer manufacturing, eco-tourism, and low cost housing using recycled materials.

OPIC also signed a Memorandum of Cooperation with the Department of Energy "affirming their intent to facilitate financing that will promote the development of

sustainable energy projects in Africa." Accordingly, OPIC and DOE will design the "U.S.-Africa Sustainable Energy Program" to provide assistance to U.S. not-for-profit entities, NGOs, and U.S. small business entities or cooperatives interested in developing sustainable energy projects in Africa. The program will target projects that (i) support community-based sustainable energy development, (ii) increase energy access and bring clean energy systems to underserved/unserved areas using renewable technologies and natural gas-fired systems, (iii) reduce greenhouse gases through programs that promote enhanced supply, renewable sources, or demand-side management, and/or (iv) promote the application of clean energy technologies.

OPIC Climate Change Initiatives

As discussed earlier in this report, any effective international effort to reduce greenhouse gas emissions will require the participation of the developing world. The Senate's Byrd–Hagel Resolution therefore predicates U.S. Senate ratification of the Kyoto Protocol on meaningful participation of developing countries. The joint implementation, emissions trading and clean development mechanisms of the Kyoto Protocol are designed to encourage the participation of developing countries and achieve the most cost-effective emission reductions. As described in its Environmental Handbook, OPIC seeks to support the Byrd-Hagel Resolution and the Kyoto mechanisms by encouraging investment in projects involving Joint Implementation and by tracking and reporting CO_2 emissions from its power sector projects.

To encourage U.S. companies, particularly small business, to participate in efforts to reduce global greenhouse gas emissions, OPIC will provide customized pricing for small business projects intended to reduce such emissions, in particular those projects certified by the U.S. Initiative for Joint Implementation. These projects involve the sharing of technology and resources, particularly transfers from Developed to Developing nations, to limit and reduce GHG emissions. In addition, OPIC will continually strive to make its portfolio more climate friendly by proactively seeking renewable energy projects and by seeking to harmonize its approach to climate change issues with that of other U.S. Government entities.

In a effort to support the management of global greenhouse gas emissions, in February 1998 OPIC became the first bilateral finance, investment insurance or export credit agency to commit to tracking and reporting GHG emissions from its power sector projects. Tracking results are made available to the public and reported annually to Congress in OPIC's Annual Environmental Report (AER). OPIC's most recent tracking and reporting efforts are contained in the OPIC's 1999 AER

In 1999 OPIC-supported six new projects, with a combined 2,367 MW of power capacity. As in prior years, the power sector projects supported by OPIC in FY 1999 were largely weighted toward natural gas, the cleanest and most climate-friendly fossil fuel. These projects, measured in terms of MW capacity, were approximately 92% gas-fired and 8% oil-fired. Annual CO_2 emissions from these projects represent less than 0.03% of annual global CO_2 emissions. The results demonstrate that OPIC continues to maintain a responsible power portfolio.

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VII. Conclusion

Climate change represents a serious global environmental challenge. Since the dawn of the industrial age, man has been emitting increasing quantities of heat-absorbing GHGs primarily through the consumption of fossil fuels. As a result, atmospheric concentrations of CO_2 - the most important GHG - are now at their highest levels in more than 160,000 years and global temperatures are rising. With emissions of CO_2 and other GHGs expected to increase - especially in developing regions - current forecasts suggest that atmospheric concentrations of CO_2 could double by 2060 with a resulting global average temperature increase of as much as 2° to 6.5° F over the next century. Such a rapid temperature increase could have potentially grave economic and environmental impacts.

This report demonstrates that OPIC-supported projects are not major contributors to global GHG emissions or climate change. Contrary to some assumptions, the OPIC power portfolio is predominately driven by clean burning low-carbon natural gas (45%) and carbon-free hydro and geothermal energy (27%). Current annual CO_2 emissions from OPIC-supported power projects represent approximately 0.24% of global CO_2 emissions. In addition, OPIC projects tend to use highly efficient advanced technologies, with more than 43% of OPIC fossil fuel-fired power projects using combined cycle technology - the most efficient electricity generating technology.

However, despite this good news about its own portfolio, OPIC understands that it has an important role to play in helping the developing world make the transition to less carbon intensive development. After all, reducing GHG emissions in developing regions - where as much as 70% of the increase in CO_2 emission over the next two decades will occur - will be critical to successfully stabilizing global atmospheric GHG concentrations.

In the near term, OPIC's commitment to natural gas will be an important part of that transition process. In the longer term, OPIC recognizes that renewables, such as wind and solar power, will have an important role to play in reducing global reliance on fossil fuels and their associated GHG emissions. As an agency whose sole focus is on the developing world, OPIC has the opportunity to play a unique role facilitating the participation of countries whose involvement is critical to the resolution of the climate problem. OPIC therefore looks forward to exploring more fully both the needs of renewable energy developers and how developing countries determine their energy requirements and establish bid specifications for power projects in order to more effectively utilize its programs to support renewable energy projects.

Appendix I
OPIC-Supported Power Projects

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Year	Project Name	IPS Sponsor	Country	Fuel	Heat Rate	Plant Type	MW	[illegible]	[illegible]
1990	Hopewell Energy Co.	Citicorp Scrimgeour Vickers	Philippines	gas	56100	simple-cycle	9757	200	827,049
1992	Puerto Quetzal Power Corporation	Enron Power Corp.	Guatemala	diesel	74050	engine-driven	7588	234	993,323
1992	Inter-American Energy Leasing	K&M Engineering Corp.	Columbia	gas	56100	combined-cycle	7266	100	307,950
1992	Belize Electric Co. Ltd.	Dominion Energy Inc.	Belize	hydro	0	hydroelectric	0	25	0
1993	Dominion Generating, S.A.	Dominion Energy, Inc.	Argentina	hydro	0	hydroelectric	0	450	0
1993	Central Termica San Nicholas, S.A.	AES Americas Inc.	Argentina	gas	56100	steam boiler	10348	325	1,425,361
				coal	94600	steam boiler	10348	325	2,403,551
1993	Batangas Power Corporation	Enron Power Corp.	Philippines	resid.	77350	engine-driven	7588	105	465,585
1994	Trakya Elektrik Uretim ve Ticaret	Enron Corp./Wing Int'l.	Turkey	gas	56100	combined-cycle	7266	480	1,478,161
1994	P. T. Paiton Energy Co.	Mission Energy Company	Indonesia	coal	94600	steam boiler	10348	1220	9,022,559
1994	Grenada Electricity Services	WRB Enterprises Inc.	Grenada	diesel	74050	engine-driven	7588	18	76,409
1994	Generacion de Vapor GENEVAP	LG&E Energy Systems, Inc.	Venezuela	gas	56100	simple-cycle	9757	315	1,302,603
1994	Dabhol Power Corporation	Enron Corp./Bechtel/GE	India	gas	56100	combined-cycle	7266	2184	6,725,634
1994	CMS Generation, S.A.	CMS Generation Co.	Argentina	hydro	0	hydroelectric	0	1320	0
1994	Ce Luzon Geothermal Power	Cal Energy/Kiewit Energy.	Philippines	geo	0	geothermal	0	180	0
1994	CE Cebu Geothermal Power	California Energy Co.	Philippines	geo	0	geothermal	0	119	0
1995	Visayas Geothermal Power Comp	Magma Power Co/ Visayas	Philippines	geo	0	geothermal	0	231	0
1995	Termobarranquilla, S.A.	Energy Initiatives, Inc.	Columbia	gas	56100	combined-cycle	7266	750	2,309,627
1995	Tampo Centro Americana	TECO Power Services Corp.	Guatemala	diesel	74050	simple-cycle	9757	78	425,754
1995	Quezon Power	Ogden Projects Inc.	Philippines	coal	94600	steam boiler	10348	480	3,549,859
1995	P.H. Don Pedro, S.A.	Energia Global, Inc.	Costa Rica	hydro	0	hydroelectric	0	14	0
1995	Doga Enerji Uretim Sanayi ve Ticaret	Edison Mission Energy	Turkey	gas	56100	combined-cycle	7266	180	554,310
1996	Termovalle S.C.A. E.S.P.	KMR Corporation	Colombia	diesel	74050	combined-cycle	7266	199	808,902
1996	TermoCandelaria S.C.A. E.S.P.	KMR Corp./NationsBank	Colombia	gas	56100	simple-cycle	9757	316	1,306,738
1996	P.T. Energi Sengkang	Tenneco Inc.	Indonesia	gas	56100	simple-cycle	7266	135	415,733
1996	P.H. Rio Volcan S.A.	Energia Global, Inc./EFI	Costa Rica	hydro	0	hydroelectric	0	17	0
1996	Nejapa Power Company	Coastal Corporation	El Salvador	resid.	77350	engine-driven	7588	150	665,122
1996	Light Servicos de Eletricidade	AES Corp/Houston	Brazil	hydro	0	hydroelectric	0	942	0
1996	Jorf Lasfar Energy Co	CMS Generation	Morocco	coal	94600	steam boiler	10348	1356	10,028,352
1996	Himpurna California Energy	Cal Energy/Kiewit Energy	Indonesia	geo	0	geothermal	0	55	0

Year	Project Name	Sponsor	Country	Fuel	Heat Rate	Plant Type	Heat Rate	Size	CO2 Emitted
1996	Empresa Guaracachi S.A.	EI Power	Bolivia	gas	56100	simple-cycle	9757	180	744,758
				diesel	74050	engine-driven	7588	36	152,819
1996	Empresa Electrica Valle Hermoso	Constellation Energy Int'l	Bolivia	gas	56100	simple-cycle	7266	181	556,466
1996	Empresa Electrica Corani S.A.	Dominion Energy, Inc.	Bolivia	hydro	0	hydroelectric	0	126	0
1996	CMS Ensenada S.A.	CMS Generation Co.	Argentina	gas	56100	combined-cycle	7266	128	394,176
1996	Central Termica San Miguel	LG&E International Inc.	Argentina	gas	56100	simple-cycle	9757	110	454,877
1996	CE Casecnan Water & Energy	Calif. Energy/Kiewit Energy	Philippines	hydro	0	hydroelectric	0	112	0
1996	Ave Fenix Energia, S.A.	NationsBank, N.A.	Argentina	gas	56100	simple-cycle	9757	168	694,722
1996	Aguaytia Energy del Peru	Aguaytia EnergyLLC/ TCW	Peru	gas	56100	simple-cycle	9757	141	583,070
1997	EMA-Power Kft.	EPEC Cogeneration Co.	Hungary	resid.	77350	steam boiler	10348	35	211,645
				gas	56100	steam boiler	10348	35	153,500
1997	EGENOR, S.A.	Dominion Energy, Inc.	Peru	hydro	74050	hydroelectric	0	225	0
				diesel	74050	engine-driven	7588	78	331,108
				diesel	74050	simple-cycle	9757	102	556,755
1997	EAL/ERI Cogeneration Partners	Teachers Insurance Assoc.,	Jamaica	resid.	77350	engine-driven	9757	17	96,928
1997	Central Generadora Electrica San Jose	TECO Power Services/Coast.	Guatemala	coal	94600	steam boiler	10348	120	887,465
1998	TRI Energy Company Limited	Texaco/Citibank/Edison	Thailand	gas	56100	combined-cycle	7266	700	2,155,652
1998	Tecnoguat S.A.	Energia Global Int'l Ltd.	Guatemala	hydro	0	hydroelectric	0	14	0
1998	Subic Power Corporation	Enron Corp.	Philippines	resid.	77350	engine-driven	7588	111	492,190
1998	NEPC Consortium Power	Ogden Energy/El Paso	Bangladesh	gas	56100	engine-driven	7588	120	385,917
1998	Elektro Electricity Dist. System	Enron Corp.	Brazil	hydro	0	hydroelectric	0	5	0
1998	Dodson-Lindblom Hydro Power	Dodson-Lindblom Int'l.	India	hydro	0	hydroelectric	0	12	0
1999	Turboven Maracay Company	PSEG Americas	Venezuela	gas	56100	simple-cycle	9757	64	264,242
1999	Turboven Cagua Company	PSEG Americas	Venezuela	gas	56100	simple-cycle	9757	72	296,497
1999	Tipitapa Power Company	Coastal Power Nicaragua	Nicaragua	diesel	74050	engine-driven	7588	51	216,069
1999	EPSA/EDC	US Capital Markets Invest.	Venezuela	hydro	0	hydroelectric	0	817	0
1999				coal	94600	steam boiler	10348	33	244,053
1999	Empresa Produtora de Energia	Enron Corp.	Brazil	gas	56100	combined-cycle	7266	480	1,478,161
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16776	56,443,654

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Environmental Procedures

Effective April 2, 2001

INTRODUCTION

The Charter of the Export-Import Bank (Ex-Im Bank), revised by Congress in October 1992, requires the Bank to establish environmental review procedures consistent with the Bank's overall export promotion objectives. The Charter also authorizes the Board of Directors to grant or withhold financing support after taking into account the beneficial and adverse environmental effects of proposed transactions.

Ex-Im Bank will maintain U.S. exporters' competitiveness in the global marketplace while ensuring that the projects it supports are environmentally responsible. The Bank will decline to finance an export transaction if the Board of Directors determines that this is appropriate in light of the project's serious adverse environmental impacts.

1. To fulfill its statutory mandate of maintaining exporter competitiveness while ensuring that its actions are environmentally responsible, Ex-Im Bank is taking a leadership role in encouraging the adoption of common environmental procedures and guidelines among the export credit agencies of the world. In conjunction with this effort, Ex-Im Bank is continuing to seek agreement among the other export credit agencies within the framework of the Organization for Economic Cooperation and Development (OECD) on appropriate responses to environmental issues associated with financial support of foreign projects.

2. Ex-Im Bank's environmental procedures and guidelines were issued on February 1, 1995 following implementation of interim procedures in October, 1993. The procedures and guidelines were revised on April 2, 1996 and April 2, 1998 following a review of their effectiveness in mitigating adverse environmental effects of Ex-Im Bank supported projects and their effect on the competitiveness of U.S. exporters. The procedures and guidelines, as revised on April 2, 1998, were extended on April 2, 2001 and will remain in effect until December 14, 2001. *(Note: The Board of Directors would call for futher review before that date should circumstances require such action, i.e. compliance with an OECD Agreement on Common Environmental Guidelines)*

3. In order to ensure that the actions it takes follow its environmental mandate, Ex-Im Bank will conduct environmental reviews by evaluating the environmental effects of certain categories of long-term transactions when the U.S. export is identified with a project. Ex-Im Bank's environmental review procedures are designed to be efficient and streamlined in order to avoid unnecessary paperwork and to maintain the competitiveness of U.S. exporters to the greatest extent possible.

4. The environmental procedures are tailored to the characteristics of different Ex-Im Bank programs. Cases will be screened so that only those long-term transactions, all project finance cases, with potentially adverse environmental impacts, will undergo environmental review.

5. Short and Medium-term transactions [These transactions have a principal liability of $10,000,000 or less, excluding exposure fee, and a repayment term of not more than seven years.]

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individual short and medium term transactions covered under credit guarantee facilities or export credit insurance, and transactions providing working capital support for U.S. exporters will not be subject to an environmental review except if, in the judgment of the Vice President, Engineering & Environment Division, such transactions have the potential for causing a significant adverse environmental effect.

6. Ex-Im Bank's Engineering and Environment Division will provide advice and counseling to exporters and borrowers on how to comply with the Bank's environmental procedures and guidelines, especially in those cases involving small and medium-sized exporters. Ex-Im Bank will give exporters an opportunity to address any environmental concerns that may arise during the review process.

7. Applicants will be required to provide environmental information satisfactory to Ex-Im Bank in support of their applications. Ex-Im Bank will also make use of information provided by other sources, including government entities, intergovernmental organizations, and non-governmental organizations.

8. To help elicit useful information concerning the environmental effects of projects from non-governmental organizations and other interested parties, when Ex-Im Bank receives an application for a final commitment (long term or project finance program) for an export which will be included in a project, it will follow the following process:

A: For all final applications covering exports which will be included in a project, Ex-Im Bank will list the project and its location on the Bank's WEB page at www.exim.gov.

B: In addition to the above, for those final applications received after July 1, 1998 where Ex-Im Bank requires submission of an environmental assessment, a copy of that document in a form authorized by the project sponsors will be made available to interested parties during Ex-Im Bank's application review process. Availability of an authorized environmental assessment will be noted at www.exim.gov where the project and its location are listed.

This process will enable Ex-Im Bank to elicit information about such projects without disclosing proprietary information about the proposed U.S. export.

9. To provide guidance to exporters, this document sets forth the environmental guidelines for assessing the environmental effects of transactions. The guidelines are derived from Ex-Im Bank's environmental objectives that address the air quality, water use and quality, waste management, natural hazards, ecology, socioeconomic and sociocultural framework, and noise associated with foreign projects. The guidelines have been developed by the Engineering and Environment Division in consultation with the World Bank Group, exporters, environmental organizations and U.S. Government agencies.

10. For those projects which may significantly affect the quality of the human environment of the U.S., its territories or possessions, or Antarctica, Ex-Im Bank will require adherence to the environmental review procedures required by the National Environmental Policy Act (NEPA).

11. Ex-Im Bank is committed to increasing its support for projects and products that are environmentally beneficial, including those which result in the reduction of greenhouse gases. Enhanced financial support through the "Environmental Exports Program" will be provided for

renewable energy projects, for projects or products that meet environmentally beneficial criteria, and for projects that meet the special "incentive" limits for designated emissions or effluents which are identified in the Environmental Guidelines.

12. To assist in the management of global greenhouse gas emissions, beginning in fiscal year 1999, Ex-Im Bank will track the estimated amount of carbon dioxide (CO_2) emissions from projects it supports in the power sector and, to the extent practical, from projects in other sectors that may cause significant production of CO_2. The estimated annual amount of the aggregate greenhouse gases from these projects will be reported annually in Ex-Im Bank's Annual Report.

OVERVIEW OF EX-IM BANK ENVIRONMENTAL GUIDELINES

1. Ex-Im Bank's environmental guidelines will provide quantitative and/or qualitative measures for air quality, water use and quality, management of hazardous and toxic materials and waste, natural hazards, socioeconomic and sociocultural effects, ecological effects and noise. Ex-Im Bank's environmental guidelines are set forth in Annex A of this document.

2. If Ex-Im Bank determines that a project satisfies the Ex-Im Bank environmental guidelines in all respects, including quantitative and qualitative, Ex-Im Bank support for exports to that project will not be rejected on environmental grounds. If a project does not meet all Ex-Im Bank environmental guidelines, the Ex-Im Bank Board of Directors will review the environmental effects of the project on a case-by-case basis, taking account of significant mitigating effects and circumstances. Financing may be conditioned on the implementation of mitigating measures.

3. Procedures and guidelines for nuclear related projects are set forth in Ex-Im Bank's Nuclear Procedures and Guidelines, a separate document also dated April 2, 2001.

ENVIRONMENTAL REVIEW PROCEDURES

Limited Recourse Project Finance and Long-Term Transactions

1. Screening Categories for Project Finance and Long-Term Transactions

Ex-Im Bank's goal is to require only the extent and detail of environmental information that is necessary to provide well-informed advice to the Board of Directors. Therefore, applicants for limited recourse project finance ("Project Finance") and long-term loans and guarantees ("Long-Term") [These transactions have either a principal liability of more than $10,000,000 or a repayment term of more than seven years.] must include an "Environmental Screening Document" (Annex B) with their applications to Ex-Im Bank. The information contained in this straightforward, one-page document will enable the Engineering & Environment (E&E) Division to screen each transaction in order to determine the extent of environmental review required.

An engineer from the E&E Division is assigned to each Project Finance and Long-Term transaction. E&E staff will work closely with exporters and borrowers, especially small and medium-sized businesses, to assist them in complying with these environmental procedures.

Depending on the transaction-specific information provided in the screening document, Ex-Im Bank will categorize the transaction as either "N", "A", "B" or "C". A description of these categories and the level of information generally needed to review transactions within the categories follows.

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Category N: Nuclear

All transactions associated with nuclear power projects, nuclear research reactors and related facilities and the production of nuclear fuel are designated as Category N transactions. Due to the special effects associated with the issues of health and safety, information requirements for transactions under this category are found in a separate document titled Ex-Im Bank Nuclear Procedures and Guidelines, also dated April 2, 2001.

Category A: Categorical Exclusions (no environmental information required)

Transactions in Category A are categorically excluded from review because individual cases do not raise significant environmental issues. This category includes the following transactions, as determined by Ex-Im Bank:

1) The export is a product not identified with any particular project (e.g., construction equipment sold to a construction company engaged in a wide variety of work throughout a country); or

2) The export is identified with a project, the project is not in Category B or C, and the project is one of the following: aircraft, locomotives, railway signalling, telecommunications equipment involving only a nominal element of civil works, radar equipment for existing airports, air traffic control systems, satellite projects, electronic data processing equipment for existing facilities, hospital equipment, and consulting services including environmental studies and feasibility studies.

Category B: Sensitive Location, Project Finance, Hydroelectric (environmental assessment required)

Includes Project Finance and Long-Term transactions involving exports for projects that will be constructed in, or sufficiently near to have perceptible environmental effects in, the following locations: primary forests, tropical forests, nationally designated wetlands, protected wildlands, national parks, nationally-designated refuges, coral reefs or mangrove swamps, nationally-designated seashore areas, habitat of endangered species, properties on the World Heritage List, areas reserved for ethnic minorities or indigenous peoples, or areas in which the project will require large-scale resettlement. Transactions associated with hydroelectric projects, water resources management projects and project finance transactions are generally considered to fall within this category.

Category C: Other (information on environmental effects required)

Includes all Long-Term transactions that are not classified as Category A or B. E&E staff will conduct a case-by-case review of all transactions included in Category C. For review of Category C transactions, Ex-Im Bank requires submission of environmental information sufficient to establish whether the project meets Ex-Im Bank's environmental objectives and guidelines (Annex A). E&E will promptly inform the applicant of the environmental information that Ex-Im Bank will need to conduct its environmental review.

For cases involving the export of products for a project, Ex-Im Bank will require information about the underlying project in order to establish whether the Bank's environmental objectives and guidelines are met. For cases involving the expansion or modernization of existing plants, the environmental information submitted should focus on the environmental effects associated with the plant expansion or modernization.

The level of detail required by Ex-Im Bank to meet the information requirements of the environmental guidelines for specific transactions may vary. Factors such as the availability of information from other sources, and the scope of the U.S. exports supported by Ex-Im Bank relative to the scope of the overall project may be taken into account. If, during the review process of a transaction that has been previously screened as Category "C", the E&E Division receives environmental information that it determines indicates that the transaction should instead be designated as a Category "B" transaction, it will promptly notify the exporter and project sponsors and will require submission of an environmental assessment in order to evaluate the environmental effects of the project. For applications received after July 1, 1998, a copy of the Environmental Assessment in a form authorized by the project sponsors will also be required, and when it is received by Ex-Im Bank, it will be made available to interested parties during the application review process.

2. Sources of Environmental Information

a. The Applicant

As early as possible, the E&E staff will inform the applicant what environmental information will be required. E&E staff will be available to counsel with applicants, especially small and medium-sized businesses, on how to comply with the Bank's environmental procedures.

It is in the applicant's interest to submit the requested information as soon as possible. Failure to submit this information may delay case processing. However, if complete environmental information is not available at a preliminary stage, such information must be submitted prior to an Ex-Im Bank decision on a final commitment.

In cases requiring an environmental assessment, the applicant may submit a copy of an environmental assessment already prepared for the project, e.g. for international financial institutions or host governments. If the environmental assessment submitted to Ex-Im Bank contains confidential or proprietary information, the applicant should also submit a version of the environmental assessment that is authorized by the project sponsors for release to interested parties during the period when the application is under review by Ex-Im Bank. During the course of the application review process, the E&E staff will advise the applicant whether additional or updated environmental information is required.

b. Other U.S. Government Agencies; Multinational Institutions

In cases considered appropriate by Ex-Im Bank, staff will consult with other U.S. Government agencies, U.S. embassies, and/or multilateral development banks to obtain information on the environmental effects of projects. Final decisions will be made by Ex-Im Bank.

c. Other Sources of Environmental Information

When Ex-Im Bank receives an application for a final commitment for a transaction screened as Category "B" or Category "C", the project and its location (e.g. "Geothermal Power Plant, Leyte Island, Philippines") will be added to a list of all Ex-Im Bank's pending Category B and C transactions which can be viewed via the internet by accessing Ex-Im Bank's home page at www.exim.gov. In addition, beginning on July 1, 1998, for applications categorized as "B", the availability of an environmental assessment authorized for release to interested parties by the project sponsors will be noted on this list, together with information on how to obtain a copy of the assessment. In order to protect competitively sensitive information, neither the list, nor the

environmental assessments will provide specific information about the exporter, contract value or identity of the products for which Ex-Im Bank financing is sought. Ex-Im Bank is prohibited by the Trade Secrets Act, 18 U.S.C. 1905, from disclosing confidential business information to anyone outside of Ex-Im Bank.

Interested parties may provide information to the E&E staff at Ex-Im Bank about potential environmental issues or other problems raised by such projects. Providing information does not give legal standing to any person or group as a participant in the Ex-Im Bank decision making process. Ex-Im Bank will review and take into account the environmental information provided but will not be able to respond to the person or group providing the information.

If material received by Ex-Im Bank from sources other than the applicant gives rise to environmental concerns, Ex-Im Bank will give the applicant an opportunity to provide further information addressing these concerns.

3. Role of Engineering & Environment Division

Ex-Im Bank has a full-time Environmental Specialist who is part of the Engineering & Environment Division. The specialist is responsible for technical leadership at the Bank on environmental matters, including the implementation of Ex-Im Bank's environmental procedures. The Environmental Specialist acts as the chief liaison with other government agencies and non-governmental organizations on environmental matters. The E&E Division will assist the applicant and provide guidance in the contents and preparation of the environmental information required.

In addition, the staff engineers in the Engineering & Environment Division have technical expertise with respect to the environmental issues in their areas of specialization and will assess the environmental effects of assigned transactions.

4. Project Financing

The procedures in this section apply to transactions handled by Ex-Im Bank's Project Finance Division.

a. The Engineering and Environment Division (E&E) will be involved in the early stages of processing a Project Financing application. E&E staff will provide guidance to the applicant to help identify significant environmental problems and to assist in determining how the project can be designed, including mitigation measures, to meet Ex-Im Bank's environmental objectives and guidelines.

b. As part of the determination whether Ex-Im Bank will issue a Preliminary Project Letter (PPL), the E&E staff will establish whether there are any potentially insurmountable environmental problems that could lead Ex-Im Bank to reject the project on environmental grounds. If such problems are identified, Ex-Im Bank shall notify the sponsor.

c.An environmental assessment which demonstrates compliance with Ex-Im Bank's Environmental Guidelines and objectives (Annex A) is required for all Project Finance transactions, except those in Category A. The sponsor of the Project Finance transaction should submit an environmental assessment to Ex-Im Bank as soon as possible, but in no event later than the time a request is made for a final commitment. The E&E staff will review the environmental assessment, request further information as necessary from the sponsors or exporters, analyze all relevant information, and prepare an environmental evaluation of the project. The evaluation may

include recommendations to the Board of Directors with respect to Ex-Im Bank support. In addition, at the time of final application the sponsor should submit a copy of the environmental assessment that does not contain confidential or proprietary business information, in a form suitable for release to interested parties in accordance with the procedure outlined above for making environmental information available on Category "B" cases.

As is the case with the financial and technical reports associated with Project Finance transactions, Ex-Im Bank reserves the right to require the sponsor to bear the expense of outside specialists to prepare an independent report with respect to any element of the environmental assessment of the project, when Ex-Im Bank determines that such a report is necessary in order to make an adequate evaluation of the environmental effects of the project.

5. Long-Term Loans and Guarantees

An application for Long-Term financing may go through two or three stages: (a) Letter of Interest (LI); (b) Preliminary Commitment (PC); and (c) Final Commitment (AP). Ex-Im Bank will require the applicant to provide environmental information at the earliest possible stage during case processing so that environmental issues can be identified and addressed.

a. Letters of Interest

Letters of Interest (LIs) are non-binding documents generally issued within seven business days of the receipt of an application. LI applications must be accompanied by an Environmental Screening Document (Annex B) which will be used for initial categorization of the transaction.

Except in rare instances involving projects that are known to have potential environmental effects that are exceptionally severe, LIs will be issued with no prior environmental review. The Letter of Interest will include language generally describing Ex-Im Bank's environmental procedures and guidelines. In Category A transactions, no mention of environmental requirements will be included in the LI. In cases in which Ex-Im Bank will require environmental information, the LI will alert the applicant to the need for material demonstrating that the project will meet Ex-Im Bank's environmental objectives and guidelines.

In cases requiring an environmental assessment guidance can be provided as to the specific elements which the assessment should address. This will allow the applicant the maximum amount of time to gather the required information, in order to avoid processing delays in subsequent application stages.

No LIs will be issued for nuclear cases or for products or projects that, in the judgment of Ex-Im Bank, involve potentially unacceptable environmental risks. As a result, such transactions must seek Preliminary Commitments or Final Commitments and will receive more detailed environmental scrutiny than would be possible at the LI stage.

b. Preliminary Commitments

Preliminary Commitments (PCs) are issued after Ex-Im Bank's staff and Board of Directors analyze the financial soundness, technical feasibility, and environmental effects of a proposed transaction. PCs are not legally binding.

Applications for a PC must always include a completed Environmental Screening Document

(Annex B). Based on the information provided in the screening form, the E&E Division will inform the applicant promptly of the category of the transaction and the scope of additional environmental information required to process the PC.

Ex-Im Bank understands that in certain cases, not all of the information needed to evaluate the project against Ex-Im Bank's environmental objectives and guidelines (Annex A) will be accessible to the applicant (usually the exporter) at the PC stage. In such cases, based on recommendations of the E&E Division, Ex-Im Bank will condition its PC on subsequent review and satisfactory evaluation of such information at the final commitment stage.

If environmental concerns are sufficiently serious and adequate information is available for evaluation, Ex-Im Bank may decline to issue a PC on environmental grounds. If a PC is issued, the PC letter will identify information that will be required in the final commitment application. PC letters may identify environmental concerns that should be addressed (for example, by mitigation measures) at the final commitment stage.

c. Final Commitments

Final commitments in long-term transactions are approved by Ex-Im Bank only after the completion of all financial, technical, and environmental analyses. If no LI or PC has been issued, the applicant for a final commitment must submit a completed Environmental Screening Form.

No final commitment will be authorized unless Ex-Im Bank has received sufficient environmental information from the applicant to enable the E&E Division to assess the application. The environmental information provided will be evaluated againstEx-Im Bank's environmental objectives and guidelines. Ex-Im Bank will take into account the potential beneficial and adverse environmental effects of transactions seeking Ex-Im Bank support.

Other Ex-Im Bank Programs

Excluded from Prior Environmental Review

1. Medium-Term Transactions

Medium-term financial support provided by Ex-Im Bank (loans, guarantees, and insurance) generally covers the sale of capital goods and services/products as opposed to entire projects. In addition, the medium-term programs often provide support for single, stand-alone products as opposed to multiple products generally contracted for a project. For this reason, products eligible for medium-term financing tend to have less broad and diverse environmental effects than many products for which long-term financing may be provided.

Ex-Im Bank will conduct environmental reviews of medium-term, single-sale transactions only in those exceptional cases which, in the judgment of the Vice-President, E&E Division, have the potential for significant adverse environmental effects.

2. Credit Guarantee Facilities (CGFs)

Most CGFs provide guarantees of medium-term lines of credit between U.S. and foreign financial institutions which may be used to finance the purchase of a wide range of capital goods by a variety of end-users. The CGF program is designed to reduce up-front administrative time and

cost and thereby better serve small- and medium-sized exporters. In most cases, Ex-Im Bank is not informed of the specific exports supported by a CGF until after the transactions are completed. Therefore, it is not practical to conduct prior environmental review of items financed under CGFs.

The eligibility rules for CGFs eliminate products that would present unacceptable environmental risks without prior review. Chemicals, pesticides, and other such commodities are not eligible for medium-term financing under CGFs. Nuclear-related items are also ineligible under CGFs.

In the limited number of CGFs where the borrower is also the end-user (typically an industrial company), rather than a bank, the borrower will be asked to provide specific information about the intended use of the CGF. If the CGF will be used to support products for an identified project and the aggregate amount exceeds $10 million, then Ex-Im Bank will require the borrower to provide information about the environmental risks associated with the project and will review those risks.

3. Short-Term Insurance

Short-term financial support for exports, provided by export credit insurance, generally covers commodities, consumer goods, and other non-capital goods and services. Insurance support is provided against risks of nonrepayment on transactions whose term usually does not exceed 180 days. These products typically have limited environmental consequences and short processing turnaround is required.

For this program, Ex-Im Bank will not provide insurance coverage for pesticides that are banned or severely restricted in the United States. A list of items ineligible for export credit insurance is attached as Annex C.

4. Working Capital Guarantee Program (WCGP)

Ex-Im Bank provides short-term working capital support for the production or supply of items for export. In most instances, the items are of a nature that do not require environmental review (e.g., shipment of commodities, consumer electronic products, etc.)

In certain cases, however, the items supported under the WCGP may relate to a Category B project. In such cases, as determined by the V.P. of the Engineering & Environment Division, Ex-Im Bank may require environmental information with respect to the foreign project for which the items are destined.

List of Annexes

Annex A Ex-Im Bank Environmental Guidelines

Annex B Environmental Screening Form

Annex C List of items ineligible for export credit insurance

Guidance Outline on Environmental Assessment Format and Contents

April 23, 1996

GUIDANCE OUTLINE ON ENVIRONMENTAL ASSESSMENT

FORMAT AND CONTENTS

All Project Finance transactions and Long-Term transactions classified as Category B require the submission of an environmental assessment (EA) that addresses the impact upon the location of the project with reference to Ex-Im Bank's environmental guidelines.

For those cases requiring an environmental assessment, the applicant may submit a copy of an environmental assessment already prepared for the project, e.g. for international institutions or host governments. The Engineering and Environment staff will advise the applicant whether additional or updated information is required.

To enable thorough and efficient review, the EA should be concise and focus on significant issues. The level of detail should be commensurate with the significance of the potential impacts. Early coordination of the EA process with Ex-Im Bank's Engineering and Environment Division would ensure that the EA addresses the project's significant issues, and is completed in a timely manner so as to expedite the decision making process.

To assist the applicant in the preparation of the Environmental Assessment, a sample outline and a list of issues to be addressed are provided below:

EA Sample Outline

The EA should include the following elements:

1. Executive Summary including a condensed discussion of significant issues and recommended actions.

2. Description of project:

- - Location, type, purpose and scope of project, size, onsite and offsite components, technologies and schedule for construction and operation.
- - Applicant and role of host country government.

3. Description of Existing Environment:

- - Project area size, location and physical, ecological and socioeconomic/cultural conditions .
- - Results from a site audit, if conducted.

4. Potential Environmental Impacts of the Proposed Project:

- Analysis of beneficial and adverse impacts of the project, and their significance, potential mitigation

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for significant adverse impacts and identification of impacts for which no mitigation is available.

5. Regulatory Requirements and Permits:

- Regulatory framework, including Ex-Im Bank and applicable national, regional or local requirements.

6. Monitoring:

- Scope and effectiveness, of existing monitoring programs and recommendations for additional monitoring.

7. Environmental Management and Training:

- Onsite staff available to evaluate, oversee and implement mitigation programs

EA Suggested Contents

The EA should include a discussion of the identified issues and potential mitigative measures applicable to the specific project:

1. Air Quality - Maintenance of ambient air quality

Issues:

- Emission of pollutants, odors, fugitive dust

Mitigation:

- Pollution prevention measures
- Odor and dust suppressing measures

2. Water Use & Quality - Protection of surface and groundwater resources

Issues:

- Use of large volumes of surface or groundwater required to operate the facility compared to local supply
- Transport of water over long distance or interbasin transfer
- Discharge of polluted effluent or effluent with elevated temperature
- Filling, damming, or dredging of water body
- Disposal of wastes

Mitigation:

- Incorporate pollution prevention measures
- Implement water reuse and/or use minimization plans
- Pre-cooling of effluent prior to discharge
- Use of wastewater treatment facility
- Implement erosion/sedimentation plans

3. Waste Management

Issues:

- Handling, processing, and storage of dangerous (flammable, corrosive, explosive, reactive, or toxic) materials:
- Disposal of large volumes of potentially hazardous wastes required
- Availability of waste disposal sites Mitigation:

- Implement waste management plan and obtain permits and approvals from local authorities

4. Natural Hazards

Issues:

- Location in coastal or low lying area prone to flooding or tidal waves
- Location in seismic area
- Location on steep slopes or landslide-prone area
- Location in Karst topography or subsidence-prone area

Mitigation:

- Implement natural hazards analysis report and recommendations

5. Sociocultural Context

Issues:

- Mixed land use in the site proximity
- Change in land use requirements; community facilities affected
- Use of large areas of agricultural or forested land required
- Use of presently undeveloped area
- Large influx of personnel
- Resettlement, relocation of indigenous people
- Historical/archaeological sites. Mitigation:

- Create buffer or transition zones at project perimeter
- Use of public consultation? What were results?
- Implement resettlement plans
- Document cultural sites

6. Ecology - Protection of biodiversity and ecosystems and encouragement of conservation of natural resources

Issues:

- Use of large areas of agricultural or forested land
- Location in presently unsettled area
- Use of large quantities of agricultural chemicals
- Discharge of large volumes of polluted effluent or effluent with

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- elevated temperature
- Effects on sensitive locations

Mitigation:

- Create buffer or transition zones within project and/or project perimeter
- Incorporate pretreatment of process effluent to meet numerical standards
- Implement replanting and reclamation plan
- Implement watershed management <
- Implement integrated pest management plan
- Implement protection plan for endangered species

7. Noise - Protection of sensitive receptors

Issues:

- Use of large stationary or mobile equipment
- Presence of sensitive receptors. i.e.,: hospitals and schools

Mitigation:

- Incorporate noise suppression measures
- Create buffer or transition zones at project perimeter

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Export-Import Bank of the United States
Revised : April 10, 1996

Environmental Screening Document - Annex B

Effective April 2, 2001

Limited Recourse Project Financing and Long-Term Programs Only

Ex-Im Bank will screen Project Finance and Long-Term transactions into three categories, as defined in Ex-Im Bank's Environmental Procedures. The information you provide in this form will help Ex-Im Bank to determine the proper Category for your application, a process that is crucial to the appropriate and timely review of your application. Please check the boxes that apply to your application.

○ Yes ○ No **Are the products or services covered in your application destined for an identified project?**
If so, identify the project_____.
If not, explain _____.

PROJECT LOCATION

Is the project located in or sufficiently near to have perceptible environmental effects in any of the following areas:

○ Yes ○ No Tropical Forest
○ Yes ○ No Nationally Designated Wetlands or Protected Wildlands
○ Yes ○ No National Parks
○ Yes ○ No Nationally Designated Refuges
○ Yes ○ No Coral Reefs or Mangrove Swamps
○ Yes ○ No Nationally Designated Seashore Areas
○ Yes ○ No Habitat of Endangered Species
○ Yes ○ No Large Scale Resettlement? (How Many Persons?_____)
○ Yes ○ No Properties on the World Heritage List

PROJECT SECTOR OR INDUSTRY

Which classification describes the project for which the exports are destined:

☐ Airport construction
☐ Consulting services
☐ Oil & gas field development
☐ Forestry
☐ Geothermal Power
☐ Pre-project Services(feasibility & Envir. studies)
☐ Pulp & paper plant
☐ Iron & steel plant
☐ Telecommunications or satellites
☐ Thermal power plant
☐ Nuclear power plant
☐ Chemical plant
☐ Hospitals & medical equipment
☐ Petrochemical plant or refinery
☐ Pharmaceutical project
☐ Hydropower plant
☐ Railway signaling
☐ Smelter
☐ Large infrastructure project
☐ Transportation carriers (aircraft,locomotives,boats)

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- ☐ Large scale water reservoir
- ☐ Mining & mineral processing plant
- ☐ Other (Describe) _____
- ☐ Waste management
- ☐ Air traffic control systems or navigational aids

Name of Applicant_____ Date_____

For inquiries and information please contact the Engineering & Environment Division at (202)565-3570.

Export-Import Bank of the United States
Revised : April 2, 2001

United Nations Environment Programme

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PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT · PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE

ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ

UNEP

UNEP Finance Initiatives

Climate Change Working Group Position Paper

November 2001

1. OVERVIEW

1.1. We believe that the precautionary approach is the appropriate way to deal with climate change, in that it is not possible to quantify all the environmental, economic, and social effects before taking action to reduce greenhouse gas emissions. Research can reduce the uncertainty, but never completely eliminate it.[1]

1.2. The financial services sector is involved in all aspects of economic activity and is affected by environmental and social issues. Owing to its business skills - particularly in innovation - and its size (insurance premiums of USD 2.3 trillion[2] and operating income for banking of USD 1.7 trillion[3] annually worldwide) the sector can play an important part in meeting the challenges posed by climate change.

1.3. The financial services sector strongly supports the Kyoto Protocol and strongly advocates that efforts be made to strengthen the process towards a long-term and effective framework to tackle climate change.

2. GENERAL POSITION

2.1. Climate Change poses major risks to the natural environment, and to society, in terms of damage to economic systems and human health, as reported in the Third Assessment Report of The Intergovernmental Panel on Climate Change (IPCC TAR). It is essential that early action is taken collectively to reduce these risks by:

Awareness raising	across all sectors and countries as the fundamental basis for initiating adaptation and mitigation.
Mitigation	reducing greenhouse gas emissions *now*.
Adaptation	taking steps to manage the effects of climate change as they impact society and natural systems.
Research	defining the effects of climate change more precisely, and refining the technology and tools to deal with it.

2.2. The solutions which are adopted must be sustainable and equitable. For example, they should promote both existing and innovative energy solutions which ensure sustainable economic development in the future.

2.3. Harnessing the resources and skills of the private and public sectors together will provide the most effective answers to the problem of climate change.

3. FINANCIAL SERVICES AND CLIMATE CHANGE

3.1. The finance sector will be affected in several ways by climate change through altered risk profiles from its clients, and through government policy on mitigation and adaptation.

3.2. Banking faces considerable changes through the changing financial prospects of its clients, and more positively, from the demand for financial services e.g. project finance, to support mitigation and adaptation activities.

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3.3. For insurance, the most obvious area of concern involves property losses, where in general risks to clients will become greater, and will be exaggerated by socio-economic trends, which are producing greater concentrations of vulnerable assets in risk prone areas.

3.4. Institutional investors, and in particular, life insurance companies and pension funds invest widely and aim to provide a long-term return for their beneficiaries. Since climate change could affect economic and social stability, investments would be affected through unanticipated changes in risk. Also, the financial prospects and risk/return characteristics of certain industries that are large greenhouse gas emitters may be affected and this must be taken into account by investors.

3.5. Policies to reduce greenhouse gas concentrations, and to manage the impacts of climate change, will inevitably entail the supply of financial services, in terms of insurance, credit and investment. At present the partial completion of the political framework for market mechanisms is hampering progress, but financial institutions are already participating in pilot schemes.

3.6. The sector is a major economic activity in its own right and needs to play its part in adopting sustainable practices internally, e.g. through energy conservation measures in its extensive portfolio of real estate.

4. A MULTIPLE-STRATEGY APPROACH

4.1. Governments, singly and collectively through the United Nations Framework Convention on Climate Change (UNFCCC), should adopt four strategies to tackle climate change, and involve all stakeholders in developing and implementing them. The four strategies are:

4.1.1. Implement the Kyoto process as a small but important first step in dealing with the problem of emissions internationally. This will allow all stakeholders to gain practical experience quickly.

4.1.2. Develop a range of policies and measures for implementation in national and regional jurisdictions, using a minimum of regulation to harness market mechanisms.

4.1.3. Construct a long-term framework to reduce emissions globally in order to achieve the necessary transition to sustainability. The approach of *Contraction and Convergence*, which the IPCC TAR described as "the logical conclusion" of a rights-based approach, provides a possible example of such a basis.

4.1.4. Promote a strong code of corporate sustainability, for business and the government sector, underpinned by the availability of key information on environmental, social and economic performance.

5. THE KYOTO PROTOCOL MECHANISMS

5.1. The Clean Development Mechanism is a valuable medium for adaptation and mitigation within the wider context of sustainable development. Adaptation has been largely ignored but could be instrumental in giving less-developed countries access to financial services in innovative ways, as suggested by the IPCC TAR. UNFCCC should initiate some pilot activity in the area of hazard management. Mitigation projects are closer to conventional business activity, and UNEP FI members are already active in this area.

5.2. Joint Implementation projects also are close to conventional activity, and the financial services sector is already participating in exploratory work here.

5.3. Emissions Trading is a useful step in achieving the transition to a sustainable economy. However, there are still major uncertainties in the modalities of the trading system. Once the rules become clear, it could become an attractive market for financial services. Trading systems within nations or trading blocs present much fewer problems, and may be an appropriate way to commence.

5.4. It is important that the modalities of the Kyoto Protocol Flexible Mechanisms are sufficiently streamlined and transparent to allow the financial sector – and broader business - to be fully engaged and to play their intended roles in emission reductions.

6. TOWARDS SUSTAINABILITY

6.1. Stopping human induced climate change requires a transition to a low carbon economy, with the emphasis on energy efficiency and renewable energy. The financial sector is willing and able to support this change, and is already active in pilot schemes. However, such activities are often placed at a competitive disadvantage by conventional infrastructure, market, fiscal and regulatory systems. Progress would be greatly enhanced by political action to provide more supportive market structures and a long-term plan towards a sustainable energy economy.

7. ACTIONS TO DATE BY UNEP FI MEMBERS

UNEP FI members have:

7.1. Developed standards for corporate reporting of CO_2 emissions[iv], which are in the process of being adopted by many other bodies.

7.2. Participated in pilot projects to refine the modalities of the Kyoto Protocol flexible mechanisms[v].

7.3. Advised and supported companies as they assessed and reported their greenhouse gas emissions and encouraged companies to integrate responses to climate change - comprehensively - into their corporate strategy.

7.4. Financed alternative energy technology ventures that significantly reduce greenhouse gas emissions.

7.5. Developed standards for environmental management systems (EMS) in their sector and taken a leadership position in their implementation.

7.6. Traded green electricity certificates in order to achieve CO_2 emission reduction targets[vi].

7.7. Participated in the IPCC process, notably in the chapters on financial services[vii].

7.8. Taken part in a large number of events to raise climate change awareness in the sector and among other stakeholders and to commence the process of translating the theory of mitigation and adaptation solutions into accepted practice.

7.9. Worked with stakeholders to manage natural hazards - likely to be affected by global climate change - through research, planning and the provision of relevant financial services for operational schemes in the private and public sector.

This paper has been discussed and approved for publication by members of the UNEP Finance Initiatives as a contribution to the climate change debate. It does not claim to represent the unanimous view of all members of the Initiative nor does it represent a UNEP position.

For further information on the UNEP FI's Climate Change Working Group visit Unepfi.net/cc

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[i] "...the overwhelming majority of scientific experts, whilst recognizing that scientific uncertainties exist, nonetheless believe that human-induced climate change is already occurring and that future change is inevitable. It is not a question of whether the Earth's climate will change, but rather by how much, how fast and where." Robert T. Watson, Chair, IPCC, 2001.

[ii] Swiss Re, Sigma 9/2000, World insurance in 1999, Soaring life insurance business

[iii] UBS AG, Group Research, Zurich; 2001

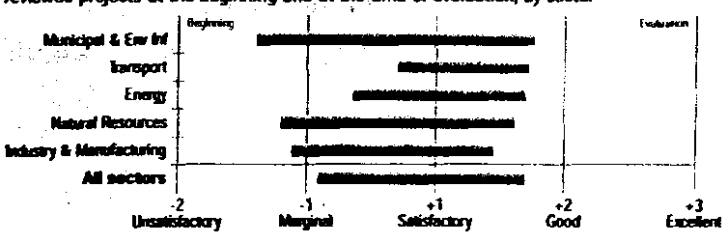
[iv] The GHG Indicator: UNEP Guidelines for Calculating Greenhouse Gas Emissions for Businesses and Non-Commercial Organisations, Charles Thomas, Tessa Tennant and Jon Rolls, UNEP 2000

[v] E.g. preparation of financing concepts tailored to the requirements of the customers, creating alternative climate/carbon funds and CDM project financing within CAF's Latin American Carbon Program.

[vi] E.g. Dresdner Bank

[vii] Climate Change 2001: Impacts, Adaptation, and Vulnerability, IPCC Third Assessment Report, Technical Summary, A Report of Working Group 2, K.S. White, et al., chapter. 4.6, and Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change, R.T. Watson, et al.

Figure 1: "Environmental Balance Sheet", average environmental performance of 113 reviewed projects at the beginning and at the time of evaluation, by sector*



*The left end of the horizontal bar indicates the environmental performance at the beginning of the project and the right end at the time of evaluation. The length of the bar indicates the extent of environmental change, or environmental impact.

and pollution loads, and the environmental change has been substantial. The extent of environmental change in energy and especially in transport projects has been less significant. The average environmental performance at the time of evaluation was highest in the MEI and the transport and energy sectors; the differences between all sectors are, however, quite small.

In large environmentally sensitive projects it has been essential to involve a financially and technologically strong and committed sponsor in order to meet the environmental objectives of the project. However, there have been some cases where a strong sponsor was not a guarantee for the implementation of sound environmental, health and safety practices and public consultation.

In general, the EBRD and its clients have held discussions with the environmental authorities, and the Bank has encouraged its clients to provide information to the public on the environmental aspects of each project. According to the Bank's environmental procedures, a public consultation component is required for all category A projects. In a few category B projects, dialogue with the authorities and the local community has been limited.

Main recommendations

Recommendations were made with regard to environmental due diligence, particularly ways of identifying more opportunities to incorporate positive environmental benefits into projects, for example, in the areas of energy efficiency, recycling and joint implementation.

The Bank could also consider additional financial vehicles to promote environmental funds and energy efficiency projects, and should look at ways of encouraging the sponsors of environmental projects to approach the Bank and its FIs.

The study's conclusion that companies with comprehensive and well-designed environmental management systems achieved the most notable progress shows the importance of attention to environmental management. The Bank could look at ways of increasing such attention, possibly through training or technical cooperation initiatives.

More progress needs to be made in environmental reporting to the Bank, while respecting company's internal policies and procedures. Models or guidelines for environmental reporting would help less well-organised project sponsors to improve in this area, particularly in the provision of numerical indicators for specific production-related pollution loads and in setting targets for reduction.

More guidance is also needed for project sponsors on public consultation and the Bank's expectations, both with groups such as non-governmental organisations, and with the local communities who may be affected by a project. This guidance may be particularly helpful on category B projects, where full environmental impact assessments and the associated consultation are not required.

Next steps

This year the Bank is undertaking a review of its Environmental Policy and Procedures and will take the conclusions and recommendations of this study into account. Internal steps are already being taken to address the issues raised regarding implementation, such as developing better monitoring tools for environmental indicators, improving reporting requirements, and so on. The following article describes the development of one such tool, a methodology for assessing greenhouse gas emissions in the Bank's projects.

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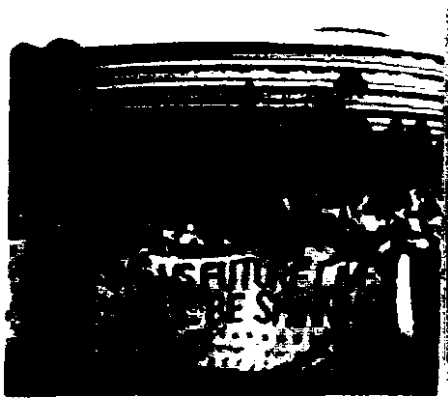
Assessing greenhouse gas emissions



According to good [illegible] protection policy and practice, it is [illegible] environmental issue within the overall [illegible] and environmental [illegible] health, [illegible] population [illegible] also has [illegible] the global [illegible] environmental [illegible]

Assessment of the impact of air emissions has always been part of the EBRD's environmental due diligence requirements. However, with the agreement in July 2001 of the Kyoto Protocol and its associated commitments to greenhouse gas reductions, it was timely for the Bank to consider incorporating into its due diligence process a formal assessment of greenhouse gas emissions and to prepare to report the greenhouse gas impact of its operations on an annual basis. At the operational level, it was also deemed appropriate for the EBRD to help its clients to participate in the "flexible mechanisms" – Joint Implementation (JI), the Clean Development Mechanism (CDM) and Emissions Trading – elaborated under the Kyoto Protocol, which have been established to encourage the development of projects leading to greenhouse gas emission reductions. These mechanisms involve the formal transfer of emission reduction units, or emission credits, between project developers and governments. Calculation of the emission reduction units that a project will achieve requires both the assessment of the project's actual greenhouse gas emissions and a systematic projection of the emissions that would have occurred if the project did not exist. Formal procedures and guidelines for participation are emerging as governments determine how best to use the flexible mechanisms to help meet their emission reduction obligations.

The EBRD's methodology

With these objectives in mind, the EBRD has developed its own Greenhouse Gas Assessment Methodology and plans to incorporate it into its formal environmental due diligence process this year. The practical application of the methodology was tested in-house during 2001, and comments were invited and received from external bodies such as the World Business Council for Sustainable Development. The text that follows considers the main features of the methodology and provides comment on some of the more controversial aspects of greenhouse gas assessments.

Fitness for purpose

Given sufficient technical information on the project process and the right operational data, the calculation of greenhouse gas emissions per se is straightforward. The Intergovernmental Panel on Climate Change (IPCC) has provided detailed recommendations on calculation methods and most of the established greenhouse gas methodologies, including the EBRD's, rely on these methods for the basis of the assessment. The differences between methodologies generally lie in the scope of assessment. To be practicable and effective, the scope, and thus the resources involved in implementing it, should be commensurate with the perceived value of the assessment.
For the EBRD, a more comprehensive

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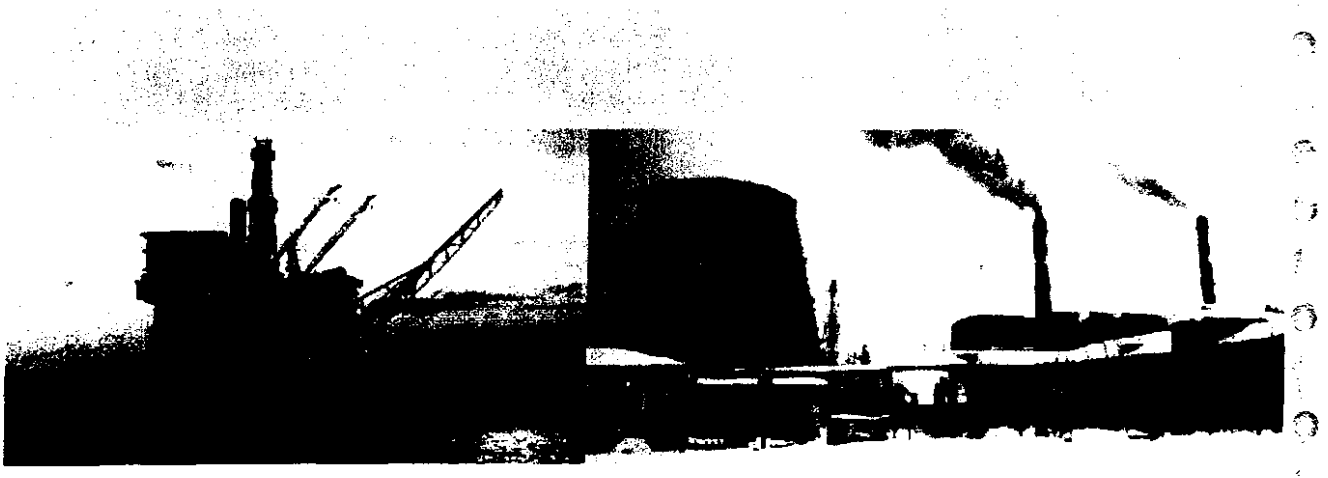

assessment would be required for a project taking advantage of JI or CDM than a small project whose greenhouse gas emissions were being evaluated simply to calculate its contribution to the overall portfolio impact. The scope of a greenhouse gas assessment is largely determined by the choice of three key aspects, and its accuracy by a fourth:

1. Project boundary
2. Baseline, or reference scenario
3. Direct and indirect emissions
4. Data adequacy

These are explained below.

1. Project boundary

One of the most controversial aspects of any greenhouse gas emissions methodology is the definition of the project boundary, i.e. its scope. One non-governmental organisation (NGO) to whom the methodology was sent for comment advocated a life-cycle approach, arguing in particular that all downstream emissions resulting from the use of marketed products of Bank projects, e.g. oil and gas products resulting from natural resource exploitation projects, should be counted as project emissions. However, such a view runs counter to the accepted IPCC view that emissions from fuel use are deemed to arise at point of use. It is at point of use that the control of emissions lies, and that is where the incentive for reduction must exist. While this aspect of the IPCC assessment protocol was driven largely by the need to avoid "double counting" of emissions, it has general validity in a world where market economics plays the major role in determining the responsibility for and location of emissions. More generally, provided that the interpretation of any assessment is consistent with the way boundaries are defined, no conflict should arise over any particular choice of boundary.

In the EBRD methodology, the default choice of project boundary is the physical (geographical) boundary of the project facility. Consideration should be given to extending the boundary to include any upstream or downstream processes directly linked with the project, and which exist or operate only as a result of the project. An example would be a dedicated mining operation that would otherwise not exist, or an associated waste or by-product utilisation facility. It would also not be appropriate to exclude from the assessment any integral part of the business of the project just because it was contracted out to a third-party operator.

For transportation and municipal and environmental infrastructure projects, boundary definition is likely to be more complex than for a power, natural resources or industrial project. A reasoned statement for the inclusion and exclusion of potentially involved sources should be made at the outset of the greenhouse gas emissions assessment.

It is essential that the chosen project boundary definition be applied consistently to the project and to the baseline/reference scenario (see below) to ensure that a valid comparison of "with-project" and "without-project" emissions can be made. For example, where the project introduces new emission sources or enables the cessation of others as a result of a change in the scope of the operation, the baseline emissions boundary must be adjusted accordingly to ensure comparability of scope.

2. Baseline or reference scenario

Estimating the future emissions that would have occurred in the absence of the project is potentially the most complex part of any greenhouse gas assessment. It involves predicting future trends in the social, economic, political, regulatory and technological climates of the host nation. For JI or CDM projects, modelling these developments to generate a time-dependent baseline over the life of the project (or over the period for which emissions credits are to be claimed) is a complex task. The EBRD methodology requires such a study to be undertaken, but recognises that the approach adopted will vary between projects in order to meet the requirements prescribed by the various bodies involved that monitor emissions.

A less sophisticated approach to estimating baseline emissions is adopted for

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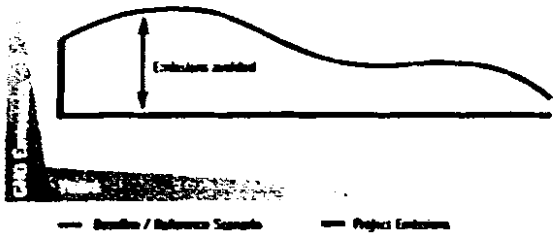

projects not seeking to use JI or CDM. A one-off measure of the emissions displaced upon the introduction of the project is used as the baseline. In such cases, the displaced emissions may typically be those from operations closed down as a result of the new project. In comparing project and baseline emissions, it is important to consider whether a change in service provision has occurred, e.g. where a new facility is delivering twice the service of the displaced operation and, although more efficient, is as a result increasing overall emissions. It would certainly be wrong to double the baseline emission to take account of this, but it would be appropriate to calculate the specific emissions – i.e. the emission per unit of product output – for both the project and the baseline in order to demonstrate the improved efficiency of the operation.

3 Direct and indirect emissions

Direct emissions are those resulting from processes occurring within the project boundary. The methodology identifies for a wide range of industrial processes the principal energy and process emissions that should be assessed. To enable a consistent comparison with a time-dependent baseline or reference scenario, future changes in emissions over the life of the project should be estimated, for example changes arising as a result of deteriorating plant performance with age. The extent of such changes will be influenced by the investment included in the project for operations and maintenance and future plant improvement.

Indirect emissions are those which arise solely as a result of the project's existence but which occur outside the project boundary. In most cases assessment of indirect emissions may reasonably be restricted to the emissions associated with electricity or heat imports where these provide a significant source of energy for the project. The need to include any other indirect emissions will depend in part on the definition of the project boundary. For example, a new mine dedicated to supplying fuel for the project may already have been incorporated within the defined project boundary. If not, its emissions should be included as indirect emissions of the project. However, emissions arising from use of a project's products are not considered to be indirect project emissions, consistent with their exclusion from the defined project boundary as discussed above.

4 Data adequacy

The value of any greenhouse gas emissions assessment is ultimately limited by the quality of the data used in the calculations. Measurements of annual emissions may in principle be calculated in a variety of ways, with varying accuracy, from a range of primary or secondary data sources. Project documentation may often appear to provide sufficient data to enable a choice of calculation method, although the assumptions used in deriving secondary data are not always adequately stated. Inconsistency between alternative calculation methods may then arise. The EBRD methodology includes guidance on action that should be taken to validate data sources and render them adequate for use in the assessment. Where possible, methods of calculation based on primary project data should be used, although the methodology gives detailed guidance on alternative calculation methods for different data availability.

Implementation

Test applications of the methodology during 2001 showed that early assessment of greenhouse gas emissions in project appraisal has the potential to identify both important areas for improving a project's greenhouse gas performance and also missing information and data relating to those emissions. Incorporation of greenhouse gas assessment into the routine due diligence process should therefore lead to a more complete understanding of a project's environmental profile and to the development of more comprehensive environmental action plans. In the light of experience gained, operation of the methodology will be reviewed and improvements implemented. Continued liaison with other international financial institutions will provide additional input to further development of the methodology.

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Role of Development Banks in Promoting Industrial Energy Efficiency: India Case Studies

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Environmental Energy Technologies Division

June 1999

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Role of Development Banks in Promoting Industrial Energy Efficiency: India Case Studies

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Manas Mukhopadhyay, Dalal Consultants and Engineers

ABSTRACT

The Industrial Development Bank of India (IDBI) is the premier institution in India purveying financial assistance to the industrial-sector projects. Its annual lending amounts to $6 billion. Recognizing the need to increase lending for energy efficiency and environmental management (ee/em) projects, the Asian Development Bank (ADB) provided a $150 million line of credit to IDBI. These funds were lent to cement, steel, paper, sugar and other industries. Accompanying the line of credit, ADB also provided funds for technical assistance to strengthen IDBI's capability for the assessment of projects related to energy efficiency and environmental management (ee/em).

The technical assistance (TA) focused on IDBI's institutional capability, the procedures it follows for lending in this area, studies of ten energy-intensive sectors, and training and data needs to improve its lending. The findings of the TA reveal a need to (1) use ee/em indicators during IDBI's appraisal, approval, and monitoring of projects, (2) increase the ee/em information resource base – in-house and out-house ee/em experts, handbooks, computerized data bases – that IDBI staff can access, and (3) increase awareness of ee/em components among industrial borrowers. The sector studies show that there is at least a 20% lag compared to best practice for energy use, and that a significant potential, $1.0 billion, exists for investment in ee/em activities. These activities include (a) housekeeping measures such as improved lighting, variable-speed motors/drives, improving power factor, etc., (b) installing co-generation and captive power generation units, and (c) changing manufacturing processes to more efficient and less polluting ones. Training and data needs were also identified which would improve IDBI's lending for energy efficiency and environmental management.

1. Introduction

Beginning in 1955, several financial institutions (Development Finance Institutions (DFIs) were established to provide funds to the large medium and small industry in India. The DFIs provide finance for the establishment of new industrial projects as well as for expansion, diversification, and modernization of existing industrial enterprises. In 1997-98, the Industrial Development Bank of India (IDBI) and the Industrial Credit and Investment Corporation of India (ICICI), the two largest DFIs, for instance, provided $12 billion worth of financing. In recent years, DFIs have been active in managing and lending for energy efficiency and environmental projects. Because of their role in lending for industrial institutions, the DFIs are in a position to transform the market for industrial energy efficiency and environmental pollution control activities.

We evaluated this potential role for IDBI in lending for energy efficiency and environmental pollution control activities. The Asian Development Bank (ADB) had provided IDBI a $150[1] million loan for the Industrial Energy Efficiency Project (IEEP) at the request of the Government of India (GOI) to improve energy efficiency in the modernization and expansion of industry. The primary energy efficiency criteria for the selection of industrial projects were that the modernized or expanded plant show at a minimum an energy efficiency improvement of 18%. In addition, a technical assistance (TA) project accompanied this line of credit to IDBI. This TA project formed the basis for our evaluation.

The project consisted of two main activities. The first was to evaluate the investment potential for ee/em activities or projects in ten industrial sectors, and the second was to examine the suitability of IDBI's current institutional structure, and policies and procedures, for ee/em lending on a regular and organized basis. The evaluation of ten industrial sectors revealed an investment potential, with a payback period less than four years that exceeded $ 1 billion. The IDBI evaluation identified many areas where the establishment of an energy and environmental center within IDBI would accelerate the achievement of this potential.

In addition to the above two main activities, the consultant's team also conducted in-house seminars, overseas training programs and site visits to steel, paper and aluminum plants, organized outreach workshops for industry, and provided bibliographic information on ee/em for the IDBI library.

The TA was managed by a US company, Energy Resources International (ERI), with primary responsibility for the technical aspects covered by the Lawrence Berkeley National Laboratory (LBNL), University of California, and Dalal Consultants and Engineers Ltd. from India. In addition, Indian sector specialists were hired to study the potential for energy efficiency improvement and environmental management in ten industry sectors. In order to facilitate the work of the ERI team, IDBI established a Task Force comprising of five IDBI officers.

The project produced ten reports, one each for the aluminum (Roy et al. 1998), cement (Karwa et al. 1998), chemicals (Fatnani et al. 1998), copper (Mitra et al. 1998), fertilizer (Trivedi et al. 1998), iron and steel (Mishra et al. 1998), pulp and paper (Srivastava

[1] As of 31 October 1998, loan applications worth approximately $125.19 million funded by IEEP had been authorized.

et al. 1998), sugar (Prabhakar et al. 1998), textiles (Hirani et al. 1998), and zinc (Krishamurthy et al. 1998) sectors. The sector reports include information on status of the industry, technologies, energy use and comparisons, energy conservation potential, costs and benefits of energy efficiency, and environmental concerns. For the cement, fertilizers, pulp and paper, sugar, and textiles sectors, separate summary reports were prepared for the industry audience. In addition, a report documenting and reviewing IDBI's institutional structure and its procedures for lending to industrial projects was prepared. Finally, a bibliography of journal and popular articles, books and conference proceedings was prepared for each sector for use by the IDBI library to add to its current collection of material on topics in these sectors.

2. Summaries of Sector Studies

The industrial sector provided 29% of India's GDP in 1994-95 and manufacturing accounted for 20 % of the GDP. The sector is a significant consumer of materials and energy and an emitter of environmental pollutants. While energy costs account for only 4.7% of manufacturing output, their share are significantly higher in the energy-intensive industries. These industries also tend to be heavy polluters because of their intensive use of raw material, which is transformed into a usable product while discarding the unusable portion, such as red mud in the production of aluminum. Below, we provide background information on the development of the manufacturing sector in India, with particular emphasis on the growth and productivity improvements of selected industries.

2.1 Sector Studies

The sector studies consumed bulk of the effort of this technical assistance. Ten industry sectors: chemicals (caustic soda), steel, fertilizers, cement, textiles, pulp and paper, aluminum, zinc, copper, and sugar were selected for study. Each sector report includes a description of the sector, technologies and processes used to manufacture the primary products in that sector, energy use in Indian plants and those in other countries, potential for reducing energy use and the associated cost, and environmental norms in that industry. Also included in each sector report is a list of suppliers for the equipment used in that industry, and a list of items that IDBI loan officers could check when appraising a loan for each sector, and information on the size of the market for energy efficiency and environmental management investments in each industry.

The primary conclusion from these studies is that in every sector there are cost-effective opportunities to reduce energy use, and pollutant loadings, and to improve the financial performance of the respective industrial plant. These opportunities remain untapped due to many barriers such as: the cost or availability of financing, lack of availability of information and access to equipment and technology.

The main challenge in preparing the sector reports was the difficulty in acquiring information on the costs of improving energy efficiency. Cost information is difficult to obtain since bids provided by equipment suppliers vary with the circumstances under which they are being sought by the buyer. Therefore, the actual costs may vary considerably across companies and loans. Selected findings of the sector reports are summarized below.

2.2 Production Capacity and Technology

India is a major producer of several energy intensive commodities. It ranks among the top five producers worldwide of aluminum, cement, steel, fertilizers, textiles, sugar, and paper. The demand for these products is growing faster than that worldwide because of the steady and relatively faster economic growth, and increased materialization of the Indian economy. The construction sector, which constitutes a major demand for products such as steel, cement, aluminum, etc., has grown faster than the rest of the Indian economy and as infrastructure expansion is targeted by the Indian government; demand for these products is likely to increase in future. The quality of the technology being used to produce these products varies across sectors, but a few common features are worth observing in this context. We report on the findings for the aluminum, cement, steel, fertilizers, and caustic soda sectors.

The production of aluminum is dominated by older technology. All the existing plants are based on foreign process know-how. They are of older design, however, wherein negligible process automation has been introduced, except in the case of one major plant owned by the National Aluminum Company (NALCO). In part because of their vintage, Indian plants lag in their efficiency of electricity use, which ranges from 14,500-23,000 kWh/tonne for the aluminum extraction plant, compared to 13,500 kWh/tonne for the best plants abroad.

Almost all the process steps in Indian aluminum plants can be improved with modification/ retrofitting and substantial scope exists for using energy more efficiently. Important areas, which could lead to significant reduction in energy consumption, include replacement of existing rotary kiln with statutory calcinator, adoption of tube digestion system in place of autoclaves, use of variable speed drives for major process pumps and large motors, introduction of microprocessors and computer based cell operation, etc.

Various varieties of cement are being manufactured employing three main technologies: the dry, the semi-dry and the wet process. The dry process provides significantly more modern and energy efficient technology. Over time, the wet and the semi-dry processes have increasingly been replaced by the dry process through addition to the dry-process capacity, as well as conversion from the wet to dry process.

Coal is the major fuel used for heat production in the cement industry. The dry process uses between 750-800 kcal/kg of cement clinker compared to the more energy-intensive wet process, which uses between 1350-1500 kcal/kg of clinker. The electricity consumption of cement plants averages around 120 kWh per tonne of cement produced. Conversion of all 61 kilns (8.5 mt) operating on wet process in India to the dry process could save 1.2 mt of coal, which in turn could be used to manufacture 7.8 mt of cement. About 25% of the wet process capacity is amenable to conversion,

The production of caustic soda is very energy intensive, with almost 50% of the value of the raw material being electrical power. Older plants all rely on mercury cells that release significant amounts of mercury in the environment causing a serious toxic hazard. In Indian plants the electrolysis power for the membrane plants (i.e., exclusive of auxiliary power consumption) per ton of caustic soda is 2700 kWh/t. The older diaphragm plants use about 4000 kWh/t. The lowest numbers are for the membrane process plants. The mercury-cell

plants (which today dominate the Indian installed capacity) use 3500 kWh/t. Energy efficiency of individual membrane plants varies because of the age of the plant, rectifier efficiency, level of automation, and the level of cell instrumentation and control.

Energy efficiency upgrades are possible in the manufacturing process, auxiliary equipment, and power system. Improving salt and brine quality will also reduce the energy load. For a 100 tonne per day capacity plant, an investment of Rs. 500 million can result in annual energy savings of Rs. 89 million for a payback period of 5.6 years. Taking all costs into consideration the payback period reduces to 3.5 years.

Presently 33 units produce nitrogenous, 53 produce phosphatic and 29 small units produce single super phosphate fertilizer in India. In 1995-96, industry produced 8.76 million tonnes (Mt) of nitrogenous and 2.59 Mt of phospahtic fertilizer. Nitrogenous fertilizers, i.e. ammonia and urea fertilizers, are highly energy intensive employing natural gas, associated gas, naphtha, fuel oil, and coal as their major feedstocks. Gas-based ammonia plants represent the most energy-efficient technology in India, which compares well with that in other countries in the world. Salient international comparisons are shown in Table 1.

Table 1. Average Energy Consumption for Ammonia Plants

Country	MkCal/t
UK	7.4
Indonesia	8.2
Malaysia	9.2
India	**9.4**
USA	10.0
UAE	12.1

The age of the technology, the scale of the plant, and management practices have a large impact on energy efficiency of the overall process. A typical ammonia plant established in 1970s would be 600 tpd gas based process with an efficiency of 9.8 to 10.2 MkCal/t. A plant established in early 1990s would consume only 8.0 to 8.5 MkCal/t.

A typical energy efficiency revamp of an older (1970s vintage) ammonia plant would cost about Rs. 300 million, and will save about one MkCal/t of output, with cost of conserved energy just below the current (1998) energy prices assuming a levelized cost with 14% interest and 10 year capital life. An estimate of total potential energy savings from pre-1980 plants (assuming savings of 2 MkCal/t for ammonia plants and savings of 1 MkCal/t for urea plants) is 17 million MkCal annually, worth about Rs.5100 million at the 1997 price of natural gas.

Integrated primary steel plants in India usually employ the blast furnace-basic oxygen/open hearth furnace process route for iron and steel production. About 26% of the total steel production is through the open-hearth process, an obsolete technology by world standards. Secondary steel production takes place in mostly privately owned small steel plants employing the electric arc furnace process (installed capacity of 8.44 million TPA in 180 units) or the induction furnace process (installed capacity of 8.83 million TPA in around 800 units). New plants using the COREX process are also being built that will be much more energy-efficient.

Investments in basic oxygen furnace gas recovery could save 1.3 million tonnes of furnace oil with a payback period of 5.7 years. Improvements in coke drying units would result in even higher savings (Rs. 2500 million) with a payback period of only 3.4 years. Other measures lead to similar savings with payback periods mostly ranging below five years. With rising cost of fuel the estimated pay back periods are likely to reduce further.

3. IDBI Lending Process, Institutional Structure, Training, Information and Data Needs

IDBI was established in 1964 under an Act of Parliament for providing credit and other facilities for the development of industry. It also acts as the principal financial institution for coordinating the activities of institutions engaged in the finance, promotion, or development of industry. The Government of India's shareholding in IDBI amounts to 72%, and the rest of the shares are owned by the general public.

IDBI has also offered specialised schemes for energy conservation viz. Equipment Finance for Energy Conservation and Energy Audit Subsidy Scheme. Presently, IDBI provides rupee and foreign currency term loans for the acquisition and installation of energy conservation equipment, and for pollution control and prevention projects in highly polluting industrial sectors, funded *inter alia*, out of World Bank's Industrial Pollution Prevention Project (IPPP) or the US Agency for International Development-funded Greenhouse Gas Pollution Prevention (GEP) Project. Besides, finance is made available for EE/EM out of the on-going Industrial Energy Efficiency Project of the ADB of which the TA forms a part. Under this project, finance is given to industrial units in rupee as well as in foreign currency. Additional funding needs left unmet by the ADB funds are supplemented by IDBI's own funds as well.

3.1 IDBI Institutional Structure

IDBI is governed by a Board of Directors and its operation is carried out under the supervision of the Chairman and Managing Director assisted by four Executive Directors and one Adviser. With its head office in Mumbai, IDBI has 43 additional offices throughout India. As of November 1998, IDBI was structured into 33 departments, which are organized into five groups to facilitate proper distribution of responsibility. Among these departments, the ones relevant to the efficient lending for ee/em activities are briefly described below.

3.1.1 Project appraisal department. The Project Appraisal Department (PAD) appraises all the industrial project proposals. PAD projects constitute the majority of projects sanctioned by IDBI in terms of value. Besides a number of smaller projects are funded at the branch level.

3.1.2 Corporate finance departments. The three Corporate Finance Departments (CFDs) follow up on the projects that have already been sanctioned, in order to ensure their timely implementation and proper utilization of funds. In addition, a new concept of a Relationship Manager was instituted within the CFDs. These managers will be dedicated to manage IDBI's

interactions with a major industrial (ownership) group, such as Reliance Industries, the Tata Group, etc.

While the relationship manager system works well from the perspective of consolidating knowledge about an industry group, it may not work as well where the focus has to be on an aspect of technology within an industry sector. For example, a relationship manager cannot be expected to be an expert on energy efficiency in every industry sector that forms a part of the industry group being dealt with by him/her. Hence, in order to develop some expertise in some of the industries, which are not necessarily dominated only by a few major industry groups, industry-sector-wise approach is also adopted. Thus the organisation of a CFD is a workable mix of industry group and industry sub-sector, with the expertise of one Dealing group drawn upon by another.

3.1.3 Forex services and treasury departments. The Treasury and Funding Division contracts, decides on utilization and monitors all lines of credit from multi-lateral institutions like the World Bank (WB) and the Asian Development Bank (ADB). It manages the various specialized loans and grants for energy and environmental technology projects, including this TA project.

3.2 Comments on Organizational Structure

IDBI's organization structure is driven by its business objectives of offering the best services to the major industry groups. At the same time it is so organised to have industry specialists in important industrial sub-sectors as well. The organisational structure is geared to provide the best products and services in the present competitive environment while simultaneously attempting to meet its developmental role governed by "issue-based" lending. Following financial sector liberalisation, the environment has turned highly competitive compelling IDBI to organise itself in a manner to prioritise the objective of offering the best services to the major industry groups over focus exclusively for energy efficiency and environmental activities. There is a need to create a "home or center" for energy and environmental technical activities. This center needs to be located at the highest level within IDBI in order to ensure visibility, and to provide a resource base, which could be accessed by all the concerned departments described above.

IEEP and other such lines of credit are being managed by the FSD, which is not directly engaged in either project appraisal or in implementation. Hence its role is one of being a facilitator and co-ordinator for giving the needed focus to the ee/em activities. It is quite possible for this Section to be upgraded to be the "home" suggested above with appropriate technical staff for policy making, facilitation of the lines of credit, developmental activities, etc. in ee/em issues. This will help clarify the varied roles of CFD and FSD and avoid duplication of effort, better coordination and communication between the FSD and the CFD. A system of built-in incentives for co-operation and co-ordination between the concerned departments will also aid the organisation in playing a more effective role in ee/em activities relating to policy formulation, loan approvals and subsequent disbursement.

3.3 IDBI Lending Procedure

The current procedure for lending at IDBI includes: (1) an inquiry stage, (2) an

application stage, (3) site visits, (4) preparation of an appraisal note, (5) an evaluation by IDBI committee, (6) the issuance of a Letter of Intent, and (7) preparation of a legal agreement for lending for suitable projects.

IDBI also operates special credit lines for the mitigation of pollution, implementation of the Montreal Protocol commitments, modernization and expansion of energy intensive industry, etc. The technical norms for these lines were determined individually, but the lending procedure is the same as that for other IDBI projects.

The lending procedure followed by IDBI is comprehensive, based on accepted methods of evaluation and collective wisdom, and is transparent. The procedure, however, does not provide for a serious attempt to evaluate the energy and environmental components of any lending proposal. At each stage of the application for a loan, a company is required to provide information on energy consumption, along with that of other utility services. Energy consumption information is disaggregated into fuels and electricity categories. The company is not required to provide indicators of energy use to IDBI, which makes the information difficult to evaluate. Indicators could link the energy (fuel and electricity) consumption to physical activity levels and permit comparison with best practice in India and abroad. IDBI could also ask for additional information on technical indicators in the loan application that industries are required to complete.

3.4 Conclusions and Recommendations

Our evaluation of IDBI's institutional structure, lending procedures, and training and information needs revealed that there is a clear need for greater focus towards ee/em activities, by strengthening the existing institutional structure and capability in this area. This strengthening can be accomplished through the creation and establishment of a "resource center" that will provide the necessary technical backup for IDBI officers at all levels. The center resources will include access to technical experts, handbooks, and databases. The technical experts will assist in the organization of seminars, workshops, and training programs.

3.4.1 Energy efficiency indicators. It is important from the viewpoint of ensuring effectiveness of investments made in energy efficiency and environmental management loans that there should be an assessment of the cost-effective potential for improving energy efficiency. This assessment needs to be conducted at the time of evaluating the loan application *(ex-ante)*, as well as subsequently as the project is implemented.

Indicators are commonly used to assess the effectiveness of a proposed energy efficiency measure, and to compare the proposed measure against other alternate measures. There are several indicators in common use related to energy efficiency investments (e.g., simple payback period, rate of return on investment). However, these are unsatisfactory since they depend on the current (or projected) price of energy, and need to be recalculated every time that price changes. Other indicators, (e.g., the quantum of gain in energy efficiency achieved), are somewhat arbitrary since they do not incorporate the quantum of investment or change in operating and maintenance cost associated with the gain in efficiency.

A more appropriate indicator that is used in the industrialized countries is the Cost of Conserved Energy (CCE). This indicator is independent of the current price of energy,

depends only on the technology and its use pattern, and appropriately incorporates the investment cost and changes in operating and maintenance cost associated with the change in technology.

4. Overcoming Barriers to Energy Efficiency

The Indian industry faces many types of barriers to improving energy efficiency. These barriers are grouped into five categories as described below (Meyers 1998). We discuss the relevance of each barrier with examples from the industrial sectors that were evaluated in this project, and comment on policies that have been or could be used to overcome the barriers.

4.1 Macroeconomic Conditions

These barriers pervade the Indian economy and affect the overall productivity of Indian industry. They inhibit energy efficiency improvements indirectly by maintaining conditions in which investments in energy efficiency are ignored, under-valued, or considered too risky by economic actors. The barriers include (1) low-level of competition among firms resulting from regulation of the domestic market and/or policies that constrain entry of imported products into the market, (2) high tariffs on imported goods, (3) low level of capital market development, and (4) high rate of inflation.

The Indian industry, particularly that in the public sector, has been affected by each of the above barriers, except possibly the third barrier. The manufacture of all the major products described above has been subject to varying degrees of control. Until the early 1980s, an administered pricing and licensing regime prevailed which allowed inefficiency in manufacturing to be the norm, and the inefficient Indian industry established during this period continues to operate to this day dragging the energy use parameters down for the industry as a whole. Overall productivity growth in Indian manufacturing has been slow at about 0.3% annually, and that for energy use has declined marginally (Mongia and Sathaye 1998).

The changes in the Indian economy since the 1950s and the impact of the government's policy of liberalization in the 1980s, and opening up to foreign investors since 1991 are well documented elsewhere. Some industries such as pulp and paper were clearly affected by these changes, and about one-third of the current capacity is idle. Other industries, such as textiles and chemicals, are restructuring to respond to the new policy environment, and the government's privatization of the public sector units should also lead to higher energy efficiency.

4.2 Energy Pricing

Energy pricing may not reflect the cost of supply that is borne by the supplier due to lack of marginal cost pricing or time-of-day pricing or the presence of price subsidies (which may involve cross-subsidies from one customer class to another, and/or subsidies from the government budget). In India, electricity price to agricultural customers is subsidized. The industrial sector, however, has paid a price above the average tariff, e.g. 70% above the average tariff, in 1994-95.

A related barrier is the vagaries of government policy with regard to energy pricing.

The Indian Aluminum plant in Belgaum, Karnataka, is a case in point. This plant has the capacity to produce both alumina and aluminum metal. The latter is very electricity intensive and requires a high quality of electricity supply. A few years ago, the Karnataka Power Corporation raised the price of electricity to the plant, which forced it to shut down the electricity-intensive aluminum production operation. The production of alumina is continuing today. The plant managers were unable to import naphtha in order to set up a captive electricity generation plant due to government regulations prohibiting its transport by road. Today the plant is not producing aluminum and the production capacity is lying idle due to lack of electricity supply and the government regulations that have prevented the company from setting up a captive power plant.

4.3 Institutional Weaknesses

Some industrial sectors have research organizations devoted to developing new technologies and improving productivity in Indian industry. Some of these play an important role in helping industry establish benchmarks and standards for energy efficiency. The textile research associations in India, ATIRA, BTRA, SITRA, and NITRA have established norms for thermal energy use by machine and plant type. Similar efforts are needed for other industries where many small firms dominate the industry, as in the case of paper mills.

Electric utility companies can be important actors in efforts to improve customer electricity use efficiency. In many countries, including India, a combination of their traditional supply-side orientation and lack of incentives prevents them from taking on a significant role. Even when there is good intention, staff may not be available to design and manage energy efficiency and environmental management programs. The State Electricity Boards (SEBs) in India, with a few exceptions, have not adopted programs to promote energy efficiency. The SEBs in India, have the expertise and know-how to play a large role in assisting industry in improving energy efficiency, either through offering incentives for energy efficient customers or through penalizing those who do not follow best practices by charging a higher tariff or a higher connection fee for example. The new regulatory boards being established at the center and state levels can provide the incentive structure for SEBs to promote the efficient use of energy by their customers. Efficient use will also help the SEB to eliminate or reduce electricity supply blackouts and brownouts.

Financial institutions often lack the experience with evaluating investments in energy efficiency or may be unfamiliar with international financing schemes that can best facilitate such investments. Improvements in financial institutions are needed to provide technical resources in the form of ee/em experts, sector-specific handbooks, databases, and training and dissemination workshops and seminars. The institutions can also secure lower cost financing from international lenders, the Global Environment Facility for example, and pass these incentives to their customers.

4.4 Market Behavior and Features

The macro-economic, energy pricing and institutional weakness barriers to energy efficiency play a major role in shaping decisions related to production and demand for energy-using technologies in a nation's economy. The importance of particular barriers varies among

specific markets. On the demand side, barriers tend to be greater with respect to small firms, than with large companies who are better able to evaluate investments. Similarly, in markets where the supply side is heavily comprised of small firms with low levels of technical, managerial, and marketing skills, the barriers to improving energy efficiency tend to be higher.

4.4.1 Barriers on the demand side of the market. Lack of information and limited access to financing, and "irrational behavior" are categories of demand-side barriers. Consumers and managers may lack information regarding the costs and benefits of technologies or services that deliver higher energy efficiency. Even when information is provided by technology suppliers, managers in firms and financing institutions may face difficulty in evaluating the veracity and applicability of claims made for a particular product or service. The paper and textiles industry in India is made up of hundreds of small firms that do not have the managerial capacity to track technical progress for instance. The caustic soda industry would benefit from more information on cell performance features of plants abroad, data on membrane stability at high current density, water conservation measures, etc. Demonstration projects done with full transparency can help to document the experiences and motivate industry to take up relevant initiatives.

Lack of access to financing has been cited by many Indian industries as a major barrier to improving energy efficiency. Financing may only be available for the short-term where long-term credit is needed. During the seminars organized for this project, industry pointed out that lack of financing for energy efficiency is a major barrier. Our findings, however, revealed that the IDBI, with its history of lead role in developmental activities, has had a number of schemes for ee/em purposes. While the schemes in the past provided an element of concession in finance and subsidy, the current schemes have limited such elements. The industry mind-set, particularly the small firms, expects concessions for ee/em activities. There are also instances where industry is unaware of such schemes. Greater outreach measures are therefore indicated.

"Irrational behavior" refers to the way in which individuals process and act on the available information. An industry's behavior may be inconsistent with its goals and more or better information alone may not be sufficient to change behavior, which is strongly influenced by habit or custom. Businesses may reject cost-effective energy efficiency investment opportunities, where management may deem these as too small a component of total production costs to warrant attention. Another equally important revelation is the preference for investment in increasing market shares over that in ee/em areas. This is because the industry management perceives greater market share and penetration to be more important than cost cutting by investment in ee/em areas.

4.4.2 Barriers on the supply side of the market. Limited availability of products and services, weakness of suppliers in market research and product development, and low level of information exchange within an industry are categories of barriers on the supply side. Individual industrial units may lack market power or knowledge about advanced designs and/or techniques to demand efficient goods from suppliers who normally carry limited product lines and are unable to offer choice of equipment with varying degree of energy efficiency.

Supplier weakness may result from firms lacking skills required for development of

new products. The processes and networks by which learning takes place such as professional associations, conferences, publications and informal networks are often weak in India. The exchange of information was observed to be quite low within the paper industry during the seminar held on that topic as a part of this technical assistance. Motor Challenge, a US Department of Energy government/ industry partnership program, for example, provides ways to bring industry together to improve the efficiency of their stand-alone electric motors. The program offerings include: the Information Clearinghouse, which provides current information about the practicality and profitability of electric motor systems, design decision tools, demonstration projects and training workshops. Such a program would decidedly be of help to Indian industry.

4.5 Features of Energy Efficient Products and Services

Performance uncertainty, high first cost, higher transaction costs, and inseparability of product features are barriers that affect particular products or services. Performance uncertainty is most problematic for new and unfamiliar technologies, particularly those that are imported to a tropical climate. For instance, the manufacture of fertilizers using natural gas in a new plant in India requires 7.4 MkCal/Mt of product. While this value compares favorably with that abroad, it will always be somewhat higher since the ambient cooling water temperature is higher in India.

High first cost is a common feature of more energy-efficient technologies, and is a barrier for consumers and firms lacking in capital. The membrane process for the production of caustic soda in India requires more capital, although it has lower operating costs and is more energy efficient than the mercury process. Conversion of the mercury process to the membrane process is cost-effective with a relatively short payback period. Financing of such plants would significantly reduce electricity use per unit of production and eliminate further mercury pollution from existing plants.

The formation of energy service companies (ESCO) is an approach to overcome the performance uncertainty and high first cost of technologies. ESCOs established by (1) vendors focus on leasing or lending equipment, (2) bankers focus on providing attractive financing packages, and (3) utility companies focus on offering attractive electricity rates and services. Many types of ESCOs are already operating in the Indian market but more needs to be done to encourage their growth, and business practices need to be more transparent to ensure that ESCOs receive adequate returns through shared savings.

5. Conclusions

This technical assistance project identified the potential for improving energy efficiency in ten industrial sectors of the Indian economy. It examined the barriers to improving energy efficiency and suggested ways by which IDBI could increase and improve its lending for energy efficiency projects. The study identified technical options that were common to all sectors, such as efficient lighting, high efficiency electric motors, pumps, compressors and drives, computerized process controls, waste heat utilization, and installation of captive power plants. In addition, it identified options that were process-oriented and thus specific to each type of industry.

The potential for investment in each sector varies with the types of options that are identified above (Table 2). For example, the investment potential in the fertilizer industry is estimated to be around Rs. 5 billion, and that for cement industry is around Rs. 3 billion. These estimates are based on the cost-effective technical potential without taking into consideration the practical challenges or the current industrial stagnation, which would reduce the. The total cost-effective potential identified in the study sectors for improving energy efficiency either through retrofits or through process modernization amounts to about Rs. 45 billion, as noted in Table 2.

Table 2. Energy Efficiency Investment Potential in India

Aluminum	: Rs. 8,400 million
Cement	: Rs. 3,000 million
Chemicals (Caustic Soda)	: Rs. 5,000 million
Copper	:Rs. 250 million
Fertilizer	: Rs. 5,000 million
Iron and Steel	: Rs.10,000 million
Pulp & Paper	: Rs. 5,000 million
Sugar	: Rs. 3,200 million
Textiles	: Rs. 9,000 million
Zinc	: Rs. 150 million

The factors that keep energy efficiency low vary among the sectors. Small plant size is an important reason in several sectors, such as paper, sugar, textiles, zinc, and copper. The historical inattention to energy efficiency, and indeed overall productivity, is evident in sectors such as steel, aluminum, paper, sugar, etc., where administered pricing of fuels and electricity, high import tariffs and protection from lower cost imports enabled industry to purchase and install inefficient technology. Lack of information and demonstrated benefits of sophisticated technology, lack of professional associations and informal networks, high first cost of energy efficient technology, are some of the other barriers that slow or prevent its penetration in Indian industry. A key barrier, however, is the institutional weakness in promoting energy efficiency and better environmental management. Some sectors such as textiles have research institutions that provide information on energy efficiency, and the Indian government has established the Energy Management Center and the National Productivity Council to study and promote efficient use of energy. The research and studies, however, have not been fully deployed into energy efficiency projects. .

Financial institutions, such as IDBI, are in a position to help industry overcome some of the key barriers in order to spur the deployment of energy efficient technology and techniques. The financial institutions, however, need to consolidate the necessary technical expertise and make a concerted effort in the energy efficiency and environmental management field if they are to have a significant impact. We recommend that IDBI establish a *"resource center"* for this purpose. The resource center would have or be equipped to (1) call upon the necessary technical expertise, (2) collate and maintain data for industry to use, (3) prepare handbooks for each industry sector, and (4) publicize the importance of energy efficiency and environmental management, through the issuance of annual reports, and by establishing an award for best practice. Given the substantial scope for investment identified by the sector

studies, such a resource center could serve as a strong asset to IDBI officers in particular and the Indian industry in general.

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United Nations Environment Programme

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UNEP Finance Initiatives

Climate Change Working Group Position Paper

November 2001

1. OVERVIEW

1.1. We believe that the precautionary approach is the appropriate way to deal with climate change, in that it is not possible to quantify all the environmental, economic, and social effects before taking action to reduce greenhouse gas emissions. Research can reduce the uncertainty, but never completely eliminate it.[i]

1.2. The financial services sector is involved in all aspects of economic activity and is affected by environmental and social issues. Owing to its business skills - particularly in innovation - and its size (insurance premiums of USD 2.3 trillion[ii] and operating income for banking of USD 1.7 trillion[iii] annually worldwide) the sector can play an important part in meeting the challenges posed by climate change.

1.3. The financial services sector strongly supports the Kyoto Protocol and strongly advocates that efforts be made to strengthen the process towards a long-term and effective framework to tackle climate change.

2. GENERAL POSITION

2.1. Climate Change poses major risks to the natural environment, and to society, in terms of damage to economic systems and human health, as reported in the Third Assessment Report of The Intergovernmental Panel on Climate Change (IPCC TAR). It is essential that early action is taken collectively to reduce these risks by:

Awareness raising	across all sectors and countries as the fundamental basis for initiating adaptation and mitigation.
Mitigation	reducing greenhouse gas emissions *now*.
Adaptation	taking steps to manage the effects of climate change as they impact society and natural systems
Research	defining the effects of climate change more precisely, and refining the technology and tools to deal with it.

2.2. The solutions which are adopted must be sustainable and equitable. For example, they should promote both existing and innovative energy solutions which ensure sustainable economic development in the future.

2.3. Harnessing the resources and skills of the private and public sectors together will provide the most effective answers to the problem of climate change.

3. FINANCIAL SERVICES AND CLIMATE CHANGE

3.1. The finance sector will be affected in several ways by climate change through altered risk profiles from its clients, and through government policy on mitigation and adaptation.

3.2. Banking faces considerable changes through the changing financial prospects of its clients, and more positively, from the demand for financial services e.g. project finance, to support mitigation and adaptation activities.

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3.3. For insurance, the most obvious area of concern involves property losses, where in general risks to clients will become greater, and will be exaggerated by socio-economic trends, which are producing greater concentrations of vulnerable assets in risk prone areas.

3.4. Institutional investors, and in particular, life insurance companies and pension funds invest widely and aim to provide a long-term return for their beneficiaries. Since climate change could affect economic and social stability, investments would be affected through unanticipated changes in risk. Also, the financial prospects and risk/return characteristics of certain industries that are large greenhouse gas emitters may be affected and this must be taken into account by investors.

3.5. Policies to reduce greenhouse gas concentrations, and to manage the impacts of climate change, will inevitably entail the supply of financial services, in terms of insurance, credit and investment. At present the partial completion of the political framework for market mechanisms is hampering progress, but financial institutions are already participating in pilot schemes.

3.6. The sector is a major economic activity in its own right and needs to play its part in adopting sustainable practices internally, e.g. through energy conservation measures in its extensive portfolio of real estate.

4. A MULTIPLE-STRATEGY APPROACH

4.1. Governments, singly and collectively through the United Nations Framework Convention on Climate Change (UNFCCC), should adopt four strategies to tackle climate change, and involve all stakeholders in developing and implementing them. The four strategies are:

4.1.1. Implement the Kyoto process as a small but important first step in dealing with the problem of emissions internationally. This will allow all stakeholders to gain practical experience quickly.

4.1.2. Develop a range of policies and measures for implementation in national and regional jurisdictions, using a minimum of regulation to harness market mechanisms.

4.1.3. Construct a long-term framework to reduce emissions globally in order to achieve the necessary transition to sustainability. The approach of *Contraction and Convergence*, which the IPCC TAR described as "the logical conclusion" of a rights-based approach, provides a possible example of such a basis.

4.1.4. Promote a strong code of corporate sustainability, for business and the government sector, underpinned by the availability of key information on environmental, social and economic performance.

5. THE KYOTO PROTOCOL MECHANISMS

5.1. The Clean Development Mechanism is a valuable medium for adaptation and mitigation within the wider context of sustainable development. Adaptation has been largely ignored but could be instrumental in giving less-developed countries access to financial services in innovative ways, as suggested by the IPCC TAR. UNFCCC should initiate some pilot activity in the area of hazard management. Mitigation projects are closer to conventional business activity, and UNEP FI members are already active in this area.

5.2. Joint Implementation projects also are close to conventional activity, and the financial services sector is already participating in exploratory work here.

5.3. Emissions Trading is a useful step in achieving the transition to a sustainable economy. However, there are still major uncertainties in the modalities of the trading system. Once the rules become clear, it could become an attractive market for financial services. Trading systems within nations or trading blocs present much fewer problems, and may be an appropriate way to commence.

5.4. It is important that the modalities of the Kyoto Protocol Flexible Mechanisms are sufficiently streamlined and transparent to allow the financial sector – and broader business - to be fully engaged and to play their intended roles in emission reductions.

6. TOWARDS SUSTAINABILITY

6.1. Stopping human induced climate change requires a transition to a low carbon economy, with the emphasis on energy efficiency and renewable energy. The financial sector is willing and able to support this change, and is already active in pilot schemes. However, such activities are often placed at a competitive disadvantage by conventional infrastructure, market, fiscal and regulatory systems. Progress would be greatly enhanced by political action to provide more supportive market structures and a long-term plan towards a sustainable energy economy.

7. ACTIONS TO DATE BY UNEP FI MEMBERS

UNEP FI members have:

7.1. Developed standards for corporate reporting of CO_2 emissions[iv], which are in the process of being adopted by many other bodies.

7.2. Participated in pilot projects to refine the modalities of the Kyoto Protocol flexible mechanisms[v].

7.3. Advised and supported companies as they assessed and reported their greenhouse gas emissions and encouraged companies to integrate responses to climate change - comprehensively - into their corporate strategy.

7.4. Financed alternative energy technology ventures that significantly reduce greenhouse gas emissions.

7.5. Developed standards for environmental management systems (EMS) in their sector and taken a leadership position in their implementation.

7.6. Traded green electricity certificates in order to achieve CO_2 emission reduction targets[vi].

7.7. Participated in the IPCC process, notably in the chapters on financial services[vii].

7.8. Taken part in a large number of events to raise climate change awareness in the sector and among other stakeholders and to commence the process of translating the theory of mitigation and adaptation solutions into accepted practice.

7.9. Worked with stakeholders to manage natural hazards - likely to be affected by global climate change - through research, planning and the provision of relevant financial services for operational schemes in the private and public sector.

This paper has been discussed and approved for publication by members of the UNEP Finance Initiatives as a contribution to the climate change debate. It does not claim to represent the unanimous view of all members of the Initiative nor does it represent a UNEP position.

For further information on the UNEP FI's Climate Change Working Group visit **Unepfi.net/cc**

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[i] "...the overwhelming majority of scientific experts, whilst recognizing that scientific uncertainties exist, nonetheless believe that human-induced climate change is already occurring and that future change is inevitable. It is not a question of whether the Earth's climate will change, but rather by how much, how fast and where." Robert T. Watson, Chair, IPCC, 2001.

[ii] Swiss Re, Sigma 9/2000, World insurance in 1999, Soaring life insurance business

[iii] UBS AG, Group Research, Zurich; 2001

[iv] The GHG Indicator: UNEP Guidelines for Calculating Greenhouse Gas Emissions for Businesses and Non-Commercial Organisations, Charles Thomas, Tessa Tennant and Jon Rolls, UNEP 2000

[v] E.g. preparation of financing concepts tailored to the requirements of the customers, creating alternative climate/carbon funds and CDM project financing within CAF's Latin American Carbon Program.

[vi] E.g. Dresdner Bank

[vii] Climate Change 2001: Impacts, Adaptation, and Vulnerability, IPCC Third Assessment Report, Technical Summary, A Report of Working Group 2, K.S. White, et al., chapter. 4.6, and Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change, R.T. Watson, et al.

IFC Facility to Purchase GHG Emission Reductions

What is the Facility? The Facility is an arrangement under which IFC will purchase greenhouse gas (GHG) emission reductions for the benefit of the Government of the Netherlands using the "Clean Development Mechanism" (CDM) of the Kyoto Protocol. The Netherlands will use these emission reductions to help meet its commitments under the Kyoto Protocol. The Netherlands has allocated €44 million (about US$ 40 million) for this Facility over the next three years. The Facility will provide additional revenues to eligible projects that generate emission reductions in developing countries.

We are pleased to introduce the IFC-Netherlands Carbon Facility. IFC welcomes all inquiries regarding projects that may be eligible for funding under this Facility please see contact details.

What are GHG emission reductions? GHG emission reductions are created when a project reduces or avoids the emission of greenhouse gases, such as carbon dioxide or methane, as compared to what would have been expected under a 'business as usual' scenario. That is, the project is measured against a baseline of expected GHG emissions in order to determine the extent of its impact. For example, a new wind power plant that displaces existing or expected coal-fired power generation would create significant GHG emission reductions as would a project at a landfill that captures and utilizes some or all of the methane that previously escaped into the air. In contrast, a wind power project that offsets hydropower would not generate GHG emission reductions, as the baseline has no GHG emissions.

What types of projects are potentially eligible?
The Facility has a particular interest in financing projects of the following types (in order of preference):

- renewable energy projects (e.g., biomass, wind, geothermal) that displace use of fossil fuels;
- energy efficiency projects, supply side or demand side, that reduce consumption of fossil fuels;
- recovery and utilization of methane from, for example, waste landfills and coal mines; and,
- switching from fuels with greater to lesser GHG intensity (e.g., from coal to natural gas).

Until the Kyoto Protocol rules on land use and forestry projects are further clarified, the Facility will not be considering projects of this type. Please also see selection criteria.

What type of funding will the Facility provide? If a project is approved, the Facility will make payments to the project over a period of 7-14 years upon periodic (e.g., annual) certification of actual GHG emission reductions. In return for these payments, the Netherlands will receive certified emission reductions (CERs) that can be used to meet its obligations under the Kyoto Protocol. The Facility may consider limited advance payments for reductions but only under unusual circumstances.

What are the key terms in a contract with the Facility? A contract with the Facility will specify:

- the volume of GHG emissions that are expected to be reduced, measured in metric tonnes of carbon dioxide equivalent (CO_2 equivalent);
- the price agreed per tonne of CO_2 equivalent; and,
- the period over which payments will be made, typically either 10 or 14 years.

Other terms and conditions will also be negotiated and agreed by the Facility and the project company.

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Can this contract be used to facilitate conventional financing?
The contract will specify a set of cash flows that will be paid to the company on delivery of certified GHG emission reductions over a period of time. Conventional providers of financing may choose to consider these additional cash flows when evaluating the capacity of the company to repay debt and/or provide a return on equity.

How long will it take to negotiate a contract with the Facility? A quick initial assessment will determine the Facility's potential interest in a project. The time required for the Facility to evaluate, negotiate and finalize a contract is expected to be only a few months. However, the need to interact with several other parties — e.g., to validate the project design with an independent auditor and to receive host-country approval (please see below) — is likely to lengthen the total time needed for the Facility to process a project to about 6-8 months. Any delays in external processes and approvals could further extend the timeline, as could delays in reaching financial closure on the project itself.

What are the main project selection criteria? In addition to the project preferences noted above, the Facility has a number of selection criteria including, but not limited, to:

- *Location*. Projects can be located in most developing countries in Africa, Asia, Latin America and the Caribbean, or the Middle East. Projects in newly industrializing countries in Central and Eastern Europe are *not* eligible under the CDM. A list of eligible countries is available on request.
- *Likely Project Closing*. Projects must be likely to reach financial closing within the short term.
- *IFC and non-IFC Investments*. The Facility prefers to work with projects in which IFC is an investor but will also consider non-IFC financed projects. For non-IFC projects, the Facility will look for well-established sponsors with access to confirmed sources of conventional financing. Non-IFC projects will require additional due diligence on project fundamentals.
- *Environmental and Social Impact*. All projects, *including* non-IFC financed projects, must comply with IFC's Environmental and Social Policies and Guidelines. Projects that have large-scale adverse environmental or social impacts will not be considered.
- *Host Country Approval*. The government of the host country will have to approve the project under the Clean Development Mechanism of the Kyoto Protocol. IFC can support the application of the project company to the government for such approval. The host country will also need to have ratified, or initiated domestic procedures to ratify, the Kyoto Protocol.
- *Independent Verifications*. The initial design of the project will need to be validated by an independent auditor, as required under the Kyoto Protocol. In addition, the emission reductions produced by a project must be verified and certified periodically by auditors.

What are the benefits of working with the Facility? The Facility could provide projects with a future stream of income that otherwise might not be available. In addition to this direct financial benefit for companies, host countries will gain access to efficient, clean technologies at a lower cost and will achieve more environmentally sustainable economic growth. The Facility will also contribute to the development of an important new market for environmental services.

Why work with IFC? IFC is the largest multilateral source of loan and equity financing for private sector projects in the developing world. In the year ending June 2001, IFC approved $3.7 billion of investments in 240 projects around the world. Given IFC's experience with project finance in developing countries, IFC is well positioned to assist mainstream project sponsors to participate in the emerging market for GHG emission reductions. The Facility expands the range of value-added services that IFC can provide to support projects' long-term sustainability.

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- energy efficiency projects, supply side or demand side, that reduce consumption of fossil fuels;
- recovery and utilization of methane from, for example, waste landfills and coal mines; and,
- switching from fuels with greater to lesser GHG intensity (e.g., from coal to natural gas).

Until the Kyoto Protocol rules on land use and forestry projects are further clarified, the Facility will not be considering projects that sequester carbon in biomass. Please also see selection criteria below.

What type of funding will the Facility provide? If a project is approved, the Facility will make payments to the project over a period of 7 – 14 years

upon periodic (e.g., annual) certification of actual GHG emission reductions. In return for these payments, the Netherlands will receive certified emission reductions (CERs) that can be used to meet its obligations under the Kyoto Protocol. The Facility *may* consider limited advance payments for reductions but only under unusual circumstances.

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This information is also available in the Facility's brochure in PDF format.

For additional information, please review Summary of the Facility's Project Cycle. You can also send an email to carbonfinance@ifc.org or you can write to International Finance Corporation, Environmental Markets Group, 2121 Pennsylvania Ave., Washington, DC, 20433, U.S.A.

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The GEF Solar PV Portfolio: Emerging Experience and Lessons

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Preface

The GEF Monitoring and Evaluation (M&E) team is tasked with analyzing and documenting GEF results. Until now, conclusions of these efforts have been in the form of evaluation and study reports, annual Project Performance Reports, and GEF Lessons Notes. With the introduction of the M&E series of Working Papers, we are publishing reports that are not full-fledged evaluations, but nevertheless deserve attention.

Many of the issues and early results that these reports identify will be pursued later in broader evaluations to arrive at more definite conclusions. We expect the M&E working papers to be a valuable catalyst for promoting dialogue on issues and results of importance within GEF's operational areas and efforts. We therefore look forward to your feedback and suggestions. Please contact us through the coordinates listed below and visit the GEF Web site to find out more about the Monitoring and Evaluation program.

The GEF Solar PV Portfolio: Emerging Experience and Lessons is the result of a 1999 thematic review. Thematic reviews are not comprehensive evaluations—when many projects in a portfolio are relatively new, such evaluations would be premature. Rather, such reviews are more modest attempts to take stock of progress to date and identify lead indicators of achievements, if any. Additionally, reviewers may identify issues related to project design and implementation, thereby enabling discussion and reexamination of strategic issues within the GEF operational programs.

This review was based on data and information collected from a variety of sources: (a) desk reviews of project documents, including proposals for funding project preparation; (b) Project Implementation Reports and evaluations of completed projects; (c) interviews with project managers in the implementing agencies; and (d) visits to Bangladesh, China, Ghana, India, Sri Lanka, Uganda, and Vietnam.

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During the preparation of this review, several colleagues in the GEF implementing agencies shared with us their valuable experiences in project design and implementation, and facilitated country visits to review projects. They include: Wolfgang Bertelsmeier, Susan Bogach, Anil Cabraal, Aeneas Chapinga Chuma, Mac Cosgrove-Davies, Stephen Duah-Yentumi, Suresh Hurry, Magdalena Manzo, Subodh Mathur, Ademola Salau, and Doug Salloum.

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- Steve Hirsh, Chief Technical Advisor, Ministry of Energy and Mineral Development/United Nations Development Programme/GEF, Uganda
- Shawn Luong, Managing Director, Solar Electric Light Company, Vietnam

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Finally, we would like to acknowledge the contributions of our colleagues at the GEF Secretariat: Alan Miller and Scott Smith for providing contrasting viewpoints and inputs, and Elizabeth Mook for editing the report.

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GEF Thematic Review of Solar PV Portfolio

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Executive Summary

Since 1991, the GEF has provided grant financing for 23 off-grid solar photovoltaic (PV) projects in 20 countries. In addition, four more projects are under preparation in the pipeline. Though specific objectives vary, the projects, in general, are aimed at stimulating and achieving commercialization of solar PV systems for rural households (called "solar home systems"). In all, these 23 projects together account for about US$210 million of GEF allocation, and about $1.4 billion in total project costs.

The review highlighted a number of important issues associated with solar home systems projects that future projects should explicitly address to varying degrees, depending on the delivery model employed:

- Technological credibility
- The role of solar PV within rural electrification programs
- Government policies vis-à-vis electricity as a basic need
- Household affordability and willingness to pay
- Marketing strategies, costs, and purveyors
- Concession selection and regulation
- Commercial creditworthiness and access to business finance
- Sustainability of development finance.

Projects in the portfolio employ either or both of two primary approaches: with a *sales model* (eight projects), private dealers sell solar home systems to rural households. The system is owned and maintained by the household, which is also responsible for servicing any debt if the system is purchased with credit. With a *service model* (10 projects), an energy-service company provides electricity for a monthly fee to rural households. In this case, the system is owned, financed, and maintained by the energy-service company. Since a large share of the portfolio is still under implementation, it is too early to draw definite conclusions regarding impacts. Nevertheless, the review of the GEF solar PV portfolio suggests ten emerging lessons:

1. Viable business models must be demonstrated to sustain market development for solar PV.

2. Delivery/business model development, evolution, and testing require time and flexibility.

3. Institutional arrangements for project implementation can greatly influence the value of the project in terms of demonstrating viable business models and thus achieving sustainability.

4. Projects must explicitly recognize and account for the high transactions costs associated with marketing, service, and credit collections in rural areas.

5. Consumer credit can be effectively provided by microfinance organizations with close ties to the local communities if such organizations already have a strong history and cultural niche in a specific country.

6. Projects have not produced adequate experience on the viability of dealer-supplied credit under a

sales model, and no project in the portfolio appears set to provide such experience.

7. Rural electrification policies and planning have a major influence on project outcome and sustainability, and must be explicitly addressed in project design and implementation.

8. Establishing reasonable equipment standards and certification procedures for solar home system components that ensure quality service while maintaining affordability is not difficult, and few technical problems have been encountered with systems.

9. Substantial implementation experience is still needed before the success of the service approach can be judged.

10. Post-project sustainability of market gains achieved during projects has not yet been demonstrated in any GEF project; it is too early in the evolution of the portfolio.

The global environmental benefits from rural solar PV projects are primarily indirect, and depend on the degree to which the GEF can help catalyze markets for rural PV applications that serve large shares of the two billion people in developing countries currently without electricity. Development benefits to households and rural communities are clearly connected with these projects, although further surveys of households are desirable to quantify income-generation effects, customer satisfaction, and delivery costs.

We recommend that future projects in the GEF portfolio focus on the following key issues:

- Affordability through fee-for-service or consumer credit approaches
- Use of GEF resources for non-recurring costs related to business and market development
- Access to finance and incremental risk sharing
- Explicit linkages to rural electrification policies and planning
- Commercially feasible business models that are sustainable and can be replicated.

Projects must be careful to avoid an "equipment demonstration" mentality where the main objective is installation and maintenance of a certain number of systems. By project completion, the number of systems installed is much less significant than whether the business, delivery, and credit models are viable, sustainable and being replicated. This emphasis requires implementing agencies to rethink traditional development assistance patterns and evaluation techniques.

We question whether purely private delivery models, by themselves, are able to achieve the widespread market penetration in poorer countries that will satisfy both global environmental and development objectives. We recognize that experience from some countries, such as Kenya, shows that the private-sector can achieve substantial market penetration without much support from subsidies or government or multilateral agencies. Still, we hypothesize that projects that involve government measures will result in greater penetration and larger shares of rural households able to benefit from PV than purely private-sector models. Regardless of government involvement, service models seem more likely to result in larger markets because they provide greater affordability for poorer households. More definitive conclusions must await further experience from the portfolio in the coming years.

Introduction

Role of Solar Photovoltaics

Photovoltaics (PV) already provide electricity to an estimated 500,000 to 1 million rural households in developing countries who lack access to electricity grids. Worldwide, two billion people lack access to electricity, so the potential for continued application of PV is large, with resultant economic, local environmental, and global environmental benefits. Traditionally, bilateral donor assistance has resulted in hardware installations but has placed less emphasis on the key ingredients for sustainability, such as viable service networks and trained personnel. In the past several years, several examples of sustainable commercialization of PV systems have emerged without much direct donor assistance, notably in China, Indonesia, Kenya, and Zimbabwe. But the reality is still much smaller than the potential.[2]

"Solar home systems" (SHS) are one of the most common forms of PV application in rural areas. An SHS usually provides electricity for two or three fluorescent lights, a radio or cassette player, television, and perhaps small fans or other small appliances. Electricity is drawn from rechargeable batteries recharged through an electronic controller by PV modules mounted on a pole beside the house or on the rooftop. The total capacity of the unit is usually in the range of 30 Wp to 100 Wp but can be smaller or larger.[3]

Solar home systems can eliminate or reduce the need for candles, kerosene, liquid propane gas (LPG), and/or battery charging. Direct economics benefits include avoided costs of battery charging and LPG or kerosene purchases; other significant benefits include increased convenience and safety, improved indoor air quality, a higher quality of light than kerosene lamps for reading, and reduced carbon dioxide emissions. Improved lighting quality can assist reading and provide additional educational benefits, especially to children, or allow income-generating activities to occur at night. PV systems can also power lights and vaccine refrigerators in medical clinics, run water pumps, and assist other applications.[4]

1 Gerald Foley, *Photovoltaic Applications in Rural Areas of the Developing World*, World Bank Technical Paper No. 304 (Washington, DC, 1995); GTZ, *Basic Electrification for Rural Households: Experience with the Dissemination of Small-Scale Photovoltaic Systems* (Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit, 1995); World Bank, *Rural Energy and Development: Improving Energy Supplies for 2 Billion People* (Washington, DC, 1996); Dan Kammen, "Promoting appropriate energy technologies in the developing world." *Environment* vol. 41, no. 5 (June 1999), pp. 11-15, 34-41; unpublished World Bank Group documents.

2 Other common applications of PV include water pumping in agriculture, commercial applications like telecommunications, and village mini-grids serving small numbers of households (often integrated with diesel and wind systems).

3 See A. Cabraal, M. Cosgrove Davies, and L. Schaeffer, *Best Practices for Photovoltaic Household Electrification Programs: Lessons from Experiences in Selected Countries*, World Bank Technical Paper No. 324 (Washington, DC, 1996); Foley 1995, op. cit. note 1; Christoper Flavin and Molly O'Meara, "Shining examples," *World Watch*, May/June (1997), pp. 28-36.

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The GEF Solar PV Portfolio

Since 1991, the GEF has provided grant financing for 23 off-grid solar photovoltaic (PV) projects in 20 countries (Annex 1). In addition, four more projects are under preparation. Though specific objectives vary, the projects, in general, are aimed at stimulating and achieving commercialization of solar PV systems for rural households. Some of the projects supported by the GEF fully fund solar PVs and/or related components, while others contain significant solar PV components. In all, these 23 projects together account for about US$210 million of GEF allocation, and about $1.4 billion in total project costs. The division of the portfolio among the implementing agencies and the geographical portfolio allocation are shown in Tables 1-2.[3]

The projects in the GEF portfolio target total direct installations of 500,000 or more solar home systems, comparable in magnitude to the current installed base of such systems in developing countries.[4] However, most projects are just starting implementation and only a few are nearing completion (the Zimbabwe project was the first to be completed, in 1998). Direct installations from the projects in the portfolio by the end of 1999 amounted to about 18,000 systems (see Annex 1).[7]

Table 1. Portfolio by Implementing/Executing Agency and Region (number of projects)

Region	UNDP	World Bank	World Bank/IFC	Total
Africa	4	4		8
East Asia & Pacific	1	3		4
Latin America & Caribbean	2	2		4
South Asia	1	2		3
Global			4	4
Total	8	11	4	23

4 Refer to Annexes 1-4 for more details of the projects covered under the review. For further descriptions and evaluations of these projects, see the GEF web site (www.gefweb.org). See also Eric Martinot and Omar McDoom, *Promoting Energy Efficiency and Renewable Energy: GEF Climate Change Projects and Impacts* (Global Environment Facility, Washington, DC, 2000); Eric Martinot, Anil Cabraal, and Subodh Mathur, "World Bank/GEF solar home systems projects: Experiences and lessons learned 1993-2000" (Washington, DC: World Bank, 2000).

5 The total targeted installations does not include 200,000 systems originally expected from the Indonesia project, which was never implemented because of Indonesia's macroeconomic crisis and will now be cancelled.

6 Most of these installations are stand-alone solar home systems, except in India, where installations directly financed by the project have included 1500 solar lanterns, five village power schemes of 25 kWp each supplying electricity to about 500 families, and 200 SHS sold by a private dealer.

Table 3: Delivery Models, Relevant Issues, and Country Applications

Delivery Models	Most Relevant Issues as Indicated by Emerging Lessons	Country Applications
SALES MODELS		
A. Cash	• Demographics and household income limit demand. • Sales to niche markets do not render comprehensive rural service. • Marketing can be costly and labor-intensive.	China India Uganda Vietnam Zimbabwe
B. Consumer credit by supplier	• Credit delivery and collection can be costly and risky. • Additional business finance required for extending consumer credit; supplier must be creditworthy. • Marketing can be costly and labor-intensive. • NGO suppliers may lack appropriate business skills for credit delivery.	Bangladesh India Indonesia Malawi Sri Lanka
C. Consumer credit by development finance institution	• Development finance institution must be willing and able to continue lending post-project. • Continued subsidies for concessional finance may be needed. • Development finance institution can assist with marketing.	Malawi Uganda Vietnam Zimbabwe
D. Consumer credit by microfinance organization	• Microfinance organization must be creditworthy. • Credible microfinance organizations must exist. • Existing microfinance organizations may not be commercially oriented for rapid delivery of credit. • Microfinance organization can assist with marketing.	Sri Lanka Uganda
SERVICE MODELS		
E. Regulated concession by existing utility	• Utility must have interest and experience in rural areas. • How should government regulate concession and set tariffs? • How should government specify/ensure quality of service in concession contracts?	Argentina Ghana (as designed) Lao PDR
F. Regulated concession by private firm competitively selected	• Concession must be creditworthy and commercially viable. • How should government regulate concession and set tariffs? • How should government specify/ensure quality of service in concession contracts? • What should be the terms and conditions for renegotiation of concession contracts? • How should government conduct competitive selection and attract qualified bidders?	Argentina Benin Cape Verde Guinea Peru Togo
G. Unregulated, open market	• Marketing can be costly and labor-intensive. • Long-term business finance required for initial capital investments. • Long-term recurring service costs may threaten continued profitability or limit financial ability to expand.	Benin Dominican Rep. India Peru (post-project) Togo
H. Community	• Supplier should have strong ties to the community, which may overcome other barriers. • Supplier may need development of technical skills. • May be community-driven if government lacks ability or interest to develop concessions for community.	India

Box 1: A Fee-for-Service Approach in Kiribati[11]

In the outer islands of Kiribati, 500 solar home systems have been installed by a government-owned energy-service company. The initial capital for the 100 Wp PV solar home systems was donated by the European Union (EU) under its Pacific Regional Energy Programme (PREP). This program also provided training and technical assistance to the company in installation, maintenance, competitive procurement, and other business practices.

The company charges households an equivalent of roughly $6-7 per month, which covers direct maintenance costs and replacement capital costs for the batteries, controllers, and lights over a period of 20 years.[12] The company maintains an interest-bearing account in which part of the fees are kept to provide financing for future equipment replacements. The monthly fees do not yet cover the full central overhead costs of the company, but they do include a component to finance PV panel replacement after 20 years. The company was supplementing its operating costs with income from other PV projects, such as installation of PV pumping systems and sales of controllers it was manufacturing itself. An evaluation by the EU estimated that an installed base of 1,000 systems minimum would allow the company to cover these overhead costs as well.

The program provides a sustainable mechanism for continued maintenance (and perpetual replacement) of donor-supplied systems and provides customers with affordable energy services. However, the scheme is not commercially replicable because it relies on donor-supplied capital equipment to get started. If the company were to finance the initial capital costs on its own, the monthly fees needed to amortize these costs would be higher (perhaps double by one estimate), and some additional financing mechanism would be needed.

The European Union is planning to extend this program and supply additional PV systems to extend the installed base to the 1,000 systems necessary for sustainable operation of the energy-service company.

Issues Associated with the Delivery Models

The review suggested a number of important issues associated with solar home systems in general and with specific delivery models in particular (refer to Table 3). These include:

Technological credibility (all models). It is important to assure the quality both of hardware and service to establish long-term credibility of the technology. The quality of panels and PV-related hardware has been more or less well-established, though the reliability of locally produced hardware, such as charge controllers, may have to be established. Even where reliability has been established, it is strongly influenced by maintenance, hence the need to focus on reliable service as a goal to establish long-term credibility. For sales models (models A-D), customer education on proper maintenance is especially important. See also lesson #8.

The role of solar PV within rural electrification programs (all models). Without the government demarcating an identified niche for solar PVs in its policies, rural consumers are enticed by the promise, often false, of electricity provision through the grid, adversely affecting demand for solar PV through private suppliers. This has been observed in several countries, including Sri Lanka and Vietnam. Grid expansion is often not a cost-effective option for provision of electricity to the most remote of rural areas. See also lesson #7.

Government policies vis-à-vis electricity as a basic need (models E, F, and G). If government policy gives rural electrification priority even in areas where grid extension is impractical, then regulated concessions (models E and F) are more likely to be favored—as has happened in Argentina. Subsidies may be provided to concessions with the clear understand-

11 Box 1 based on Bill Gillet and Gill Wilkins, "Solar so good—An EC funded solar utility succeeds in Kiribati," *The ACP-EC Courier* No. 177 (Oct-Nov, 1999), pp 5-7; personal communication with Suresh Hurry, UNDP (New York), January 2000; personal communication with Gill Wilkins, AEA Technology-ETSU (Oxfordshire, UK), April 2000.

12 The program expects PV panels to last 20 years. Lifetimes are estimated at 5 years for batteries and lighting ballasts and 8 years for controllers and DC/DC converters.

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ing that electricity is part of rural development policy. If national policy is lacking, local communities may decide to promote community-based energy service delivery as a way of obtaining service for an entire community (model G). See also lesson #7.

Household affordability and willingness to pay (all models). The choice of delivery model is influenced by the affordability and willingness of households to pay. Affordability is most at issue with cash sales (model A), as only a small fraction of the rural population may be able to afford to purchase a system outright (depending on rural demographics). Other sales models with credit (models B, C, and D) may improve but still limit affordability, depending on the term of credit available. In absence of government interest in and/or regulation of concessions, an "open-market" energy-service company (model G) may be an attractive alternative. Under this model, a firm provides fee-for-service to specific territories but without monopoly status granted by a regulator (as has been seen in the Dominican Republic). Refer to Box 2 for typical cost comparisions facing a consumer between the sales and service models.

Marketing strategies, costs, and purveyors (models A, B, C, D, and G). Private firms may need to expend substantial resources on marketing their products, especially if rural households are highly dispersed or difficult to reach (Bangladesh is one such case). Mass media methods may be ineffective; door-to-door campaigns may prove most effective. For sales models with credit, the purveyor of credit may provide marketing services in addition to or instead of the dealer (this has happened in Sri Lanka and Vietnam). Under regulated concession models, marketing may still be important but not as essential to the survival of the business. See also lesson #4.

Concession selection and regulation (models E and F). For concession models, numerous issues must be resolved: setting tariffs, finding and attracting capable bidders, and conducting competitive bidding procedures, plus ensuring service quality and regulating concessions on an ongoing basis. If an existing utility is being considered for rural energy service delivery, then the interest and experience of that utility in operating in rural areas becomes a factor. These issues are clearly visible in Argentina.

Commercial creditworthiness and access to business finance (all models). Business finance is an important issue for all delivery models except perhaps model E, where an existing utility would be presumed to have access to credit. Supplier-provided credit (model B), as well as private concessions (model F) and open-market energy service companies (model G) in particular require large amounts of business finance because they must finance installed systems over extended periods. Creditworthiness also affects the terms of consumer credit that can be provided, and thus the market demand (this is clearly seen in Bangladesh; see also lesson #6). If a microfinance organization is providing consumer credit (model D), then it must itself be creditworthy enough to obtain credit from the banking or financial system, a major issue in Sri Lanka.

Sustainability of development finance (model C). If development finance organizations provide consumer credit, then their willingness or ability to continue after the project completes (including the need for any ongoing subsidies) is an important issue—as seen in Zimbabwe and potentially in Vietnam. See also lesson #5.

The next section amplifies these issues in the context of emerging lessons from the thematic review.

Box 2: Consumer Costs of Solar Home Systems: Credit Sales versus Fee-for-Service

How much will a consumer pay for a solar home system over its lifetime if purchased on credit compared to the same system provided with a fee-for-service arrangement? There is little available cost data with which to make such an analysis, but the following numbers are illustrative. Based upon data collected during this review and published sources, a typical 50 Wp solar home system can be expected to cost between $450 to $800 fully installed, depending upon several factors:

- level of import duties on imported components like PV panels
- level of profit margins incorporated by system integrator and/or system installer firms
- degree to which components are produced locally and are cheaper than imported components
- quality standards applied to components and installation
- complexity/features of battery controller.

Assuming an installed cost of $600, a lifetime of 10 years, a 3-year loan at 20 percent real interest with 25 percent down-payment, an average annual cost of battery replacement of $20 ($50 battery with 2.5 year life), and estimated O&M costs of $20/year, the lifecycle costs of a purchased system are about $1200. With fee-for-service, a $17/month charge for the system over a 10-year period totals $2040, or almost double the lifecycle costs of a purchased system.[13] But fee-for-service has several advantages:

- the energy-service company assumes the performance risk
- an initial down payment may not be required (or is smaller than for a credit sale)
- service is guaranteed as long as the firm is providing fee-for-service
- consumers can return the system at any time, minimizing the risk of electric-grid extensions.

Given a choice, some consumers may prefer these benefits even though total lifecycle costs may be higher.

13 Monthly charges vary in the projects examined. In the Argentina Renewable Energy in Rural Markets Project, an estimated monthly recovery cost to the concession is given as $17 for a 50-Wp system (15-year SHS life, 14% return on investment, various other assumptions); this figure is only calculated ("Argentina Renewable Energy in the Rural Market: Project Appraisal Document," World Bank, 1999). In the Dominican Republic, Soluz Dominicana has been charging customers $20/month for a 50-Wp system (see Annex 4).

Ten Emerging Lessons from the Review of Solar PV Projects

The review of the GEF solar PV portfolio suggests ten emerging lessons. Since a large share of the portfolio is still under implementation, it is too early to draw definite conclusions regarding impacts. However, from trends identified during project implementation, and early indication of some impacts on the ground, some initial lessons can be drawn.

Lesson 1. Viable business models must be demonstrated to sustain market development for solar PV.

Demonstration of a viable business model, whether that business is public, private, utility, or even permanently subsidized, is key to achieving project sustainability and achieving GEF's programmatic objective of transforming (or developing) markets for solar PV. Viability means that expenses and receipts, cash flow, profits (or subsidies), management and service arrangements demonstrate an entity can continue to exist and function on commercial terms. "There is a high value-added [by the GEF] in terms of developing and improving business models...you want to stimulate markets based on these business models" said one dealer being supported by the GEF.

For profit-oriented commercial businesses, profit is the ultimate measure of whether a business model is viable, which in turn depends on maximizing income (which depends on demand, pricing, and competition) and minimizing expenses (for marketing, service, training, procurement, and operations). If a business receives public support because of economic development or other public objectives associated with solar home systems, such that continuing subsidies are required to sustain it, then the extent of these subsidies must be clearly documented within an income-expense framework, and arrangements for their continuation must be secured.

Virtually all GEF projects have explicit or implicit goals directed towards developing viable business models (see Annexes 1-4). But these pilot models have yet to be tested. Delivery is clearly linked with profitability and business model development in projects in Bangladesh, China, Dominican Republic, Sri Lanka, and Zimbabwe. For example, the firm Soluz Dominicana in the Dominican Republic is demonstrating a "proof of concept" for its fee-for-service business model for up to 5,000 systems and is seeking to adapt the model to a larger scale—perhaps 25,000 systems (see Annex 4).

Lesson 2. Delivery/business model development, evolution, and testing require time and flexibility.

Building markets and identifying viable sustainable delivery models in specific contexts are slow and time-consuming processes requiring a much greater degree of flexibility and adaptation than currently allowed by most GEF project designs. GEF projects do not allow sufficient time or resources to first identify the most promising approaches and, then, develop those approaches to a point where their viability and sustainability are clear and tested. Projects should explicitly allow for testing multiple models and for adapting and modifying models over time until viable approaches become clear and are tested sufficiently. Insufficient project durations, de-

lays in project start-up due to unanticipated circumstances, and fixed project completion dates can hinder this process.

This lesson is clearly illustrated in Sri Lanka, where dealer credit and fee-for-service approaches were tried early in the project without much success and the project began to emphasize consumer credit through microfinance organizations (see Annex 3). This later approach appeared to the dealers and the project to show the most promise, and the rate of system installations under this approach was accelerating through one main microfinance organization. But more time would be needed to replicate and amplify the microfinance model to provide greater volumes of installations and include greater numbers of microfinance organizations. Unfortunately, the project is scheduled to close before the microfinance model can be adequately tested. In particular, there is a question as to whether commercial financiers will consider microfinance organizations beyond the main one participating in the project good enough credit risks to extend commercial credit to them.

Lesson 3. Institutional arrangements for project implementation can greatly influence the value of the project in terms of demonstrating viable business models and thus achieving sustainability.

This lesson can be illustrated by the Ghana project, which was originally designed to demonstrate a business model in which the national utility would provide fee-for-service to rural households using solar home systems (see Annex 2). At the conclusion of the project, the costs, service, cash flow, and management of these installations could be assessed in terms of the viability of this model from the utility's perspective. The demonstration of this business model could also be used to convince other private companies to enter the market, which is an explicit project objective. But project implementation responsibility was transferred to a "project" established under the Ministry of Mines and Energy early in the project implementation. Although this office may succeed in installing and servicing a given number of systems, given that it is subject to the rules and regulations of a government ministry, demonstrating and judging business viability in a transparent commercial manner is bound to be difficult, meaning that sustainability is seriously called into question. Changes in institutional arrangements can go unnoticed by GEF or implementing agency staff; but the overriding importance of sustainability and replication in a GEF project demand a much greater awareness of how implementation arrangements affect the demonstration value of a project.

Lesson 4. Projects must explicitly recognize and account for the high transactions costs associated with marketing, service, and credit collections in rural areas.

Long distances, poor transport infrastructure, impassable roads during monsoons, low literacy rates, cash-and-barter based transactions, and lack of technical skills all mean that transaction costs of operating a rural PV business, whether sales or service-for-fee, can be quite high. The costs and staff time needed for marketing, credit or fee collections, service, establishing business infrastructure, and training staff can easily eat away already-slim profit margins. This lesson is illustrated in Sri Lanka, where dealers decided not to offer consumer credit, citing the high costs of credit collections in remote rural areas (see Annex 3), and in Bangladesh, where a dealer was investing heavily in marketing out of its own operating budget (without government or grant assistance), delaying its ability to begin to make a profit (see Annex 4).

No one has figured out how to conduct a standardized-product/high-volume approach to low transaction costs. Some form of subsidies (e.g., multilateral or host-country government) may be a permanent and essential feature of SHS delivery for this reason alone. Dealers and energy-service companies need experience, training, and developed business infrastructure in rural areas to be able to operate effectively with low transaction costs.

Lesson 5. Consumer credit can be effectively provided by microfinance organizations with close ties to the local communities if such organizations already have a strong history and cultural niche in a specific country.

Under the sales model, a few projects are successfully providing consumer credit through microfinance organizations (Sri Lanka) and development-finance organizations (Zimbabwe and Vietnam). However, the sustainability of these consumer credit mechanisms is questionable in two of the three. The Agricultural Finance Corporation in Zimbabwe has not been able

to replenish their credit revolving fund, which will wind down otherwise (see Annex 2). In Vietnam, consumer credit by the Vietnam Bank for Agriculture and Rural Development is partly dependent on dealer-provided credit guarantees (see Annex 4). In Sri Lanka, consumer credit by microfinance organizations appears sustainable, but perhaps because Sri Lanka has a strong and long-standing microfinance industry (see Annex 3).

Lesson 6. Projects have not produced adequate experience on the viability of dealer-supplied credit under a sales model, and no project in the portfolio appears set to provide such experience.

The Indonesia Solar Home Systems project was one of the first projects to utilize dealer-supplied credit as a delivery mode. The experience from this project would have been extremely valuable. Unfortunately, this project never really got started because of the macroeconomic difficulties in Indonesia in the late 1990s, and now will be cancelled.[14] The Solar PV project in Bangladesh is the only one that shows dealer-supplied credit to be working (see Annex 4). The dealer receives three-year credit from the IFC. Once this credit is completed, the dealer may depend on continued development institution assistance unless commercial business financing for the dealer becomes available for longer terms thus increasing profitablilty. Longer term commercial financing depends on the dealer's ability to overcome high overhead and marketing costs.

Lesson 7. Rural electrification policies and planning have a major influence on project outcome and sustainability, and must be explicitly addressed in project design and implementation.

Participants in some projects cited unrealistic political promises or planning about rural grid extension as a serious barrier to solar-home-system market expansion, one that was not anticipated adequately in project design. "Our main competition is the false promise of the grid and kerosene and battery charging, not other companies" said one supplier in Sri Lanka when asked about competition (see Annex 3). A private dealer in Vietnam was also encountering problems as rural electrification encroached upon potential customers and interfered with marketing (see Annex 4). Of course, all else being equal, households would prefer to be connected to a grid than obtain energy services from a solar PV system. Still, in most countries, 100 percent grid extension is too costly and unrealistic. Policy development, in conjunction with solar home system delivery models, is thus crucial so that areas of planned rural electrification are clear and realistic, and rural electrification planning explicitly accounts for the potential of solar home systems in providing a least-cost path to rural electrification in some areas (and ultimately, the utility itself may explicitly plan to install solar home systems in certain areas as an alternative to grid extension).

Lesson 8. Establishing reasonable equipment standards and certification procedures for solar home system components that ensure quality service while maintaining affordability is not difficult, and few technical problems have been encountered with systems.

Suppliers in all projects have generally been able to comply with standards and certification procedures established under projects. The technologies have worked with few problems. Where difficulties with standards compliance have occurred in projects, projects were able to slightly relax standards without sacrificing quality of installations or performance of systems. Few customer complaints or technical problems have been encountered in those projects where substantial systems have been installed (Zimbabwe, Sri Lanka, Dominican Republic, and Bangladesh). Certification has been often slower than anticipated; for example, in Sri Lanka it took almost the whole first year of the project before suppliers had certified products on hand to deliver to customers.

Lesson 9. Substantial implementation experience is still needed before the success of the service approach can be judged.

The best experience with the service model has taken place in the Dominican Republic, where 3,500 systems were installed from 1996–2000, about 1,700 of these on a fee-for-service basis (see Annex 4). In 2000, the great majority of new installations were being installed on a fee-for-service basis and the firm, Soluz Dominicana, had passed the break-even point

14 A project completion report for the Indonesia project is expected in 2000.

of profitability.[15] In Sri Lanka, one dealer attempted a service approach in 1998–99 but quickly (perhaps prematurely) gave up on this approach and switched to a sales approach, citing the high administration and transaction costs and other difficulties of monthly fee collections in rural areas (see Annex 3). Early experience in Argentina also suggests that selecting and effectively regulating energy-service concessions in rural areas can be a formidable regulatory challenge that requires significant assistance and capacity building for regulatory and institutional development (see Annex 5). The Argentina project should provide a wealth of new experience with the service approach, but was just getting under way in 2000.

Lesson 10. Post-project sustainability of market gains achieved during projects has not yet been demonstrated in any GEF project; it is too early in the evolution of the portfolio.

Most projects are in early implementation and those few completed or nearly completed are not yet demonstrating market sustainability. Even in Zimbabwe, where the private dealer market was greatly expanded and 10,000 systems were sold under the project, the question of continued consumer credit mentioned above—and the sustainability of many of the businesses created during the project—is still in question (see Annex 2). Sri Lanka appears to be closest to demonstrating sustainability, based upon consumer credit through microfinance organizations and the entry of Shell International Renewables into the Sri Lanka market (see Annex 3). Shell attributed their entry to the World Bank/GEF project there, and other dealers see Shell's entry as helpful to market maturity and sustainability after the project.[16]

15 IFC/GEF assistance to Soluz has taken the form of a $75,000 convertible loan with a 12% interest rate and a six-year term, through the IFC Small and Medium Scale Enterprise program. Counting all sources, Soluz has raised over $1.5 million to invest in Soluz Dominicana's operations.

16 For a fuller treatment of methodologies for monitoring and evaluating post-project market gains, see Eric Martinot, *Monitoring and Evaluation of Market Development in World Bank-GEF Climate Change Projects: Framework and Guidelines*, World Bank Environment Department Paper No. 66 (Washington, DC, 1998).

Conclusions and Recommendations

The global environmental benefits from rural solar PV projects are primarily indirect. That is, the direct global environmental benefits from solar home systems projects, in terms of avoided carbon dioxide from displaced kerosene, candles and batteries, are small relative to other sources of carbon dioxide emissions in these countries.[17] The emergence of significant global environmental benefits is primarily dependent on the degree to which a market for PV emerges, serving large shares of the two billion rural population currently without electricity. This is expected to have two results: (i) avoidance of fossil-fuel use for providing electricity in rural services; and (ii) lowering of global PV cost and spurring of applications in both developed and developing countries that would otherwise be delayed.

Clearly there are immediate welfare-enhancing benefits from rural solar PV systems or services. In addition to the direct benefits to households discussed in the introduction, local economic benefits from employment by PV dealers and service firms are significant. The extent of income-generation benefits for rural households is more uncertain.[18] Field visits in Ghana, Sri Lanka, Uganda, and Vietnam showed early purchasers of systems to be among the wealthiest households in rural areas. Some historical surveys have shown substantial income-generation benefits are possible, but further survey work will be required to assess the economic benefits achieved in GEF projects.[19] Such surveys should also include other unknowns that influence market sustainability, such as customer satisfaction, system performance, dealer marketing costs, and system prices. Surveys conducted in Kenya, for example, by the UNDP/World Bank Energy Sector Management Assistance Program, have shown high levels of customer satisfaction and technical performance.[20]

How well suited are GEF-supported projects for achieving both global environment and development goals? The evidence from emerging project experience suggests that some GEF projects will demonstrate delivery models with significant replication potential, but it is too early to be more definitive. Based upon this review, we recommend that future projects in the GEF portfolio focus on five key issues:

17 Steven Kaufman, "Rural electrification with solar energy as a climate protection strategy." Renewable Energy Policy Project Research Report No. 9 (Washington, DC, 2000). Due to the inefficiency of kerosene lighting, avoided CO_2 emissions per installed Wp of PV in rural households are greater than for grid-connected applications, in some cases by a factor of ten, says Kaufman. This presumes that PV is used to displace kerosene rather than provide additional energy services; the issue of fuel displacement vs. added services has been inadequately studied.

18 We have not looked at rural development literature to examine income-generation and income-distribution effects.

19 Kaufman, op. cit. note 17.

20 Robert J. van der Plas and Mark Hankins. "Solar electricity in Africa: A reality." *Energy Policy* vol. 26, no. 4 (1998), pp. 295-300.

1. *Affordability.* Affordability through fee-for-service or consumer credit approaches will continue to be a central issue. Projects should experiment with different approaches to affordability and show a reasonable chance of making solar PV available to more than just the wealthiest households. The potential for widespread affordability exists; some private sector studies claim 25-50 percent of rural households currently without electricity would be able to afford systems under fee-for-service or consumer credit arrangements.[21]

2. *Use of GEF resources for non-recurring costs.* GEF resources should pay for incremental, non-recurring business and market development costs, rather than partial equipment subsidies. Such non-recurring costs include, for example, business planning, feasibility studies, consumer awareness, credit delivery pilot schemes, and initial marketing and market development efforts.

3. *Access to credit and incremental risk sharing.* Initial market development efforts can be assisted by providing financial services such as partial risk guarantees, performance incentives, and other forms of contingent finance to local PV businesses.

4. *Explicit linkages to rural electrification policies and planning.* Policy development and rural utility planning should be explicitly linked to solar PV delivery models, so that areas of planned rural electrification are clear and realistic and provide greater certainty for off-grid markets. Rural electrification planning should account for the potential of solar home systems and other rural energy options, and consider incentive mechanisms, like energy-service concessions, to provide a least-cost path to rural electrification.

5. *Commercially feasible business models.* Projects must be careful to avoid an "equipment demonstration" mentality where the main objective is installation and maintenance of a certain number of systems. By project completion, the number of systems installed is less significant than whether the business, delivery, and credit models are sustainable and whether replication mechanisms are effective. This emphasis requires implementing agencies to rethink traditional development assistance patterns and evaluation techniques.

We conclude the review by questioning whether purely private delivery models, by themselves, are able to achieve the widespread market penetration in poorer countries that will satisfy both global environmental and development objectives. In many countries, rural populations are simply too poor to afford solar home systems on their own. This can be seen in particular in the African GEF projects. Short-term profits may exist for a few dealers serving the wealthiest households, but market penetration may be limited. However, if sales to the wealthiest households provides a future "pathway" to more widespread sales because of significant cost reductions (there are analogies in diffusion of technologies like mobile phones), then private delivery models may lead to further market gains.

One cannot dispute the private-sector-led experience in Kenya, where an estimated 80,000 households had solar PV systems in 1999. This experience shows that the private sector can achieve substantial market penetration without much support from subsidies, governments, or multilateral agencies (although training and performance standards are still important components of market facilitation there). In Kenya, most households have purchased systems for cash, and a thriving market has emerged, now growing at 10-18 percent annually. A modular system of buying has emerged where households can invest small sums in modest systems and upgrade as income allows. After 10 years, the commercial market has reached about one percent of rural households.[22]

Still, we hypothesize that projects involving government measures will result in greater penetration and larger shares of rural households able to benefit from PV than purely private sector models. Such measures may include government support for local industry, policy approaches like regulated concessions, favorable rural development or power sector reform policies, and even continuing government subsidies for

21 Kaufman, op. cit. note 17.

22 Van der Plas and Hankins 1993, op. cit. note 20; Dan Kammen, op. cit. note 1. For other experiences with solar PV in rural areas, also see GTZ, op. cit. note 1; Geerling Loos and Bernard van Hemert, eds., *Stand-Alone Photovoltaic Applications: Lessons Learned* (London: James and James, 1999).

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the rural poor as part of poverty reduction objectives (perhaps equivalent to those for grid-connected customers). Regardless of government involvement, service models seem more likely to result in larger markets because they provide greater affordability for poorer households, particularly if available credit terms under sales models are short. Evidence for these conclusions from GEF experience is still lacking and may not exist for several more years as service models in the portfolio are tested.

Annex 1: List of Projects and Status (as of 12/99)

Project (year approved by GEF)	Responsible agency	GEF contribution ($mn)	Total project cost ($mn)	Status	Approximate number of installations by end of 1999
India: Alternate energy/renewable resources development (1991)	WB	26	186	under implementation	2,200
Zimbabwe: PV for household and community use (1991)	UNDP	7	7	completed	10,000
Small and Medium Scale Enterprise Program (1994)	IFC	1.6	4.8	under implementation	5,100
Indonesia: Solar home systems (1995)	WB	24	118	to be cancelled	—
Uganda: PV pilot project for rural electrification (1995)	UNDP	1.8	3.6	under implementation	—
Ghana: Renewable energy-based electricity for rural, social and economic development (1996)	UNDP	2.5	3.1	under implementation	—
PV Market Transformation Initiative (1996)	IFC	30	120	under implementation	—
Renewable Energy and Energy Efficiency Fund (1996)	IFC	30	130	soon operational	—
Sri Lanka: Renewable energy capacity building (1996)	UNDP	1.5	1.5	under implementation	—
Sri Lanka: Energy services delivery (1996)	WB	5.9	55	under implementation	1,000
Argentina: Renewable energy in rural markets (1997)	WB	10	120	under implementation	—
Bolivia: Rural electrification with renewable energy (1997)	UNDP	4.5	8.5	under implementation	—
China: Capacity building for renewable energy commercialization (1997)	UNDP	8.8	28	under implementation	—
Lao PDR: S. provinces renewable energy pilot (1997)	WB	0.7	2.1	under implementation	—
Benin: Decentralized rural energy (1998)	WB	1.1	5.7	pending approval by WB	—
Cape Verde: Energy & water sector reform and development (1998)	WB	4.9	65	under implementation	—
China: Renewable energy development (1998)	WB	35	445	under implementation	—
Peru: PV-based rural electrification (1998)	UNDP	4	9.2	under implementation	—
Solar Development Group (1998)	IFC	10	50	under implementation	—
Togo: Decentralized rural energy (1998)	WB	1.1	5.7	pending approval by WB	—
Guinea: Rural energy (1999)	WB	2	10	pending approval by WB	—
Malawi: Barrier removal to Malawi renewable energy program (1999)	UNDP	3.4	10.7	pending approval by UNDP	—
Mexico: Renewable energy for agriculture (1999)	WB	8.7	26	pending approval by WB	—

Annex 2: Approaches to Solar Home Systems in Africa[23]

Three UNDP/GEF African projects illustrate the two primary approaches to solar home systems. The Ghana project employs the fee-for-service model, while the Uganda and Zimbabwe projects employ a dealer-sales model. While Ghana and Uganda have been under implementation for less than a year, the Zimbabwe project was the first solar home system project in the GEF portfolio to be completed (in 1998).

The goal of the Ghana project is to establish a sustainable capacity in Ghana to provide decentralized renewable energy-based electricity services to rural communities through the fee-for-service model. The project is under implementation through a special office—the Renewable Energy Services Project (RESPRO)—established in the Ministry of Mines and Energy (MOME). RESPRO is intended to act as a for-profit enterprise to be "spun-off" as a private sector company towards the end of GEF project design. This is a departure from the original project design, where the project was to have been implemented by the Volta River Authority/Northern Electric Department (VRA/NED), the electricity utility in Ghana, which is expected to be privatized in the future. The current implementation structure does raise questions about the potential for privatization of RESPRO, as it is currently housed within a ministry.

The project, which has just started implementation, targets some of the poorest households in northern Ghana, and expects to sell electricity through installation of 50 Wp (for the equivalent of US$7 per month) or 100 Wp (US$12 per month) in households. Willingness-to-pay surveys and demand from households show that these rates are affordable. However, it is unclear whether these rates can generate enough revenue to offset expenses, including capital, operation, and maintenance costs.

In contrast, the Uganda project is based on the sales model. Consumer credit is provided through two local credit institutions: a private rural development bank and a credit-union type of women's trust. In addition to the GEF grant, UNDP has provided cofinancing to guarantee credit lines of these institutions. The project is at very early stages of implementation, and hence it is not possible to assess the likelihood of overall project success. But there is a clear contrast in this approach to the Ghana project; in Uganda, the project is clearly targeted towards those who are credit worthy and can afford the cost of credit (perhaps only the top 10% wealthiest households). Households that cannot afford commercial credit still constitute the vast majority of the rural population.

The Zimbabwe project was also based on the sales model. From 1995 to 1998, over 10,000 solar home systems were sold, primarily through private dealers. A utility-sales model was also piloted, through the national electric utility, which sold about 200 systems under the project but appeared to lack sufficient interest to continue after the project completed. Expected experience with sales by NGOs was limited. Consumer credit was provided by the Agricultural Finance Corporation (AFC), a development institution, through a revolving fund mechanism. The AFC provided credit to 4,200 households but has been unable to replenish the fund, which will be depleted without replenishment.

The Zimbabwe project was designed to enhance and upgrade indigenous solar manufacturing and delivery infrastructure, to develop an expanded commercial market in rural areas for affordable domestic solar electric lighting by providing low-interest financing through existing institutions, and to establish new credit mechanisms at the grassroots level to benefit lower income groups in rural areas (both households

23 Annex 2 is based on field visit to Ghana, October, 1999 (met with UNDP; World Bank; Ministry of Finance and Economic Planning; Ministry of Environment, Science and Technology; Ministry of Mines and Energy; a member of parliament; University of Science and Technology; MICAP Coral Technology; Solarvent; Solarco; Wilkins Engineering; Gold River Solar Electric, Deng Limited, and Solar Light Co.); field visit to Uganda, October, 1999 (met with UNDP; World Bank; African Development Bank; Ministry of Finance, Planning and Economic Development; Ministry of Energy and Mineral Development; Uganda Renewable Energy Association; Uganda Women's Finance and Credit Trust Ltd.; Solar Energy Uganda Ltd; Solar Energy for Africa; Impact Solar Systems; Shell Uganda Ltd.); Martinot and McDoom, op. cit. note 4; Resource Futures International, "Lessons learned during the GEF pilot phase" (Ottawa, Ontario, 1998).

and community-based institutions). The project has had a number of impacts on the market for PV systems in Zimbabwe, including a greatly expanded network of dealers, reduced market prices (partly through elimination of import duties on imported components), improved technical knowledge among firms, establishment of PV module standards for certifying and guaranteeing installed systems, development of equipment certification institutions and procedures, and much greater awareness of PV by consumers, NGOs and government.

In comparing these projects, the fee-for-service delivery model seems to be oriented more towards the poorer of the rural population than the sales model. Also, the fee-for-service model looks affordable to larger sections of the rural population, and hence might have better potential for developing large markets for rural solar PV applications. Regardless of the model used, continued finance after the project, either from private or public sources, will be essential for the sustainability of the energy-service businesses or the delivery of consumer credit through development-finance or credit-union institutions.

Annex 3: Consumer Credit Through Microfinance Organizations in Sri Lanka[24]

The Sri Lanka project demonstrates the initial viability of a "microfinance model" in which solar home system (SHS) dealers market, sell, service, and guarantee their products to rural consumers through their own local sales/service offices. Consumers obtain loans from Sarvodaya, a national microfinance institution (MFI) with many local branches and strong ties to the communities in which it operates. A customer signs a credit agreement with Sarvodaya, Sarvodaya pays the supplier, and Sarvodaya is responsible for repayment and collections. The supplier provides maintenance service for the first three years, a one-year warranty for the system and a 10-year warranty for the PV module. The credit provided by the microfinance organization for purchase of solar home systems is similar in kind to that provided for enterprise development: $500 with 20 percent down payment, terms of up to five years, and 24 percent interest rate. "This is the only way to go," said the two major SHS suppliers in the market, who today sell more than 90 percent of their systems this way (now 50-100 systems per month). For 2000, Sarvodaya has signed agreements with the two major SHS suppliers to provide credit for an additional 5,000 systems and is looking at extending credit for 10,000 systems in 2001.

However, Sarvodaya is currently "the only game in town" in terms of consumer credit, and there is a need for other MFIs to participate in the SHS market. It appears that the market is being constrained by the lack of other MFIs with whom suppliers can sell systems on credit. "Help us to strengthen the rural credit structure," advised the two suppliers. "Sarvodaya is a social mobilization organization, not really a business," said one SHS industry observer. Sarvodaya sees these projects as primarily social projects and thus does not approach the market with the aggressiveness of a private company. Without other MFIs in the market, credit delivery through Sarvodaya may simply be too slow for the market expansion desired by suppliers.

The project also demonstrates the initial failure of a fee-for-service model in that country. Initially, one dealer provided 140 systems on a fee-for-service basis and thought this approach held promise. But it soon stopped offering systems this way because it did not want the expense of monthly collections in a fee-for-service scheme. "Collection costs were eating up our entire profit margin," the dealer said. "You need a strong fee collection system with good timing, otherwise customers will spend the money on something else (if your timing is off) and default. Or they say they will pay next month and ask us to wait, or cite poor performance. It's a continuing problem. Also, we found that if customers don't own the system, they won't take proper care of it and this increases our costs."

Dealer credit through the project suffered the same fate. In the early stages of the project, suppliers found collections too difficult and time-consuming. "Building a rural service infrastructure with technicians is a very different business from building a rural credit delivery and collection infrastructure," said the suppliers. "Credit is not [the suppliers] business," echoed one industry observer, "it is the business of microfinance institutions, and the success of credit depends on local connections, knowledge, and institutions already in place." One factor affecting the viability of dealer credit is a very low rural population density in Sri Lanka. Transport and labor costs involved in collections are substantial because of the long distances and time required to travel those distances by supplier personnel. Population density and transport costs also greatly influence supplier costs for marketing and service.

24 Annex 3 is based on: field visit to Sri Lanka, November 14-19, 1999 (met with World Bank Project Management Unit, Shell Renewables Lanka Ltd., Resco Asia Ltd., Alpha Thermal Systems Ltd., Sarvodaya Economic Enterprises Development Services (central office and Mayangaya district office), UNDP, World Bank, Lalith Gunaratne & Associates, DFCC Bank, Sanasa Development Bank Ltd., Hatton National Bank, Browns Ltd., and three households that purchased solar PV systems); World Bank project supervision reports; Lalith Gunaratne, "Funding and repayment management of PV system dissemination in Sri Lanka," paper presented at Financial Services for Decentralized Solar Energy Applications II, 20-23 October 1998, Harare, Zimbabawe; Jayantha Nagendran, "Building local capacity in rural and renewable energy: Emerging lessons from Sri Lanka," paper presented at World Bank Energy Week, 6-9 April 1999, Washington, DC.

Both SHS suppliers and Sarvodaya have had no problem obtaining business financing from commercial banks and do not anticipate having problems in the future. But other MFIs besides Sarvodaya may face more difficulty, as commercial financiers see lending to MFIs as too risky and a marginal business. Because MFIs do not have assets, some observers felt that commercial banks would not lend to them, but this has not been tested yet in the project.

In 1999, Shell International Renewables purchased one of the existing SHS dealers and observers saw Shell's entry into the market as a very promising sign, one directly attributable to the World Bank/GEF project.[25] "Anybody who is really going to advance the market here has to have deep pockets," said one long-time participant and observer of Sri Lanka's SHS market. Shell also signed a memorandum of understanding with the national electric utility that included a statement by the prime minister that the government would promote the private SHS industry. "The credibility of SHS has increased several notches" within the government due to the World Bank/GEF project and Shell's entry into the market, said an industry observer.

25 Shell International Renewables has stated that they would not have entered the Sri Lanka market if the World Bank/GEF project had not taken place, according to the World Bank task manager for the project.

Annex 4: Solar PV Businesses and the IFC/GEF Small and Medium Scale Enterprise Program[26]

Business financing is being provided under the IFC/GEF Small and Medium-Scale Enterprise Program to three solar home systems businesses in Bangladesh, Vietnam, and the Dominican Republic.

The Bangladesh project demonstrates a dealer-credit model in which one organization (Grameen Shakti, legally a non-profit), performs all functions: marketing, sales, service, credit provision, collections, and guarantees. From 1997 to 1999, Grameen Shakti installed 1,500 systems using this model (about 1,100 systems since IFC financing began in July 1998), and plans to install 2,000-2,500 systems in 2000 (consistent with their original business plan). Grameen Shakti is so far the only player in the Bangladesh SHS market. Before the IFC loan, Grameen Shakti was installing about 20 systems per month using Grameen Bank financing exclusively, which was for one-year terms only. Therefore, Grameen Shakti could only extend credit for one-year terms, limiting demand greatly. The IFC SME loan enables Grameen Shakti to extend three-year credit to customers, which has made a large difference in its business. Grameen Shakti believes they will ultimately be able to receive loans from commercial banks in perhaps another 3-4 years, after they demonstrate profitability.

In Bangladesh, Grameen Shakti is selling to households that have incomes two or three times higher than Grameen Bank "members" (those eligible to borrow from the Grameen Bank). Grameen Shakti's customers represent the top 10 percent to top 15 percent of income status among rural households. Grameen Shakti's biggest problem is the cost of marketing and consumer education. They are spending all their own money (financed through business loans) on this. They don't receive any grants from the government or Grameen Bank. Grameen Shakti finds the process of building customer demand and confidence to be enormously draining on their time, resources, and profitability. Grameen Shakti is finding that after a "critical mass" is reached in a particular community (perhaps 100 systems), word spreads among friends and relatives, people see systems in operation, and marketing is easier.

In Vietnam, sales by a private dealer (SELCO) are assisted by a complex credit delivery scheme involving the Vietnam Women's Union (VWU), an NGO, and the Vietnam Bank for Agriculture and Rural Development (VBARD), a development finance institution. VWU markets SELCO's systems and administers consumer loans provided by VBARD (VWU collects fees for these services). SELCO provides systems (receiving full cash payments) and is responsible for service. VBARD provides consumer loans, assuming risk for 75 percent of the purchase price. Of the remaining 25 percent of the purchase price, SELCO provides a collateralized guarantee to VBARD for 5-10 percent and the customer pays 15-20 percent as a down-payment. SELCO covers its collaterized guarantee to VBARD with IFC/GEF financing. If a purchaser defaults on the VBARD loan, SELCO repossesses and refurbishes the system, and VWU finds a new buyer for it. If there is any loss in this repossession/refurbishing/resale process, VBARD has access to the SELCO guarantee. Despite instructions from the head office, some conservative branch managers of VBARD have been reluctant to participate in the SELCO business. Where this has happened, SELCO has extended consumer credit itself. So far SELCO has sold 500 systems in Vietnam.

In the Dominican Republic, the U.S. firm Soluz has been developing a subsidiary, Soluz Dominicana, into a successful fee-for-service business that targets up to 50 percent of the population in the rural communities it serves and charges $10 to $20 per month for

26 Annex 4 is based on: field visit to Bangladesh November 20-22, 1999 (met with Grameen Shakti, Bangladesh Center for Advanced Studies, and World Bank); field visit to Vietnam October, 1999 (met with IFC; World Bank; UNDP; Japan Bank for International Cooperation; Electricity of Vietnam; Ministry of Science, Technology and Environment; Vietnam Women's Union; Vietnam Bank for Agriculture and Rural Development; BP Solar Vietnam; Selco Vietnam; Shell Vietnam; Trans Energ); Richard Hansen, "Solar Electric Energy Delivery—A Business Model," paper presented at Village Power '98, 6-8 October 1998, Washington, DC (Golden, CO: National Renewable Energy Laboratory); personal communications with Richard Hansen of Soluz in October 1998, February 2000 and April 2000.

electricity service from SHS.[27] The Soluz business model revolves around a "service center" for up to 2,000 customers and "zones" of about 500 customers served by technicians collecting payments at "collection points" covering 20 to 100 customers. Collection rates have been typically over 95 percent, although to maintain high rates Soluz Dominicana has needed to make household visits to a portion of customers. Through continuous improvement to the business model, including business and technical systems optimization, Soluz expects to complete a robust "proof of concept" with Soluz Dominicana at a scale of 5,000 fee-for-service customers. As of April 2000, Soluz Dominicana had installed over 3,500 systems and had passed the break-even point where revenues cover the direct costs of operations. About 1,700 of these systems have been installed on a fee-for-service basis. Soluz also established Soluz Honduras to enter the Central American market and diversify.

Soluz is now working on developing its business model to the point where eventually it will be able to support 25,000 customers. Soluz finds such "business model R&D" very difficult to fund from operating revenue alone at the proof-of-concept scale. Thus Soluz sees the need for concessional funding to help it cover first-time commercialization costs, including financial transaction engineering and optimization of its business and technical systems. Said Soluz of its commercialization efforts, "We are doing the work to prepare for a $5-10 million company (25,000-50,000 customers), but we are concerned about burdening a $1 million company (5,000 customers) with the overhead and first-time costs of building an energy-service company on a larger scale. The business is risky, and the GEF still has a legitimate role. This is a lean margin business, so a small difference can affect profitability greatly. Over the next three years we need to create a strong franchise. There are necessary overheads as well as first-time innovation and transaction costs to keep the thing going on a solid path—the question is how to cover these costs. To rely only on equity would place high pressure for rapid and more difficult-to-achieve growth to meet return requirements, which adds risk."

27 Monthly fees are $10 for a 20 Wp system, $15 for 40 Wp, and $20 for 50Wp. Customers own and are responsible for the battery, although Soluz Dominicana can include financing for batteries in the monthly fees.

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Annex 5: Rural Energy Service Concessions in Argentina[28]

The World Bank/GEF Renewable Energy in the Rural Market project aims to supply electricity to 66,000 households with individual solar home systems (of 50Wp to 400Wp), 1,100 public facilities with solar photovoltaic systems, and 3,500 households with village power systems (using mini-hydro or hybrids such as solar/wind, wind/diesel, or solar/diesel) through province-level energy service concessions. Concessions are free to select which technology to apply in any given situation, including diesel-only village power systems. Concessions will be obligated to:

- provide electricity services to rural off-grid customers anywhere in the province for a period of at least 15 years, upon request;
- carry out all necessary maintenance, repairs, or replacement of components as needed to ensure the continuity of the electricity service to each and every customer;
- provide "state-of-the-art commercial service standards" for connection requests, billing, collection, and claims handling; and
- provide the provincial utility regulatory agency (ENRESP) with periodic reports on the status of the concession including but not limited to performance indicators such as number of connections by type of consumer and method and technology supply, outages statistics, and financial results.

Concessions are eligible to re-bid for their business every 15 years (for up to a total of 45 years) competitively against other eligible firms. The 15-year period was seen as a compromise between the need for a short period for the quasi-monopoly and a long period for the annuity calculations of the concession. After 15 years, the government may modify the concession rules to account for new technological developments, or may even decide to abandon the concession system and open the market to competition. During the 15 year period, the concession, provincial government, and provincial utility regulatory agency renegotiate the tariffs every 2 years.

Eight provincial governments (out of 22 total) are eligible to participate in the project. Each of these provinces has privatized or is in the process of privatizing its power sector, or at least has made a legal commitment to privatize.Four of these provinces have existing private concessions serving the concentrated (urban) market that are regulated by the provincial governments. Under the project, these governments will first try to negotiate a rural concession contract with their existing concessions (as an amendment to the existing contract). If such negotiation fails, or if there is no existing concession for that province, then a new concession contract will be awarded according to international competitive bidding procedures.

28 Annex 5 is based on Eric Martinot and Kilian Reiche, "Regulatory Approaches to Off-Grid Electrification and Renewable Energy: Case Studies from Six Developing Countries," (Washington, DC: World Bank, 2000).

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CLIMATE CHANGE PROGRAM STUDY
SYNTHESIS REPORT

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FOREWORD

1. The GEF Council, at its meetings in December 1999 and May 2000, requested a review of GEF operations prior to the next replenishment, which begins in 2001.[1] This review, the Second Study of GEF's Overall Performance (OPS2) is to be carried out by a "fully independent team" which is expected to complete its work by the end of 2001. The OPS2 is the third major GEF-wide review to take place since the Facility was created.[2] Among the broad topics the OPS2 team will assess are:

(a) Program Results and Initial Impacts
(b) GEF Overall Strategies and Programmatic Impacts
(c) Achievement of the Objectives of GEF's Operational Policies and Programs
(d) Review of Modalities of GEF Support
(e) Follow-up of OPS1

2. To facilitate the work of the OPS2 team, GEF's Monitoring and Evaluation team, in cooperation with the implementing agencies, decided to undertake program studies in the biodiversity, climate change, and international waters focal areas. The role of these program studies is to provide portfolio information and inputs for the OPS2 team's consideration.

3. The Climate Change program study was undertaken by an inter-agency team comprised of staff from the GEF Secretariat, the three Implementing Agencies, and the GEF Scientific and Technical Advisory Panel with additional support from consultants contracted to undertake detailed studies on specified parts of the portfolio. The team worked under the guidance of the Steering Committee.

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Senior Monitoring and Evaluation Coordinator

[1] Joint Summary of the Chairs, GEF Council Meeting, December 8-9, 1999, and GEF/C.15/11.
[2] The first two studies, respectively, were: *Global Environment Facility: Independent Evaluation of the Pilot Phase.* UNDP, UNEP and World Bank (1994) and Porter, G., R. Clémençon, W. Ofosu-Amaah and Michael Philips, *Study of GEF's Overall Performance*. Global Environment Facility (1998).

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EXECUTIVE SUMMARY

Introduction

1. During the last decade, the GEF has provided financial support for more than 270 projects for a total GEF allocation of over a billion US Dollars in 120 countries under its climate change focal area. Not counting enabling activities and some short-term measures, there are 120 projects covering 60 countries demonstrating an impressive range of approaches to promoting energy efficiency, renewable energy, and to a lesser extent sustainable transport.

2. The GEF Climate Change Program Study, initiated in June 2000, set out to answer four questions:

(a) Are activities relevant to country needs and global objectives?
(b) What are the most significant implementation issues and lessons?
(c) What are the impacts/likely impacts of GEF projects?
(d) What are the factors influencing sustainability and replication?

3. As of April 2001, the Program Study has resulted in eight new draft reports and has incorporated one completed report:

(i) Efficient products manufacturing and marketing thematic review

(ii) Grid-connected renewable energy thematic review

(iii) Energy service company thematic review

(iv) Solar thermal power plant thematic review

(v) Solar PV review (published August 2000)

(vi) Assessment of GEF climate change portfolio coverage

(vii) Country reviews of China, India, and Mexico, with overall objectives to assess how GEF projects are collectively addressing country and global environment objectives.

4. The content and lessons to be drawn within these individual draft reports are substantially complete, although they continue to undergo agency review, integration, final revisions, and editing. The India country review is an exception, as it is still in progress, with results to be incorporated into the thematic reviews and synthesis report. All reports are expected to be finalized by June 2001. Copies of individual draft reports are available upon request by May 2001. This synthesis report provides a brief overall look at the results from these reports, organized by the four basic questions laid out in the program study initiating memorandum.

Scope of the Climate Change Portfolio

5. The program study has not been able to definitively assess, within the confines of time and resources available to the study, the degree to which country needs have been met through GEF-financed projects. Such an assessment would require explanation of where countries were prior to GEF, what baselines might have been, and where countries are now. Such data are often lacking or difficult to obtain. Further, the national communications do not always fully reflect national development priorities. Most GEF projects do not result from coherent, integrated approaches to development and environment at the country level. Nevertheless, the GEF has clearly helped to promote renewable-energy-based rural and agricultural development programs.

6. Reviews of GEF-financed climate change portfolios in Mexico and China have indicated that GEF projects are consistent with national priorities in those countries. Across all countries, the technology applications promoted in GEF projects are broadly relevant to at least some national objectives. For example, off-grid solar PV projects are serving fairly universal objectives of rural electrification. However, there is a need to further document how these projects serve other development objectives like employment and livelihood, health, sanitation, water, and literacy.

7. Meeting global environmental objectives depends greatly on the replication occurring as a result of demonstration of project benefits and on broader indirect impacts, since individual projects are small relative to the scale of the climate change problem. The challenge of measuring global objectives is compounded by the fact that replication is difficult to monitor. In general, the portfolio is still too immature to gauge how well replication is providing global environmental benefits. Replication has occurred in some projects -- efficient lighting, efficient refrigerators,, solar PV,, coal-bed methane, and electric power demand-side management. Replication from other projects has been minimal or remains undocumented.

8. Project approaches have clearly evolved from the pilot phase to the present. The initial direction for the climate change portfolio came from the Ad-hoc Working Group on Global Warming and Energy (AWGGWE) set up by the GEF Scientific and Technical Advisory Panel (STAP), which came up with a list of interventions that reduce or limit the emissions of greenhouse gases. Early GEF projects often focused on demonstrations of technologies. More recent projects focus on sustainable market-oriented approaches and demonstrations of business models, financing mechanisms, demand-side awareness and incentives, and public involvement. At the same time, the portfolio has become dominated by a few technologies and strategies over time, not necessarily related first and foremost to greenhouse-gas reduction, but reflecting a complex balance of needs, interests, and interactions among governments and GEF implementing agencies.

9. As the portfolio evolved, the need to support rural energy enterprises, provide financial intermediation (particularly to reduce risks), and attract private-sector financing became apparent. To respond to these needs and demonstrate how the GEF can leverage private-sector resources to achieve global benefits, the International Finance Corporation of the World Bank Group developed five projects

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that feature new forms of enterprise support, financial intermediation and private-sector co-financing These projects have used GEF funding commitments to mobilize more than US$200 million of private sector co-financing to-date. Impacts from two of these projects are included in the energy-service company and solar PV thematic reviews, while the others are just starting implementation. This unique group of projects will warrant a separate thematic review in the future.

Emerging Lessons

10. Eight significant lessons emerging from the climate change program study are highlighted in this synthesis:

(a) *Lessons and good practices are emerging but need to be better incorporated into project designs to promote cross-learning.* One of the key advantages of supporting projects through the GEF Operational Programs is to facilitate learning within the portfolio. This study finds that cross learning is slow and has not happened effectively until more recently. While the annual Project Implementation Reviews do provide a forum for learning, the first concerted effort in the climate change portfolio was the Solar PV cluster review completed in 2000.

(b) *Indirect influences and impacts are key GEF results.* Some of the key impacts of GEF-financed projects are indirect in the sense that they are not explicit objectives of projects. Also, in many cases, significant impacts from projects have been recorded during project preparation (PDF) phases or early in implementation.

(c) *Replication of project results is not well planned and monitored.* In general, the portfolio is still too immature to gauge how well replication is providing global environmental benefits.

(d) *Project risk assessment and management needs to be strengthened.* Project implementation is often hindered by the inability to adjust to changes in the market, policy, macroeconomic conditions, cofinancing and government commitment.

(e) *Technological know-how transfer is more difficult* than projects anticipate given problems with technology acquisition and application to domestic conditions.

(f) *Long-term programmatic approaches require sufficient GEF "credibility" and experience in a country.* It takes time to accumulate experience with a set of GEF-financed projects before a wide range of country stakeholders can develop a program embracing the principles of GEF operational programs.

(g) *The GEF's potential for influencing policy needs to be better utilized.* While influence of GEF projects can be seen in three main areas – national codes and standards, electric power sector policies, and rural electrification policies --, the impacts achieved to date are modest.

(h) *Impacts on social benefits and poverty alleviation need to be assessed.* Though there is a fair amount of evidence of beneficiary participation in projects, especially those that cater to rural energy development needs, these experiences need to be documented and systematically integrated into country sustainable development programs.

Impacts

11. Project impacts are slow in emerging. Only 11 projects in the portfolio are completed, and perhaps another 25-30 ongoing projects have significant recorded impacts. These 35-40 projects have been analyzed for impacts by application cluster.

12. *Energy-efficient products.* GEF-financed projects have demonstrated important and effective approaches for facilitating and accelerating greater demand and supply of energy-efficient manufactured products, particularly for lighting, but also for refrigerators, motors and building materials. The benefits from almost 5 million efficient lights installed through GEF projects are being sustained and replicated on larger scales. Sustained market price reductions are occurring as a result of projects. The carbon abatement impacts from such approaches appear to be highly cost-effective.

13. *Grid-connected renewable energy.* The GEF has facilitated important regulatory frameworks supportive of grid-connected renewable energy, but has done so in only two countries so far (Mauritius and Sri Lanka). Otherwise, one-time demonstrations, research, and broad-based increases in capacities and awareness have characterized impacts so far. The GEF's largest impact has been in India, where direct and indirect influences on private-sector power project development and financing have been very significant and resulted in close to 1000 MW of new renewable energy generating capacity.

14. *Off-grid solar PV.* A small number of installed systems (18,000) relative to the expected number of installations from all projects in the portfolio (600,000) shows that this cluster, the largest single group of projects in the portfolio, is still immature. Still, several promising business and consumer credit models are showing initial success, with good prospects for replication and scale-up, and progress has been made with increased awareness and technical standards in several countries. Impact on rural electrification planning and policies has been modest despite the relative importance of this issue and emphasis placed upon it in more recent projects.

15. *Energy service companies.* Viable energy-service companies have been established in two countries (Tunisia and China) as a result of GEF projects. Financing for existing ESCOs has been facilitated in the Hungary project. Other projects with "ESCO" components provide technical assistance, training, and audits, but are not expected to lead to full-service (i.e., "performance-contracting") ESCOs, which are a new phenomena in developing countries many of which often have commercial conditions that are not suitable or supportive of energy saving applications. With the exceptions of China and Hungary, no replication or energy-savings impacts have been documented. Prospects for replication and sustainability appear strongest in the China project, which is also pioneering the resolution of key policy and legal issues needed for a growing ESCO industry. Several

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of the projects appear to be increasing the familiarity and acceptance of ESCO approaches among industrial clients, policy-makers and financiers.

16. *Other applications.* A collection of other applications, from coal-bed methane, gas pipeline leakage repair, fuel switching, decentralized wind power, demand-side management, village-scale mini-grids, and district heating efficiency improvements, have all shown significant impacts that could be replicated on larger scales and used to inform ongoing and future GEF projects. So far, three projects, coal-bed methane in China, decentralized wind in Mauritania, and demand-side management in Thailand, are resulting in replication.

Sustainability

17. A number of examples of factors that influence sustainability, both positively and negatively, can be seen through the climate program study. Some examples of positive influences on sustainability:

    (a) Demonstration of sustainable business models, whether that business is public, private, utility, or even permanently subsidized, is key to achieving project sustainability.

    (b) "Market transformation" approaches, whereby viable markets have been developed for energy efficient products.

    (c) Voluntary agreements with the private sector in weeding out inefficient products out of the market.

    (d) Establishment or precedents of new legal frameworks for establishment of ESCO businesses.

18. A number of examples illustrate factors that can negatively influence sustainability:

    (a) Privatization of power utilities without consideration of the future existence and role of demand-side management units.

    (b) Short-term power-purchase tariffs for grid-based renewable energy, holding it hostage to fluctuations in conventional fuel prices.

    (c) Consumer finance and rural business dependence on project resources, without creating viable and sustainable commercial sources.

    (d) Project implementation arrangements that do not demonstrate business models, but fall into an "equipment installation and demonstration" role.

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I RELEVANCE OF GEF-FINANCED PROJECTS TO COUNTRY NEEDS AND GLOBAL OBJECTIVES

1. The question of whether activities across the entire GEF portfolio are relevant to client country needs is a very complex one. Such an assessment would require explanation of where countries were prior to GEF, what baselines might have been, and where countries are now. Such data are often lacking or difficult to obtain. Further the national communications do not always fully reflect national development priorities. In the end, the climate program study is only able to address this question based on the three specific country reviews for China, India, and Mexico.

2. Portfolio coverage has evolved and expanded but not necessarily in a directed, strategic manner. After the GEF was restructured and became a financial mechanism of the climate change convention, the GEF operational strategy and operational programs were developed to respond to guidance from the convention. The scope of activities eligible under the operational programs actually increased or expanded from the pilot phase to the restructured GEF. The GEF interpretation has been judged to be flexible, and rarely have sensible proposals in the renewables or energy saving areas proposed by countries been rejected. As such, existing projects under the operational programs cover a very diverse set of technologies, applications and sectors. Of course, it is difficult to make a judgment on those proposals that never were presented to the GEF because of decisions made by governments or GEF implementing agencies.

3. Portfolio coverage ranks well on two key priorities of developing countries–technology transfer and capacity building. Most climate change projects have a high degree of technology content directed towards technology understanding, awareness, diffusion, adaptation, know-how transfer, and/or domestic manufacturing appropriate to recipient countries. In some cases, as in the projects to introduce CFLs, the technology has been locally adapted and manufacturing capacities established or further supported. In others, such as rural solar PV, local manufacturers may produce items such as charge controllers, batteries, and lamps, even if the solar panels continue to be imported. Also, most projects during their implementation seem to have enhanced local capacity. There are many examples in the portfolio where projects have trained local technicians, developed financing and institutional capacity, and/or supported regulatory or legal development, all setting the stage for project replication.

4. The evolution of the portfolio has left no obvious and undue over-concentration of any technology application in Operational Program 5 (Removal of Barriers to Energy Efficiency and Energy Conservation). However, this is not true for Operational Program 6 (Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs). A significant share of projects in the OP6 portfolio focus on solar home systems for off-grid applications. These projects are directed towards rural populations and meet rural electrification objectives. Although projects need to continue to improve approaches to handle the questions of affordability and sustainability, they have demonstrated the viability of using renewables as a plank in rural electrification. However, linkages between rural electrification strategies and rural development needs related to health, education, water, sanitation and employment have yet to be systematically incorporated in project designs. Although no

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income-generation or other social benefits have yet been surveyed or recorded in the portfolio of rural solar PV projects, such impacts are known to be occurring and need to be the subject of more focused future review

5. Under Operational Program 7 (Reducing the Long-term Costs of Low Greenhouse Gas-Emitting Energy Technologies), four solar thermal power plant projects are proceeding under the original philosophy of OP7—that sequential support of multiple projects would catalyze cost reduction from economies of scale and learning-by-doing—although the sequential concept for these four projects remains in question, since in practice they may all occur at the same time. Most technologies envisioned under this program are now represented by at least one project under implementation or in the pipeline, with the exception of stationary fuel cells.

II SIGNIFICANT IMPLEMENTATION ISSUES AND LESSONS

6. Eight significant lessons emerging from the climate change program study are highlighted here. While some of these lessons are country-specific, most are applicable across the portfolio and hence provide an opportunity for the GEF to fertilize cross-learning.

1. Lessons and good practices are emerging but need to be better incorporated to promote cross-learning.

7. The available lessons from early projects are just emerging as a body of knowledge with which to inform current and future project designs. The exceptions are projects that directly follow prior projects. For example the Efficient Lighting Initiative employed lessons from prior efficient lighting projects in the portfolio, the China TVE Phase II built upon the lessons of the China TVE Phase I project, and a recent demand-side management (DSM) project in Vietnam has drawn from the DSM project in Thailand. Off-grid solar PV projects in the past few years are beginning to note experience from some of the early solar PV projects in the portfolio, particularly with the completion of the solar PV portfolio review by the GEF Secretariat in 2000. Annual Project Implementation Reviews do provide a forum for learning, even if the level of information available is often not enough to provide in-depth understanding of project performance.

8. There is considerable opportunity and need for the GEF to facilitate cross-learning within the cluster of solar thermal projects. The four projects in the cluster – projects approved by the Council in India, Morocco, and Mexico, and project financing approved for a fourth project in Egypt – account for about $150 million of GEF resources and are expected to install 137 MW of solar components. The solar thermal thematic review suggests that the GEF would benefit from much greater efforts to facilitate cross-learning between the four projects.

2. *Indirect influences and impacts are key GEF results, and influences can begin even before project implementation*

9. Many GEF-finance projects have resulted in indirect influences and impacts. These influences were not explicit objectives of projects, but represent important results of GEF support. In addition, significant impacts from GEF projects can occur during project preparation (PDF) phases or early in implementation, even before any hardware is installed. One explanation for this phenomenon is that the GEF commitment of funds itself, as well as the visibility, dialogues, training, priority-setting, and institutional coordination that typically occur during project preparation result in increased awareness and confidence in technologies by a variety of stakeholders, including policy-makers, financial institutions, firms, utilities, other investors, and NGOs. Increased awareness and confidence may lead to investment decisions or policy actions in parallel with the GEF project. Some examples:

10. *Mauritius Bagasse Power* influenced several sugar mills to make bagasse power plant investments on their own, independent of the project, and stronger regulatory frameworks for independent power producers using bagasse emerged. These indirect impacts occurred even though a planned demonstration power plant under the project was never built.

11. *Mexico Efficient Lighting*. The positive experience by the Mexican utility CFE with the original 1991-97 GEF project led it to run an ambitious follow-on program. From 1998-2000, the new program sold 4.8 million CFLs all over the country. With the experience gained from the GEF project, the new program was able to run without subsidies, with reduced administrative costs, and with shorter repayment terms. CFE staff indicated that their experience with the GEF project played an important role in the design of subsequent nationwide energy saving programs

12. *Sri Lanka Energy Services Delivery*. The business climate for rural PV sales and supporting infrastructure, developed in part through this project, convinced Shell International Renewables to enter the Sri Lanka PV market (by purchasing an existing dealer). In addition, the project indirectly influenced a decision by a nation-wide department store in Sri Lanka to enter the solar PV business.

13. *Costa Rica Wind Power* helped influence and support the emergence of a significant private sector wind power industry due to the government's decision to re-engage in the power supply business. Although the planned government-owned 20 MW demonstration windfarm has not yet been installed, the GEF-supported project did promote a renewed dialogue with private developers and helped put in place an appropriate regulatory framework that resulted in more than 50 MW of operational privately-financed wind-farms.

14. *Poland Coal-to-Gas*. Soon after project initiation, many of Poland's environmental investment funds began to fund coal-to-gas conversions. In fact, a large coal-to-gas industry emerged, with many boiler conversions taking place using government and private financing, long before any GEF-supported installations occurred. The project is credited with catalyzing the broader trends.

solar home systems projects in Sri Lanka and Vietnam, uncertain rural electrification policies have depressed demand for solar home systems. In Ghana, imported equipment costs are rising due to currency depreciation, while political pressure is reducing fees charged to rural households for system use, thus calling profitability of the venture (and thus its sustainability) into question.

27. For grid-connected renewable energy projects, institutional conditions have played major roles in project progress. In Sri Lanka, the tough challenge of allowing third-party small-hydropower producers into a previously monopoly utility system has resulted in compromise power purchase frameworks that are not sustainable from the private producers' viewpoint. In China, changing institutional arrangements in the electric power sector due to restructuring have left provincial utilities unable or unwilling to embark on planned investments of 190 MW in new wind power capacity as part of a GEF-supported project, and almost all of that investment will be cancelled.

28. A few examples can be seen so far where changes in co-financing or government commitment have hindered project progress. In the China biomethanation project, for example, changes in local government leadership and lack of promised co-financing for demonstration projects have delayed implementation by a number of years. This issue should be tracked carefully in the future to gauge how significant it is across the portfolio.

29. While it might be difficult to design a project to exactly fit the market, macroeconomic, and policy conditions, adjustment during project implementation can go a long way towards enhancing project performance. Even if the projects have been designed taking initial conditions into account, their flexibility during implementation to respond to changing conditions is important. Given that there are only a few examples of projects that have successfully adapted to changing conditions during implementation, it will be useful for the useful for the GEF to employ flexible funding mechanisms such as adaptable program loans.

5. Technological know-how transfer is more difficult than projects anticipate

30. Two China projects for efficient boilers and efficient refrigerators provide direct support to manufacturers to acquire technological know-how. In both cases this acquisition is proving more difficult than originally expected, suggesting that attempts in other GEF projects to transfer technological know-how directly to domestic manufacturers may prove difficult. The efficient boilers project had problems with a first round of technology license acquisition because foreign manufacturers wanted more money than the project had allocated and because foreign technology was not directly applicable to China's conditions (i.e., necessity to burn raw coal). The project did acquire one license for a new technology package for one Chinese manufacturer by allocating a larger share of project funds, but settled for acquisition of lesser improvements to existing boiler designs and of product design tools for the remaining eight manufacturers. In the efficient refrigerators project, planned study tours for China manufacturers to visit foreign manufacturers were refused by the foreign manufacturers because of market competition concerns. Instead, Chinese manufacturers are having to rely on foreign academic

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and research institutions during study tours, which do not adequately convey the most practical technological and commercial know-how that manufacturers want.

6. Long-term programmatic approaches require sufficient GEF "credibility" and experience in a country

31. The China country review highlights the challenges of programmatic assistance frameworks and the need for sufficient credibility by the GEF. Two programmatic assistance frameworks have been under development in China, one for energy efficiency and one for renewable energy. But even as late as 1996, the credibility and awareness of the GEF in China was relatively low and such frameworks would not have been possible, the review found. A few projects had been approved, some were under development, but little experience had accumulated. But now, there is a solid base of projects under implementation, Chinese stakeholders have embraced the principles of the GEF operational programs, and the GEF has gained credibility among officials and industry. Given this situation, the GEF and China have recently been able to agree on development of long-term programmatic approaches to energy efficiency and renewable energy, currently under development by the UNDP and World Bank.

7. The GEF's potential for influencing policy need to be better utilized.

32. Influence of GEF projects on policy development can be seen in three main areas so far: (i) national codes and standards; (ii) electric power sector policies; and (iii) rural electrification policies. However, impacts achieved to-date are modest in all three areas except in a handful of projects. Yet the projects that have had policy impacts suggest that the GEF potential to facilitate appropriate policies is underutilized. Projects have successfully supported codes and standards for efficient lights in Mexico, efficient refrigerators in China and Thailand, and solar home systems in Zimbabwe, Sri Lanka and Indonesia. The GEF has proven quite capable of facilitating important regulatory frameworks supportive of grid-connected renewable energy in two countries--Mauritius and Sri Lanka. And rural electrification policies and planning have been influenced in at least two projects—Argentina and Sri Lanka. When asked what was the most important influence of the GEF in China (for both existing and new projects), a Chinese government official ranked policy influence in first place.

8. Little information is available about impacts on social benefits and poverty alleviation

33. There is a fair amount of evidence of beneficiary participation in projects, especially those that cater to rural energy development needs, particularly the off-grid renewable cluster of projects, but these experiences need to be documented and systematically integrated into country sustainable development programs. More than three-quarters of GEF-support off-grid projects are implemented through multi-stakeholder steering or advisory committees. Aside from representatives from the private sector, non-governmental organizations and consumer groups are also included in these committees.

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34. Despite the high degree of participation, more work is required in evaluating project impacts on-the-ground, specifically, how these projects have benefited communities in terms of increasing incomes and employment and expanding social services. Such effects can be expected from the portfolio as it matures, but have not been measured yet. Two emerging patterns are expected: (a) the integration of renewable energy with redefinitions of sustainable development and poverty alleviation programs; and (b) value-added alternatives to traditional delivery and financing models, including microfinance and community-based enterprises.

35. An example of redefinition of sustainable development programs is Mexico, where the government redesigned its rural development plan from grid-connected rural electrification to solar- and wind- powered systems. Another example is Malawi, where the government has integrated microcredit and community banking approaches being applied in the GEF-supported renewable energy project into its energy and sustainable development program. An example of value-added approaches is the energy and water sector reform project in Cape Verde, which extends wind power and solar PV to community-based electricity cooperatives for street lighting and water pumps. Another example is the Bolivia project, which sets up a revolving fund to support small enterprises in 23 municipalities..

III IMPACTS/LIKELY IMPACTS OF GEF PROJECTS

36. There are about 32 projects in the current portfolio of OP5/6/7 projects for which significant documented impacts can be found, either in PPRs, country visits, thematic reviews, agency reports, or informal communications. In addition, impacts from 3 energy-related short-term response measures have been documented. Of these 35 total projects, 11 are formally completed. This section summarizes the prominent impacts from projects in the four thematic clusters reviewed, plus samples of impacts from other projects outside of these four clusters. This section does not discuss likely impacts of other, less mature, projects in the portfolio. A recent M&E working paper (Measuring Results from Climate Change Programs: Performance Indicators for GEF, Monitoring and Evaluation Working Paper 4, September 2000) suggested that impacts should be organized by cluster, and discussed according to seven indicator types. The discussion below follows these suggestions.

Efficient Products Cluster

Projects with impacts (year of Council approval, year completed)

Mexico Efficient Lighting	World Bank	1991	1997
Thailand DSM	World Bank	1991	2000
Poland Efficient Lighting	IFC	1994	1998
China Efficient Boilers	World Bank	1996	
China Efficient Refrigerators	UNDP	1998	

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37. *Summary*: GEF-financed projects have demonstrated important and effective approaches for facilitating and accelerating greater demand and supply of energy-efficient manufactured products, particularly for lighting, but also for refrigerators, motors and building materials. The benefits from almost 5 million efficient lights installed through GEF projects are being sustained and replicated on larger scales. Sustained market price reductions are occurring as a result of projects. The carbon abatement impacts from such approaches, through sustainability and replication, appear to be highly cost-effective.

38. *Energy production or savings and installed capacities*. Three projects in Thailand, Mexico, and Poland have resulted in installation of more than 4.6 million compact fluorescent lamps (CFLs) and electricity savings of 3,400 GWh (equivalent to several months' output from a 1000 MW coal or oil power plant). Other energy consumption reductions were achieved through industrial, commercial and residential energy-efficiency improvements in the Thailand project. One of the most notable achievements of that project was the compete transformation of the fluorescent-light market, representing 20 million in annual sales, in which virtually all sales of less-efficient T-12 lights were replaced with sales of T-8 lights that are 10% more efficient.

39. *Costs per technology unit or measure installed*. The most visible price-reduction effects in the GEF portfolio have occurred in this cluster. Three completed projects clearly decreased prices of the technologies they targeted. The Poland project resulted in a sustainable price decrease for CFLs of at least 35%; in fact, one of the project's key influences was the lowering of CFL prices. In Thailand, sales of low-price CFLs increased in part because of the widespread publicity campaign promoting the benefits of CFLs sold at "7-11" convenience stores nationwide, and offered at lower prices due to bulk purchases by the national electric utility. Bulk procurement in the Mexico project, coupled with utility-provided subsidies, reduced consumer prices to $5-8, from pre-project prices of up to $25. Since project completion, average CFL prices have declined further, by up to 30%, and the project is credited with accelerating price reductions that would have happened more slowly otherwise.

40. *Business and supporting services development*. Supporting institutions for energy efficiency have been strengthened through several projects. As part of the Thailand DSM project, the national electric utility (EGAT) created a Demand-Side Management Office. Many signs point to the capabilities of this office, including successful negotiation of voluntary T-12 to T-8 lamp changeover, bulk procurement of CFLs and distribution through convenience stores nationwide, and campaigns to promote public awareness of energy efficiency and conservation, appliance energy labels, and dissemination of classroom educational materials. The experience that the Mexican utility CFE gained during the Mexico project has allowed it to proceed with further DSM programs without GEF support, including plans for selling an additional 4 million CFLs. The China efficient refrigerators project resulted in the enactment of new energy efficiency standards for refrigerators. The China industrial boilers project has provided nine Chinese boiler manufacturers with technology licenses from foreign suppliers for upgraded or new industrial coal-fired boiler technologies that are more efficient.

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Financing availability and mechanisms. The Poland project provided an innovative subsidy mechanism whereby an overall GEF subsidy of $2.6 million leveraged a total CFL retail price reduction worth $7.2 million through competitively-solicited manufacturer subsidies and retail markup-up effects. The Mexico project introduced to Mexico two new mechanisms for consumer financing of CFLs: (i) pay-on-the-bill financing, where the price of the lamp is deducted by installments off of a customers electricity bill; and (ii) a similar procedure managed by employers, in which an employee's investment in CFLs is made through paycheck deductions. Both of these Mexican financing approaches continue to be used after the close of the project.

41. *Policy development.* Policy development in at least three projects has focused on national codes and standards for efficient equipment. In Mexico project, the development of national CFL quality standards began in the early stages of project development, and were launched and enforced during the project. Since then, an increasing number of CFL models are being sold and labeled according to these standards. In the Thailand project, EGAT's DSM Office worked with the Thai Consumer Protection Agency to make energy efficiency labeling mandatory on single-door refrigerators. In the China project, national standards for refrigerators were enacted.

42. *Awareness and understanding of technologies.* The Poland project has produced the most data of any project* on changes in awareness and understanding of technologies, in this case of compact florescent lamps (CFLs). CFL penetration increased from one in ten Polish households owning at least one CFL prior to PELP, to one in three, a year after the program. About 97% of CFL purchasers surveyed intended to replace their CFLs with another one upon burn out.. After PELP, CFLs were sold by a larger number of shops, and in a wider variety of shops (ranging from small shops to hypermarkets), than before the program, and shops carried a wider variety of models. Print media coverage of CFLs increased and shifted from describing CFLs to explaining where and how to best use them. The Ministry of Education wrote that "it is apparent that as a result of the project large numbers of students and teachers have gained useful insight into the use of energy and its impact on the environment." The Thailand project conducted a major public awareness campaign that resulted in 87% of Thais aware of energy efficiency issues, and particularly on the advantages of energy efficient lighting, refrigerators, and air-conditioners.

43. *Energy consumption, fuel-use patterns, and impacts on end-users.* Impacts on energy-consumption patterns can be seen through changes in market shares associated with a few projects in this cluster. The Poland project resulted in an increase in the number of households with CFLs from 11.5% to 19.6%. The Thailand project also had significant impacts on market shares: an air conditioner program increased the market share of energy-efficient air conditioners from 19% in 1996 to 38% in 1998, and a refrigerator program transformed the single-door refrigerator market, increasing the market share of the most efficient units from 12% in 1995 to 96% in 1998. One of the most notable achievements of that project was the compete transformation of the fluorescent-light market,

* The Poland Efficient Lighting Project had a very comprehensive monitoring and evaluation program that was designed along with the project and implemented very effectively.

representing 20 million in annual sales, in which virtually all sales of less-efficient T-12 lights were replaced with sales of T-8 lights that are 10% more efficient.

Grid-Connected Renewable Energy Cluster

Projects with impacts (year of Council approval, year completed)

India Renewable Resources	World Bank	1991	
India Small Hydel	UNDP	1991	
Mauritius Bagasse Cogeneration	World Bank	1991	1997
Philippines Geothermal Power	World Bank	1991	2000
Brazil Biomass Gasification Project I	UNDP	1992	1996
Costa Rica Wind Power	World Bank	1992	
India Biomethanation	UNDP	1994	
Sri Lanka Energy Services	World Bank	1996	
Brazil Biomass Gasification Project II	UNDP	1996	
China Renewable Energy Capacity Building	UNDP	1997	

44. *Summary:* The GEF has facilitated important regulatory frameworks supportive of grid-connected renewable energy, but has done so in only two countries so far (Mauritius and Sri Lanka). Otherwise, one-time demonstrations, research, and broad-based increases in capacities and awareness have characterized impacts so far. The GEF's largest impact has been in India, where direct and indirect influences on private-sector power project development and financing have been very significant and resulted in close to 1000 MW of new renewable energy generating capacity.

45. *Energy production or savings and installed capacities.* Directly installed grid-connected renewable energy capacity from two projects totals 110 MW (86 MW in India and 24 MW in Sri Lanka). Indirectly, at least another 840 MW of capacity has been influenced by GEF support. The India Renewable Resources project assisted the India Renewable Energy Development Agency (IREDA) to promote and finance more than 360 MW of wind projects and 65 MW of mini-hydro projects by the private sector. The Mauritius project indirectly influenced almost a doubling of electricity generated from bagasse in that country, with the addition of an estimated 3-5 MW of new bagasse generation capacity. The Costa Rica project indirectly helped to support more than 50 MW of private finance and operated wind farms.. The Philippines project expanded the capacity of an existing geothermal facility and transmission system to influence an increment 390 MW of geothermal. The India Biomethanation project has so far resulted in six demonstration installations, including three 180-kW biogas engines and four 450-kW dual-fuel engines for power generation from biogas from two sewage treatment plants, with other subprojects nearing completion, including a 1-MW power plant based on biogas from a sugar factory.

46. *Business and supporting services development.* Business development has been fostered by facilitating conditions for independent power producers in Mauritius, Sri Lanka, Costa Rica, and India. For example, the India Small Hydel project has resulted in supporting services for small hydro business

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development. Capacity-building activities have trained more than 50 officials in small hydro power planning, design, construction, management, and maintenance. Local ownership and management models are being tested at three of the demonstration sites. An "Alternate Hydro Energy Center" has strengthened its ability for testing equipment and training stakeholders and a local educational establishment now offers a postgraduate program on alternate hydro energy. Thirteen states have issued guidelines for engaging the private sector in the commercial installation of small hydro. Renewable energy business associations have been fostered in Sri Lanka and China; the China Renewable Energy Capacity Building project created the China Renewable Energy Industry Association, which has supported new activities by its members to expand their business and link with foreign expertise.

47. *Financing availability and mechanisms.* Projects in Costa Rica, Sri Lanka, and India (Small Hydel, Biomethanation, and Renewable Resources) have provided direct financing for power project developers and for demonstration installations. But only one project has so far facilitated a long-term financing mechanism for grid-based power: the India Renewable Resources project strengthened the capabilities of the India Renewable Energy Development Agency (IREDA) to promote and finance private-sector investments. As a result, more than 360 MW of wind projects and 65 MW of mini-hydro projects have been financed through IREDA. The project also helped to raise awareness among investors and banking institutions of the viability of wind power technology and helped to lobby for lower import tariffs for wind systems. During the 1990s, many financial institutions decided to offer financing for wind farms in India, which was a key project goal. Other impacts on financing availability from other projects have not been documented.

48. *Policy development.* Electric power sector policies supportive of renewable energy have been influenced by the GEF in Sri Lanka and Mauritius. The Sri Lanka project has developed regulatory frameworks for IPPs, including standardized "non-negotiable" power-purchase tariffs and contracts (PPAs). This project provided enough incentive for the national utility to adopt IPP frameworks and agree to PPAs, which together with demonstration effects of prior mini-hydro installations and new incentives for developers (such as import duty waivers and income tax concessions) spurred the market. Likewise, the Mauritius project led to the establishment of a framework for independent-power-producer (IPP) development. A project evaluation states that "the project's major accomplishment was progress in helping to establish an institutional and regulatory framework for private power generation in Mauritius and the provision of technical studies and trials to support technologies for improved bagasse production and improved environmental monitoring."

49. *Awareness and understanding of technologies.* All projects have fostered greater awareness of grid-connected renewable energy technologies among policy-makers, utilities, private firms, and financiers. One example of broad-based capacity and awareness building is the India biomethanation project, which has resulted in increased awareness and knowledge about biomethanation technologies in India. Representatives from various technical institutes and government agencies have participated in overseas study tours to visit biomethanation plants, manufacturers, and experts in the field of waste-to-

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conducted village-level workshops throughout the country to promote solar home systems. In these workshops, dealers are able to demonstrate their products and village leaders learn about the technology. In addition, potential local microfinance organizations have learned about the project and gauged local interest in solar home systems. The Mexico project conducted a first series of training courses in 7 states for promotion and information to farmers and state and local authorities, resulting in 180 qualified people.

57. *Energy consumption, fuel-use patterns, and impacts on end-users.* No data is available so far on the amounts of fuel that are displaced by solar home systems in GEF projects, nor on the impacts on end users in terms of social benefits and income-generation effects. In general, project M&E plans have not addressed these issues.

Energy Service Company (ESCO) Cluster

Projects with impacts (year of Council approval, year completed)

Peru TA for Energy Efficiency	UNDP	1991	1995
Tunisia ESCO (SME)	IFC	1994	
Hungary Energy Efficiency Co-financing program (HEECP)	IFC	1996	
China Energy Conservation	World Bank	1997	
Egypt and Palestinian Authority Energy Efficiency	UNDP	1997	

58. *Summary:* The ESCO cluster review documents that viable energy-service companies have been established in two countries (Tunisia and China) as a result of GEF projects. Financing for existing ESCOs has been facilitated through commercial financial intermediation in the Hungary project. Other projects with "ESCO" components provide technical assistance, training, and audits, but are not expected to lead to full-service (i.e., "performance-contracting") ESCOs, which are a new phenomena in developing countries and still inappropriate to commercial conditions found in most countries. With the exceptions of China and Hungary, no replication or energy-savings impacts have been documented. Prospects for replication and sustainability appear strongest in the China project, which is also pioneering the resolution of key policy and legal issues needed for an ESCO industry. Several of the projects appear to be increasing the familiarity and acceptance of ESCO approaches among industrial clients, policy-makers and financiers.

59. *Energy production or savings and installed capacities.* Few energy savings impacts have been quantified for this cluster, with the exception of the China and Hungary projects. Estimated lifetime energy savings from approved subprojects under the China project amounts to 3.3 million tons coal equivalent (mtce), or the equivalent to 2.2 Mt carbon emissions reduction.

60. *Business and supporting services development.* Two projects have established new ESCOs to work with industry and utilities to make energy efficiency investments. These ESCOs pilot business models that are the first of their kind in these countries, and thus a major result of the projects are

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demonstrations of the viability of such business models. The Hungary project has strengthened the capabilities of 20 energy efficiency companies to market, assess, and finance energy efficiency projects. The China project established three pilot private-sector ESCOs that have so far invested $30 million in 150 projects using energy performance contracting models for the first time in China. The project is also encouraging more widespread use of the ESCO business model throughout China, as more than 80 potential ESCOs have expressed interest in participating in a second phase of the project more than ten additional ESCOs have already started operating. The Tunisia project established one ESCO as a joint venture between a Canadian ESCO and a group of Tunisian banks; after two years of operation, this ESCO has completed 70 energy audits, made 35 proposals, and so far undertaken one investment project. The Egypt project has supported 70 industrial audits, with 12 sites currently employing the audit results to implement a number of energy saving measures. The Egypt project has not yet resulted in the development of a commercial ESCO model, although other developments in Egypt, including an operating ESCO funded through the IFC/GEF SME program, suggest that commercial ESCO models can be viable.

61. *Financing availability and mechanisms.* Three projects in particular have expanded financing availability. The Hungary project has piloted new financing mechanisms that have facilated and guaranteed financing for energy service companies. Three Hungarian financial institutions have utilized the project's "partial guarantees" (provided on a 'first loss' basis), to fund, on a transaction-by-transaction basis, an initial six investment projects valued at $1.6 million. The project has helped lower the credit risks and hence has demonstrated the financial viability of investment projects. The project has also generated interest from most major commercial banks in Hungary, providing good foundations for expansion via a recently approved IFC parallel investment program. In the Egypt project, commercial banks are lending to individual energy efficiency projects. The China project has attracted the interest of commercial banks in financing ESCOs, and increased their willingness to do so.

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Other Applications/Impacts

Projects with impacts (year of Council approval, year completed)

China Coal-bed Methane	UNDP	1991	1997
Poland Coal-to-Gas	World Bank	1991	
China Sichuan Gas	World Bank	1992	
Mauritania Decentralized Wind	UNDP	1992	1996
Jamaica Demand-Side Management	World Bank	1993	1999
Sri Lanka Energy Services Delivery	World Bank	1996	
Bulgaria Energy Efficiency	UNDP	1996	

62. *Summary:* a collection of other applications, from coal-bed methane, gas pipeline leakage repair, fuel switching, decentralized wind power, demand-side management, village-scale mini-grids, and district heating efficiency improvements, have all shown significant impacts that could be replicated on larger scales and used to inform ongoing and future GEF projects. So far, three projects, coal-bed methane in China, decentralized wind in Mauritania, and demand-side management in Thailand, are resulting in replication.

63. *Sri Lanka Energy Services* influenced development of 80 village-scale mini-grids using small hydro serving about 3500 people (using 500 kW total capacity). Seven of these schemes were financed directly through the GEF project (totaling 70-100 kW capacity), while the remaining ones have been financed by international donors and local government.

64. *China Sichuan Gas* made a substantial contribution to increasing gas reserves and gas production capacity in Sichuan province, as well as improving safety and environmental protection throughout the province's gas transmission network. The project increased the proven reserves from 400 bcm in 1993 to 554 bcm in 1998 and increased annual production capacity from 6.5 to 9.3 bcm over the same period. The project also helped to reduce pipeline leakages and introduced the process of leakage detection and repair to the gas transmission company for the first time. The company hadn't realized the importance of pipeline monitoring and had to bring in new analytical tools and gain new skills, including the establishment of a new pipeline monitoring and rehabilitation center. As a result of the project, system leakage rates went from 3.6% in 1996 (the first time leakage had ever been monitored) to 1.5% in 1998.

65. *China Coal-bed Methane* created the China Coal-Bed Methane Corporation, which is facilitating joint ventures and providing financing for exploitation of coal-bed methane. This project has created new business infrastructure and supporting services to recover coal-bed methane. The project demonstrated at three sites a number of techniques and technologies that Chinese coal mines can employ to reduce atmospheric methane emissions and recover methane as a fuel, and held training workshops at these sites. The project published a detailed assessment of China's coal-bed methane

resources and strengthened national capacity to conduct such assessments routinely. More than 500 people were trained, from senior government policy makers to senior managers and engineers of coal mining companies. Several additional exploration and development agreements with foreign partners have been negotiated since the project completed.

66. *Mauritania Decentralized Wind* installed demonstration wind-electric systems for rural electrification in 19 villages with 900 households. The project piloted sustainable service-delivery models (with cooperatives), trained local technicians, promoted consumer awareness, and developed financing and institutional capability for further development of small wind-electric systems. A second phase, extending the experience to 100 villages, has started with financing from the French government.

67. *Poland Coal-to-Gas* promoted the conversion of small- and medium-sized boilers from coal to natural gas fuels. The project raised awareness of the potential for coal-to-gas conversions in Poland. In particular, many of Poland's environmental investment funds, like the Bank for Environmental Protection, began to fund coal-to-gas conversions. In fact, a large coal-to-gas industry emerged in Poland with many boiler conversions taking place using Polish government and private financing. The project helped contribute to a greater awareness and priority within the government to address boiler conversions nationwide. The project generated information, publicity, and promotion that influenced the thinking of boiler owners and financiers. In addition, the EU Phare program took note of the project and began to develop similar projects for coal-to-gas conversions in neighboring countries.

68. *Bulgaria Energy Efficiency* has conducted feasibility studies of several municipal energy efficiency projects, and a number of energy efficiency investment projects are now underway as a result of the capacity building and institutional development in the project. These projects involve a school, district heating improvements, residential apartment buildings, and street lighting.

IV FACTORS INFLUENCING SUSTAINABILITY AND REPLICATION

69. A number of examples of factors that influence sustainability, both positively and negatively, can be seen through the climate program study. A more complete synthesis and ongoing cataloguing of such factors will be needed in the future. Given the early development of the portfolio and limited examples of replication so far, a discussion of the factors influencing replication is premature; rather, the lesson on "indirect impacts and influences" under Question #2 above addresses replication.

70. Some examples of positive influences on sustainability:

(a) *Demonstration of sustainable business models.* "Demonstration of a viable business model, whether that business is public, private, utility, or even permanently subsidized, is key to achieving project sustainability and achieving the GEF programmatic objective of transforming (or developing) markets for solar PV" concluded the solar PV thematic review. While no projects have yet to conclusively demonstrate sustainable business models, two projects appear close. In Sri Lanka, a partnership between solar home systems dealers and a rural microcredit organization appears to offer a sustainable model for household purchases of these systems. In the Dominican Republic, the firm Soluz Dominicana is close to demonstrating a "proof of concept" for a business model for serving up to 5,000 households using a "fee-for-service" approach.

(b) *"Market transformation" approaches.* The market changes brought about by *Poland Efficient Lighting* have been sustainable. Two years after the close of the program, the market changes resulting from the project were still in place. Retail prices of CFLs in Poland decreased by 34% in real terms and Polish CFL market experts and manufacturers agree that the project was largely responsible for this dramatic price decrease. The project helped increase sales volumes and manufacturer competition, and the public education campaigns helped increase consumer demand to the point where the price decrease was sustainable. In Thailand, a refrigerator program appears to have sustainably transformed the refrigerator market. High efficiency refrigerators are now the norm, and the highest level of efficiency became the dominant unit on the market as early as the second year of the program. In fact, surveys show that a variety of energy-efficient appliances promoted through the Thailand project have sustained markets. Customers have been highly satisfied with the reliability of the efficient products, which suggests that the gains from the market transformation programs are not likely to be reversed.

(c) *Voluntary agreements with the private sector.* Two of the *Thailand DSM* market transformation programs (fluorescent tubes and refrigerator labeling) have had sustainable impacts on the market. The voluntary agreement concluded between EGAT and fluorescent tube manufacturers effectively and completely 'washed' the Thai market clear of inefficient T-12 fluorescent tubes. In 1994, when the program began, efficient tubes had a 40% market share, and by the end of 1995, the efficient lamps had achieved a 100% market share.

(d) *Establishment or precedents of new legal frameworks.* The ability of projects to foster new legal frameworks, whose development might not have been possible in the absence of the project (i.e., no need for lawmakers or administrators to consider the legal issues raised by projects), is an important element of sustainability. For example, the value of the China *Energy Efficiency* project may be as much about encouraging

new legal precedents or contractual forms as it is about direct energy efficiency investments. The project is likely to set precedent for the legal accounting status of ESCOs in China. Such precedent is important for the future growth of the ESCO industry in China, and was only possible after the three pilot ESCOs had grown and accumulated assets sufficient to warrant government scrutiny. Second, the contractual forms that the three ESCOs have used with their clients also came under government auditor scrutiny and created the need for the government to formally classify these types of contracts. Once a legal ruling occurs, other future ESCOs and their clients will face lower risks and greater confidence in applying the performance contracting models, in establishing business plans, and in understanding the legal and tax implications of performance contracting.

71. A number of examples illustrate factors that can negatively influence sustainability:

(a) *Privatization of power utilities supporting demand-side management.* In Thailand, the fate of the highly successful Demand-Side Management Office (DSMO) of the national electric utility (EGAT), created under the project, is uncertain in the face of EGAT's planned privatization. Thus despite impressive achievements under the project, the main innovation piloted by the project—the publicly-supported DSMO office itself—may not be sustainable.

(b) *Short-term power-purchase tariffs for grid-based renewable energy.* A sustained market for small hydropower development under the *Sri Lanka Energy Services* project is questionable given the way power-purchase tariffs were established. Tariffs were tied to *short-run* avoided utility costs based on the international price of oil. In 1997 and 1998 tariffs were set at the equivalent of 5 cents/kWh and mini-hydro development flourished. However, because of the downturn in oil prices in 1998-99, prices were only the equivalent of 3.5 cents/kWh in 1999. As a result, all development essentially stopped in 1999. And this fluctuation has seriously hurt the longer-term interest of private mini-hydro developers in Sri Lanka. "The low tariffs and unresolved dispute [on tariff calculation methods] have caused a deep slump in mini-hydro development" said a project status report in 2000.

(c) *Consumer finance and rural business dependence on project resources.* The Zimbabwe *Solar Home Systems* project resulted in a greatly expanded network of private dealers and 10,000 systems sold, but there are questions about how the consumer credit will be sustained after the Agricultural Finance Corporation revolving fund winds down. This fund is depleted, partly because of concessional terms and partly because of macroeconomic conditions. Also in question is whether many of the businesses established or strengthened during the project are sustainable. During the project, businesses were dependent on the Project Management Office (PMO) for

customers, credit, equipment subsidies, and even the equipment itself. Without the PMO, some of these businesses have been unable to operate on their own and have closed.

(d) *Project implementation arrangements that do not demonstrate business models.* The Ghana project was originally designed to demonstrate a business model in which the national utility would provide fee-for-service to rural households using solar home systems (see Annex 2). At the conclusion of the project, the costs, service, cash flow and management of these installations could be assessed in terms of the viability of this model from the utility's perspective. The demonstration of this business model could also be used to convince other private companies to enter the market, which is an explicit project objective. But project implementation responsibility was transferred to a "project" established under the Ministry of Mines and Energy early in the project implementation. Although this office may succeed in installing and servicing a given number of systems, given that it is under a government ministry subject to its rules and regulations, demonstrating and judging business viability in a transparent commercial manner is bound to be difficult, meaning that sustainability is seriously called into question.

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