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Independent Evaluation Group

THE WORLD BANK

New Renewable Energy

A Review of the World Bank's Assistance

THE WORLD BANK GROUP

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http://www.worldbank.org/ieg

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The World Bank
Washington, D.C.

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

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World Bank InfoShop
E-mail: pic@worldbank.org
Telephone: 202-458-5454
Facsimile: 202-522-1500

Independent Evaluation Group
Knowledge Programs and Evaluation Capacity Development (IEGKE)
E-mail: eline@worldbank.org
Telephone: 202-458-4497
Facsimile: 202-522-3125

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ACRONYMS AND ABBREVIATIONS

AAA	Analytical and advisory assistance
ASTAE	Asia Sustainable and Alternative Energy Program
BDS	Business development services
CAS	Country Assistance Strategy
CO_2	Carbon dioxide
CRESP	China Renewable Energy Scale-Up Program
EBRS	Energy Business Renewal Strategy
EIRR	Economic internal rate of return
ERR	Economic rate of return
ERT	Energy for Rural Transformation Project (Uganda)
ESD	Energy Services Delivery Project (Sri Lanka)
ESMAP	Energy Sector Management Assistance Programme
GEF	Global Environment Facility
GHG	Greenhouse gas
ICR	Implementation Completion Report
ICT	Information and communication technology
IDCOL	Infrastructure Development Company Limited
IEG	Independent Evaluation Group
kW	Kilowatts
kWh	Kilowatt hours
M&E	Monitoring and evaluation
MFI	Microfinance institutions
MW	Megawatt
NGO	Nongovernmental organization
NO_x	Nitrogen oxides
NRE	New and renewable energy
OBA	Output-based assistance
PDO	Project development objective
PRSP	Poverty Reduction Strategy Paper
PSD	Private sector development
PV	Photovoltaic system
RED	Renewable Energy Development Project (China)
RERED	Renewable Energy and Rural Economic Development Project (Sri Lanka)
RERM	Renewable Energy in the Rural Market Project (Argentina)
RET	Renewable energy technology
RRD	Renewable Resources Development Project (India)
SHS	Solar home system
SO_2	Sulfur dioxide
SPPA	Small Power Purchase Agreement
TA	Technical assistance
W	Watts

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Director-General, Evaluation: *Vinod Thomas*
Director, Independent Evaluation Group–World Bank: *Ajay Chhibber*
Manager, Sector, Thematic, and Global Evaluation Division: *Alain Barbu*
Task Manager: *Fernando Manibog*

Executive Summary

The purpose of this review by the Independent Evaluation Group (IEG) of the World Bank is to inform the efforts to scale up the Bank's support for renewable energy by evaluating the performance of the Bank's current portfolio and the extent to which strategic objectives were achieved.

At the 2004 Conference on Renewable Energy in Bonn, Germany, the Bank announced that it would increase its lending for renewable energy and energy efficiency by an average of 20 percent per year for the five-year period fiscal 2005–09. This review assesses the Bank's readiness to deliver on that announcement. This assessment of "new renewables" is restricted to geothermal; solar; wind; biomass; and small, mini-, and micro-hydro energy sources. It updates and expands the renewable energy sections of IEG's 2003 study on private sector development (PSD) for the electricity sector (IEG-World Bank, IEG-IFC, and IEG-MIGA 2003b).

The Bank's Renewable Energy Objectives

Strategic framework

The Bank's institutional objectives for new and renewable energy (NRE) are contained in strategy papers for rural energy (World Bank 1993), the environment (World Bank 2001b; IEG 2002), and the Energy Business Renewal Strategy (EBRS) (World Bank 2001a). The EBRS provides the most detailed list of energy development "pillars" and operational activities relevant to NREs (as well as other energy subsectors).

Thus, following IEG's objectives-based methodology, this review is keyed to the EBRS operational goals for NRE and the following three pillars: (i) helping the poor directly, (ii) promoting good governance and PSD, and (iii) helping protect the environment. The fourth pillar of macro-fiscal impacts is also relevant, given the potential of NRE to displace imported fuels; however, renewable energy still accounts for a small proportion of the energy balances of the developing countries where the Bank provided NRE support.

Cost competitiveness of renewable energy and the role of the Bank

A recent technical and economic assessment (Chubu Electric Power Co., Inc. and others 2005)[1] indicates that renewable energy technologies (RETs) are the least-cost electrification option for many off-grid, mini-grid, and grid-based applications, on a levelized economic cost basis (see figure 2.1 in chapter 2).

RETs would be even more competitive today, given current oil prices of around US$70 per barrel, compared with the assumption of US$38–40 per barrel in the 2005 assessment study. Costs for off-grid systems of around 300 watts (W) (pico-hydro, small wind, and photovoltaic system [PV]–wind hybrids) are projected to be in the range of 15–25 cents per kilowatt hour (kWh), or less than half of the 30–40 cents per kWh for gasoline and diesel generators. Solar PV system costs for small power applications (50–300 W) are comparable to the diesel/gasoline alternatives. For stand-alone mini-grid systems at the village level with loads between 5 and 500 kilowatts (kW), numerous RETs—biomass, biogas, geothermal, wind, and micro-hydro—are potentially the least-cost generation options, compared with conventional energy alternatives.

For grid-connected RETs, however, conventional electricity-generating technologies—open-cycle and combined-cycle gas turbines and coal- and oil-fired steam turbines—remain the least-cost options. Although biomass, hydro, and wind power can potentially compete with conventional power plants smaller than 50 megawatts (MW), these RETs are simply costlier than larger conventional power generating units of 50–300 MW.

Conventional energy technologies, however, have been highly subsidized through direct, indirect, and nontransparent means. These means include cash transfers to producers and/or consumers, tax exemptions, price controls, trade restrictions, regulatory hurdles for RETs, and government failure to correct market imperfections. That subsidization skews the playing field against renewable energy. Including the cost of environmental externalities and a value for energy diversification significantly increases the economically viable quantity of renewable energy.

The Bank's role in renewable energy lending is to level the playing field between renewable and conventional energy sources—renewable energy cannot compete financially with conventional energy because of the distortions cited above. That in turn requires continuing government and donor support. In cofinancing projects with the Global Environment Facility (GEF), the Bank seeks to remove the market and regulatory barriers to RETs and achieve global environmental benefits by financing the incremental costs of renewable energy investments. The Bank's Carbon Financing Program also contributes to the explicit valuation of the positive externality benefits of renewable energy.

Evaluation approach

This review draws on Bank as well as IEG evaluations, including reviews of Implementation Completion Report (ICR) Reviews, Project Performance Assessment Reports, and thematic studies. The review team also interviewed Bank staff and conducted a focused literature review that included studies by the Monitoring and Evaluation Unit of GEF, the Energy Sector Management Assistance Program (ESMAP), and external publications. The Bank's new Carbon Finance Program is outside the scope of this evaluative review and will be covered in the planned IEG climate change study.

The review's methodological approach was to evaluate project outcomes and assess overall NRE portfolio progress based on project performance ratings and the extent to which the EBRS pillars of poverty reduction, PSD, and environmental protection, as well as their respective operational activities specific to NREs, were achieved.

Portfolio performance—main findings

Main characteristics. The NRE portfolio consists of 65 NRE projects: 56 NRE projects listed in the 1990–2004 *Progress Report on Renewable Energy and Energy Efficiency* (World Bank 2005d), plus nine projects approved in fiscal 2005. Of the 65 projects, only 27 (42 percent) have closed; 38 (58 percent) are still active.

The portfolio is relatively young, as 69 percent of the projects were approved after 1997. The Africa, East Asia and Pacific, and South Asia

Regions account for almost 75 percent of the total number of NRE projects. The Latin America and the Caribbean and Europe and Central Asia Regions have eight projects each, and the Middle East and North Africa Region only two. In fiscal 2005, the International Bank for Reconstruction and Development/International Development Association, carbon finance, and GEF commitments to NRE amounted to $190 million, or 10.5 percent of total lending for the energy and mining sector, of $1.8 billion (World Bank 2005a, 2005d).

From the total portfolio of 65 projects, 56 could be evaluated, as performance data on 9 projects that had just been approved at the time of this review were not yet available. Of those 56 projects, 46 percent are freestanding; these included the full spectrum of interventions covering technical assistance, market development, producer and consumer financing, commercialization, and after-sales service. The East Asia and Pacific and the South Asia Regions had most of the Bank's freestanding NRE projects. The other 54 percent of projects involve NRE components of larger power, rural electrification, and petroleum and water projects (called "blended" projects in this review). Thirty-eight (68 percent) of the projects have received GEF cofinancing.

Closed projects. The outcomes of the 27 closed, freestanding projects and separate ratings of the NRE components of blended projects show that more than half (17) had satisfactory or moderately satisfactory outcomes, while the remainder had weak results. Freestanding NRE projects were generally satisfactory, except those that involved geothermal energy or that were interrupted by economic crises.

Regarding NRE components of blended projects, there appears to be some association between the rating and the component's size and integration in the larger project. Most NRE components performed satisfactorily or moderately so. Yet NRE components that accounted for 15 percent or more of the costs of their respective projects, or that were well integrated in their projects, had satisfactory outcomes. These were projects in rural electrification or energy sector reform with a sizeable biomass component and those involving a mix of NRE and energy efficiency or solid waste management.

For small components that were less than 15 percent of project costs and that did not have a strong relationship with the overall project goals, the outcome ratings were only moderately satisfactory. Ratings for NRE components in energy sector reform projects that were small and had little connection to the dominant project objectives were mixed, with three rated as unsatisfactory.

Ongoing projects. Compared with the mixed performance of closed projects, active NRE projects show better progress toward satisfactory outcomes. Indeed, a few have already surpassed their targets for the physical installation of RETs.

There is also strong evidence that, over time, many lessons learned have helped the design of ongoing projects. The latest project development objective ratings are all satisfactory for NRE projects in the South Asia Region and for the majority of NRE projects in the East Asia and Pacific and the Latin America and the Caribbean Regions as well. But performance is weaker in the Africa Region, with three projects rated unsatisfactory and one rated moderately unsatisfactory. Components in blended projects tended to have low ratings in project development objective, implementation progress, or both.

Lessons learned. The lessons from older projects have led to better designs of more recent NRE projects. This has had an influence on outcomes, as the satisfactory or highly satisfactory freestanding projects were also the more recent ones.

One of the key lessons is that integrating NRE provision with supporting inputs from social service institutions and small and medium-size enterprises has enhanced development outcomes. Another lesson is that reliable credit services are needed to make NRE systems afford-

able to rural households. Also, a policy and regulatory framework for NRE that is conducive to widespread adoption needs to be in place for NRE projects to succeed. Another key lesson is the importance of building the capacity of key stakeholders to develop the environment for NRE commercialization and ensure service quality.

Finally, a practical lesson for the Bank is to support stakeholder and community participation and to demonstrate that this can lead to flexibility on project design and implementation. To promote continuous improvement of NRE project designs, the scaling up of NRE lending should be matched by a wider dissemination and application of these lessons.

Factors of performance. Some factors behind satisfactory and less-than-satisfactory performance have emerged from IEG's review of ICRs and Project Performance Assessment Reports. While not present in all satisfactory projects, good performance tends to be associated with strong government commitment and effective Bank performance in project design, supervision, and adaptive management. There are additional factors unique to satisfactory NRE projects:

- Extensive consultations with entrepreneurs, consumers, and nongovernmental organizations
- Effective credit and output-based grant financing mechanisms that facilitate access to NRE technologies by the poor
- Strong institutional capacity prior to or resulting from the project
- Focused attention to addressing the market barriers to NRE
- Active interest from local investors and financiers.

Poor performance seems to be associated with several factors, including inadequate attention to policy and regulatory issues specific to NRE, poor supervision of NRE components, weak country commitment, a risk-averse private sector, insufficient public and private institutional capacity, and sociopolitical or economic crises.

Main Findings on Implementing the EBRS Strategic Pillars

1. *To what extent did the Bank's NRE interventions help the poor directly?*

It is not the case that poverty-reduction goals surfaced only after the 2001 EBRS. The portfolio review finds that the Bank has been consistently pursuing poverty reduction as a major objective in its NRE portfolio; that is part of its broader goal of improving energy access. In practice, the poverty-reduction goals were integrated into project design through welfare improvements, enhanced livelihoods and incomes, and/or promotion of rural transformation through energy development.

Many recent projects factor these goals into their design, but only two closed projects included poverty reduction as an explicitly stated objective. Thus, for a significant one-third of the closed projects, it is from the preparatory studies, the design, and the targeted beneficiaries of the NRE projects that an *implied* poverty-reduction objective can be discerned.

At this stage, however, the poverty-reduction impact is largely nonevaluable, because monitoring and evaluation (M&E) systems have been absent or weak among closed projects. Even for recent projects, wherein increased income is an explicit goal, only a few have M&E systems that will be able to identify the income gains attributable to increased energy access. None of the projects provides any data on increased household income. M&E of gender impacts has been unsatisfactory as well, with little evidence available to substantiate the often-cited claim that women have benefited.

The Bank—through ESMAP—has recently been developing methods and tools to better assess the socioeconomic impacts of improved energy access. Some of the latest NRE projects (for example, in Bangladesh and Uganda) are using these approaches.

On balance, it is still unclear to what extent and how the Bank's NRE assistance has reduced poverty. This lack of evidence is a serious handicap in targeting the Bank's NRE lending. That handicap needs to be addressed through the establishment of stronger M&E systems in ongoing and forthcoming projects, particularly those designed with output-based assistance (OBA) components, which are especially demanding of M&E systems.

2. *To what extent did the Bank's NRE projects protect the environment?*

Few of the closed NRE projects include mitigation of harmful environmental effects as an explicit objective. From this portfolio review, there is only partial evidence that NRE projects are achieving their targeted global environmental benefits. About a third of the closed projects provide little or no data, but generally the greenhouse gas (GHG) emission-reduction targets have been achieved. Among NRE projects, larger-scale, grid-connected renewables have greater potential to reduce GHGs than small off-grid projects, such as those using solar PV technology.

The Bank supports both energy efficiency and NRE, which makes the most strategic sense. On one hand, a recent GEF evaluation concluded that although NRE investments can contribute to preventing global climate change, greater GHG emissions reductions have resulted from Bank-GEF energy efficiency than from NRE projects. On the other hand, over the 40- to 80-year time horizon where the most significant reductions in GHG emissions will be required, both energy efficiency and NRE (along with physical and biological carbon sequestration) will need to play a role. Energy efficiency alone will not enable the desired reduction levels to be reached; the large-scale deployment of low-carbon and no-carbon energy sources will also be a requirement.

The global environmental impacts of NRE projects could be greater if the projects catalyzed the creation of NRE markets, reduced market barriers, and focused on maximizing local impacts. Data on the local benefits of Bank-GEF NRE projects have been lacking because of weak M&E. However, M&E systems in these projects should focus more on measuring the *removal of market barriers* than just on the levels of GHG reductions. The Bank's carbon finance operations—which are recent and are outside the scope of this review—have implemented rigorous M&E protocols for measuring and verifying GHG reductions.

3. *To what extent did the Bank's NRE program promote PSD?*

The portfolio data provide strong evidence that the Bank has added the most value in NRE projects where it has supported PSD, particularly in the areas of establishing a commercialization process, building investor and consumer confidence, strengthening institutional capacity, and mobilizing private financing. However, the Bank paid inadequate attention to creating a nondiscriminatory regulatory environment for NRE—despite its parallel push for broader energy sector reforms—with adverse effects on some NRE schemes.

With ESMAP assistance, recent NRE projects have now started to address regulatory issues. The Bank has also supported local financial institutions and mobilized investments, often through public-private partnerships. Yet institutional weaknesses and lack of readiness, experience, and incentives among local NRE investors to serve rural markets have been constraining factors. As with NREs' poverty-reduction impact, M&E for the Bank's PSD work in NRE has been unsatisfactory. The M&E needs to be improved to assess the factors behind the success of the different delivery mechanisms, adapt and apply the lessons when scaling up elsewhere, and serve as a decision tool for effectively implementing ongoing and future OBA schemes.

Project experience suggests that partnerships and community involvement are essential, because PSD alone cannot lead to improved energy access. An important lesson is that private-

public partnerships that include nongovernmental organizations, the consumer communities, and extensive stakeholder consultations can play a vital role in promoting NREs and reaching the poor. Where projects relied solely on the private sector to increase energy access, achievements in reaching the poor were low.

Conclusions and Next Steps

The Bank's NRE strategy is relevant to developing country energy priorities. The Bank's NRE program is well anchored in the larger EBRS pillars and is properly focused on its goals of reducing poverty, promoting PSD, and contributing to environmental protection. As reconfirmed in recent forums (including the Bank's 2006 Energy Week), the Bank and the donor community need to help address the dire energy predicament of developing countries by acting on all fronts, including petroleum, clean coal, hydropower, biomass, and energy efficiency, as well as renewable energy.

As the Bank seeks to deliver on its commitment to increase NRE support, it needs to capitalize on its demonstrated strength of creating an investment climate conducive to commercializing NRE and promoting PSD. The Bank needs to focus on other strengths as well, such as building public-private partnerships and appropriate risk-mitigation structures. It needs to consider a series of operations and suitable lending instruments that will accommodate the long gestation periods for NREs, from institutional capacity building and policy/regulatory reform all the way to full commercialization. And it needs to internalize—in its Regional budgets and work programs—the operational costs of its successful "brokering" and advisory role in NREs, rather than continuing to depend on bilateral donor funds.

The Bank's likely contributions on other objectives are more doubtful. Experience in the past 15 years indicates that the Bank's impact in helping the poor directly, or achieving local and global environmental benefits through its NRE interventions, has been hard to measure because M&E has been weak or absent. But the little evidence that has emerged suggests that the impact has so far been limited.

Good M&E systems should be established for energy services intended to help the poor. Renewable energy projects with OBA components should be the first targets. Rigorous impact evaluations should be carried out for selected renewable energy projects that are closing within the next two to three years.

An important first step is for the Bank to include NRE objectives and work programs in Country Assistance Strategies—which historically have given little attention to NRE—whenever relevant. The Bank needs to signal the importance of NRE in country and energy sector strategies. While promoting energy sector reforms and architectures, the Bank needs to simultaneously address the constraints that hinder NRE development and commercialization. The key thrusts of the Bank's NRE assistance should be economic energy pricing, increased private financing, and effective regulation.

In sum, the Bank should do more of what has worked, focusing in particular on its catalytic role for PSD in NRE projects, staying flexible and innovative by applying lessons learned to improve the design of newer projects, and more widely disseminating good practices. The Bank should also address areas of past weakness, which include M&E, the mainstreaming of NREs in Country Assistance Strategies, and the internalization of "NRE business incubation" costs within the Bank's own budget.

In particular, the NRE portfolio should benefit increasingly from self- and independent evaluations, given the strategic role that the Bank gives to NREs in improving energy access, particularly for the poor. These assessments should focus more rigorously on outcomes and impacts; differentiate the lessons more sharply among rural electrification, grid-connected NREs, and off-grid renewables as the portfolio of closed NRE projects expands; and have strong feedback loops that would allow flexibility and responsiveness in implementing the objectives of the Bank's NRE strategy.

This is a challenging task, given the current budget stringency. Yet it is a task that merits serious Bank management support, given the Bank's global NRE commitments.

Résumé analytique

Le Groupe indépendant d'évaluation (IEG) a réalisé cette étude pour fournir des éléments d'information à l'appui de l'effort d'intensification de l'aide de la Banque dans le domaine des énergies renouvelables, en évaluant les résultats du portefeuille actuel de l'institution et le degré de réalisation des objectifs stratégiques.

Lors de la Conférence sur les énergies renouvelables, organisée à Bonn, en Allemagne, en 2004, la Banque a fait savoir qu'elle augmenterait d'environ 20 % par an pendant cinq ans (exercices 05-09), l'aide qu'elle consacre à la promotion des énergies renouvelables et à la maîtrise de l'énergie. Nous avons évalué dans quelle mesure la Banque est prête à atteindre l'objectif annoncé. Cette évaluation des sources d'énergie renouvelable se limite au géothermique, au solaire, à l'éolien, à la biomasse et à la mini et microhydraulique. Elle actualise et complète les sections sur l'énergie renouvelable de l'étude que l'IEG a réalisée en 2003 sur le développement du secteur privé à l'appui du secteur de l'électricité (IEG-Banque Mondiale, IEG-Société financière internationale, IEG-Agence multilatérale de garantie des investissements 2003b).

Objectifs de la Banque en matière d'énergies renouvelables

Cadre stratégique

Les objectifs institutionnels de la Banque en matière d'énergies nouvelles et renouvelables (ENR) sont énoncés dans les documents stratégiques sur l'énergie rurale (Banque mondiale 1993), l'environnement (Banque Mondiale 2001b ; IEG 2002), et la Stratégie de refonte des opérations dans le secteur de l'énergie (EBRS) (Banque mondiale 2001a). Cette stratégie fournit la liste la plus complète des « pôles » de mise en valeur des énergies et des activités opérationnelles dans le domaine des ENR (et dans les autres branches du secteur de l'énergie).

La méthodologie de l'IEG s'organisant autour d'objectifs, la présente étude s'articule sur les objectifs opérationnels de l'EBRS en matière d'ENR et sur les trois pôles suivants : i) aide directe aux pauvres, ii) promotion de la bonne gouvernance et du développement du secteur privé, et iii) aide à la protection de l'environnement. Le quatrième pôle, les impacts macrobudgétaires, a également son importance, les ENR pouvant se substituer aux combustibles importés. Il est toutefois à noter que les énergies renouvelables ne représentent qu'une petite part du bilan énergétique des pays en développement dans lesquels la Banque a favorisé le recours aux ENR.

Compétitivité du coût des énergies renouvelables et rôle de la Banque

Une récente évaluation technique et économique (Chubu Electric Power Co., Inc. et al. 2005)[1] montre que, si l'on retient un coût économique normalisé (voir figure 2.1, chapitre 2), les technologies exploitant les énergies renouvelables (ou convertisseurs d'énergie renouvelable (CER) (offrent la formule d'électrification la moins coûteuse pour beaucoup d'applications hors réseau, en miniréseau ou raccordées au réseau.

Les CER seraient encore plus compétitifs aujourd'hui, le prix du baril de pétrole étant d'environ 70 dollars, contre les 38-40 dollars retenus comme hypothèse dans l'évaluation de 2005. Selon les prévisions, le coût des systèmes décentralisés d'environ 300 watts (W) (picohydraulique, petit éolien et systèmes hybrides associant le photovoltaïque et l'éolien) serait compris entre 0,15 et 0,25 dollar le kilowattheure (kWh), soit moins de deux fois celui des unités alimentées à l'essence ou au gazole (0,30-0,40 dollar). Lorsque la puissance installée est faible (50-300 W), le coût du photovoltaïque est comparable à celui des unités au gazole ou à l'essence. Pour les miniréseaux décentralisés où la puissance appelée est de 5 à 500 kW, de nombreux CER (transformation de la biomasse, biogaz, géothermique, éolien et microhydraulique (sont potentiellement les formules d'électrification des villages les moins coûteuses, si on les compare aux sources d'énergie classique.

En revanche, pour les installations raccordées au réseau, les moyens classiques de production d'électricité, à savoir les turbines à gaz à cycle ouvert et à cycle combiné et les turbines à vapeur alimentées au charbon et au fioul restent les solutions les moins onéreuses. Bien que la biomasse, l'hydraulique et l'éolien puissent rivaliser avec les centrales thermiques classiques de moins de 50 mégawatts (MW), ils sont tout simplement moins avantageux dès lors que des installations de 50 à 300 MW sont nécessaires.

Les convertisseurs d'énergie classique, cependant, sont largement subventionnés de façon directe, indirecte et non transparente, par des transferts monétaires aux producteurs et/ou aux consommateurs, des exonérations d'impôts, des mesures de contrôle des prix, des pratiques commerciales restrictives, des obstacles réglementaires aux CER et le fait que l'État ne corrige pas les imperfections du marché. Ces subventions faussent le jeu au détriment des énergies renouvelables. Si l'on tient compte du coût des externalités environnementales et de la valeur qu'ajoute la diversification énergétique, la quantité économiquement viable d'énergies renouvelables s'accroît sensiblement.

Dans ses prêts à l'appui des énergies renouvelables, la Banque doit avoir pour rôle de placer les sources d'énergie renouvelable et classique sur un pied d'égalité, car les distorsions citées plus haut font que les premières ne peuvent financièrement soutenir la concurrence avec les secondes. Par voie de conséquence, cela suppose une aide soutenue des pouvoirs publics et des bailleurs de fonds. En cofinançant des projets avec le Fonds pour l'environnement mondial (FEM), la Banque cherche à lever les barrières réglementaires et les obstacles à l'exploitation commerciale des CER, et à améliorer l'état environnemental de la planète en finançant le surcoût des investissements dans les énergies renouvelables. Le programme de transactions sur les crédits de réduction des émissions, que conduit la Banque (programme « crédits carbone »), contribue aussi à mesurer expressément la valeur des externalités positives des énergies renouvelables.

Approche retenue

Nous nous sommes appuyés sur des évaluations de la Banque et de l'IEG ainsi que sur des examens de rapports de fin d'exécution, de rapports d'évaluation rétrospective de projets et d'études thématiques. Nous avons également rencontré des membres des services de la Banque et examiné de façon sélective des études du Bureau indépendant de l'évaluation du FEM, des rapports du programme d'assistance à la gestion du secteur de l'énergie (ESMAP) et des publications extérieures. Le nouveau programme « crédits carbone » de la Banque n'entre

pas dans le champ de la présente évaluation ; il sera examiné lors de l'étude que l'IEG prévoit de consacrer au changement climatique.

La méthodologie adoptée consistait à évaluer les résultats des projets et à mesurer la progression globale du portefeuille sur les ENR en s'appuyant sur la notation de la performance des projets et en déterminant dans quelle mesure les pôles stratégiques de l'EBRS (réduction de la pauvreté, développement du secteur privé, protection de l'environnement) et les opérations en rapport avec les ENR, propres à chacun d'entre eux, avaient été mis en pratique.

Gestion du portefeuille — Principaux résultats de l'étude

Physionomie du portefeuille. Le portefeuille sur les ENR se compose de 65 projets, dont 56 énumérés dans le *Progress Report on Renewable Energy and Energy Efficiency* (Banque mondiale 2005d), qui couvre la période 1990-2004, et 9 approuvés pendant l'exercice 05. Sur ces 65 projets, seuls 27 (42 %) sont achevés et 38 (58 %) sont en cours.

Le portefeuille est relativement jeune, 69 % des projets ayant été approuvés après 1997. Près de 75 % du nombre total de projets sont concentrés sur les régions Afrique, Asie de l'Est et Pacifique, et Asie du Sud. Les régions Amérique latine et Caraïbes, et Europe et Asie centrale en comptent huit chacune, la région Moyen-Orient et Afrique du Nord, deux. Pendant l'exercice 05, les engagements consacrés aux ENR par la Banque internationale pour la reconstruction et le développement et l'Association internationale de développement, le programme « crédits carbone » et le FEM se sont élevés à 190 millions de dollars, soit 10,5 % du volume total des prêts au secteur de l'énergie et des mines (1,8 milliards de dollars) (Banque mondiale 2005a, 2005d).

Sur les 65 projets qui composent le portefeuille, 56 ont pu être évalués, les chiffres sur la performance des neuf projets restants, qui venaient juste d'être approuvés, n'étant pas encore connus. Quarante-six pour cent de ces 56 projets sont des projets à part entière qui couvrent la gamme complète des interventions : assistance technique, développement des marchés, prêts aux producteurs et aux consommateurs, exploitation commerciale et services après-vente. La plupart d'entre eux sont concentrés sur les régions Asie de l'Est et Pacifique, et Asie du Sud. Les 54 % restants correspondent aux composantes ENR de plus grands projets consacrés à l'électricité, à l'électrification des zones rurales, au pétrole et à l'eau (les projets dits « mixtes »). Trente-huit des projets (68 %) sont cofinancés par le FEM.

Projets clos. Il ressort des résultats des 27 projets à part entière aujourd'hui clos et des composantes ENR des projets mixtes que plus de la moitié de ces opérations (17) sont jugées satisfaisantes ou marginalement satisfaisantes, les autres obtenant des notes inférieures. En règle générale, les projets à part entière sont jugés satisfaisants, à l'exception toutefois de ceux qui font intervenir l'énergie géothermique ou qui ont été interrompus par des crises économiques.

S'agissant des composantes ENR des projets mixtes, il semble qu'il existe un lien entre la note attribuée et la taille de la composante ou son degré d'intégration au projet. Les résultats de la plupart de ces composantes ont été jugés satisfaisants ou marginalement satisfaisants. Cela étant, les composantes ENR qui représentaient au moins 15 % du coût du projet ou dont le degré d'intégration était important ont obtenu la note « satisfaisant ». Il s'agissait de projets sur l'électrification rurale ou la réforme du secteur de l'énergie comportant un important volet « biomasse » ou de projets combinant ENR et maîtrise de l'énergie ou gestion des déchets solides.

Les composantes qui représentaient moins de 15 % des coûts du projet et qui n'étaient pas étroitement liées aux grands objectifs de l'opération n'ont été jugées que marginalement satisfaisantes. Dans les projets de réforme du secteur de l'énergie, les composantes de taille limitée et

peu liées aux objectifs majeurs de l'opération ont obtenu des résultats en demi-teinte, insatisfaisants pour trois d'entre elles.

Projets en cours. Comparés aux projets clos, dont le bilan est mitigé, les projets en cours semblent s'acheminer vers des résultats satisfaisants. Plusieurs d'entre eux ont même déjà dépassé leurs objectifs de résultats en ce qui concerne l'installation physique des CER.

Plusieurs éléments montrent aussi clairement que de nombreux enseignements tirés des projets clos ont contribué au fil du temps à la conception des opérations en cours. Les dernières notations de l'objectif de développement sont toutes satisfaisantes pour les projets de la région Asie de l'Est. Il en est la plupart du temps de même dans les régions Asie de l'Est et Pacifique, et Amérique latine et Caraïbes. Les résultats sont toutefois moins bons dans la région Afrique, où trois projets ont été jugés insatisfaisants et un marginalement insatisfaisant. Les résultats des composantes des projets mixtes ont tendance à être médiocres pour l'objectif de développement, l'état d'avancement, voire pour les deux critères.

Enseignements tirés des projets. Les enseignements tirés des anciens projets ont contribué à une meilleure conception des projets actuels. Les résultats s'en ressentent, les projets à part entière jugés satisfaisants ou très satisfaisants étant justement les plus récents.

Lorsque le recours aux ENR se double d'un soutien aux apports des prestataires de services sociaux et des petites et moyennes entreprises, les résultats s'améliorent. C'est là l'un des grands enseignements tirés des anciens projets. On a également constaté que des services de crédit fiables étaient nécessaires pour mettre les CER à la portée des ménages ruraux. Pour que les projets réussissent, il faut aussi mettre en place des politiques publiques et un cadre réglementaire favorisant l'adoption à grande échelle des ENR. De même, il est très important de renforcer la capacité des acteurs clés à créer les conditions nécessaires à l'exploitation commerciale des ENR et à assurer la qualité des services.

Enfin, dans la pratique, la Banque doit associer la population locale et les acteurs concernés à son action et montrer que cette participation peut être gage de souplesse pour la conception du projet et l'exécution des opérations. Pour contribuer à l'amélioration constante de la conception des projets, l'intensification de l'effort de prêt à l'appui des ENR doit s'accompagner d'une diffusion et d'une application plus larges de l'ensemble de ces acquis.

Facteurs influant sur la performance. Notre examen des rapports de fin d'exécution et des rapports d'évaluation rétrospective des projets met en évidence certains facteurs influant sur la performance des projets, qu'elle soit satisfaisante ou inférieure à satisfaisante. Bien que ce ne soit pas systématiquement le cas, les bons résultats tendent à être liés à une forte motivation des pouvoirs publics et à des prestations efficaces de la Banque lors des phases de conception et de supervision des projets, et en matière de gestion évolutive. En outre, les facteurs suivants sont propres aux projets de mise en valeur des ENR :

- Ampleur de la consultation des entrepreneurs, des consommateurs et des organisations non gouvernementales
- Efficacité des mécanismes de crédit et de financement sous forme de dons assortis d'un contrat de résultats pour faciliter l'accès des pauvres aux CER
- Solidité des capacités institutionnelles préexistantes ou résultant du projet
- Adoption de mesures visant à s'attaquer aux obstacles à l'exploitation commerciale des ENR
- Présence d'un intérêt réel des investisseurs et bailleurs de fonds locaux.

Les mauvais résultats semblent être liés à plusieurs facteurs tels que le manque d'attention aux politiques et au cadre réglementaire propres aux ENR, la médiocrité de la supervision des composantes ENR, le manque de détermination des pays, l'aversion au risque du secteur privé, l'insuffisance des capacités institution-

nelles publiques et privées et les crises sociopolitiques et économiques.

Mise en pratique des pôles stratégiques de l'EBRS : Principaux résultats

1. *Dans quelle mesure les projets de mise en valeur des ENR de la Banque ont-ils aidé les pauvres ?*

Il serait erroné de dire que les objectifs de réduction de la pauvreté ne sont apparus qu'après l'EBRS de 2001. Il ressort de notre étude du portefeuille sur les ENR que la lutte contre la pauvreté a systématiquement été une considération majeure de la Banque, dans le cadre de son objectif plus large d'amélioration de l'accès à l'électricité. Dans la pratique, les objectifs de réduction de la pauvreté étaient intégrés à la conception des projets au moyen de mesures en faveur de l'amélioration des conditions de vie, de l'accroissement des moyens de subsistance et des revenus, et/ou de la promotion de la transformation des zones rurales par leur électrification.

Bon nombre de projets récents incluaient de telles mesures dans leur conception, mais la réduction de la pauvreté n'était un objectif explicite que dans deux des projets clos. Pour un bon tiers des projets clos, c'est donc à travers les études préparatoires, la conception des opérations et les bénéficiaires visés que l'on peut mettre en évidence un objectif *implicite* de réduction de la pauvreté.

À ce stade, une grande partie de l'impact des opérations sur le recul de la pauvreté ne peut toutefois être évaluée, compte tenu de l'absence ou de la faiblesse des systèmes de suivi et d'évaluation dans les projets clos. Même pour les projets plus récents, dans lesquels l'accroissement des revenus est un objectif explicite, il est rare qu'il existe un système de suivi et d'évaluation à même de faire ressortir les augmentations de revenus résultant d'un meilleur accès à l'électricité. Aucun des projets ne fournit de données sur l'amélioration du revenu des ménages. Le suivi et l'évaluation des impacts sur la parité des sexes ne sont pas non plus satisfaisants, peu d'éléments venant confirmer le bien-fondé de la thèse répandue selon laquelle les femmes ont bénéficié de ces projets.

Dans le cadre de son programme ESMAP, la Banque a récemment mis au point des méthodes et des outils pour mieux évaluer l'impact socioéconomique d'un meilleur accès à l'électricité. Certains des derniers projets (au Bangladesh et en Ouganda, par exemple) utilisent ces techniques.

L'un dans l'autre, il n'est toujours pas possible de dire clairement dans quelle mesure et en quoi l'aide de la Banque aux ENR a fait reculer la pauvreté. Du fait de ce manque d'éléments probants, il est très difficile d'orienter précisément les opérations de prêts de la Banque à l'appui des ENR. Il faut remédier à cette situation par l'adoption de systèmes de suivi et d'évaluation plus solides dans les projets en cours et à venir, particulièrement dans ceux qui comportent des composantes dans lesquelles l'aide est assortie de contrats de résultats, une formule qui dépend beaucoup de l'existence de tels systèmes.

2. *Dans quelle mesure les projets de mise en valeur des ENR de la Banque protègent-ils l'environnement ?*

Parmi les projets clos, rares sont ceux qui comportent un objectif explicite d'atténuation des méfaits sur l'environnement. Dans notre évaluation du portefeuille, seuls quelques éléments montrent que les projets ont les effets positifs recherchés sur l'environnement mondial. Pratiquement aucune donnée n'existe pour près d'un tiers des projets clos, mais les objectifs de réduction des émissions de gaz à effet de serre (GES) ont généralement été atteints. Les grands projets de mise en valeur d'ENR raccordées au réseau ont plus de chances de réduire les émissions de GES que les petites installations décentralisées, telles que celles faisant appel au photovoltaïque solaire.

La Banque apporte son appui à la maîtrise de l'énergie comme aux ENR, ce qui est stratégi-

quement le plus logique. D'un côté, selon une étude récente du FEM, les projets Banque-FEM de maîtrise de l'énergie permettent une plus forte réduction des émissions de GES que les investissements dans les ENR, même si ces derniers peuvent aider à prévenir le changement climatique au niveau mondial. De l'autre, dans les 40 à 80 prochaines années, pendant lesquelles les réductions les plus importantes devront intervenir, la maîtrise de l'énergie, mais aussi les ENR, auront un rôle à jouer (parallèlement à la fixation biologique et au stockage matériel du carbone). Une meilleure maîtrise de l'énergie ne permettra pas à elle seule d'atteindre les niveaux de réduction voulus. Un large recours aux énergies peu ou non polluantes sera également nécessaire.

Les investissements dans les ENR pourraient avoir un plus grand impact sur le patrimoine environnemental de la planète s'ils stimulaient la création de marchés de ces énergies, réduisaient les obstacles à leur exploitation commerciale et visaient à optimiser les effets au niveau local. Le manque de systèmes de suivi et d'évaluation explique l'absence de données sur les effets positifs locaux des projets Banque-FEM dans ce domaine. De tels systèmes devraient toutefois servir davantage à mesurer le degré d'élimination des obstacles à l'exploitation commerciale des ENR que le niveau de réduction des émissions de GES. Les opérations de la Banque sur le marché du carbone, qui ont démarré récemment et n'entrent pas dans le champ de notre étude, s'accompagnent de protocoles de suivi et d'évaluation pour mesurer et vérifier rigoureusement ces réductions.

3. *Dans quelle mesure le programme de la Banque sur les ENR aide-t-il à promouvoir le développement du secteur privé ?*

Les données du portefeuille sur les ENR montrent clairement que la valeur ajoutée aux projets a été la plus grande lorsque la Banque a favorisé le développement du secteur privé, notamment en créant des mécanismes d'exploitation commerciale, en suscitant la confiance des investisseurs et des consommateurs, en renforçant les capacités institutionnelles, et en mobilisant des financements privés. Bien qu'ayant parallèlement facilité une réforme plus large du secteur de l'énergie, la Banque ne s'est pas suffisamment efforcée de créer un cadre réglementaire non discriminatoire pour les ENR, ce qui a été préjudiciable à certains projets dans ce domaine.

Avec l'aide du programme ESMAP, les projets récents prennent en compte la question du cadre réglementaire. La Banque prête également son concours à des institutions financières locales et mobilisent des investissements, souvent au moyen de partenariats public-privé. Toutefois, les faiblesses institutionnelles et le manque de préparation, d'expérience et de motivation des investisseurs locaux sur les marchés ruraux sont des facteurs limitatifs. Peu à même de mesurer l'impact des projets sur la réduction de la pauvreté, les systèmes de suivi et d'évaluation de la promotion du développement du secteur privé dans les investissements de la Banque sur les ENR ne sont pas non plus satisfaisants. Il faut améliorer ces systèmes pour évaluer les facteurs à l'origine des bons résultats de différents mécanismes d'intervention, adapter et appliquer les enseignements tirés des projets lorsqu'il s'agit de transposer les opérations à plus grande échelle, et utiliser le suivi et l'évaluation comme un outil d'aide à la décision pour mettre efficacement en œuvre les actuels et futurs programmes d'aide assortis de contrats de résultats.

L'expérience montre que les partenariats et la participation des populations locales jouent un rôle déterminant, le développement du secteur privé n'étant pas suffisant pour améliorer l'accès à l'électricité. Il ne faut pas non plus oublier que les partenariats public-privé faisant intervenir des organisations non gouvernementales, des cercles de consommateurs et une vaste consultation des différents acteurs concernés peuvent beaucoup aider à promouvoir les ENR et à atteindre les pauvres. Les projets ne s'appuyant que sur le secteur privé pour accroître l'accès à l'électricité ne sont pas bien parvenus à toucher les pauvres.

Conclusion et dispositions à prendre

La stratégie de la Banque en matière d'ENR est bien adaptée aux priorités énergétiques des pays en développement. Le programme de la Banque dans ce domaine est solidement ancré aux grands pôles stratégiques de l'EBRS et s'articule bien sur ses objectifs de réduction de la pauvreté, de promotion du développement du secteur privé et d'aide à la protection de l'environnement. Ainsi que l'ont récemment reconfirmé différentes assemblées (dont la Semaine 2006 de la Banque sur l'énergie), la Banque et la communauté des bailleurs de fonds doivent aider les pays en développement à sortir de leur situation très difficile au plan énergétique en intervenant tous azimuts, c'est-à-dire sur les fronts du pétrole, du charbon propre, de l'hydraulique, de la biomasse, de la maîtrise de l'énergie, et aussi des énergies renouvelables.

Pour accroître son aide aux ENR comme elle s'est engagée à le faire, la Banque doit tirer parti de sa capacité avérée à créer un climat de l'investissement favorable à l'exploitation commerciale de ces énergies et à la promotion du développement du secteur privé. La Banque doit également s'appuyer sur d'autres atouts tels que la mise en place de partenariats public-privé et des structures voulues d'atténuation des risques. Elle doit examiner toute une série d'opérations et d'instruments de prêt bien adaptés, qui permettront de prendre en compte la longue période de gestation des projets de mise en valeur des ENR, en intervenant aussi bien pour renforcer les capacités et favoriser les réformes des politiques publiques et du cadre réglementaire que pour promouvoir la pleine exploitation commerciale de ces énergies. Elle doit aussi inscrire à ses budgets régionaux et programmes de travail le coût opérationnel de ses précieux services de « courtage » et de conseil à l'appui des ENR afin de ne plus être tributaire des fonds des bailleurs d'aide bilatérale.

La contribution possible de la Banque à la réalisation des autres objectifs est plus douteuse. L'expérience des 15 dernières années montre qu'il est difficile de mesurer l'impact de la Banque sur l'aide directe aux pauvres ou sur les effets positifs pour l'environnement local ou mondial de ses investissements dans les ENR, du fait du manque ou de l'absence de systèmes d'évaluation et de suivi. Les rares éléments dont on dispose semblent toutefois indiquer que l'impact reste limité.

De bons systèmes de suivi et d'évaluation doivent être mis en place pour les services énergétiques qui visent à aider les pauvres. Les projets de mise en valeur des énergies renouvelables qui comportent des composantes dans lesquelles l'aide est assortie de contrats de résultats doivent être les premiers à en bénéficier. Il faut faire une évaluation rétrospective rigoureuse de l'impact d'un certain nombre de projets sélectionnés deux ou trois ans avant leur clôture.

Pour commencer, il est important que la Banque inclue, dans les cas voulus, des objectifs et des programmes de travail pour les ENR dans ses stratégies d'aide aux pays, qui traditionnellement en comportent peu. La Banque doit faire ressortir l'importance des ENR dans ses stratégies-pays et dans sa stratégie sectorielle pour l'énergie. Tout en favorisant la réforme du secteur de l'énergie et l'adoption de l'architecture nécessaire, elle doit s'attaquer aux obstacles qui entravent la mise en valeur des ENR et leur exploitation commerciale. L'aide de la Banque doit être principalement axée sur la tarification rationnelle de l'énergie, l'accroissement des financements privés et l'efficacité du cadre réglementaire.

En un mot, la Banque doit réitérer ce qui a donné de bons résultats, notamment en se concentrant sur sa capacité à stimuler le développement du secteur privé dans les projets sur les ENR, en appliquant avec souplesse et créativité les enseignements tirés des anciens projets pour mieux concevoir les nouvelles opérations et en diffusant plus largement les méthodes ayant fait leurs preuves. Elle doit aussi intervenir sur les questions qui laissent à désirer, dont le suivi et l'évaluation, la prise en compte systématique des ENR dans les stratégies d'aide aux pays et l'inscription à son propre budget des « coûts d'incubation » des

entreprises dans le secteur des énergies renouvelables.

Enfin, compte tenu du rôle stratégique que la Banque veut faire jouer aux énergies nouvelles et renouvelables pour améliorer l'accès à l'électricité, surtout au profit des pauvres, le portefeuille sur les ENR doit pouvoir de plus en plus s'appuyer sur des autoévaluations et des études indépendantes. Celles-ci doivent cibler plus rigoureusement les résultats et les impacts ; établir une distinction plus fine entre l'électrification des zones rurales, les ENR raccordées au réseau et leurs applications hors réseau à mesure que le portefeuille de projets achevés s'accroît ; et mettre en place de solides chaînes de remontée de l'information qui fourniront la souplesse et la capacité d'adaptation nécessaires pour s'efforcer d'atteindre les objectifs de la stratégie de la Banque sur les ENR.

Dans un contexte d'austérité budgétaire, il s'agit là d'une tâche ardue, qui mérite cependant toute l'attention de la direction de la Banque, compte tenu des engagements mondiaux que l'institution a pris dans ce domaine.

Resumen

El objetivo de este evaluación realizado por el Grupo de Evaluación Independiente (IEG, por su sigla en inglés) del Banco Mundial es orientar los esfuerzos para ampliar el apoyo del Banco a las fuentes de energía renovables evaluando el desempeño de la cartera actual de proyectos del Banco y el nivel de logro de los objetivos estratégicos.

En la Conferencia Internacional sobre Energías Renovables celebrada en Bonn (Alemania) en 2004, el Banco anunció su intención de aumentar el financiamiento para las fuentes de energía renovables y la eficiencia energética en una media del 20% anual para el quinquenio de 2005–2009. En el presente examen se evalúa si el Banco está en condiciones de asumir ese compromiso. Esta evaluación de las nuevas energías renovables se limita a las fuentes geotérmica, solar, eólica y de biomasa, así como a las fuentes de energía hidroeléctrica a escalas pequeña, mini y micro. Se actualizan y amplían las secciones sobre fuentes de energía renovables del estudio realizado por el IEG en 2003 acerca del desarrollo del sector privado para el sector de la electricidad (IEG-Banco Mundial, IEG-Corporación Financiera Internacional, IEG-Organismo Multilateral de Garantía de Inversiones 2003b).

Objetivos del Banco en relación con las fuentes de energía renovables

Marco estratégico

Los objetivos institucionales del Banco en relación con las fuentes de energía nuevas y renovables están plasmados en documentos de estrategia energética para las zonas rurales (Banco Mundial, 1993), estrategia para el medio ambiente (Banco Mundial 2001b; IEG 2002) y la Estrategia de renovación del sector de la energía (Banco Mundial 2001a). Esta estrategia consta de una lista muy detallada de "pilares" para el desarrollo energético y las actividades operacionales relacionadas con las energías nuevas y renovables (así como otros subsectores de la energía).

Por consiguiente, siguiendo la metodología del IEG, basada en objetivos, este evaluación se adecua a los objetivos operacionales de la estrategia de renovación del sector de la energía para las fuentes de energía nuevas y renovables y los tres pilares siguientes: i) ayudar directamente a los pobres, ii) fomentar una buena gestión y el desarrollo del sector privado, y iii) ayudar a proteger el medio ambiente. El cuarto pilar de impactos macrofiscales reviste también importancia, puesto que las fuentes de energía nuevas y renovables podrían desplazar a los

combustibles importados; sin embargo, esas fuentes siguen representando una parte reducida de los balances energéticos de los países en desarrollo donde el Banco ha proporcionado apoyo a las energía nuevas y renovables.

Competitividad de los costos de las fuentes de energía renovables y papel de Banco

Una reciente evaluación técnica y económica (Chubu Electric Power Co., Inc. y cols. 2005)[1] indica que la tecnología de energías renovables es la opción de electrificación más económica para muchas aplicaciones fuera de la red, basadas en ella o que funcionan en minirredes, sobre la base de un régimen de costos económicos actualizados y anualizados (véase el cuadro 2.1 en el capítulo 2).

La tecnología de energías renovables sería incluso más competitiva hoy, habida cuenta de los precios actuales del crudo en torno a los US$70 por barril, en comparación con la hipótesis de US$38–40 por barril que se utilizó en la evaluación de 2005. Se prevé que los costos de sistemas de unos 300 vatios fuera de la red (microgeneradores hidroeléctricos, sistemas eólicos pequeños e híbridos fotovoltaicos-eólicos) ronden los 15–25 centavos por kilovatio/hora (kWh), o menos de la mitad de los 30–40 centavos por kWh de los generadores de gasolina y diésel. Los costos del sistema solar fotovoltaico para las aplicaciones de poca potencia (50–300 W), son comparables a las alternativas diésel/gasolina. Por lo que respecta a los sistemas independientes de minirred para poblaciones pequeñas, con cargas de entre 5 y 500 kilovatios (kW), existe abundante tecnología de energías renovables—concretamente, de energía de biomasa, biogas, geotérmica, eólica y microhidroeléctrica— que constituye la alternativa de generación de energía potencialmente menos onerosa frente a otras opciones energéticas convencionales.

No obstante, con respecto a la tecnología de energía renovable conectada a la red, la tecnología convencional de generación de electricidad —es decir, las turbinas de gas de ciclo abierto y de ciclo combinado y las turbinas de vapor alimentadas con carbón o petróleo— sigue siendo la opción más barata. Aunque la energía de biomasa, hidroeléctrica y eólica puede competir, en principio, con las centrales eléctricas convencionales de menos de 50 megavatios (MW), esos sistemas son, simplemente, más caros que las unidades generadoras convencionales más grandes, de 50–300 MW.

Sin embargo, la tecnología de energía convencional ha recibido muchas subvenciones por medios directos, indirectos y poco transparentes. Estos medios incluyen transferencias de efectivo a los productores, los consumidores o ambos, las exenciones fiscales, el control de precios, las restricciones comerciales, los obstáculos normativos a la tecnología de energías renovables y la incapacidad de las autoridades para corregir las deficiencias del mercado. Esas subvenciones inclinan la balanza en contra de las fuentes de energía renovables. Si se tienen en cuenta el costo de factores ambientales externos y el valor de la diversificación de la energía, la cantidad de energías renovables económicamente viables aumenta de forma considerable.

El papel del Banco en el financiamiento de las fuentes de energía renovables consiste en alcanzar un equilibrio entre las fuentes de energía renovables y las convencionales, porque las distorsiones que acabamos de mencionar hacen que las energías renovables no resulten económicamente competitivas con las fuentes de energía convencional. Ello, a su vez, requiere un respaldo continuo de los gobiernos y de los donantes. Cuando financia proyectos con el Fondo para el Medio Ambiente Mundial (FMAM), el Banco trata de eliminar las barreras comerciales y normativas a la tecnología de energías renovables y conseguir beneficios ambientales a nivel mundial financiando los costos incrementales de las inversiones en fuentes de energía renovables. El programa del Banco para el financiamiento del carbono contribuye, asimismo, a la valoración explícita de los beneficios positivos de los factores externos de las energías renovables.

Planteamiento de la evaluación

Este examen documental se basa en evaluaciones realizadas tanto por el Banco como por el IEG, incluido el examen de informes finales de ejecución, informes de evaluación de los proyectos y estudios temáticos. El grupo encargado del examen se entrevistó, además, con personal del Banco y analizó diversas publicaciones específicas, entre otros, estudios realizados por la Unidad de Seguimiento y Evaluación del FMAM, el Programa de asistencia para la gestión del sector de energía (ESMAP) y publicaciones externas. El nuevo Programa de financiamiento del carbono que ha puesto en marcha el Banco queda fuera del ámbito de este examen evaluativo y se abordará en el estudio del IEG sobre el cambio climático.

El planteamiento metodológico del examen era evaluar los resultados de los proyectos y analizar la evolución general de la cartera de proyectos sobre energías nuevas y renovables en función de las calificaciones de desempeño de los proyectos y de la medida en que se alcanzaron los pilares de la Estrategia de renovación del sector de la energía, a saber, la reducción de la pobreza, el desarrollo del sector privado y la protección ambiental, así como sus respectivas actividades operacionales en relación con las energías nuevas y renovables.

Desempeño de la cartera: Conclusiones más importantes

Características principales. La cartera de energías nuevas y renovables está integrada por 65 proyectos: 56 proyectos incluidos en el documento *Progress Report on Renewable Energy and Energy Efficiency* 1990–2004 (Banco Mundial 2005d) y nueve proyectos aprobados en el ejercicio de 2005. De los 65 proyectos, sólo 27 (42%) han concluido; 38 (el 58%) siguen en marcha.

La cartera es relativamente joven, ya que el 69% de los proyectos se aprobó después de 1997. Las regiones de África, Asia oriental y el Pacífico, y Asia meridional representan casi el 75% del número total de proyectos sobre energías nuevas y renovables. Las regiones de América Latina y el Caribe y Europa y Asia central acogen ocho proyectos cada una, y la región de Oriente Medio y Norte de África sólo dos. En el ejercicio de 2005, los compromisos del Banco Internacional de Reconstrucción y Fomento/ Asociación Internacional de Fomento, del programa de financiamiento del carbono y del FMAM con respecto a las energías nuevas y renovables ascendieron a US$190 millones, es decir, el 10,5% del financiamiento total para el sector de la energía y la minería, que asciende a US$1.800 millones (Banco Mundial 2005a, 2005d).

De la cartera total de 65 proyectos, se pudieron evaluar 56, ya que los datos de desempeño correspondientes a nueve proyectos que acababan de aprobarse no estaban aún disponibles cuando se realizó el presente examen. De esos 56 proyectos, 46% son autónomos e incluyen toda la gama de intervenciones, que cubre la asistencia técnica, el desarrollo del mercado, el financiamiento de los productores y los consumidores, la comercialización y los servicios posventa. Las regiones en que el Banco realizó más proyectos autónomos relacionados con las energías nuevas y renovables fueron Asia oriental y el Pacífico, así como Asia meridional. El 54% restante son proyectos con componentes de energías nuevas y renovables vinculados con proyectos más grandes de energía, electrificación rural y de petróleo y agua (denominados proyectos “combinados” en este examen). Treinta y ocho proyectos (68%) han recibido cofinanciamiento del FMAM.

Proyectos terminados. Los resultados de los 27 proyectos autónomos terminados y las calificaciones separadas de los componentes sobre energías nuevas y renovables de los proyectos combinados revelan que más de la mitad (17) obtuvieron resultados satisfactorios o moderadamente satisfactorios, mientras que los demás obtuvieron resultados insatisfactorios. Los proyectos autónomos fueron satisfactorios en general, salvo aquéllos relacionados con la energía geotérmica o que se vieron interrumpidos por crisis económicas.

Por lo que atañe a los componentes sobre energías nuevas y renovables de los proyectos combinados, hay indicios de la existencia de cierta relación entre la calificación y la magnitud e la integración del componente en el proyecto general. La mayoría de los componentes sobre energías nuevas y renovables arrojaron resultados positivos o moderadamente positivos. Así y todo, los que representaban el 15% o más de los costos de sus proyectos respectivos, o que estaban bien integrados en sus proyectos, tuvieron resultados favorables. Fueron proyectos de electrificación rural o reforma del sector de energía con un componente considerable de energía de biomasa y proyectos que incluían una combinación de fuentes de energía nuevas y renovables y eficiencia energética o gestión de los desechos sólidos.

Para los componentes pequeños que representaban menos del 15% de los costos del proyecto y que no incidían de forma determinante en los objetivos generales del proyecto, las calificaciones de desempeño sólo fueron moderadamente satisfactorias. Las calificaciones de los componentes de energías nuevas o renovables de los proyectos de reforma del sector de la energía que eran pequeños y guardaban poca relación con los objetivos principales de los proyectos fueron desiguales, ya que tres se consideraron insatisfactorios.

Proyectos en curso. En comparación con el desempeño dispar de los proyectos terminados, los proyectos de energías nuevas y renovables activos muestran una evolución más favorable hacia resultados satisfactorios. De hecho, varios han superado ya las metas de instalación física de tecnología.

Existen, asimismo, pruebas sólidas de que, a lo largo del tiempo, muchas de las enseñanzas extraídas han contribuido a diseñar los proyectos en curso. Las calificaciones más recientes relativas al objetivos de desarrollo de los proyectos son todas satisfactorias para proyectos de energías nuevas y renovables en la región de Asia meridional, así como para la mayoría de los proyectos de las regiones de Asia oriental y el Pacífico, y América Latina y el Caribe. Pero el desempeño es peor en la región de África, donde se han calificado tres proyectos de insatisfactorios y uno de moderadamente insatisfactorio. Los componentes de los proyectos combinados tienden a obtener calificaciones mediocres con respecto al objetivo de desarrollo de los proyectos, los avances logrados en la ejecución, o ambos.

Enseñanzas extraídas. Las enseñanzas extraídas de proyectos más antiguos han permitido diseñar mejor los proyectos de energías nuevas y renovables más recientes, lo cual se ha reflejado en los resultados, ya que los proyectos autónomos satisfactorios o muy satisfactorios son también los más recientes.

Una de las principales enseñanzas es que la combinación del suministro de energías nuevas y renovables con aportaciones de las instituciones de servicios sociales y pequeñas y medianas empresas ha permitido mejorar los resultados en materia de desarrollo. Otra lección es que se necesitan servicios de crédito fiables para que los sistemas de energías nuevas y renovables sean asequibles para los hogares rurales. Además, debe instaurarse un marco normativo y reglamentario para esas energías que propicie una adopción a gran escala de modo que estos proyectos tengan éxito. Otra importante enseñanza es la utilidad de fortalecer la capacidad de los principales interesados para desarrollar el entorno para la comercialización de energías nuevas y renovables y garantizar la calidad del servicio.

Por último, una enseñanza práctica para el Banco es la necesidad de respaldar la participación de la comunidad y las partes interesadas y demostrar que se puede favorecer así la flexibilidad en el diseño y la ejecución de los proyectos. A fin de promover la mejora continua de los diseños de proyectos de energías nuevas y renovables, es necesario que el aumento del financiamiento de esas energías se acompañe de una mayor divulgación y aplicación de estas enseñanzas.

Factores que influyen en el desempeño. El análisis realizado por el IEG de los informes finales de

ejecución y los informes de evaluación de los proyectos ha revelado algunos de los factores que explican los resultados satisfactorios e insatisfactorios. Aunque no están presentes en todos los proyectos satisfactorios, los buenos resultados tienden a estar vinculados a un compromiso sólido de las autoridades y una labor eficaz del Banco en cuanto al diseño, la supervisión y la gestión adaptable del proyecto. Existen factores adicionales inherentes a los proyectos de energías nuevas y renovables:

- amplias consultas con empresarios, consumidores y organizaciones no gubernamentales,
- mecanismos eficaces de crédito y de financiamiento en condiciones concesionarias en función de los resultados que faciliten el acceso de los pobres a tecnologías de energías nuevas y renovables,
- una capacidad institucional sólida adquirida con anterioridad o a raíz del proyecto,
- más atención al modo de afrontar las barreras comerciales a las fuentes de energía nuevas y renovables,
- un interés activo de los inversionistas y financiadores locales.

Los malos resultados parecen guardar relación con diversos factores, entre ellos la insuficiente atención prestada a los aspectos normativos y reglamentarios inherentes a las energías nuevas y renovables, la supervisión deficiente de los componentes de energías nuevas y renovables, un compromiso nacional escaso, un sector privado con aversión al riesgo, una capacidad institucional pública y privada insuficiente y crisis sociopolíticas o económicas.

Principales conclusiones sobre la ejecución de los pilares estratégicos de la Estrategia de renovación del sector de la energía

1. *¿En qué medida favorecieron directamente a los pobres las intervenciones del Banco en materia de energías nuevas y renovables?*

Los objetivos de reducción de la pobreza no han aparecido precisamente después de la estrategia de renovación de 2001. El examen de la cartera revela que el Banco ha perseguido siempre la reducción de la pobreza como uno de los principales objetivos de su cartera de proyectos de energías nuevas y renovables, que forma parte de su objetivo más amplio de mejorar el acceso a la energía. En la práctica, los objetivos de reducción de la pobreza se han integrado en el diseño de los proyectos mediante mejoras del bienestar, el aumento de la calidad de vida y los ingresos o la promoción de la transformación rural a través del desarrollo energético.

Muchos proyectos recientes tienen en cuenta estos objetivos en su diseño, pero sólo dos proyectos terminados incluyeron la reducción de la pobreza como un objetivo explícito. Así pues, para un nada despreciable tercio de los proyectos concluidos, el objetivo *implícito* de reducción de la pobreza se desprende de los estudios preparatorios, del diseño de los proyectos y de los beneficiarios seleccionados.

Sin embargo, en este momento, es prácticamente imposible evaluar el impacto en la reducción de la pobreza porque los proyectos concluidos carecían de sistemas de seguimiento y evaluación o éstos eran deficientes. Incluso entre los proyectos recientes, en que uno de los objetivos explícitos es lograr el aumento de los ingresos, son pocos los que disponen de sistemas de seguimiento y evaluación que permitan determinar las mejoras en el ingreso atribuibles a un mayor acceso a la energía. Ninguno de los proyectos ofrece datos sobre el aumento de los ingresos de los hogares. El seguimiento y la evaluación de las repercusiones de género han sido también poco satisfactorios, pues se disponen de pocas pruebas que corroboren la frecuente afirmación de que las mujeres se han beneficiado.

Recientemente, el Banco —a través del ESMAP— ha estado desarrollando métodos e instrumentos para evaluar mejor las repercusiones socioeconómicas de un mayor acceso a la energía. Algunos de los proyectos de energías nuevas y renovables más recientes (por ejemplo, en Bangladesh y Uganda) están usando esos planteamientos.

En cualquier caso, sigue sin estar claro en qué medida y de qué modo el apoyo del Banco a las energías nuevas y renovables ha reducido la pobreza. La falta de pruebas es un serio inconveniente a la hora de encauzar su financiamiento a esas fuentes. Esta dificultad debe abordarse mediante el establecimiento de sistemas de seguimiento y evaluación más sólidos en los proyectos actuales y futuros, en especial en los diseñados con componentes de asistencia basada en resultados que necesitan particularmente sistemas de seguimiento y evaluación.

2. *¿En qué medida protegieron los proyectos de energías nuevas y renovables del Banco el medio ambiente?*

Pocos proyectos de energías nuevas y renovables terminados tienen la atenuación de los efectos perjudiciales para el medio ambiente como objetivo explícito. Este examen de la cartera sólo ha hallado pruebas parciales de que estos proyectos están logrando los beneficios ambientales mundiales previstos. Aproximadamente el tercio de los proyectos concluidos no proporciona datos o proporciona muy pocos, pero, en general, se han alcanzado las metas de reducción de las emisiones de gases de efecto invernadero. Entre los proyectos, los relativos a las energías renovables a gran escala y conectadas a la red tienen más posibilidades de reducir las emisiones de gases que los proyectos pequeños fuera de la red, como los que emplean tecnología solar fotovoltaica.

El Banco respalda tanto la eficiencia energética como las fuentes de energía nuevas y renovables, lo cual tiene mucho sentido desde el punto de vista estratégico. Por un lado, en una evaluación reciente del FMAM se llegó a la conclusión de que, aunque las inversiones en energías nuevas y renovables pueden contribuir a evitar el cambio climático, se han obtenido mayores reducciones de emisiones de gases de efecto invernadero gracias a la eficiencia energética propugnada por el Banco y el FMAM que a los proyectos de energías nuevas y renovables. Por otro lado, en un horizonte de 40 a 80 años, donde se necesitarán las reducciones más notables de emisiones de gases, tanto la eficiencia energética como las fuentes de energía nuevas y renovables (junto con el secuestro físico y biológico del carbono) tendrán un papel que desempeñar. La eficiencia energética por sí sola no permitirá alcanzar los niveles deseados de reducción; será también necesario un despliegue a gran escala de fuentes de energía que reduzcan o eliminen las emisiones de carbono.

Las repercusiones ambientales mundiales de los proyectos de energías nuevas y renovables podrían ser mayores si éstos catalizasen la creación de mercados de energías nuevas y renovables, redujeran las barreras comerciales y se concentraran en maximizar los efectos a nivel local. No se dispone de datos sobre los beneficios locales de los proyectos de energías nuevas y renovables del Banco y el FMAM porque el seguimiento y la evaluación han sido deficientes. Sin embargo, los sistemas de seguimiento y evaluación de estos proyectos deberían centrarse más en cuantificar la *eliminación de las barreras comerciales* en lugar de limitarse a medir los niveles de reducción de gases de efecto invernadero. Las operaciones de financiamiento del Banco en relación con el carbono —que son recientes y quedan fuera del ámbito de este examen— han aplicado protocolos rigurosos de seguimiento y evaluación para medir y verificar las reducciones de las emisiones de gases.

3. *¿En qué medida permitió el programa del Banco fomentar el desarrollo del sector privado?*

Los datos relativos a la cartera apuntan claramente a que el Banco ha obtenido mejores resultados con los proyectos de energías nuevas y renovables que han apoyado el desarrollo del sector privado, en especial en relación con el establecimiento de un proceso de comercialización, el fortalecimiento de la confianza de los inversionistas y los consumidores, el fortalecimiento de la capacidad institucional y la movilización de financiamiento privado. Sin embargo, el Banco no ha prestado suficiente atención a la creación de un marco normativo no discriminatorio para las fuentes de energía nuevas y

renovables —a pesar del impulso que ha dado paralelamente a reformas más amplias en el sector de la energía— con efectos negativos para algunos planes relativos a esas fuentes.

Gracias a la asistencia del ESMAP, algunos proyectos recientes sobre energías nuevas y renovables han comenzado a abordar ya las cuestiones normativas. El Banco ha apoyado, asimismo, a instituciones financieras locales y movilizado inversiones, a menudo mediante asociaciones entre el sector público y el privado. Sin embargo, las deficiencias institucionales y la falta de preparación, experiencia y motivación entre los inversionistas locales para atender a mercados rurales han sido factores limitadores. Al igual que ocurre con el impacto de las energías nuevas y renovables en la reducción de la pobreza, el seguimiento y la evaluación de la labor de desarrollo del sector privado del Banco en este ámbito han sido insatisfactorios. Es necesario mejorar ambas actividades para analizar los factores que explican el éxito de los distintos mecanismos de ejecución, adaptar y aplicar las enseñanzas extraídas cuando se amplíe el alcance de los proyectos en otros sitios y disponer de instrumentos de decisión para poner eficazmente en práctica planes presentes y futuros de asistencia basada en resultados.

La experiencia derivada de los proyectos sugiere que las asociaciones y la participación de la colectividad son fundamentales, porque el desarrollo del sector privado no basta para propiciar un mejor acceso a la energía. Una enseñanza importante es que las asociaciones entre el sector público y el privado con participación de organizaciones no gubernamentales y comunidades de consumidores, y las amplias consultas a los interesados pueden desempeñar un papel capital para fomentar las energías nuevas y renovables y llegar a los pobres. Cuando los proyectos dependían únicamente del sector privado para aumentar el acceso a la energía, apenas se lograba llegar a los pobres.

Conclusiones y pasos siguientes

La estrategia sobre energías nuevas y renovables del Banco es congruente con las prioridades las prioridades energéticas de los países en desarrollo. El programa de fuentes de energía nuevas y renovables del Banco está sólidamente anclado en el marco más amplio de los pilares de la Estrategia de renovación del sector de la energía y se centra adecuadamente en sus metas de reducir la pobreza, fomentar el desarrollo del sector privado y contribuir a la protección del medio ambiente. Como se ha confirmado una vez más en foros recientes (incluida la Semana de la Energía organizada por el Banco en 2006), el Banco y la comunidad de donantes deben abordar la crítica situación energética que viven los países en desarrollo interviniendo en todos los frentes, incluido el petróleo, el carbón limpio, la energía hidroeléctrica y de biomasa y la eficiencia energética, así como las energías renovables.

A fin de cumplir su compromiso de aumentar el apoyo a las fuentes de energía nuevas y renovables, el Banco necesita aprovechar su capacidad probada para crear un clima de inversión propicio para la comercialización de fuentes de energía nuevas y renovables y el fomento del desarrollo del sector privado. El Banco ha de centrarse también en otros puntos fuertes, como el fortalecimiento de las asociaciones entre el sector público y el privado y estructuras apropiadas de reducción del riesgo. Habrá de considerar una serie de operaciones e instrumentos crediticios adecuados para responder a los largos periodos de gestación de los sistemas de energías nuevas y renovables, desde el fortalecimiento de la capacidad institucional y la reforma normativa y reglamentaria hasta la plena comercialización. Y deberá incorporar —en sus presupuestos y programas de trabajo regionales— los costos operacionales de su satisfactoria "intermediación" y su papel consultivo, en lugar de seguir dependiendo de fondos de donantes bilaterales.

Las eventuales contribuciones del Banco a otros objetivos son más dudosas. La experiencia de los últimos 15 años indica que los resultados de los esfuerzos del Banco para ayudar directamente a los pobres o lograr beneficios ambientales locales o mundiales a través de sus intervencio-

nes en materia de energías nuevas y renovables han sido difíciles de medir porque el seguimiento y la evaluación han sido deficientes o inexistentes; ahora bien, la pocas pruebas de que se dispone indican que, hasta la fecha, el impacto ha sido limitado.

Habría que establecer buenos sistemas de seguimiento y evaluación de los servicios energéticos destinados a asistir a los pobres. Los primeros objetivos deberían ser los proyectos sobre fuentes de energía renovables con componentes asistencia basada en resultados. Habría que realizar evaluaciones rigurosas del impacto de algunos de los proyectos sobre energías renovables que concluirán en los próximos dos o tres años.

Un primer paso importante es que el Banco incluya objetivos y programas de trabajo relacionados con las energías nuevas y renovables en las estrategias de asistencia a los países —que históricamente han prestado poca atención a esas fuentes de energía— siempre que sea pertinente. El Banco necesita señalar la importancia de la fuentes de energía nuevas y renovables en las estrategias nacionales y del sector de la energía. Cuando fomente las reformas y arquitecturas del sector de la energía, el Banco deberá abordar también las limitaciones que obstaculizan el desarrollo y la comercialización de energías nuevas y renovables. Las principales orientaciones de la asistencia del Banco en este ámbito deberían ser la fijación de precios económicos para la energía, el aumento del financiamiento privado y una reglamentación eficaz.

En resumen, el Banco debe seguir tomando las medidas que han funcionado, centrándose en particular en su papel catalizador para el desarrollo del sector privado en proyectos de energías nuevas y renovables, permaneciendo flexible e innovador aplicando las enseñanzas extraídas para mejorar el diseño de nuevos proyectos, y dando una mayor divulgación a las buenas prácticas. El Banco debería, asimismo, abordar ámbitos que en el pasado han sido deficientes, como el seguimiento y la evaluación, la integración de las energías nuevas y renovables en las estrategias de asistencia a los países y la inclusión de los costos de "incubación de negocios de energías nuevas y renovables" en el presupuesto del propio Banco.

En particular, la cartera de proyectos de energías nuevas y renovables debería beneficiarse cada vez más de evaluaciones tanto internas como independientes, dado el papel estratégico que atribuye el Banco a esas fuentes en la mejora del acceso a la energía, especialmente para los pobres. Esas evaluaciones deberían centrarse de manera más rigurosa en los resultados y los impactos, en diferenciar más radicalmente las enseñanzas de la electrificación rural, de las fuentes de energía nuevas y renovables conectadas a la red y de las energías renovables fuera de la red a medida que se amplía la cartera de proyectos terminados en este campo, así como en un sistema sólido de intercambio de información que permitiría tener flexibilidad y capacidad de respuesta en la ejecución de los objetivos de la estrategia del Banco sobre energías nuevas y renovables.

Se trata de una tarea difícil habida cuenta del rigor presupuestario actual. Sin embargo, es una tarea que merece un apoyo firme de la administración del Banco, dados sus compromisos mundiales en materia de fuentes de energía nuevas y renovables.

Objectives and Evaluation Approach

The main objective of this Independent Evaluation Group (IEG) review is to assess *prospectively* how the implementation performance outcomes of the Bank's new renewable energy (NRE) portfolio could inform the strategic goal of expanding the Bank's NRE support. This assessment is important in view of the Bank's 2004 commitment to increase its lending for NRE by an annual average of 20 percent during fiscal 2005–09.

Whereas IEG has conducted a study related to the 1998 Fuel for Thought Strategy[1] and evaluated the private sector development (PSD) outcomes resulting from the 1993 electric power lending policy, the Bank's NRE portfolio has not been independently evaluated before. Similarly, given IEG's evaluation of the extractive industries (IEG-World Bank, IEG-IFC, IEG-MIGA 2003a) and the large number of external studies and regional self-evaluations of large hydro (more than 10 megawatts [MW]), this assessment is restricted to geothermal, solar, wind, biomass, and hydro energy sources of less than 10 MW. The review also expands on the NRE sections of IEG's widely disseminated 2003 study on PSD in the electric power sector (IEG-World Bank, IEG-IFC, IEG-MIGA 2003b).

Evaluation Approach

There are three main aspects to this review's evaluation approach. First, IEG's evaluation methodology is objectives based. Thus, the assessment of NRE project outcomes was conducted vis-à-vis objectives at both the project and strategic levels. At the project level, the review considered the objectives as stated in project Staff Appraisal Reports or Project Appraisal Documents. At the strategic level, the review assesses the extent to which the Energy Business Renewal Strategy (EBRS) pillars of poverty reduction, PSD, and environmental protection, as well as the relevant lines of action under each, were achieved.

Second, the NRE portfolio is also highly diverse; that is, the Bank's Regions focused on distinct renewable energy technologies[2] and demonstrate sharply contrasting institutional and governance frameworks. Consequently, the study focused on deriving findings (rather than thematic lessons) and on assessing the Bank's performance, with a view to informing the NRE scale-up efforts and priority business lines in the coming years.

Third, in its strategy for the electric power sector, the Bank's support is predicated on country commitment to improving sector efficiency through policy reforms and sector

restructuring. Therefore, at the country level, this review also takes into account the energy sector reform context wherein the NRE projects were implemented.

Project ratings used

For the project-level review, portfolio results are reported for both completed and ongoing operations.

For completed projects, the rating catgories include outcome (comprised of relevance to country-sector objectives, efficacy, and efficiency); sustainability; institutional development impact; and Bank and borrower performance during the project design, implementation, and completion stages.

For ongoing projects, the review uses Project Status Report ratings—Achievement of the Project Development Objective (PDO), Global Environmental Objective, and Implementation Progress—as one source of data among others, with the caveat these ratings have not been independently validated. NRE components in "blended" projects were rated separately.

Documents reviewed

The evaluation draws on several elements: (i) Bank project documents, particularly Implementation Completion Reports (ICRs), supervision reports, and aide-memoires; (ii) IEG products, including ICR Reviews, Project Performance Assessment Reports, and energy-environment thematic studies; (iii) Bank staff interviews; and (iii) a focused literature review covering the Global Environment Facility (GEF), the Energy Sector Management Assistance Program (ESMAP), and external studies selected for their data and insights on NRE's poverty-reduction impacts, evaluative content, and applicability to the countries that received Bank NRE support. This review also draws from the recently completed ESMAP self-evaluation (ESMAP 2004b). Specific examples to illustrate ESMAP's contributions to project design and preparation are provided in the report.

Portfolio reviewed

The NRE portfolio is relatively recent: out of 65 NRE projects in the total portfolio (annex A),[3] 27 are closed;[4] the 38 that are ongoing are from the last seven years. The study reviewed in greater depth 12 of these 56 projects, with 5 closed and 7 ongoing "full-spectrum" projects that have the greatest value for deriving evaluative findings with potentially broad applicability (annex B). By "full spectrum," the review means the following:

- These projects pursued the full range of activities, including technical assistance (TA) and studies, market development, PSD, consumer and producer financing, commercialization, and after-sales service. Most were approved recently and are in the East Asia and Pacific and the South Asia Regions, plus a few in the Africa and the Latin America and the Caribbean Regions. Nearly all the activities focus on electricity access; a few focus on household energy. Outside this subset, the NRE components consist mainly of studies or pilot activities.
- The projects are major lending vehicles with significant Bank and GEF financing, or they are rural electrification projects that have included a large NRE component.

Given the constraints of this review (mainly the small number of closed and full-spectrum NRE projects that were reviewed) and the still-expanding and mostly young NRE portfolio, it was premature to draw generalized, evidence-based findings and lessons that distinguish among rural electrification, grid-connected NRE, and off-grid NRE interventions, which do have different objectives, characteristics, and expected outcomes, as noted in the report (see chapter 4). This level of disaggregation should be possible as more NRE projects close and further self- and independent evaluations are carried out in the coming years.

The Bank's relatively recent carbon finance operations were also outside the scope of this review, as few if any lessons can be derived from the still mostly active portfolio. The Carbon Finance Program, however, will be part of the IEG's climate change study planned for fiscal 2008.

2

The Bank's NRE Objectives

Energy is a vital input to economic growth and human well-being. The rapid growth in consumption and global economic dependence on oil, natural gas, and electric power has deepened the geopolitical importance of these commercial energy resources.

Meanwhile, traditional fuels such as firewood, agricultural residues, and animal wastes continue to be the only energy resources used by almost one-third of the world's population to meet their cooking, heating, and other basic needs. Among these consumers are the world's poorest people, for whom commercial energy (particularly grid-based electricity) is unaffordable or is not economical to deliver. About 1.6 billion people are without electricity access today. Renewable energy from solar and wind resources was initially promoted as a way to reach these isolated consumers, but renewable energy technologies (RETs) have been harnessed recently to feed into electricity grids or provide off-grid, decentralized power supply solutions at the village level.

For people in developing countries, the most critical energy issue is lack of access to either commercial or traditional energy sources. The Millennium Development Goals for reducing poverty, hunger, and disease and for expanding education and achieving gender equality will not be met without accessible, affordable, and reliable energy services (UN 2005). The commercial energy subsector (petroleum products and electricity) has traditionally attracted large investment resources from private, bilateral, and multilateral financiers. Traditional fuels, while extremely important to large segments of the world's population, have received much less support. For new renewables, the 1990s witnessed growth in the promotion of NRE technologies to meet rural energy needs and mitigate greenhouse gas (GHG) emissions and thus achieve both local and global environmental benefits.

Through its advice and project lending in all three areas—commercial, traditional, and renewable energy—the Bank has responded strategically and operationally to the dire and challenging energy predicament of its client countries. The energy sector accounted for about 8 percent of total International Bank for Reconstruction and Development/International Development Association commitments of $22.3 billion in fiscal 2005. In the past five years, NRE lending has grown rapidly, from $20 million in fiscal 2001 to $190 million in fiscal 2005. In the latter year, NRE lending accounted for 10 percent of total Bank energy lending. More than

half of the Bank's NRE projects have been cofinanced with grants from GEF.

The Bank's strategic framework for NRE includes (i) two institutional papers in 1993 on energy efficiency and rural energy (World Bank 1993), where the Bank's commitment to NRE was first stated,[1] and (ii) three formal strategies—the Electric Power Lending Policy (1993), Fuel for Thought (World Bank 1998), and the EBRS (World Bank 2001a). The Bank's most recent action was to announce at the May 2004 Conference on Renewable Energy in Bonn, Germany, that it planned to increase lending for renewable energy and energy efficiency by 20 percent per year for the 5-year period fiscal 2005–09.

The EBRS articulates the Bank's objectives and planned actions to support NRE. The three EBRS pillars (out of four) for which specific NRE lines of action have been identified are as follows: (i) help the poor directly, (ii) promote governance and PSD, and (iii) protect the environment. (Although NREs have the potential to displace imported petroleum, their macrofiscal impact—the fourth EBRS pillar—is limited, because NREs are presently a small contributor to the overall energy supply of the Bank's country clients.) Specific activities were established under each of these objectives:

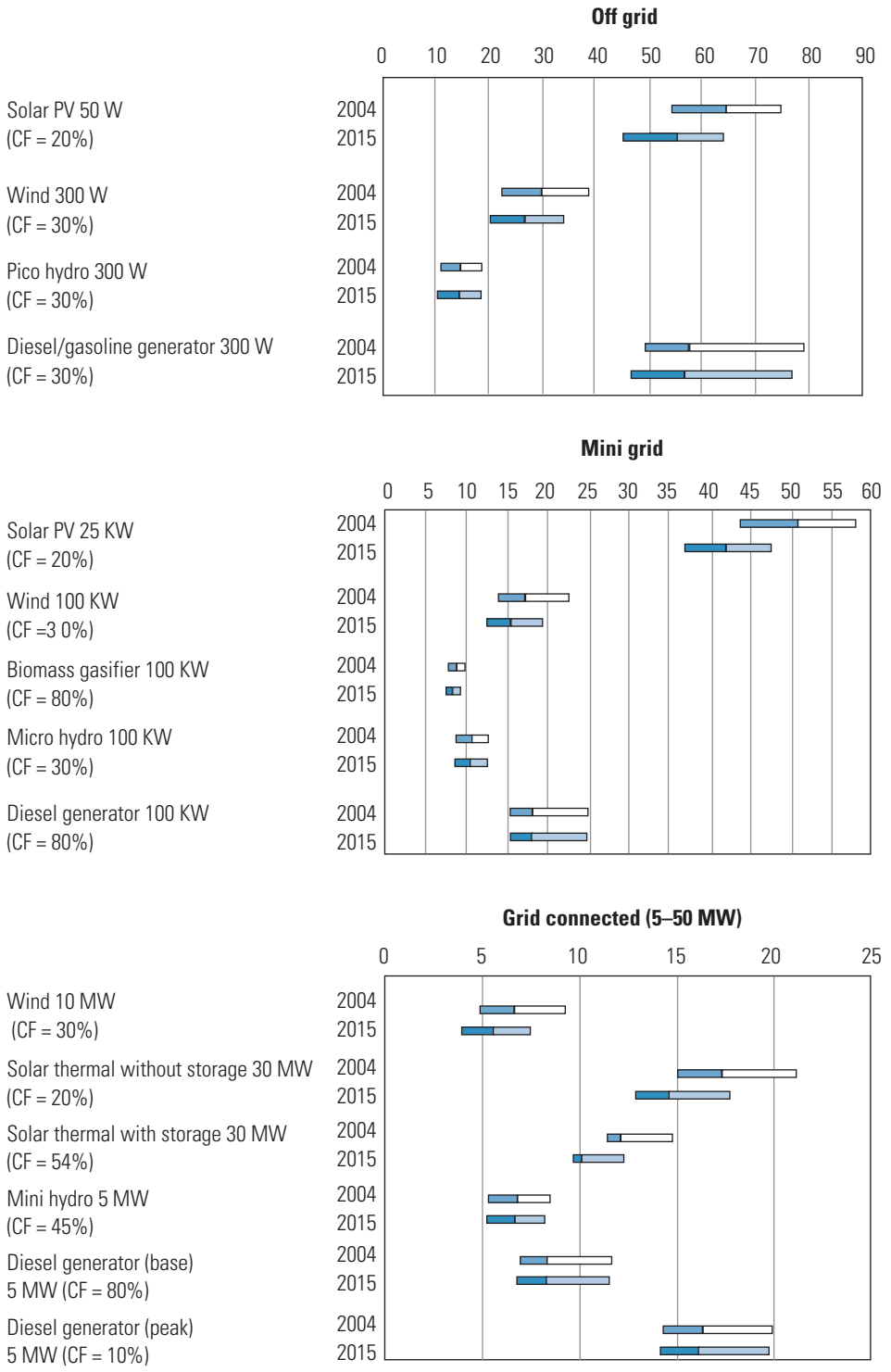
- To *help the poor directly*, the Bank sought to facilitate access to modern fuels and electricity, including NRE; ensure that energy subsidies were targeted toward and reached the poor; and create energy service enterprises run by the poor, such as rural energy services provision based on NRE.
- To *promote good governance and PSD*, the Bank aimed to create objective, transparent, and nondiscriminatory regulatory mechanisms that level the playing field between NRE and conventional energy. The Bank also sought to strengthen local financial institutions to provide long-term financing for NRE businesses.
- To *protect the environment*, the Bank, often in partnership with GEF, sought to remove market and regulatory barriers to NRE as well as achieve global environmental benefits by financing the incremental costs of renewable energy investments.

The Bank aims to play a crucial role in leveling the playing field between renewable and conventional energy sources. Although RETs largely remain financially noncompetitive with conventional energy sources for electricity generation, a recent Bank assessment (Chubu Electric Power Co., Inc. and others 2005) indicates that RETs are the least-cost electrification option for many off-grid, mini-grid, and grid-based applications, as shown in annex C and figure 2.1—on a levelized economic cost basis, and assuming the availability of the renewable energy resource.[2] The assessment characterizes current (2004) and future (2015) commercial prospects for RETs and fossil fuel-fired electricity generation technologies in these applications and compares levelized generation costs using a consistent economic methodology differentiated according to deployment conditions and plant size ranges.[3]

For off-grid (or stand-alone) systems, pico-hydro (300-watt [W]–1-kilowatt [kW]), small wind (300 W), and photovoltaic system (PV)–wind hybrid (300 W) technologies are projected to be in the range of 15–25 cents per kWh, or less than half of the 30–40 cents per kWh for gasoline and diesel generators. Solar PV system costs for small power applications (50–300 W) are comparable to these conventional energy alternatives. For mini-grid systems at the village or district levels not connected to the grid and with loads between 5 and 500 kW, numerous RETs—biomass, biogas, geothermal, wind, and micro-hydro—are potentially the least-cost generation options, compared with diesel gasoline alternatives. Biogas digesters and biomass gasifiers are especially promising given their high capacity factors and the flexibility of matching their size to the mini-grid load.

For grid-connected RETs, however, conventional electricity-generation technologies—open-cycle

Figure 2.1: Forecast Generating Costs for Selected Renewable and Conventional Electricity Generation: 2004 versus 2015 (cents/kWh)



Source: Chubu Electric Power Co. Inc. and others 2005.

Note: Cents/kWh, based on crude oil prices of US$38/bbl (blue barrel) base case in 2004 and US$63/bbl high case in 2015.

and combine-cycle gas turbines and coal- and oil-fired steam turbines—remain the least-cost options. For these conventional sources, site-specific considerations such as the load profile, demand growth, and interfuel cost differentials determine which specific conventional technology is the lowest cost. For power plant sizes less than 50 MW, geothermal, biomass, hydro, and wind power are potentially as economical as conventional power plants, but these RETs simply cannot compete with larger conventional power-generating units of 50–300 MW.

Conventional energy technologies, however, have been highly subsidized through direct, indirect, and nontransparent means, such as cash transfers to producers and/or consumers, tax exemptions, price controls, trade restrictions, regulatory hurdles for RETs, and government failure to correct market imperfections. This has all skewed the playing field against renewable energy. For example, in 2004, for the United States and Europe combined, government support for renewable energy was roughly US$10 billion.

In contrast, total global energy subsidies for fossil fuels are reported to be between $150 and $250 billion per year. Some studies show that with environmental externalities considered, the economic costs of RETs—particularly wind, mini-hydro, and biomass electric for off-grid and potentially mini-grid applications—are lower than those for conventional power generation and, on a levelized basis, are the least economical cost option for such applications.

Inclusion of the cost of environmental and global externalities increases significantly the economically viable quantity of renewable energy. If, in addition, a value for energy diversification is added, the economically viable quantity of renewable energy increases even more. The Bank has conducted studies to determine this economically viable optimum quantity of renewable energy in China, Croatia, Mexico, and South Africa in the context of RET projects.

The Bank's role in renewable energy lending is to level the playing field between renewable and conventional energy sources, because the distortions cited above make renewable energy financially uncompetitive with conventional energy sources in both developing and developed countries. These distortions therefore continue to require government and donor support. The Bank, often with cofinancing from GEF, seems to remove the market and regulatory barriers to RETs and achieve global environmental benefits by financing the incremental costs of renewable energy investments. The Bank's Carbon Financing Program is also contributing to the explicit valuation of the positive externality benefits of renewable energy.

NRE Portfolio Characteristics and Trends

Since 1990, the Bank has financed 65 NRE projects or projects with NRE components,[1] of which 56 could be evaluated for this review. Performance data on nine projects that had just been approved at the time of the review were not yet available from the Bank's data systems.

This chapter on portfolio characteristics is based on the overall 65 projects, while the next chapter on performance evaluation is based only on the 56 projects with available performance data. Of the 65 total projects, 27 have closed (42 percent) and 38 are still ongoing (58 percent).[2] Moreover, 26 are freestanding (12 closed and 14 ongoing), and 39 are "blended" (15 closed and 24 ongoing); that is, the NRE activities are components of larger power, petroleum, or rural development projects. Most of the NRE projects were approved after 1997, and 28 (43 percent) received Board approval in fiscal 2002 or later. Thus, the Bank's NRE portfolio is relatively young.

NRE projects are unevenly distributed across the Bank's Regions.[3] The Africa Region has had the highest number of NRE projects, mainly as relatively small components. Although the East Asia and Pacific and the South Asia Regions have fewer projects, they have most of the Bank's main freestanding ones in solar PV and hydro. The Latin America and the Caribbean and the Europe and Central Asia Regions have implemented few projects since 1990, and only one project was approved in the Middle East and North Africa Region.

The Africa and the South Asia Regions have been implementing NRE projects since the 1980s and have increased their lending pace over time. The other Regions, however, became active only in the mid-1990s. In Latin America and the Caribbean, most projects were approved after 1999. In all the Regions, it was not until after the mid-1990s that freestanding NRE projects began to be implemented.

After starting mainly with solar PVs, the Bank now supports a wide range of RETs. Initially, solar PVs were promoted in all Regions, except Europe and Central Asia. The Africa Region had a strong biomass focus and all the freestanding fuel wood projects. Geothermal projects were implemented in the 1990s in the East Asia and Pacific and recently in the Europe and Central Asia Region. In the East Asia and Pacific Region, a shift away from geothermal to solar PV and small and mini-hydro projects has taken place. In the South Asia Region, small, mini-, and village hydropower have been among the primary RETs. In addition, most of the

projects supported TA (90 percent), studies (70 percent), and pilot activities (60 percent). In many cases, the NRE component consisted of just these activities. This is particularly true of the closed projects in the Africa Region.

The NRE portfolio had a strong rural focus. About 55 percent of the Bank's NRE portfolio targeted rural areas. Bank projects sought to reach areas where NRE technologies (such as small hydro) could be connected to the grid, as well as having off-grid small-/mini-hydro and PV applications. Rural households, public service centers such as schools and clinics, and, more recently, small businesses have been the intended recipients. Rural electrification in particular has been an area where the Bank promoted NRE. Twelve projects have featured grid-connected RETs, but these have also been used to provide electricity in areas that the power grid cannot access for physical or cost-effectiveness reasons.

More than half the NRE portfolio was cofinanced by GEF. GEF cofinanced more than 38 projects (68 percent), with the objective of removing market barriers to NRE commercialization (GEF 1996).

GEF funds the incremental or additional costs associated with transforming a conventional energy project with national benefits into an NRE project with global environmental benefits. GEF grants reduce market barriers by covering the difference or "increment" between an option that was less costly and polluted more and a more costly, more environmentally friendly option.

The average costs of preparing NRE projects, which were historically higher than conventional energy projects, have decreased in recent projects. Although, as table 3.1 illustrates, preparation costs were higher for the initial NRE projects, follow-up projects have cost much less—7–12 times less in three countries that have been foci of the Bank's NRE assistance (India, Indonesia, and Sri Lanka). Nonetheless, the "stigma" of high processing costs still seem to affect NRE projects at the conceptualization stage and may be a factor in the relatively weak emphasis on NRE in programming country assistance (as discussed later in the report). The supervision of NRE projects may also require more resources and intensity to ensure that project implementation proceeds successfully.

The Bank's broader energy sector reform work in the 1990s largely orphaned NRE, despite the clear need to integrate regulatory, pricing, and planning issues specific to NRE in the Bank's country-sector dialogue (see chapter 5). In addition to costs, this has also contributed to marginalizing NRE when mapping out country and sector assistance. As a result, the earlier NRE projects were seen as "boutique" operations that pioneering Bank staff made possible only through arduous championing and mobilization of external funds.

Table 3.1: Preparation Costs for NRE Projects Higher than for Conventional Power Projects

	Electric power	NRE
Preparation cost		
Average (US$ thousands)	393	461
Median value (percent of total commitment)	0.3%	0.4%
Range (US$ thousands)	63–1900	77–1,215
Project size		
Average (US$ millions)	161	95
Range (US$ millions)	5–485	11–224
Sample size	80	10

Source: Cabraal 2004.

The Implementation Scorecard and Main Findings on Delivering the NRE Strategy

Ratings of closed projects are mixed. Based on a review of the 27 closed projects in the Bank's NRE portfolio, the number of closed, freestanding projects and NRE components in blended projects that performed well was slightly higher than the number of those for which performance was weak, as table 4.1 shows.

NRE Portfolio Performance

Among the freestanding NRE projects, the ones in Chad, Mauritius, Tunisia, and India had moderately satisfactory or satisfactory outcomes. The Senegal and Sri Lanka projects earned high satisfactory outcomes (the Sri Lanka project received the IEG Best Practice Award for 2005).

All three freestanding geothermal projects, however, had unsatisfactory outcomes. The outcomes of NRE components that are blended with larger projects in Burundi, the Philippines, Rwanda, and Uganda were unsatisfactory or moderately so. This would suggest that freestanding projects have generally performed better than projects where NREs are only a component. This requires further field study, however, as some local factors may be involved. Out of the total 65 NRE projects in this review,

Table 4.1: Outcome Ratings for Closed NRE Freestanding Projects and Components of Blended Projects

Overall scorecard: Satisfactory performance, but a high level of unsatisfactory outcomes		
Rating	**No.**	**Projects**
Highly satisfactory	2	2 freestanding (Sri Lanka, Senegal)
Satisfactory	8	3 freestanding, 5 components
Moderately satisfactory	7	1 household wood fuel, 6 components
Moderately unsatisfactory	3	2 freestanding, 1 geothermal component
Unsatisfactory	6	1 freestanding, 2 geothermal, 3 components
Not rated/not available	1	1 freestanding
Total	27	

Source: Implementation Completion Report Reviews and Project Performance Assessment Reports.

38 are still ongoing. The detailed ratings for closed NRE projects are in annex D.

As table 4.1 illustrates, freestanding projects were generally rated as satisfactory, unless they involved geothermal energy or were interrupted by an economic crisis in the country. The projects rated satisfactory or highly satisfactory were also the more *recent* of the freestanding projects, which may be associated with the strong lesson learning between older and newer projects that is discussed in chapter 5.

Regarding NRE components of blended projects, each of which were separately rated for this assessment (see annex E), there appears to be some association between the outcome rating and the component's size and integration in the larger project. NRE components that constituted a significant share of their respective projects (15 percent or higher) or that were well integrated in the larger projects despite their small size had satisfactory outcomes. These were projects in rural electrification and energy sector reform with a sizeable biomass component and those involving a mix of NRE and energy efficiency. However, for components that were small (generally less than 15 percent) and that did not have a strong relationship with the other aims of the larger projects, the outcome ratings were only moderately satisfactory.

In terms of regional performance, the South Asia Region's projects were either satisfactory or moderately so. In the Africa Region, the experience is mixed, with satisfactory and unsatisfactory projects and components.

The performance of projects in the East Asia and Pacific Region is similarly quite mixed. Biomass projects or components have all shown satisfactory or moderately satisfactory ratings (except one project in Mali). NRE components in irrigation or rural electrification projects have all shown either satisfactory or moderately satisfactory ratings as well. NRE components in energy sector reform projects that were small and had little connection to the dominant objectives of their projects were quite mixed, with three rated as unsatisfactory.

Results to date of ongoing projects are mostly satisfactory, a few far surpass their targets, and lessons learned have led to better project design. The portfolio review and interviews of Bank staff show that the design of ongoing NRE projects benefited from applying the lessons from closed and active projects (a full discussion of the lessons learned is in chapter 5).

The review also found that the supervision ratings for ongoing projects are predominantly satisfactory or moderately satisfactory; that is, less than one-fourth of the projects are rated as moderately unsatisfactory or unsatisfactory, as shown in table 4.2. This compares favorably with the Bank-wide figure of 79 percent of projects receiving moderately satisfactory or higher ratings for development outcome.[1]

It is worth noting that the implementation progress rating in the first few years is not a predictor of whether the projects will have satisfactory final outcomes, because new NRE projects take time to build momentum as institutional capacities are built (for example, in the India Renewable Resources Development [RRD] Project, Sri Lanka Energy Services Delivery [ESD] Project, Argentina Renewable Energy in the Rural Market [RERM] Project, and China Renewable Energy Development [RED] Project). The detailed ratings for ongoing NRE projects are presented in annex E.

In terms of achieving PDOs, the latest PDO ratings are all satisfactory for NRE projects in the South Asia Region, and the majority of East Asia and Pacific and Latin America and the Caribbean Region projects as well. In the Africa Region, PDO ratings are mixed but mainly poor, with three projects rated unsatisfactory and one project moderately unsatisfactory. Blended projects tend to have low ratings in PDO, implementation progress, or both.

Some NRE projects are making significant achievements in disseminating NRE technologies, while

Table 4.2: Ratings for Ongoing NRE Projects[a] Mostly Satisfactory

	No. of projects (N = 27)	Highly satisfactory	Satisfactory	Moderately satisfactory	Moderately unsatisfactory	Unsatisfactory
Project development objective	21[b]		11	6	1	3
Implementation progress	22[c]		9	8	4	1
Global environment objective	16[d]	1[e]	6	6	2	1

Source: Implementation Status Reports.

a. Based on the latest Implementation Status Report for each project. Four projects closed between June 2004, when the initial portfolio evaluation was conducted, and the end of June 2005, bringing the active portfolio from 33 to 29.

b. A PDO was not applicable for two GEF-only projects in Mexico (methane gas capture and rural electrification for agriculture), not available for two GEF medium-size projects (Hungary Rehabilitation and Expansion of Small Hydro and Uruguay Landfill Methane Recovery Demonstration Project), and not provided for three projects (Philippines Rural Power; Vietnam System Efficiency Improvement, Equitization, and Renewables; and India Second Rural Electrification).

c. An implementation progress rating was not applicable or not available for the GEF medium-size projects in Hungary and Uruguay and was not provided for four projects (Philippines Rural Power; Vietnam System Efficiency Improvement, Equitization, and Renewables; India Second Rural Electrification; and Mexico Methane Gas Capture).

d. For eight projects, including the GEF medium-sized projects in Hungary and Uruguay, a global environmental objective was not applicable. The supervision documents for three projects did not provide a rating for the achievement of this objective.

e. GEF only: Mexico Methane Gas Capture.

others are making only minor progress, if any. As table 4.3 shows, the major ongoing and recently closed NRE projects present a contrasting picture in terms of performance. The evidence that the Bangladesh project will far surpass its original target has led to the establishment of an even higher goal for solar home system (SHS) connections. The China RED project has already gone beyond its target for PV systems, and the Sri Lanka Renewable Energy for Rural Economic Development (RERED) Project is on track to meet its installation goals. As a result of the first India RRD project, the NRE share of total generation grew from 0.4 percent in 1995 to 3.4 percent by 2001, for which the RRD project was a significant contributor. Similarly, in Sri Lanka, NRE grew from zero percent prior to the ESD project to 124 MW either commissioned or under construction by September 2005 (compared with total generation capacity of about 2,000 MW). China has more than 30,000 MW of small hydro and plans to increase NRE share of total generation to 15 percent by 2020.

In contrast, the Argentina, India Second Rural Electrification, Nicaragua, and Uganda projects have been lagging behind in meeting their PV system sales or small-hydro development objectives. The first two projects have chronically lagged behind to the point that their closing dates were extended. This uneven performance has implications for their ultimate poverty-reduction impact.

Grid-connected projects are not necessarily easier to implement than off-grid NRE projects. NRE projects that supply power to the grid are sometimes assumed to be relatively easier to design and implement than off-grid projects. However, this is not necessarily the case, particularly when the overall energy sector regulatory framework and tariff structure are taken into account (see chapter 5).

Grid-connected RETs exhibit different characteristics than off-grid technologies (see table 4.4), which need to be taken carefully into account during project design and supervision to yield successful outcomes. A review of the latest supervision reports for six NRE projects (two closed and four ongoing) in Sri Lanka, India, China, and Uganda show that both grid and off-grid components had satisfactory ratings (moderately satisfactory in Uganda) for implementation progress and PDOs.[2]

Delivering off-grid NRE services has been a challenging course for the Bank, given that the requirements, costs, and benefits of those services are quite different from those of

Table 4.3: NRE Projects' Dissemination Targets

Country (and fiscal year approved)	RET	Target (in PAD)	Achieved	Closing date
Argentina (1999)	Solar PV for households Solar PV for public institutions Small wind off-grid systems for households and institutions	65,000 households 1,100 public institutions 3,500 house-holds/ institutions	1,900 households[a]	Original: 9/30/2005 Revised: 12/31/2006
		Revised: 30,000 households		
Bangladesh (2002)	Solar PV	64,000 households (*revised* to 200,000) (Baseline = 250)	53,000 households[b]	6/30/2008
Bolivia (2003)	Solar PV	15,000 systems	0[c]	12/31/2007
China RED (1999)	Wind	2,618 GWh	685 GWh/year electricity generated from (baseline = 526)	6/30/2007
	Solar PV	10 MWp 353,000 units	7.8 MWp[d] 356,000 units[d]	
India Second Rural Electrification (2000)	Small hydro	200 MW	69.4 MW[e]	Original: 3/31/2006 Revised: 3/31/2007
Lao PDR (1998)	Solar PV and micro-hydro	4,600 households	6,097 households	Closed 12/2004
Nicaragua (2003)	Mini- and micro hydro-based independent grids	2 MW total installed capacity	0[f]	12/31/2008
	Solar PV	100 kW of installed PV capacity—all types of users	7.6[f]	
	Solar PV or mini-grid	7,000 new connections	104[f]	
Sri Lanka RERED (2002)	Grid-connected small-hydro, wind, and biomass	Additional 85 MW installed capacity (baseline = 31 MW)	An additional 85 MW operating or under construction[d]	6/30/2008
	Solar PV and village hydro	Electricity access to an additional 100,000 households and 1,000 SMEs and public institutions (baseline = 22,685 households)	An additional 83,773 SHSs; 4,594 households served by village hydro[d]	
Uganda (2002)	Hydro	15-MW capacity installed or under installation	14 MW under construction[g]	8/31/2006
	Solar PV	320,000 cumulative Wp sales of PV systems to households/ institutions	19,000 Wp installed[g]	

Source: Implementation Status Reports and Project Appraisal Documents.

Note: PAD = Project Appraisal Document, SME = small and medium-size enterprises, GWh = gigawatt hour, MWp = peak megawatt, Wp = peak watt, SHSs = solar home systems. Notes below indicate Implementation Status Report dates.

a. November 9, 2005.

b. December 5, 2005.

c. November 21, 2005.

d. December 31, 2005.

e. January 24, 2006.

f. February 7, 2006.

g. December 21, 2005.

Table 4.4: Characteristics of Grid-Connected and Off-Grid NRE Projects

Criteria	Grid-connected	Off-grid
Cost to financing institution	Moderate (*Sri Lanka ESD* mH: US$ 963.5/kW; *India RRD* SH: $990/kW, wind: $1,150/kW)	Substantial–high (*Sri Lanka ESD* PV:11/Wp; vH: $2,060/kW; *India RRD* PV: $4.8-$14.2/Wp)
Regulatory requirement	Substantial–high (predictable, supportive environment, such as sector reform, tariff rationalization, and small power purchase agreement)	Low–moderate ("light-handed" regulation, tariff determination for low-income areas)
Social requirement (community and NGO participation)	Low	High
Institutional requirements for financing	Substantial (public-private partnerships, commercial banks, medium-large firms)	High (public agencies, private banks, village cooperatives, microfinance institutions)
Capital needs	High (large up-front investments, long repayment periods)	Substantial (grants for system affordability, working capital for private firms)
Pace and magnitude of increased energy provision	Substantial–high (faster pace, wider coverage)	Moderate (slower pace, less coverage)
Service reliability	Substantial (higher energy levels, more hours of availability)	Moderate–substantial (low energy levels, limited hours of availability)
Economic rate of return[a]	High (*Sri Lanka ESD* mH: 26%[b] *India RRD* SH: 28–33%)[c]	Low–high (*Sri Lanka ESD* vH: 61%, PV: 42.6%[b] *India RRD* PV: 14–108%)

Source: Implementation Completion Reports, Project Appraisal Documents, and Project Performance Assessment Reports.

Note: NGO = nongovernmental organization, mH = mini-hydro, SH = small hydro, vH = village hydro, Wp = peak watt.

a. Includes environmental benefits, such as GEF support for off-grid renewable technologies, and consumer surplus, unless otherwise noted.

b. The calculation is for avoided cost only.

c. Does not include global environmental benefits or consumer surplus.

providing grid-connected NRE. Despite a possible impression that the implementation of grid-based NRE poses less difficulty, it should be noted that creating policy and regulatory environments that support grid-connected renewables has remained a significant challenge.

The importance of a conducive environment at the national level can be seen from the experience of some of the ongoing projects. A factor that has adversely affected the India Second Renewable Energy Project is the regulatory uncertainty that private developers face as a result of legislative changes at the state level. There has been a request from both private and public stakeholders for assistance to determine prices for power from renewables, and the Bank has offered its help. However, not all the borrower agencies have been cooperative.

In Uganda, grid-connected and bagasse-based energy generation has taken longer to implement than expected largely because of the time required to negotiate a power purchase agreement. But with the approval of agreements, investment has been increasing significantly.

In Sri Lanka's case, a small power purchase agreement (SPPA) was developed during the first project, Energy Services Delivery, and had notable positive impact on mini-hydro investments for the grid. But while the follow-up RERED project has been proceeding well, the lack of explicit policy support for renewables in the country places the sustained growth of the subsector in question.

Some supportive policy decisions have been made for NRE, often in response to lobbying by sector groups. However, these are likely to have limited impact, as they have not been given any financial support and have gone unimplemented. These decisions, moreover, have been made without taking into account a broader vision and policy for the sector.

As the portfolio grows in size and more NRE projects close, the differences in objectives, outcomes, and impacts between rural electrification, off-grid NRE, and grid-connected NRE interventions should be closely evaluated. Rural electrification interventions focus more on poverty reduction and broad improvement of the quality of life of consumers. Grid-connected NRE projects, in contrast, have a stronger potential for reducing GHG emissions and contributing to energy security. Off-grid NREs remain a subset of rural electrification and have their own specific challenges, such as the effectiveness, efficiency, transparency, and targeting of subsidies, and better integration with the larger rural electrification program.

Larger-scale, grid-connected NRE projects, however, are concerned more with the overall enabling environment (policy, regulations, pricing, and financing), because, given an adequate tariff regime as well as transparent and predictable regulations, many NREs can be competitive without subsidies. Therefore, future assistance strategies may differ, depending on the type of NRE intervention. That makes it important to continuously derive findings and lessons from the NRE portfolio, with a view to adapting the Bank's NRE assistance strategy to be more responsive to country client needs.

Economic rates of return (ERRs) for closed NRE projects vary considerably but are generally favorable. In the India RRD Project (1992), rates of return for small hydro and solar PV systems were 28 to 33, and 14 to 108 percent, respectively. The ERR for wind energy was 14 percent[3] (these figures include the GEF cofinancing for wind and solar PV).

In the Sri Lanka ESD Project (1997), ERRs for village hydro and solar PV were 61 and 42.6 percent, respectively, while for wind energy the ERR was only 3.9 percent (these figures include the GEF cofinancing for all three technologies and consumer surplus for village hydro and PV). Annex F provides additional details on ERRs for the projects in India, Sri Lanka, and two other countries.

An important observation is that ERRs at project completion tended to be higher than appraisal estimates, suggesting that costs were lower or that benefits were higher than estimated at appraisal. If the benefits to consumers were higher, further study is merited, and the importance of strengthening monitoring and evaluation (M&E) in NRE projects is further underscored.

The GEF funds for off-grid projects were provided for barrier removal and offered on the basis of performance. In the economic analyses of these projects, the GEF funds were used as a proxy to value the global externality. With GEF support, NRE electricity-generation schemes can provide substantial economic returns, especially when consumer surplus benefits are included, as they are in the figures for solar PV and for small hydro in Sri Lanka. However, full commercialization of NRE has not yet been achieved, and the rates of return would be significantly lower in some cases in the absence of financial incentives or subsidies.

It is important to note that subsidies for conventional energy-based electricity, such as lifeline rates, are a generally accepted practice. The absence of a level playing field between NRE and conventional energy remains a contentious issue in the Bank's energy practice, as the

interviews and literature review for this assessment have found.

Some potential factors of performance have emerged in selected NRE projects. Satisfactory NRE outcome ratings tend to be associated with several elements: strong government commitment; effective Bank performance, including adaptability based on high-quality supervision; extensive consultation and participation with entrepreneurs, consumers, and nongovernmental organizations (NGOs); effective credit and output-based (GEF) grant-financing mechanisms for the private sector; efficient credit arrangements for grid NRE financing and consumer access to off-grid NREs; strong capacity before the project or as a result of its activities; focused attention to addressing the market barriers to renewables; and strong interest from local investors and financiers. Recent freestanding (NRE only) and rural electrification (grid and off-grid) projects, which aimed at commercialization through the private sector, exhibit these factors and performed well.

In contrast, neglect and lack of commitment led to unsatisfactory performance. Projects that have performed poorly tend to be associated with inadequate attention to ensuring a conducive policy and regulatory environment for NRE, weak country or implementing agency commitment, a private sector that is hesitant to take risks, weak Bank performance, insufficient capacity of public and/or private institutions, and sociopolitical or economic crises in the country.

Poor supervision may also be part of the reason small NRE components in conventional energy or water sector reform projects did not achieve their objectives, as unsatisfactory outcomes for the components tended to occur at the same time as unsatisfactory ratings for Bank performance. However, if the Bank is to scale up NRE components in nonenergy sectors (for example, education and health) where NRE solutions can provide important energy services, other factors may be involved that need closer study.

Results in Terms of Poverty Reduction

The poverty-reduction impacts of the Bank's NRE projects are largely nonevaluable, mainly because of weak or absent M&E. Partial evidence, however, suggests highly mixed poverty-reduction outcomes. This is because some ongoing and closed projects have exceeded their installation targets, while others have only made minor progress, if any. The review also found that the poorest of the poor have been unable to benefit because the costs of energy delivery remain prohibitive for them. See annex G for the detailed review.

Although the EBRS strategy anchors the Bank's support for NRE partly on poverty reduction, only one closed NRE project included poverty reduction as a *stated* objective. This said, by pursuing the improvement of energy access, poverty reduction was a major *implied* objective in NRE assistance through welfare improvements, enhanced livelihoods and incomes, and/or promotion of rural transformation.

As shown in table 4.3 on the pace of RET installations in ongoing and closed projects, the poverty-reduction outcomes of the Bank's NRE interventions are highly mixed, based on the degree to which installation targets have been achieved. For example, through NRE power provision, the Argentina, Nicaragua, and Uganda projects have sought to reduce poverty by implementing quality-of-life improvements, fostering small businesses, and spurring rural transformation, respectively. But their poverty impacts have been small because of the minor progress being made to date in NRE installation.

Weak M&E for poverty-reduction outcomes in the Argentina and Nicaragua projects will make it difficult to assess whether these projects have contributed to reducing poverty. Targets for small hydro in the Sri Lanka and India NRE projects were exceeded, but solar home systems in five projects fell short of their targets by significant amounts.

The poverty-reduction impact of NREs, however,

has multiple dimensions and needs to be assessed beyond the level of household incomes. This need underlines the importance of adequate M&E. The activities of NRE entrepreneurs, service providers, and investors can have significant poverty-alleviation outcomes.

For example, the China RED Project supports 34 companies that are selling 120,000 PV systems with a gross value of about $24 million annually. These companies have set up about 12 rural retail outlets each and employ 60–90 staff each. In addition, more than 100 companies are supplying goods and services to these 34 companies.

In Sri Lanka, 13 solar PV companies, through more than 100 rural outlets, are selling 24,000 solar PV systems, with $10 million equivalent in gross revenues annually. Moreover, 35 private hydro development companies have invested in about 115 MW of private generation (with gross revenues of about $15 million/year), and 10 financial institutions are lending for NRE.

India now has a robust and growing renewable energy manufacturing, design, and engineering operation and maintenance capability compared with the conditions in 1993 (details are in section 4.5 of the ICR). Similar experiences are emerging from the Latin America and the Caribbean and the Africa Regions.

Compared with decentralized power systems based on NRE, wood fuel supply projects were more likely to have reached households at all income levels because they involved whole communities in forest management and the wood fuel trade. It should be noted, however, that evaluating the impacts at the household level for these electricity-supply projects is difficult, because M&E systems in the projects have been absent or weak. None of the projects, for example, provides data on household income. Although increased income is a goal for recent projects, only a few have M&E systems that will be able to identify the income gains attributable to increased energy access.

In recent years, the Bank, through ESMAP, has been developing methods and tools to better assess the socioeconomic impacts of improved energy access. The methodology developed by ESMAP is not technology specific; it is outcome based. Where applicable, ESMAP used the consumer surplus methodology, thus enabling it to capture the impact of technological change. Although these approaches are being employed in some of the latest NRE projects, such as those in Bangladesh and Uganda, they are quite recent, so it is still unclear if the Bank's assistance to improve access through renewable energy has reduced poverty to any significant degree. This is a major analytical gap. Addressing this data vacuum is critical in mapping out and targeting the Bank's expanded NRE lending.

To What Extent Were Global Environmental Benefits Achieved?

The global environmental benefits of most Bank NRE projects have generally met expectations, but M&E is weak or absent in many cases. Together with GEF financing, the Bank pursued the EBRS objective of protecting the environment by removing market barriers to renewables. As table 4.5 shows (see also annex H), out of five closed projects, three met or nearly met their appraisal targets and one exceeded its estimated reductions.

One project in Indonesia, which fell far short of its target, was severely affected by an economic crisis in the country, as is the ongoing project in Argentina. Because of weak M&E, data on the projects' environmental impacts are limited: about a third of the closed projects provide little or no data. Overall, the limited evidence from NRE project documents shows that targets for the reduction of GHG emissions were largely not met. However, although many GEF projects have not implemented well-structured M&E protocols, reductions in GHG emissions have become a less-important measure over time in the GEF framework. Rather, what counts are the *reductions of market barriers,* which is what the M&E systems in GEF projects should try to measure.

Table 4.5: Data on Reductions in Greenhouse Gas Emissions from NRE Projects (metric tons)

Project	Targeted reduction		Actual reduction
Argentina (closing 2006)	25,000		310
Bangladesh (closing 2008)	257,664 (over 15-year life, by replacing kerosene, through grid & off-grid)		Not reported
Bolivia (closing 2007)	14,000		0
China RED (closing 2007)	*Targets (MT)*	*Baselines (MT)*	Not estimated at midterm
	CO_2: 38.6	CO_2: 11.1	
	SO_2: 4.41	SO_2: 1.57	
	NO_x: 0.119	NO_x: 0.035	
	TSP: 0.213	TSP: 0.076	
Indonesia SHS (closed)	1.3 million (over 15 years)		9,000 (over 15 years)
India RRD PV component (closed)	116,000 (over 10 years)		94,000 (over project lifetime)
Lithuania Geothermal Demo (closed)	52,000		46,000
Nicaragua (closing 2008)	10,000		Not reported
Sri Lanka ESD (closed)	140,000 (excluding reductions from mini-hydro)		514,000 (total including hydro)
Sri Lanka RERED (closing 2008)	1,250,000		900,000
Tunisia Solar Water Heating (closed)	18,000		25,000

Source: Implementation Completion Reports for closed projects and latest available Implementation Status Report for ongoing projects.
Note: CO_2 = carbon dioxide, SO_2 = sulfur dioxide, NO_x = nitrogen oxides, MT = metric tons, TSP = total suspended particulates.

Regarding the Bank's carbon finance operations, the Bank pioneered the design and implementation of rigorous M&E protocols to measure and verify GHG emissions. The Carbon Finance Program, which is relatively new, is outside the scope of this review and will be covered in the planned IEG climate change study (fiscal 2008).

Addressing both energy efficiency and renewables makes sense. According to a recent evaluation of the GEF Climate Change Program (GEF 2004), the direct contribution renewables have made and will be able to make to global climate change prevention is not substantial. PV systems, which feature heavily in the Bank's off-grid electricity provision and rural electrification projects, have a low impact on GHGs.

In the NRE subsector, the systems that have had the largest effect in reducing carbon emissions and that have the potential to make the largest contribution in the future are grid-connected ones. The global environmental impact of NRE projects is likely to be greatest when projects catalyze the creation of NRE markets and reduce market barriers—or, at the local level, if they focus more on addressing beneficiaries' environment-related concerns. There can be win-win solutions that address both local and global environmental issues; for example, clean fuels for urban transport could significantly reduce urban air pollution and the negative health impacts on the poor.

However, preliminary evidence gathered by the GEF study suggests that increased energy efficiency may be more effective in reducing GHG emissions. Table 4.6 shows the greater cost-effectiveness GEF has achieved in energy efficiency projects compared with those in renewable energy for preventing climate change. Energy efficiency projects have been found to yield greater net economic benefits than NRE projects.

The study concludes that more emission reductions have resulted, and will result, from Bank-GEF energy efficiency projects than from

Table 4.6: Energy Efficiency Measures Cost-Effective in Reducing Greenhouse Gas Emissions

Cluster	GEF, US$ per ton CO_2	GEF, US$ per ton carbon
Energy efficiency	0.21	0.77
Renewable energy	0.63	2.29

Source: GEF 2004.

NRE projects (GEF 2004). It is anticipated that ongoing energy efficiency projects will better reduce GHGs than those in any other energy subsector, accounting for two-thirds of the total lifetime reductions of 1.7 billion tons of CO_2.[4] In contrast, the renewable energy subsector, which contains a larger number of projects than energy efficiency, will produce only a quarter of the overall GHG impact (GEF 2004).

The foregoing findings, however, have been the subject of much debate and should not necessarily suggest that the Bank should focus on energy efficiency instead of NRE. In weighing energy efficiency versus NRE, it is important to consider timescale. Over the 40- to 80-year time horizon where the most significant reductions in GHG emissions will be required, both energy efficiency and NRE (along with physical and biological carbon sequestration) will need to play a role. Energy efficiency alone will not enable the desired reduction levels to be reached; the large-scale deployment of low-carbon and no-carbon energy sources will also be a requirement.

Moreover, although there are cost-effectiveness differentials as cited in the GEF report, both GEF energy efficiency and GEF renewable energy interventions are highly cost-effective by any measure under the Kyoto Protocol. Finally, unlike the Bank's Carbon Finance Program, the GEF's role is to remove market barriers in order to leverage considerably more NRE investments beyond a particular project. For example, under the follow-up to the China RED Project, the government is planning a village electrification program to provide off-grid PV services to inhabitants of 20,000 villages. According to the government, this will require up to 200 MW of PV, or 20 times the capacity to be installed under the earlier project.

Outcomes Related to PSD and Promotion of Good Governance

The Bank's effectiveness in facilitating PSD in its NRE portfolio has been substantial, and particularly high in recent projects. (See annex I for the evaluation of the portfolio's PSD performance.)

Bank-financed projects have helped remove market barriers and establish processes for NRE commercialization in several ways. They have consistently promoted PSD through a flexible approach of supporting various NRE technologies and business models for their delivery. They have developed NRE policies, involved diverse stakeholders, and strengthened local financial institutions to provide long-term financing for rural energy businesses. The business models have been sales based and have involved consumer credit (dealer or end-user credit; lease or hire-purchase schemes) and fee-for-service approaches, with the credit model performing better than service fees for solar PVs. The NRE policies developed have included those for standards and certification, as well as the standardization of SPPAs to reduce investor risk and boost their confidence.

The Bank has also supported local financial institutions and mobilized investments, often through public-private partnerships. In Sri Lanka, the Bank was especially successful in promoting the role of local commercial and development banks in financing private developers. As a result, subsidy-free NRE commercialization has begun to appear.

For promoting biofuels and greater efficiency of traditional wood fuel use, the Bank has helped develop the private sector, involving firms in the creation of ethanol-based gel fuel and improved cookstoves and bringing wood fuel markets

under improved regulation and governance. This has benefited rural communities that act as private entities in supplying wood fuel.

In the design of successful NRE projects, the Bank has employed complementary interventions to help commercialize NRE technologies, as follows:

- Promoting private competition
- Encouraging cost-effectiveness through economies of scale
- Mobilizing financial resources through public-private partnerships
- Providing output-based aid (OBA) for gradual phase-out
- Verifying and improving the technical performance of NRE systems to ensure quality standards in the market and boost consumer confidence
- Demonstrating the commercial viability and utility of NRE
- Using sales models for the delivery of renewable energy technology
- Involving the beneficiary communities.

Most of the electricity-oriented NRE projects have used several of these interventions as components that complement one another.

OBA,[5] financed through GEF grants, was used in selected projects as a mechanism to ensure that RET installation and service met dissemination volumes and quality standards. Some projects have explicitly sought to boost consumer support and demand for renewables by improving the technical performance of RETs.

OBA appears to have helped increase consumer confidence in the private provision of NRE, although concrete evidence is limited because of the lack of M&E for private sector activities. Some progress is being made in a few NRE projects, such as the M&E reports by the Indian Renewable Energy Development Agency and the NGO Dian Desa in Indonesia, as well as surveys done in Sri Lanka.

However, M&E remains a major gap that needs to be addressed if the Bank is to build on its PSD successes, as OBA approaches are particularly M&E-intensive—especially so in the highly decentralized NRE projects. Worth noting is the innovative approach of the Bolivia NRE project, wherein the private sector operators will be collecting social and economic data annually from the consumer households during their required technical visits.

The Bank's effectiveness was modest with respect to the EBRS goal of promoting good governance and creating regulatory environments conducive to NRE (as discussed immediately below). More recent projects, however, and ESMAP assistance have started to address the issue. In some cases, institutional weaknesses have been constraining factors. Public partners have been weak, and private investors lacked experience and readiness.

Main Lessons Learned and Strategic Implications for the Bank

The Bank's NRE interventions are anchored in the larger EBRS pillars and are well focused on its goal of reducing poverty, promoting PSD, contributing to global environmental protection, and improving macro-fiscal balances.

The Bank's NRE strategy is relevant to developing country energy priorities. As reconfirmed during the Bank's 2006 Energy Week, the Bank and the donor community need to help address the dire energy predicament of developing countries by acting on all fronts, including petroleum, clean coal, hydropower, biomass, energy efficiency, and renewable energy. The 2006 Energy Week also highlighted the need to diversify supply and how NRE is a part of the supply diversification strategy that leads to least-cost supply.[1]

Although the NRE strategy continues to be relevant, there are important implications with respect to its implementation, based on the lessons learned from older NRE projects (which have had a mixed performance) as well as more recent projects (which to date have mostly been performing satisfactorily). These lessons, what is working and what is not, and their strategic implications are discussed below.

Lessons learned in older projects have led to better NRE project designs; the scaling up of NRE lending should be matched by broader lesson learning to ensure continuous design improvement. As the Bank scales up its NRE involvement, it is important to ask whether the newer projects have benefited from applying the lessons of earlier projects.

The interviews and portfolio review showed that important lessons of experience emerged from earlier, major projects—notably the India RRD Project (fiscal 1993–2002), the Indonesia SHS Project (fiscal 1997–2001), and the Sri Lanka ESD Project (fiscal 1997–2003)—and that more recent projects drew on them to develop improved designs. The five main lessons learned over the span of the NRE portfolio are described below.

- ***Lesson One:*** To enhance development outcomes, NRE provision needs to be accompanied by supporting inputs and services from social service institutions and small and medium enterprises.

Drawn initially from the experience of the Sri Lanka ESD project, this lesson has continued to influence the design of several later NRE projects, in Argentina, Bangladesh, Bolivia, Nicaragua, Sri Lanka (for the follow-on RERED

project), and Uganda. These projects have sought to support business, microfinance, social, and information and communication (ICT) services alongside NRE provision.

At a broader level, this learning is reflected in the evolution of the Bank's approach from primarily supporting welfare enhancement by disseminating NRE systems to households to also promoting wider-scale social development by making NRE available to clinics and schools; income generation through a connection with productive uses; and the supply of other services, such as ICT or business development, to encourage broader rural transformation and larger-scale poverty reduction. Internal and external research on the possible contributions of NREs to poverty reduction also informed this shift in the Bank's design approach.

- ***Lesson Two:*** Reliable credit services are needed to make NRE systems affordable to rural households.

This lesson has also significantly shaped the design of the Bank's NRE projects. In the Sri Lanka and Indonesia projects, PV dealers had difficulty providing credit services, and large financial institutions in the case of mini-hydro schemes are averse to supporting such schemes. As an adaptation, the Bank gave NGOs with strong capacity to provide microcredit services an important role in NRE dissemination.

This lesson significantly shaped the design of the Bangladesh project and the Sri Lanka RERED projects, which included microfinance NGOs from the start. Part of the value of partnering with such NGOs was found in the lower financial incentive these organizations required to serve remote, low-income areas compared with private firms. This lesson was also learned in the Argentina project, where large concessionaires were reluctant to serve poor areas but cooperatives and public agencies offered to do so. As a result, a later project in Bolivia was designed to support different kinds of contractual arrangements, including those with local cooperatives and NGOs for off-grid areas, where the market attractiveness may be low.

- ***Lesson Three:*** A policy and regulatory framework conducive to NRE needs to be in place for widescale adoption to be successful.

This lesson was present in the ICRs of all the earlier projects in India, Sri Lanka, and Indonesia. In the Sri Lanka ESD project, the successful, standardized SPPA was developed based on similar work that the Bank supported earlier in Indonesia under the second NRE project. In later projects in Argentina, Bolivia, and Nicaragua and the China Renewable Energy Scale-Up Program (CRESP), policies and regulations supportive of NRE had been established prior to the project.

In Latin American countries, ESMAP assistance helped create appropriate and coherent frameworks for tariff setting, quality of service, technical standards, and delivery service obligations. It also helped improve regulatory enforcement and supervision before the projects became effective. The CRESP is perhaps the most successful example of this approach, as it includes a mandated market share for renewable energy, for which the Bank invested considerable time during project preparation.

- ***Lesson Four:*** Building the capacity of key stakeholders is an important factor in developing the environment for NRE commercialization and ensuring service quality.

The designs of the more recent NRE projects have incorporated strengthening the capacity of stakeholders (private dealers, public agencies, and financial institutions) to foster NRE commercialization and enhance service quality. In the Indonesia SHS project, institutional capabilities were developed to technically certify and establish national components standards for SHS. In the Sri Lanka ESD project, capacity development for the private sector, government agencies, and NGOs was undertaken, first on a piecemeal basis but later on a scaled-up basis. This provided knowledge on the RETs and for risk analysis, implementation, and monitoring.

Based on these successes, a number of later projects have pursued broad-scale capacity development. The Uganda Energy for Rural Transformation Project, for example, has provided training for public agencies, NGOs, business development, and social service agencies to coordinate other inputs, and for the monitoring of development impacts. Capacity development in the China RED Project has targeted the technical, policy, and institutional issues related to wind energy; it has also sought to improve the abilities of solar PV companies in marketing, sales and service network development, after-sales service, financial management, and system testing and certification.

- ***Lesson Five:*** To promote project ownership and rapid market development, the Bank should support stakeholder and community participation and demonstrate that this can lead to flexibility in project design and implementation.

Another feature of recent projects is the Bank's wider consultation with stakeholders, which has led to support for community participation and an associated flexibility in project design and implementation. One of the major reasons for the success of the Sri Lanka ESD project was that management was adaptive, enabling it to try new approaches to resolve the difficulties it encountered. For example, faced with low sales of SHSs and a lack of credit for rural households, the project expanded the role of microcredit institutions in servicing rural areas.

This flexible approach can be seen in the Bangladesh and follow-up Sri Lanka projects. According to the design of the former, one of the implementing agencies will solicit requests for proposals from consumers, communities, and companies on how to respond to market conditions and develop ideas for this purpose. The off-grid market development program will be prepared in consultation with representatives of microcredit institutions, consumers, other agencies, and stakeholder communities and include support for activities such as public information campaigns, capacity development of SHS dealers, and creation of new mechanisms for consumer financing.

Similarly, in the design of the Sri Lanka RERED project, stakeholders have been given a strong voice on the use of TA funds so that innovations for a sustainable renewable energy market may develop. Moreover, a community participation approach was used to give households a strong say in decisions regarding the choice of NRE systems, financing, tariffs, system maintenance, and other issues.

An important lesson of this evaluation is that PSD alone cannot lead to improved energy access. Public-private partnerships that integrally involve NGOs and the consumer communities are essential for promoting NRE and reaching the poor.

Growing evidence points to the private sector's effectiveness in delivering rural energy services—but only through public-private partnerships that include community organizations and consumer groups. Household energy projects, in particular, have sought to engage rural communities as private actors in the supply of wood fuels to urban consumers. However, the private sector working alone cannot directly improve energy access for the poor. Where projects relied solely on the private sector to increase energy access, achievements in reaching rural communities were poor. In the Sri Lanka ESD Project (1997), for example, involvement of a key NGO became necessary for PV system consumers to receive financing, which private solar companies were unable to provide.

The Bank's "brokering" and advice helped promote NRE and led to improved project design. In 1992, the Bank and donor partners established the Asia Sustainable and Alternative Energy Program (ASTAE) to support mainly the identification and preparation of NRE projects, and to a lesser extent their implementation and evaluation. By the period 1998–2000, ASTAE had succeeded in facilitating the inclusion of alternative energy in the Asia Region's energy lending program, reaching 12 percent of power lending during that period.

In 2002, ASTAE's goals were refocused toward the achievement of the Millennium Development Goals, and in 2004–2006, its business plan was reoriented away from inputs (dollar lending) toward outputs. Examples of outputs include an increase in the number of households with access to energy, installation of NRE-generating capacity, avoidance of conventional electricity-generating capacity, establishment of energy service companies, and reduction of CO_2 emissions.

ASTAE's 2005 Annual Report (World Bank 2005b) provides information on the positive results to date, which include the enactment of the Chinese Renewable Energy Law and the establishment of the first three energy service companies in China. ASTAE's experience in China is having an important demonstration effect in other countries. ASTAE has also pioneered the funding of three resident staff in China, Indonesia, and Vietnam and the preparation and launching (jointly with ESMAP) of six national programs[2] under the Global Village Energy Partnership.

Effective analytical and advisory assistance (AAA)—a large amount of it under the donor-funded ESMAP—has also been an important factor of performance in successful Bank NRE projects. Almost all NRE projects had AAA associated with their preparation and appraisal. This assistance ranges from market assessments to the development of standardized SPPAs or workshops for stakeholders and practitioners.

The direct, positive impact of AAA on NRE promotion is substantial, and country beneficiaries have been diverse, based on the literature review and a small survey. Many examples of ESMAP's AAA for NRE projects were provided earlier in this report.

But the Bank needs to internalize AAA and brokering costs. Many challenges remain in ensuring that the Bank's AAA keeps pace with new issues as the NRE portfolio is scaled up. A complex AAA agenda lies ahead for NRE.

Because AAA is an important tool of quality assurance, the Bank should internalize its costs, particularly those that directly affect project design and implementation and are therefore part of the Bank's own work. This step would be in contrast to depending mainly on bilateral donor grants and trust funds, which are intended to benefit the country clients and not substitute for the Bank's internal budget. These external funding sources include the consortium of ASTAE and ESMAP, project preparation funds from the GEF or Japan's Policy and Human Resources Development Fund, and various bilateral donor trust funds. This heavy reliance on external funding has created disconnects and time lags between meeting the country clients' needs quickly and fulfilling the procedural and fiduciary requirements of mobilizing external funds.

ASTAE's role of "NRE business incubator" has now matured through the increasing number of Bank-GEF projects, and these activities could be mainstreamed into the Bank's own budget as part of its core business. In addition, ASTAE's funding could instead increasingly focus on (a) improving M&E, particularly in NRE projects with OBA components; (b) conducting two or three rigorous impact evaluations, possibly for the closed China, India, and Sri Lanka projects; and (c) strengthening local capacity in these areas.

The Bank should also strengthen M&E considerably, including carrying out rigorous impact evaluations for selected projects, because of the continuing debate surrounding the benefits of NRE provision.

On one hand, it is widely accepted in the international community that the provision of modern energy is an intrinsic requirement of development. Hence, the allocation of resources should really not be framed as a choice between energy *or* other (social) sectors; energy is a complementary input to investments in those sectors. However, research also shows that the impacts from electricity investments, in terms of the number of people brought out of

poverty, are less than those from investments in education, road infrastructure, agricultural research and development, and telecommunications (Fan, Hazell, and Thorat 1999; Fan, Zhang, and Zhang 2002).

The literature survey carried out for this review shows that the research is inconclusive on whether NRE investments achieve poverty reduction. While electricity access has, overall, led to quality-of-life improvements and has made some, but not major, contributions to incomes, in some cases it has had no effect. In others it has had an adverse one on the poorest (Cook and others 2004). In many areas of the developing world, the poverty impact of renewables has been minimal.

According to literature on NRE in rural China, some of which was produced as inputs into Bank project preparation, household PV system use in remote areas of China has had little, if any, impact on poverty (van der Linden and others 2003). These systems—or rather the electricity they produce—are desired by rural households because they end the sense of social exclusion in a country that is more than 90 percent electrified (IDS 2003). The electricity from PV systems does provide some intangible gains, such as the ability to gain information from TV and in some cases to study at night (though one author has reported that the quality of lighting is too poor to allow this [van der Linden and others 2003]). These gains may in turn bring livelihood improvements in the distant future.

The Bank's NRE program needs to be better integrated with the Bank's work on energy sector reforms. Integration of NRE with larger sector reforms—particularly on transparent and predictable regulation, as well as economic pricing of alternative petroleum fuels—has been neglected by the Bank. Early in the EBRS implementation, the Bank paid inadequate attention to creating a nondiscriminatory regulatory environment for NRE—despite its parallel push for energy sector reforms in general. This caused adverse effects on some NRE schemes, as was experienced by private small hydro developers in India (IEG 2003a).

Even today, the key regulatory and pricing ingredients for successful NRE promotion have deteriorated in some states in India; for example, legislative changes and regulatory uncertainty have adversely affected the second NRE project. With ESMAP assistance, NRE projects have now started to address regulatory issues. Institutional weaknesses and lack of readiness, experience, and incentives among local NRE investors to serve rural markets have also been constraining factors.

Regulatory improvements conducive to NRE commercialization have been the orphans of energy reforms. This works against the Bank's own NRE goals, because privatization and competition in power markets tend to weaken interest in serving rural markets, lead to a preference for petroleum-based fuels, and shorten time horizons for fuel choices. The Bank focused on the reform of large utilities and paid insufficient attention to the critical issue of reforming regulatory and policy environments for NRE, particularly during the early to mid-1990s.

The Bank did this to create objective, transparent, and nondiscriminatory regulatory mechanisms aimed at creating an energy market in which renewable energy could be competitive. But renewable energy competes—and is stunted—in markets with distorted prices for conventional energy sources, often through government subsidization of petroleum products. Additionally, where privatization and unbundling of the energy sector has not occurred or is incomplete, the true costs of grid-based rural electrification remain hidden because of implicit cross subsidies. Thus, the potential cost-effectiveness of off-grid NRE systems is hard to demonstrate without broader energy sector reforms that integrate renewable energy promotion.

Neglecting NRE in the design and implementation of energy reforms can have important

negative consequences that are difficult to reverse. This can be seen in the second India NRE project, which has sought to commercialize small hydro.

When the first project was approved in 1992, the prevailing regulations and tariff guidelines were adequate to support grid-connected NRE. However, after the Electricity Act was promulgated in 2003 and regulatory authority was moved to the state level, uncertainties started affecting the second NRE project, which had begun in 2001.

For the second project, the impact of the regulatory uncertainties stemming from the inconsistencies between national and state-level frameworks, the reform backsliding in some states, and the absence of a clear policy framework and future plans for NREs was not sufficiently addressed. Consequently, small hydro development was adversely affected, as continuing government policy shifts and uneven state adoption of national legislation deterred private actors from investing in NRE systems. This Bank inaction is partly due to the sharp division between the "sector reform team" and the "renewables team" in the Bank's energy practice, and the weak coordination between them.

The Bank did not begin to pay more attention to promoting policy and regulatory environments that are conducive for its NRE projects until about 2000. Since then, the Bank has had several successes in helping resolve regulatory and policy uncertainties. In the Sri Lanka ESD project, a standardized SPPA was developed under the project (based on similar work that the Bank supported in Indonesia under the second NRE project) and employed with the participating firms to resolve a tariff determination issue between the Ceylon Electricity Board and developers. As a result of the agreement, there was significant growth in the number of mini hydro investments.

In recent years, ESMAP—through its advisory and analytical assistance—has helped establish the regulatory frameworks for rural electrification, as is evident in Argentina, Bolivia, and Nicaragua. This assistance has helped put in place appropriate and coherent regulatory frameworks regarding off-grid electrification. It covers tariff setting, quality of service, delivery service obligations, technical standards, and other matters. The assistance has also helped regulatory agencies to enforce and supervise off-grid rural energy policies and develop detailed regulations in the context of national energy legislation. These are being incorporated into the design and implementation of rural electrification projects in these countries.

An additional feature of this ESMAP assistance is that it has involved and promoted the exchange of information and experience among policymakers of different countries.

Focusing on getting the regulatory and incentives framework right has proven more useful for getting project results than trying to get governments to enunciate a national renewable energy policy. This portfolio review found that the performance of an NRE project is not sensitive to whether the government has established a policy promoting renewables or not. For example, although policy support for renewables existed in India when the satisfactory RRD Project (1992) was approved, no explicit government support for NRE existed in Sri Lanka when the highly satisfactory ESD Project (1997) was implemented. Adequately addressing the regulatory and market barriers to private sector involvement is a factor of good performance, as is country commitment (what a government does), but a formal NRE policy (what a government says) is not.

NRE has only recently been mainstreamed in the Bank's Country Assistance Strategies (CASs) and operations. The Bank's support for NRE has been hindered by its limited mainstreaming in CASs. Based on a review of 24 CASs since 1995 for 8 countries where major NRE projects evaluated in this report were implemented (Argentina, Bangladesh, China, India, Indonesia, Nicaragua, Sri Lanka, and Uganda), only 10 mention NRE

development as a goal—and four of those were for India.

Despite comprehensive and innovative NRE projects implemented recently in Nicaragua, Sri Lanka, and Uganda, there was no mention of NRE in the CASs for these countries. However, the situation has improved in recent years, with a much larger number of CASs and Poverty Reduction Strategy Papers (PSRPs) in fiscal 2005 making a *substantive* reference to renewable energy.

The fiscal 2005 Renewable Energy and Energy Efficiency Progress Report (World Bank 2005d) indicates that 60 percent of CAS and PSRPs issued in fiscal 2004, and 74 percent of those issued in fiscal 2005, have specific references to renewable energy and energy efficiency. This momentum needs to be maintained, as it is clear that the Bank's ability to deliver on its global NRE commitments is predicated on support from the Bank's country units through clear strategic and budgetary signals to Bank staff.

The crisis in traditional biomass fuels remains the main energy issue for the world's poor. The heavy global dependence on traditional wood fuels is projected to grow; hence, biomass production on a renewable basis remains the top priority in meeting the energy needs of the poor.

This is most evident in Sub-Saharan Africa, which is dependent on traditional fuels for more than 60 percent of its energy supplies. In 2000, about half of the population in developing countries relied on traditional biomass for cooking and heating. Global evidence shows that poor people allocate most of their energy expenditure on cooking fuels. In 2003, it was estimated that 2.6 billion people will continue to rely on biomass despite efforts to substitute other fuels for it.

According to the Bank's Energy and Water Department, the Bank has done significant work on rural forestry, which is classified under community/ rural forestry projects rather than as energy projects. Community forestry projects reportedly increased from 19 in the 1980–1990 period to 72 in the 1990–2005 period. It would be important to assess whether this biomass work meets the energy-poverty goals that the Bank is pursuing. The Energy Sector Board needs to monitor and take stock of these activities to facilitate the integration of biomass energy within the NRE portfolio.

Overall, the Bank's support has led to increased country commitment to NRE, but strategic issues and challenges remain. Country commitment to NRE has grown where NRE projects have been implemented, often with GEF cofinancing. Borrower countries such as Sri Lanka and India, in which full-scale NRE projects were implemented, have engaged in follow-up projects, demonstrating their growing interest in NRE. In these and a growing number of countries, the governments have played more of a market-enabling than a market-making role.

Many developing countries, however, still see the energy sector as having a narrow purpose and still do not consider energy a priority. Energy is generally given inadequate importance (and NRE even less so) in national development frameworks and is viewed only within the context of large-scale infrastructure projects. The issue of energy access is usually absent from those frameworks.

Furthermore, development strategies tend to focus only on electricity and ignore rural energy needs. A United Nations Development Programme study of 80 Millennium Development Goal country reports found that only 5 percent discussed plans to expand new and renewable energy. In those few reports, the discussion was only in the context of the goal of environmental sustainability, not poverty alleviation. Only 5 percent discuss the link between energy, poverty, and rural development. In contrast, many more reports—25 percent—discuss energy efficiency for environmental sustainability (UNDP 2005).

Several strategic questions arise for the Bank as it tries to meet its commitment to scale up its NRE lending.

- Will certain regions and countries be priorities, and if so, which ones and under what criteria?
- If spreading out NRE assistance would no longer be possible under the new GEF Resource Allocation Framework, would the Bank's NRE work still be consistent with its poverty-reduction goal, as GEF resources move toward a much smaller number of (likely large) beneficiary countries than before?
- Will the selected NRE projects support the full spectrum of NRE commercialization and service delivery, or will investments be distributed among a much larger number of projects to fund mainly TA and market-development assistance, even though this may significantly defer the energy service delivery that is required to achieve consumer/investor confidence and market expansion?
- If the strategy to increase support for NRE is to be largely country driven, how will the Bank ensure that a 20 percent increase will result each year, when the main focus of many borrowing countries continues to be on conventional fuels?

Conclusions and Next Steps

The Bank's NRE strategy is relevant to developing country energy priorities. Its NRE interventions are anchored in the EBRS pillars—reducing poverty, promoting PSD, contributing to global environmental protection, and improving macro-fiscal balances.

As reconfirmed during the Bank's 2006 Energy Week, the Bank and the donor community need to address the dire energy predicament of developing countries on all fronts. This includes petroleum, clean coal, hydropower, biomass, energy efficiency, and renewable energy, which should be pursued, because it can be financially viable and sustainable if barriers are removed. With respect to renewable energy specifically, the much improved design and performance of recent NRE projects augurs well for the Bank's readiness to deliver on its Bonn commitments to increase its NRE support.

As the Bank scales up its NRE assistance, however, it would do well to focus on its demonstrated strengths in creating an investment climate conducive to commercializing NRE and promoting PSD through public-private partnerships and appropriate risk-mitigation structures. The Bank has a satisfactory scorecard in consistently promoting PSD, and it has been flexible in its approaches. Its stakeholders and the NRE technologies it supported also have been highly diverse.

The Bank helped remove market barriers by developing NRE policies (including on standards and certification) and various business models for NRE technology delivery (with sales models involving consumer credit performing better than fee-for-service ones). The Bank has played a key role in leveling the playing field between NRE and conventional energy technologies, and subsidy-free NRE commercialization has started to materialize.

Therefore, the Bank should focus on its strengths in building public-private partnerships. It should consider a series of operations and appropriate lending instruments to accommodate the long gestation periods for NREs, from institutional capacity building and policy/regulatory reform all the way to full commercialization. It should internalize—in its regional budgets and work programs—the operational costs of its successful "brokering" and advisory role for NREs.

The Bank's performance on other EBRS objectives has been weaker: experience in the

past 15 years indicates that the Bank's impact in helping the poor directly or achieving global environmental benefits through NRE promotion has been hard to measure because M&E has been notoriously weak or absent. But the little evidence that has emerged suggests that this impact is limited.

Good monitoring and impact evaluation systems should be established for energy services intended to help the poor. Renewable energy projects with output-based aid components should be the first targets. Rigorous impact evaluations should be carried out for selected renewable energy projects that are closing within the next two to three years.

An important first step would be for the Bank to include NRE objectives and work programs in CASs, which historically have given little attention to NRE. Bank management needs to clearly signal the relevance of NRE in country and energy sector strategies. As the Bank pursues its energy sector reform agenda, it needs to simultaneously address issues that hinder NRE development and commercialization. The key thrusts of the Bank's NRE assistance should be economic energy pricing, increased private financing, and effective regulation.

Moving forward, the Bank could do more of what works, which includes its strong lesson-learning, "brokering," and advisory record that has positively influenced recent NRE project design. As the Bank scales up its NRE assistance, it needs to foster innovation and flexibility by also disseminate more widely the lessons learned, with a view to achieving continuous improvement in the design and implementation of newer NRE projects. The Renewable Energy Toolkit released in 2006 is a step in that direction.

Wider dissemination of good NRE practices also presents (vis-à-vis other NRE financiers) a global leadership opportunity for the Bank, which distinguishes itself as being the largest financier of NRE (World Bank 2005c). For example, the Inter-American Development Bank, the Asian Development Bank, and the African Development Bank lend much less for NREs, about 1–2 percent of their total lending for the energy sector.

But the Bank also needs to do a better job of integrating its NRE program within its own work on energy sector reforms and architectures. To achieve this, the Bank's country units need to strengthen their support for the mainstreaming of NRE in the Bank's CASs and operations (a goal that the new ESMAP Renewable Energy Thematic Group could pursue further); assign due importance to traditional biomass fuels in addressing the needs of the world's poor; and integrate biomass projects better within the NRE portfolio.

Moreover, Bank management needs to give priority and resources to address the serious lack of M&E in its NRE projects, especially because the Bank is promoting OBA approaches that do require intensive monitoring of performance data. The Bank needs to internalize the costs of NRE "business incubation" as part of its core business. To this end, the Bank and the donors may also consider reorienting ASTAE's work program toward a stronger focus on capacity building to integrate M&E systems in NRE projects and rigorous impact evaluations for the NRE projects series in India, Sri Lanka, and China.

The NRE portfolio should benefit increasingly from self- and independent evaluations, given the strategic role that the Bank gives to NREs in improving energy access, particularly for the poor, as well as its joint global commitments with other donors. These assessments should focus rigorously on outcomes and impacts (while differentiating more sharply among rural electrification, grid-connected NREs, and off-grid renewables as the portfolio of closed projects expands) and have strong feedback loops that would allow flexibility and responsiveness in implementing the objectives of the NRE strategy.

ANNEXES

ANNEX A: THE BANK'S NEW RENEWABLES PORTFOLIO

Region/ country	Approved (fiscal year)	Project	Energy type	IBRD/IDA (project or NRE component, US$ millions)	GEF co-financing (US$ millions)
South Asia Region					
Afghanistan	2005	Emergency National Solidarity—Supplemental	Renewable	5.6	
Bangladesh	2002	Rural Electrification and Renewable Energy Development	SPV, H	17.19	8.20
India	1993	Renewable Resources Development/Alternate Energy	W, SPV	190.00	26.00
India	2000	Second Renewable Energy	H	110.00	
India	2001	Rajasthan Power Sector Restructuring	Renewable	1.80	
India	2002	Uttar Pradesh Water Sector Restructuring	H	1.49	
Nepal	1993	Sunsari Morang Headworks	H	5.60	
Nepal	1997	Irrigation Sector	H	0.79	
Nepal	2003	Power Development	H	22.68	
Sri Lanka	1992	Second Power Distribution and Transmission	H	1.50	
Sri Lanka	1997	Energy Services Delivery	W, SPV	23.23	5.90
Sri Lanka	2002	Renewable Energy for Rural Economic Development	W, SPV, H, BM	74.25	8.00
Middle East and North Africa Region					
Tunisia	1995	Solar Water Heating	ST		4.00
Yemen, Rep. of	2005	Rural Electrification and Renewable Energy	RE		0.55
Latin America and the Caribbean Region					
Argentina	1999	Renewable Energy in Rural Markets	SPV, W	26.70	10.00
Bolivia	2003	Decentralized Infrastructure for Rural Transformation	SPV	6.80	
Ecuador	2002	Power and Communications Sector Modernization and Rural Services	Renewable		2.84
Honduras	1992	Energy Sector	BM, W, Solar, H	3.54	
Mexico	2000	Renewable Energy for Agricultural Productivity	W		8.90
Mexico	2001	Methane Gas Capture and Use and Landfill	BM/BG		6.27
Nicaragua	2003	Off-grid Rural Electrification	SPV, H	8.88	4.02
Uruguay	2000	Landfill Methane Recovery Demonstration	BM/BG		0.98
East Asia and Pacific Region					
Cambodia	2004	Rural Electrification and Transmission	ST, H	3.20	5.75
China	1999	Renewable Energy Development	W, SPV	100.00	35.00
China	2004	Fourth Inland Waterways	H	13.65	
China	2005	Renewable Energy Scale-Up Program	Wind, BM	87.0	40.22
Indonesia	1995	Second Rural Electrification	GT, H	19.40	
Indonesia	1997	Renewable Energy Small Power	BM, H	63.74	4.00

(*Continues on the following page.*)

Region/ country	Approved (fiscal year)	Project	Energy type	IBRD/IDA (Project or NRE component, $US millions)	GEF co-financing ($US millions)
Indonesia	1997	Solar Home Systems	SPV	20.00	24.00
Lao, PDR	1998	Southern Provinces Rural Electrification	SPV	1.04	0.74
Philippines	1990	Energy Sector	GT	50.70	
Philippines	1994	Leyte Luzon Geothermal	GT	213.38	30.00
Philippines	1994	Leyte Cebu Geothermal	GT	56.97	
Philippines	2004	Rural Power	SPV, H	5.00	9.00
Vietnam	2002	System Efficiency Improvement, Equitization and Renewables	H	13.50	4.50
Europe and Central Asia Region					
Croatia	2005	Renewable Energy Resources	RE		5.5
Latvia	1998	Solid Waste Management	BM/BG	3.74	5.12
Lithuania	1996	Klaipeda Geothermal	GT		6.90
Macedonia, FYR	2000	Mini-Hydropower	H		0.75
Moldova	2005	Renewable Energy from Agricultural Waste	BM		0.68
Poland	2000	Podhale Geothermal District Heating and Environment	GT		5.40
Turkey	2004	Renewable Energy	H	50.51	
Hungary	2003	Small Hydro	H		0.42
Africa Region					
Benin	2005	Energy Service Delivery APL	BM	5.70	
Burundi	1991	Energy Sector Rehabilitation	BM/BG, H	1.60	
Cape Verde	1999	Energy/Water Sector Reform	W, SPV	1.23	4.70
Chad	1998	Household Energy	BM	0.85	
Ethiopia	1998	Energy II	BM, H	4.00	
Ethiopia	2003	Energy Access	SPV, BM, H	21.71	4.93
Guinea	2003	Decentralized Rural Electrification	SPV, H	3.50	
Kenya	2005	Energy Sector Recovery	Geothermal	31.50	
Kenya	1997	Energy Sector Reform	GT	20.00	
Madagascar	1996	Energy Sector Development	BM / BG, H	7.82	
Madagascar	2004	Environment Program III	BM	4.00	
Mali	1995	Household Energy	Renewable		2.50
Mali	2004	Household Energy and Universal Rural Access	W, SPV, BM/BG, H	17.83	3.50
Mauritius	1992	Sugar Energy Development/Sugar Bio-Energy Technology	BM/BG, H	15.00	3.30
Mozambique	2003	Energy Reform and Access	SPV, H	1.82	2.09
Niger	1988	Energy			
Rwanda	1993	Energy Sector Rehabilitation	SPV, ST, H	2.60	
Rwanda	2005	Urgent Electricity Rehabilitation SIL	H	4.70	
Senegal	2005	Rural Electric Service	BM	4.10	
Senegal	1998	Sustainable and Participatory Energy Management	BM	5.20	4.70
Uganda	2000	Power III Supplemental	H	16.50	
Uganda	2002	Energy for Rural Transformation	SPV, H	3.90	12.10
Total commitments				1,375.44	301.46

Source: World Bank Group Progress Reports.

Note: The table is fully consistent with the World Bank Group Progress Reports on Renewable Energy and Energy Efficiency for 1990–2004 and fiscal 2005 (World Bank 2005d), except for seven projects: South Africa Concentrating Solar Power for Africa; Honduras Energy Sector Adjustment (Ref 2); Mexico Solar Thermal Integrated Cycle Project; Brazil Itaparica Supplemental; Egypt Integrated Solar Thermal; Guinea Rural Energy; and China Passive Solar Rural Health Clinics. Information was either not available for these projects, or they are still at the proposal stage. BG = biogas; BM = biomass; GEF = Global Environment Facility; GT = geothermal; H = hydro; ST = solar thermal; SPV = solar PV; W = wind.

ANNEX B: NRE PROJECTS SELECTED FOR IN-DEPTH REVIEW

The study reviewed 65 new and renewable energy (NRE) projects, of which 27 are closed and 38 are ongoing. The complete list of closed projects, along with their Independent Evaluation Group (IEG) ratings, are presented in annex C. In terms of in-depth evaluation (including IEG Project Performance Assessment Reports in some cases), the report focused especially on those closed and ongoing NRE projects, as listed below, that are most indicative of the Bank's performance, given the project's size, level of financial commitment, innovativeness, range of objectives, scope of components and activities, country significance, and importance given to renewable energy.

Region/ country	Project	NRE type	Bank approval (fiscal year)/ closing	GEF ($US millions)	IBRD/IDA ($US millions)
South Asia Region					
India	Renewable Resources Development/ Alternate Energy (GEF)	W, SPV, H	1993/2001	26.00	190.00
India	Second Renewable Energy[a]	H	2000/Ongoing	N.A.	110.00
Sri Lanka	Energy Services Delivery	W, SPV, H	1997/2002	5.90	23.23
Sri Lanka	Renewable Energy for Rural Economic Development	W, SPV, H	2002/Ongoing	8.00	74.25
Bangladesh	Rural Electrification and Renewable Energy Development[a]	SPV, H	2002/Ongoing	8.20	17.19
Latin America and the Caribbean Region					
Argentina	Renewable Energy in the Rural Market	SPV, W	1999/Ongoing	10.00	26.70
Nicaragua	Off-grid Rural Electrification[a]	SPV, H	2003/Ongoing	4.02	8.88
East Asia and Pacific Region					
Indonesia	Solar Home Systems	SPV	1997/2001	24.30	20.00
China	Renewable Energy Development	W, SPV	1999/Ongoing	35.00	100.00
Africa Region					
Uganda	Energy for Rural Transformation[a]	SPV	2002/Ongoing	12.10	3.90
Mali	Household Energy	BM	1995/2000	2.50	N.A.
Senegal	Sustainable and Participatory Energy Management	BM	1998/2004	4.70	5.20

Source: Project Appraisal Documents and World Bank Operations Portal.

Note: BM = biomass; H = hydro; SPV = solar PV; W = wind.

a. Projects with large NRE components. The rest are freestanding projects.

ANNEX C: COST COMPETITIVENESS OF RENEWABLE AND CONVENTIONAL ENERGY TECHNOLOGIES

The Bank aims to play a crucial role in leveling the playing field between renewable and conventional energy sources. The economics of renewable energy are driven mainly by the *operational* costs of using alternative fuels, such as kerosene or diesel in the decentralized power applications that are the subject of this review.

Capital cost differentials between NREs and fossil fuels play a relatively small role, as over the past two decades the costs of NRE technologies have been decreasing, but those of conventional energy technologies have decreased as well, as illustrated by major advances in wind turbines and combined gas cycle technology. While solar, wind, and hydro resources are free in nature, petroleum is a global commodity; hence, what really drives comparative NRE versus conventional energy economics are international crude oil and petroleum product prices, whose rates of increase could offset decreases in costs resulting from technological progress. For large-scale electricity generation, fuel price may constitute 46–87 percent of the total levelized economic cost of electricity (Chubu Electric Power Co., Inc. and others 2005).

In economic terms, what used to be the hypothetical *upper bound* of $50–$70 per barrel of crude oil in many studies on renewable energy economics has now become a daily *reality*, making NREs economically competitive, at least in principle. This upper bound is even underestimated, because global petroleum use entails negative environmental externalities and should command an "energy security premium" that is not captured in world prices. In financial terms, however, most developing countries continue to domestically adopt "social pricing" of petroleum products (thus resulting in massive drains in their fiscal resources), which cancel out any margin of competitiveness that NREs might have had.

Consequently, with the exception of a few technologies, renewable energy in both developing and developed countries remains financially uncompetitive with conventional energy sources and therefore continues to require government and donor support (REN21 Renewable Energy Policy Network 2005). Yet as table C.1 below shows, for off-grid applications, a range of renewable energy technologies (RETs) are economically competitive with gasoline generators. For mini-grid applications, micro hydro and biomass gasifiers are lower-cost options, compared with diesel generation, and wind power is marginally competitive. For grid-connected applications less than 50 megawatts (MW), wind, mini-hydro, and geothermal (where available) are lower-cost options than diesel for peaking load and can be competitive with diesel for base load. Above 50 MW and up to 300 MW, coal-fired generation remains the least-cost option, but wind power is not far behind. Off-grid, solar photovoltaics (PV) can be competitive with gasoline generators but are uncompetitive in grid-connected applications.

In table C.1, costs are not inclusive of subsidies and other policy incentives, or of all environmental externalities. Cost figures are based on assumptions regarding capacity, capacity factor, and life span specific for each technology, and they include capital plus operating costs, expressed on a levelized basis, using a 10 percent real discount rate over the economic life of the plant, in constant 2004 US$. Assessments

Table C.1: Renewable and Conventional Energy Costs

	Rating (watts)	2004 US¢/kWh	2015 US¢/kWh
Off grid			
Solar PV	50–300	40–75	35–65
Wind	300	22–39	20–34
PV-wind hybrid	300	24–37	21–31
Pico hydro	300	11–19	10–18
Pico hydro	1,000	10–16	9–15
Gasoline generator	300	49–79	47–77
Mini grid			
Solar PV	25	44–58	37–47
Wind	100	14–23	12–19
PV-wind hybrid	100	16–24	14–20
Geothermal (binary)	200	13–16	13–16
Biomass gasifier	100	8–10	7–9
Biogas	60	6–7	5–7
Micro hydro	100	9–13	9–13
Diesel generator	100	15–25	15–25
Micro turbines	150	27–33	27–33
Fuel cells	200	23–29	21–26
Central generation (<50 MW)			
Solar PV	5	37–49	29–40
Wind	10	5–9	4–7
Solar thermal (no storage)	30	15–21	13–18
Solar thermal (w/storage)	30	11–15	10–12
Geothermal (binary)	20	6–8	6–8
Biomass (gasifier)	20	7–8	6–8
Landfill gas	5	5–7	5–6
Mini-hydro	5	5–8	5–8
Diesel, base load	5	7–12	7–12
Diesel, peaking	5	14–20	14–20
Fuel cells	5	11–16	9–14
Central generation (50–300 MW)			
Biomass (steam)	50	6–7	6–7
Geothermal (flash)	50	4–5	4–5
Wind	100	4–8	3–6
Large hydro	100	4–7	4–7
Hydro (pumped storage), peaking	150	29–39	28–39
Oil/gas combined cycle (1100 C class)	150	9–15	9–14
Oil/gas combined cycle (1300 C class)	300	4–7	3–7
Coal steam	300	3–5	3–5
Coal IGCC	300	4–6	3–5
Coal AFB	300	3–4	3–4
Oil steam	300	5–10	5–10

Source: Chubu Electric Power Co., Inc. and others 2005.

Note: kWh = kilowatt hour.

are based on the approach and formulas in the Electric Power Research Institute's *Renewable Energy Technical Assessment Guide* (EPRI 2004). Average fuel prices for 2004 and 2015, based on World Bank forecasts, are assumed to be, respectively, $38/bbl and $31/bbl for oil; $54/ton and $34/ton for coal; and $4.9/MMBTU and $4.0/MMBTU for natural gas.

To simplify estimations, all capital and operating costs were calculated on the basis of one power plant's construction in India. Adjustments were made for labor costs, the largest variable accounting for costs between locations. Capital and operating cost calculations assume all generating equipment is designed under World Bank environmental guidelines and therefore include costs for typical environmental impacts, from normal operations and standard emissions control measures.

Yet not all environmental and social externalities are included. Costs in 2015 are calculated by considering future price decreases due to both technological innovation and mass production. Key uncertainties including fuel costs, future technology cost and performance, and resource risks are addressed using a probabilistic approach. In the case of solar PV, wind, and PV-wind hybrids in a mini-grid area or off-grid configuration, total costs include battery or backup generator costs to smooth stochastic variations in the available resource and provide a reliable output.

Conventional energy technologies, though, have been highly subsidized through a variety of direct as well as indirect and nontransparent means, such as cash transfers to producers and/or consumers, tax exemptions, price controls, trade restrictions, regulatory hurdles for NREs, and government failure to correct market imperfections. These subsidies skew the playing field against renewable energy.

An estimate of energy sector subsidies in the European Union in 2001 was calculated at Euros 29 billion (EEA 2004). Subsidy levels for renewable energy even in the European Union, where renewable energy has received strong support, are low in comparison with other forms of energy. For the United States and Europe combined, government support for renewable energy in 2004 was roughly US$10 billion. In contrast, total global energy subsidies for fossil fuels are reported to be in the range of US$150–$250 billion per year (REN21 Renewable Energy Policy Network 2005). To help level this playing field, Global Environment Facility (GEF) financing present in many Bank NRE projects seeks to remove the market and regulatory barriers to NRE as well as achieve global environmental benefits by financing the incremental costs of renewable energy investments.

Deriving the true costs of renewable and conventional energy technologies is challenging because of the difficulties encountered in determining the environmental externalities, values for energy security, and the subsidies involved. However, some studies show that, considering environmental costs and assessing more rigorous technology and capital and generation costs, the economic costs of RETs—particularly wind, hydropower, geothermal, and biomass-electric for grid applications—are lower than those for conventional generation. On a levelized basis, RETs are the least-cost option for such applications.

Several RETs are potentially the least-cost option for mini-grid applications as well (Chubu Electric Power Co., Inc. and others 2005). For remote areas, conventional versus NRE cost comparisons may serve little purpose, because off-grid technologies constitute the only option and are far more economical than grid extension to these areas. Table C.2 illustrates that for European Union member countries, renewable energy can in fact be more competitive than fossil fuels when environmental and social externalities are taken into account.

Table C.2: External Cost Figures for Electricity Production in Selected European Countries for Existing Technologies (Euro cents per kWh)

Country	Coal and lignite	Peat	Oil	Gas	Nuclear	Biomass	Hydro	Wind
Austria				1–3		2–3	0.1	
Belgium	4–15			1–2	0.5			
Germany	3–6		5–8	1–2	0.2	3		0.05
Denmark	4–7			2–3		1		0.1
Finland	2–4	2–5				1		
France	7–10		8–11	2–4	0.3	1	1	
Greece	5–8		3–5	1		0–0.8	1	0.25
Ireland	6–8	3–4						
Italy			3–6	2–3			0.3	
Netherlands	3–4			1–2	0.7	0.5		
Norway				1–2		0.2	0.2	0–0.25
Portugal	4–7			1–2		1–2	0.03	
Spain	5–8			1–2		3–5[a]		0.2
Sweden	2–4					0.3	0–0.7	
United Kingdom	4–7		3–5	1–2	0.25	1		0.15

Source: Martinot 2005.

Note: Subtotal of quantifiable externalities (such as global warming, public health, occupational health, material damage).

a. Biomass cofired with lignites.

ANNEX D: RATINGS OF CLOSED NRE PROJECTS

Project	Outcome[a]	Sustainability	Institutional development impact	Bank performance	Borrower performance
Blended					
Burundi Energy Sector Rehabilitation	U (U)	UN	N	U	U
Niger Energy Project	MS (S)	L	SU	S	S
Kenya Energy Sector Reform and Power Development	S (U)	L	SU	S	U
Rwanda Energy Sector Rehabilitation	MU (MS)	NE	M	U	S
Uganda Power III Supplemental	MU (S)	UN	N	U	U
Indonesia 2nd Rural Electrification	S (MS)	UN	M	S	S
Lao PDR Southern Provinces Rural Electrification	S (S)	L	SU	S	U
Philippines Energy Sector	S (U)	UNC	M	U	U
Honduras Energy Sector Adjustment Loan	MS (MS)	UNC	M	S	U
Latvia Solid Waste Management & Landfill Gas Recovery	S (S)	L	SU	S	S
Macedonia Mini-Hydropower[b]	S (S)	NA	NA	NA	NA
Poland Podhale Geothermal District Heating & Environment	MU (MU)	L	M	U	U
Nepal Sunsari Morang Headworks	S (MS)	UNC	SU	S	S
Nepal Irrigation Sector	MS (MS)	UN	M	S	S
Sri Lanka 2nd Power Distribution and Transmission	MS (MS)	L	M	S	U
Freestanding					
Chad Household Energy	MS	NE	H	U	S
Mali Household Energy	MU	NE	SU	U	S
Mauritius Sugar Energy Development	S	L	SU	U	S
Senegal Sustainable and Participatory Energy Management	HS	HL	SU	S	S
Indonesia Solar Home Systems	U	L	SU	HS	S
Indonesia Renewable Energy Small Power	NR	NR	NR	NR	NR
Philippines Leyte Cebu Geothermal	U	UN	N	S	S
Philippines Leyte Luzon Geothermal	U	UN	M	U	U
Lithuania Klaipeda Geothermal Demonstration	MU	NE	SU	S	S
Tunisia Solar Water Heating	S	NE	SU	S	S
India Renewable Resources Development	S	L	M	S	S
Sri Lanka Energy Services Delivery	HS	L	H	HS	HS

Source: Implementation Completion Report Reviews and Project Performance Assessment Reports.

Note: HS = highly satisfactory; S = satisfactory; MS = moderately satisfactory; MU = moderately/marginally satisfactory; U = unsatisfactory; L = likely; UN = unlikely; H = high; SU = substantial; M = modest; N = negligible; UNC = uncertain; NA = not available; NE = nonevaluable; NR = not rated.

a. Closed projects as of end of fiscal 2005. For blended projects, the outcome rating in parentheses is of the NRE component.

b. Ratings for certain criteria not available (GEF medium-size grant project).

ANNEX E: RATINGS OF ONGOING NRE PROJECTS UNDER SUPERVISION

Country and project	Freestanding or blended	Achievement of PDO		Implementation progress		Global env. objective	
		Previous	Latest	Previous	Latest	Previous	Latest
Cape Verde Energy and Water Sector Reform and Development	B	U	U	U	U	U	U
Ethiopia Energy Access/Renewable Energy	B	U	U	S	S	NP	S
Ethiopia Energy II	B	U	U	S	S	NA	NA
Guinea Decentralized Rural Electrification	B	MU	MS	S	MS	MU	MU
Madagascar Energy Sector	B	MU	MU	MU	MU	NA	NA
Madagascar Environment III	B	S	MS	MS	MS	S	S
Mali Household Energy and Universal Access	FS	S	MS	S	MS	S	MS
Mozambique Energy Reform and Access	B	S	MS	S	MS	S	MS
Uganda Energy for Rural Transformation	B	MS	MS	MS	MS	MS	MS
Cambodia Rural Electrification and Transmission	B	S	S	S	MS	S	MS
China Fourth Inland Waterways	B	S	S	S	S	NA	NA
China Renewable Energy Development	FS	S	S	S	S	S	S
Philippines Rural Power	B	MS	NP	S	NP	S	NP
Vietnam System Efficiency Improvement, Equitization and Renewables	B	S	NP	S	NP	S	NP
Hungary Rehab. and Expansion of Small Hydro (GEF med.-size project)	FS	NAV	NAV	NA	NA	NA	NA
Turkey Renewable Energy	FS	S	S	S	MS	NA	NA
Argentina Renewable Energy in the Rural Market	FS	MS	MS	MU	MU	MS	MS
Bolivia Decentralized Infrastructure for Rural Transformation	B	S	S	MS	S	NA	NA
Ecuador Power and Communications Sector Modernization and Rural Services	B	S	S	MS	MS	MS	MS
Mexico Methane Gas Capture and Use at a Landfill (GEF only)	FS	NA	NA	HS	NP	HS	HS
Mexico Renewable Energy for Agriculture (GEF only)	FS	NA	NA	S	S	S	S
Nicaragua Off-Grid Rural Electrification	FS	MS	MU	MS	MU	MS	MU
Uruguay Landfill Methane Recovery Demonstration Project (GEF med.-size project)	FS	NAV	NAV	NA	NA	NA	NA
Bangladesh Rural Electrification and Renewable Energy Development	B	S	S	S	S	S	S
India Rajasthan Power Sector Restructuring	B	S	S	S	S	NA	NA
India Second Renewable Energy	FS	S	NP	NP	NP	S	NP
India Uttar Pradesh Water Sector Restructuring	B	S	S	MU	MU	NA	NA
Nepal Power Development	B	S	S	U	MU	NA	NA
Sri Lanka Renewable Energy for Rural Economic Development	FS	S	S	S	S	S	S

Source: Latest Implementation Status Reports for projects.

Note: Updated active NRE project ratings, February 2006.

PDO = project development objective; B = blended; FS = freestanding; S = satisfactory, MS = moderately satisfactory, MU = moderately unsatisfactory, U = unsatisfactory, NA = not applicable, NAV = not available, NP = not provided.

Closed Projects

The outcomes of closed projects have been mixed. Based on the IEG ratings from Implementation Completion Report (ICR) Reviews and Project Performance Assessment Reports, the scorecard for closed projects reflects both weak and good performance, as shown in annex C. Among the free-standing projects, the ones in Chad, Mauritius, Tunisia, India, and Sri Lanka had moderately satisfactory or satisfactory outcomes (highly satisfactory in the case of Sri Lanka). However, all three freestanding geothermal projects in the Philippines and Lithuania had unsatisfactory outcomes.[1]

The outcomes of the NRE components in energy projects in Burundi and the Philippines were unsatisfactory.[2] In only three projects were the NRE components satisfactory, while six of them were moderately satisfactory. The Niger Energy Project (1988), of which the NRE component was for wood fuels and was 16 percent of the project, is one of them: wood energy markets in the country are still functioning, according to IEG's project evaluation (IEG 2005).

It is important to note that in two of the countries for which the NRE component was unsatisfactory or moderately unsatisfactory—Burundi and Rwanda—civil conflict disrupted the projects and was the main reason for their inability to meet their objectives. Four others have been adversely affected or canceled because of conflict and/or economic crises: NRE projects in Argentina, Bolivia, and Indonesia (two projects).[3] Four of these six canceled projects are closed and constitute one-quarter of the subset of projects that are the focus of this study. That makes lesson learning a challenge.

Freestanding projects performed better than projects where NRE is only a component. The closed portfolio is marked by solid achievements. Excluding geothermal projects, freestanding NRE projects performed well, better than blended projects (table F.1). The outcomes for the projects in India and Mauritius were satisfactory, and that for Sri Lanka was highly satisfactory. While not performing as well, the projects for household energy (sustainable wood fuel management) achieved moderately satisfactory outcomes (the outcome of Mali's household energy project, though, was moderately unsatisfactory).

The potential also existed for even better overall performance. The two projects in Indonesia received either a poor rating or were not rated at all because projects were canceled after the East Asia financial crisis. Project documents indicate, however, that the conditions for success existed for both projects.

The efficiency of closed, "full-spectrum" NRE projects has been generally substantial. An analysis of the efficiency of four closed NRE projects found that the recalculated economic internal rates of return (EIRR) at project completion were higher than those estimated at appraisal for almost all RETs. Hydro and solar components—the most common across the projects—met or exceeded their target EIRRs. The exceptions were wind and geothermal energy, although wind energy holds considerable potential (World Bank 2004a).

Table F.1: Overall Ratings for Closed Freestanding Projects and Projects with NRE Components

	Overall ratings				
Projects	**Outcome**	**Sustainability**	**Institutional development impact**	**Bank performance**	**Borrower performance**
Freestanding (12)	Mixed: *6 moderately to highly satisfactory 5 moderately unsatisfactory or unsatisfactory*	Mixed: *5 likely (1 highly likely) 6 unlikely or nonevaluable*	Substantial or high (except 3)	Mixed: *7 satisfactory or highly satisfactory 4 unsatisfactory*	Satisfactory *(except 1)*
With NRE components (15)	Mixed: *11 satisfactory or moderately satisfactory 4 unsatisfactory or moderately unsatisfactory*	Unlikely or uncertain (except 4)	Modest *(except 5 substantial, 2 negligible)*	Mixed: *9 satisfactory 5 unsatisfactory*	Mixed: *6 satisfactory 8 unsatisfactory*

Note: The Indonesia Renewable Energy Small Power Project (1997), which was canceled, was not rated.

Table F.2 provides the EIRR figures for these closed projects (a more detailed analysis is in annex C). The EIRR calculations include the GEF grants intended to remove market barriers to NRE by financing the incremental costs incurred in shifting from conventional to renewable energy sources. Calculations done for the India and Sri Lanka projects show that, without GEF assistance, project completion EIRRs would still be marginally higher than appraisal estimates. As GEF subsidies are phased out, it is important to monitor the economic performance and commercialization prospects (without subsidies) of several Bank-GEF projects that will close in the next few years.

Factors of Performance

Good performance requires significant resources and maturation periods. Based on the experience of closed projects with satisfactory outcome ratings from IEG's ICR Reviews, key factors that tend to be associated with good performance were identified. Although these factors are not present in all projects, those projects that have performed well generally have strong government commitment; effective Bank performance; extensive consultation and participation with entrepreneurs, consumers, and nongovernmental organization (NGO); effective credit and output-based (GEF) grant-financing mechanisms for the private sector; efficient credit arrangements that facilitated access to RETs by the poor; strong capacity prior to the project or as a result of its activities; focused attention to addressing the market barriers to renewables; and strong interest from local investors and financiers. Recent freestanding (NRE only) and rural electrification (grid and off-grid) projects that aimed at commercialization through the private sector exhibit these factors and performed well. The importance of the factors of performance discussed above for a selected group of successful projects is presented in table F.3.

A focus on getting the regulatory and incentives framework right has proven more useful to maximizing project results than trying to get governments to enunciate a national renewable energy policy. An examination of the successful projects in table F.3 shows that the performance of an NRE project is not sensitive to whether the government has established a policy promoting renewables or not. For example, while policy support for renewables existed in India when the satisfactory Renewable Resources Development Project (1992) was

Table F.2: Economic Internal Rates of Return for Selected NRE Projects (percentages, with GEF grants for incremental costs)

Country/project	Appraisal	Actual
Sri Lanka Energy Services Delivery		
Grid-connected mini-hydro	18	26
Off-grid village hydro	12	18
Solar home systems	12	42.6
Wind farm	14	3.9
India Renewable Resources Development		
Small hydro (dam-toe)[a]	13–65	28
Small hydro (canal and run of river)[a]	12–29	33
Wind farm	12	14
Solar PV lanterns		33
Solar PV home systems		108
Solar PV power packs	14–14.6	21
Solar PV village power		19
Solar PV water pumping		43
Tunisia Solar Water Heating		
Solar	34	42
Philippines Leyte-Luzon Geothermal		
Geothermal	10.5	7.5

Source: Implementation Completion Reports.

a. EIRR figures are without GEF grant.

Table F.3: Factors of Performance in Successful NRE Projects

Closed projects	IEG outcome rating	Strong country commitment	Good Bank performance: project design, AAA, supervision, and adaptability	Involvement of all stakeholders	Effective GEF grants and OBA	Efficient credit mechanisms enabling the poor access to RETs	Solid institutional and/or technical capacity at entry or as a result of project	Attention to addressing regulatory and market barriers	Solid private sector interest
Sri Lanka ESD	Highly satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
India RRD	Satisfactory	✓	✓					✓	✓
Mauritius	Satisfactory	✓		✓			✓		✓
Senegal	Highly satisfactory	✓	✓	✓	✓		✓	✓	✓

Note: A checkmark indicates that the factor was evident in the project. The absence of a checkmark indicates that the factor was not relevant to the project and/or there was little reporting provided on it in the ICR or supervision documents. AAA = analytical and advisory assistance; OBA = output-based assistance.

approved, no explicit government support for NRE existed in Sri Lanka when the highly satisfactory Energy Services Delivery Project (1997) was implemented. As table F.3 shows, adequately addressing the regulatory and market barriers to private sector involvement and NRE scale-up is a factor of good performance, as is country commitment (what a government does). A formal NRE policy (what a government says) is not.

Neglect and lack of commitment easily lead to bad performance. Projects that received unsatisfactory outcome ratings tend to be associated with inadequate attention to ensuring a conducive policy and regulatory environment for NRE. These ratings are also associated with poor supervision of NRE components in a larger conventional energy or water sector project, weak country or implementing agency commitment, a private sector hesitant to take risks, weak Bank performance, insufficient capacity of public and/or private institutions, and sociopolitical or economic crises in the country.

The influence of these factors in unsuccessful projects is shown in table F.4. Small NRE components in conventional energy or water sector reform projects generally did not achieve their objectives, mainly because of poor supervision.

Table F.4: Factors of Performance in Unsuccessful NRE Projects

Closed projects	IEG outcome rating	Socio-political or economic crisis	Inadequate attention to policy and regulatory framework	Poor supervision of NRE components in a larger project	Weak country or implementing agency commitment	Risk-averse private sector	Weak Bank performance	Insufficient institutional capacity (despite capacity-building activities)
Philippines Leyte Luzon Geothermal	Unsatisfactory				✓		✓	✓
Mali Household Energy	Moderately unsatisfactory		✓				✓	✓
Burundi Energy Sector Rehabilitation	Unsatisfactory	✓		✓	✓		✓	✓
Rwanda Energy Sector Rehabilitation	Moderately unsatisfactory	✓		✓	✓		✓	✓

ANNEX G: ASSESSMENT OF THE NRE PORTFOLIO'S CONTRIBUTION TO POVERTY REDUCTION AND GOOD GOVERNANCE

Poverty reduction is a major objective of NRE projects that was mostly implied but not stated. Reducing poverty by increasing energy access for the rural poor has been an important objective of the NRE projects that the Bank has pursued from the early 1990s to the present, and poverty reduction is often an implicit objective in the design and target beneficiaries of the Bank's NRE projects. Thus, a key question is whether the Bank's financial assistance and advice contributed to achieving this objective.

Although this has been at least an implied objective in NRE projects judging from the components and activities, the portfolio review found that of the Bank's 27 closed NRE projects,[1] only two—the Mali Household Energy Project (1995) and the Senegal Sustainable and Participatory Energy Management (1997)—explicitly stated a poverty reduction objective. In seven other projects, livelihood improvement was an implied goal.[2]

The Bank sought to reduce poverty through three approaches: improving welfare, enhancing incomes, and initiating rural transformation. The welfare improvement approach generally reflected in the Bank's NRE projects in the 1990s[3] sought to increase the welfare of the rural poor through household lighting, which would provide more time for study and chores and improve comfort and safety. The Argentina Renewable Energy in the Rural Market (RERM) Project (1999) is an example of this approach; it seeks to make electricity accessible to dispersed households for lighting and small appliances, as well as to schools and public health clinics in poor, rural areas. Beyond immediate benefits, it is expected that the increased hours of lighting will generate longer-term positive impacts on livelihood, education, and social development.

A more recent approach is to focus on *increasing incomes* of the poor through electricity provision, such as the Sri Lanka Renewable Energy for Rural Economic Development (RERED) Project (2002). This project seeks to increase nonfarm incomes by targeting electricity supply to household-based enterprises and small and medium-size enterprises. The Senegal Sustainable and Participatory Energy Management Project (1997) also sought to generate revenue for villages by having them participate in the trade of sustainably managed wood fuels.

Cross-sectoral *rural transformation* has been the third and latest Bank approach to link energy access and poverty reduction. By providing electricity and information and communication technology (ICT) links to rural enterprises (considered as catalysts for rural sector transformation) and to public service institutions, the Bank is striving to generate broad-based economic growth, which will in turn reduce poverty levels. The Uganda Energy for Rural Transformation Project (2001) is the best example of this approach. It aims to induce indirect and long-term effects from economic growth, such as increased employment, income generation, and improved health care and education; these effects will increase the rural standard of living.

The three approaches have not been applied in the portfolio exclusive of each other. While in some projects only welfare improvement or income enhancement has been pursued, in

others two or even all three of the approaches are reflected.

In tackling poverty through NRE provision, the Bank's recent areas of emphasis are to improve livelihoods and incomes and establish a sustainable process for the full commercialization of renewables. Improving livelihoods and incomes as key goals of renewable energy provision is evident in many of the most recent ongoing projects, such as in the Bolivia Decentralized Infrastructure for Rural Transformation Project (2003) and Bangladesh Rural Electrification and Renewable Energy Development Project (2002).

As in the Uganda project, the goal of the Bolivia project is to promote the growth of the rural and micro-enterprise sector through electricity and ICT provision, thus expanding employment and income-earning opportunities. Electricity access for rural schools and clinics is also intended to improve primary education and preventive health services. Availability or electricity for poor households will increase safety and time for study and chores.

In an effort to raise levels of social development and economic growth in rural areas, the Bangladesh project seeks to support rural initiatives for the productive use of electricity, such as in agriculture, to increase income and improve the delivery of health and education services. Increased access of households to reliable supplies of electricity would enable more direct gains; greater convenience, safety, and ability to operate small appliances; and indoor air quality improvement from the elimination of kerosene smoke.

The Bank has also sought to establish a multistakeholder commercialization process for NRE technologies. The Bank has done this by removing the barriers to viable and sustainable renewables markets, building the confidence of investors and consumers, strengthening institutional capacity, and mobilizing private financing. As a result of this process, an environment is likely to emerge that will enable the development of NRE in the Bank's borrower countries beyond the levels achieved at the end of its projects—in itself a measure of sustainability. This increased dissemination through a well-functioning market could improve livelihoods on a larger scale.

Of the Bank's physical targets for renewable energy installations, some have been surpassed, while others are making minimal progress. Except for hydro in Sri Lanka and India, where targets were exceeded, physical targets for RET installations have not been met (see table 4.3). Each of the five closed projects involving the installation of solar home systems (SHS), which were mainly intended for poor households, fell short of achieving their dissemination targets, in some cases by a significant amount. Even in a project with a highly satisfactory IEG rating, the Sri Lanka Energy Services Delivery (ESD) Project (1997), the SHS component did not do as well as the grid/off-grid hydro ones because, although the project surpassed its target for SHS installation, the target had been revised downward from its original figure.

Monitoring and evaluation (M&E) systems in NRE projects have been mostly absent or weak, despite the goal of poverty reduction consistently stated in Country Assistance Strategies (CASs) of countries with NRE projects. As a result, there are no active performance indicators, so evaluating the subsidy-targeting and poverty-reduction impacts of improved access is difficult. For example, the Mali Household Energy Project (1995) intended to improve the living standards of residents in 250 villages by employing them as suppliers in the firewood trade. The project also planned to provide benefits for low-income urban wood fuel consumers in five towns by supplying them with cost-saving, improved charcoal stoves. However, no monitoring indicators or systems were established to assess the income effects on the villagers and urban households. That makes an evaluation of the project's impact impossible at this stage.

The Senegal Sustainable and Participatory Energy Management Project (1997) was an improvement over the Mali project in terms of determining the economic benefits of the

project on the villages, but it had important weaknesses. The project was designed to generate revenue for low-income rural villages by involving them in both the sustainable supply of wood fuel to towns and various agriculture and other natural resource-based activities.

But based on supervision documents, in tracking the income the villages received, the project made no distinction between income from the wood fuel component and income from non-energy-related activities. How much the wood fuel component contributed to poverty reduction is therefore difficult to measure.

Furthermore, although the project intends to benefit low-income urban households by providing improved cookstoves, there was no indication that the cookstove component was being monitored, and no information is available on whether the component benefited users. Capacity building for monitoring and evaluation (M&E) design was provided in the project, and an M&E plan was developed on schedule. But it is not clear in light of the above what the plan's purpose was and what indicators were monitored.

The lack of effective M&E systems to determine poverty impacts is also found among the projects that have sought to improve electricity access. In the Argentina RERM Project (1999), performance indicators that were developed at start to assess welfare improvements included hours of lighting, study, and socializing and the extent of population migration. Yet no annual target levels that could serve as benchmarks were developed for these indicators.

The project's implementation design also did not include steps for monitoring these indicators or evaluating the impact of electricity access on poor households. Only the number of households and public centers connected to a renewable energy system were to be counted. Although the steps to develop a complete monitoring system were eventually taken, these came rather late. Four years after the project's initiation and one year before its expected closing, the Bank and the borrower decided that a monitoring system would be designed and implemented to understand the socioeconomic impacts of the different NRE technologies.

In terms of lack or absence of M&E, an exception is the Sri Lanka ESD Project (1997). Based on detailed interviews with beneficiaries, the project conducted an evaluation of the social and economic impacts of electricity access through solar home systems and off-grid village hydro schemes. The evaluation found the following improvements in the quality of life of customers:

- Women could do household work at night.
- Children could study longer hours, and it was felt their educational performance had improved.
- Entertainment hours were extended, and family interaction was enhanced.
- A feeling of safety was increased.
- Health conditions improved with the elimination of kerosene lamp fumes.

The survey, however, showed little evidence that electricity access from the NRE systems increased economic or income-generating activities apart from the seasonal employment each village hydro scheme provides to 30–60 people in construction (IEG 2004).

Though gender impact has been a focus in the social development goals of many renewable energy projects,[4] there is little evidence to support the claim that women have benefited. The lack of proper M&E of the impact on women is significant, given the finding of some studies that women often lose when a wood fuel market is established (IEG 2003b). The Mali Household Energy Project claims to have benefited women in both urban and rural areas substantially. In urban areas, women allegedly gained because of the cleaner indoor environment and reduction in energy expenditures that improved stoves allowed. Rural women supposedly benefited from the creation of wood fuel markets and improved charcoaling techniques because they

tend to be major actors in the wood fuel chain. Yet no monitoring was done to determine whether the project actually benefited urban and rural women.

Increasing the income of women through their involvement in wood fuel management and marketing and other income-generating activities was a specific aim of the Senegal Sustainable and Participatory Energy Management Project (1997); training for women in these activities was included in the project. However, it did not delineate how the welfare impacts on women were to be determined. While the project claimed to have achieved "gender development," it has provided no data to support this claim. The Argentina RERM Project, as the one in Senegal, identified women as well as children as groups that would benefit particularly from the project, but it too has not tracked their welfare for most of the project.

Increased income is a goal of nearly all of the recent freestanding projects (2001–present).[5] But thus far, supervision records do not provide data on increased household incomes. Only a few projects have M&E systems to determine the contribution of improved energy access to incomes. The goal of the Sri Lanka RERED Project (2002) is to increase incomes of the rural poor by providing electricity for nonfarm-productive activities. Yet in the Project Appraisal Document, there is no description of an M&E plan or of the data-collection methods that would be used.

The project's M&E system is not sufficiently developed to assess the project's specific contribution to poverty alleviation. It does not capture the various income effects or distinguish between the income gains that are or are not attributable to energy access. For household income, the only performance indicator is measurable increases in incomes of households that gain access to electricity.

The Nicaragua Off-Grid Rural Electrification Project (2003) also illustrates the absence of rigorous M&E found among many of the recent NRE projects. The project's main development objective is to generate welfare improvements and enhanced income in rural areas through electricity provision. It seeks to do this by supporting the delivery of services by microfinance (MFI) services for connection to electricity systems and of business development services (BDS) to rural enterprises. But no key performance indicators exist under the project for poverty reduction or welfare improvement. The project indicators consist only of those regarding the implementation of MFI services and BDS, such as the number of households using MFI services to access electricity and the use of BDS by rural enterprises. The project includes the development of a participatory M&E system to assess the project's ultimate results. But a year after approval, it was still unclear what the M&E plan consists of and how the impact on the poor is to be evaluated.

Although late, the Bank has been developing approaches and tools recently to better assess the socioeconomic impacts of improved energy access. The Energy Sector Management Assistance Programme (ESMAP), for example, is pioneering new methods and instruments. In 2002, ESMAP published *Rural Electrification and Development in the Philippines: Measuring the Social and Economic Benefits*, a study that offers a practical approach to qualitatively and quantitatively assessing the effects of electricity access on education, health, comfort and protection, productivity, and other areas and discusses its application in the Philippines. The study, which includes a measurement of the effects of electricity access in monetary terms, also offers evidence that rural electrification has a positive impact on the poor and thus is an important element for development.

ESMAP also recently released *Guidelines for Designing Energy Modules in Multi-Topic Household Surveys* (2004) to help the Bank integrate energy modules into its Living Standard Measurement Studies and other multitopic household surveys. The guidelines were developed under the reasoning that with energy modules, surveys will be able to provide more extensive and reliable data on household energy use. These data would enable not only

better policy making for poverty-targeted rural energy provision, but together with other household information, the surveys provide M&E of the impacts of improved energy access on living standards.

Some of the latest NRE projects are using these new methods and tools to help the development community better understand the impacts of energy access. The Uganda Energy for Rural Transformation (ERT) Project (2001) will be the first project to use a variety of approaches and advanced analytical tools to rigorously quantify the various indirect impacts of electricity provision on the different dimensions of rural poverty and growth.

The M&E program will do several things:

- Document services in energy, water, health, education, and roads, and economic and social welfare, in a sample of communities before project implementation to obtain baseline information.
- Track welfare in these communities, including its distribution within the household and with respect to gender, to identify the changes that project implementation has brought.
- Distinguish between the impacts on connected and unconnected entities.
- Compare project with nonproject communities to distinguish the impacts from other society-wide changes.

As most of the impacts on poverty will be indirect, the M&E plan's goal is to identify these effects and help draw lessons to maximize the project's contributions in subsequent phases. The program builds on ESMAP's monitoring work and was designed with reference to Uganda's poverty survey systems.

The Bangladesh Rural Electrification and Renewable Energy Development Project (2002) is another recent project that gives M&E more emphasis. The project includes several socioeconomic development objectives—enhanced education; improved quality of life from greater safety, comfort, and convenience; women's empowerment through improved education for girls and better access to information; income benefits from the reduced cost of electricity from NRE; enhanced rural productivity and development opportunities, and poverty reduction—and for each of these a specific set of indicators to assess whether the objectives have been achieved.

By providing technical assistance to the M&E cell of the public Rural Electrification Board, the project also seeks to establish an institutional system for measuring and documenting the impacts of electricity provision and building borrower capacity for M&E. As with the Uganda project, this one in Bangladesh aims to collect baseline data, resurvey households on a regular basis after electrification, and use the results to assess the performance of the rural electrification program in terms of socioeconomic outcomes.

The recent initiatives to improve monitoring methods and instruments are too recent to be evaluated. On balance, it is still unclear whether the Bank's assistance to improve access through NRE has significantly contributed to poverty reduction. It has been often accepted that NRE supplying grid and off-grid energy has reduced poverty and brought about overall improvements in welfare and had positive economic impacts at the national level. Yet the lack of evidence on whether the Bank's NRE portfolio has made a significant contribution to poverty reduction is a major analytical gap. This is consistent with IEG's finding that there is little hard evidence to date on the poverty-reducing impact of community development projects (IEG 2005), which include many NRE projects.

The Bank's credibility is at stake when it adopts "helping the poor directly" as an institutional mandate in its energy assistance without knowing whether such an impact is being achieved. Addressing this information gap is especially critical for mapping the Bank's expanded lending for NRE. The Bank's lack of leadership in promoting good M&E systems works against its catalytic role for poverty-

targeted NRE development in the long run. That is because the Bank loses the opportunity to build critical monitoring capacity in its client countries, which is essential for measuring baselines and setting indicators for future projects. It is hoped that the Bank's M&E work in its Uganda and Bangladesh NRE projects will lead the way.

ANNEX H: AN EVALUATION OF THE PORTFOLIO'S PERFORMANCE IN ACHIEVING GLOBAL ENVIRONMENTAL BENEFITS

Together with GEF financing, the Bank pursued the Energy Business Renewal Strategy (EBRS) objective of protecting the environment by removing market barriers to renewables. The environmental objectives of the EBRS are twofold: protect the environment by removing the market and regulatory barriers to renewables and achieve global environmental benefits.

The Bank and the GEF have sought to achieve the first objective by catalyzing impacts beyond direct, project-related ones and by using different strategies. These strategies have included using business models appropriate to the local context and making financing available through various mechanisms. This annex focuses on the effectiveness of the Bank-GEF in generating environmental benefits by examining closed NRE projects, which are the only ones with information on final impacts.

Out of the total of 27 closed projects (as of June 2005), the GEF cofinanced 13. However, a total of 17 projects included mitigating harmful environmental effects or the provision of an environmentally clean form of energy as a project development objective. The 10 that did not were conventional energy or irrigation projects in which NRE constituted only a component, although two geothermal energy projects in the Philippines were among them. Of the ongoing projects, 20 are GEF cofinanced.

The Bank has sought to make energy use more environmentally sustainable in two ways: (i) by reducing the emissions of CO_2 and other greenhouse gases (GHGs) through the substitution of NRE for conventional ones and (ii) by establishing management plans for the sustainable extraction of wood fuel energy for household use to conserve forests. (Three projects in the closed portfolio—in Chad, Mali, and Niger—and one ongoing project in Senegal focused on the sustainable supply of wood fuel energy for household cooking and forest conservation.)

Excluding wood fuel projects, the Bank's NRE portfolio has been centered on electricity or heat provision through the use of solar, wind, hydro, biomass, and geothermal resources. Six projects involved renewables-based heating. Three were implemented in the Philippines and one in Lithuania. Tunisia was the recipient of one solar water heating project.

In terms of achieving global environmental benefits through NRE projects, the Bank's effectiveness was generally satisfactory. Projects that aimed to reduce GHG emissions generally met their targets, and wood fuel projects achieved their environmental objectives and had positive local impacts. Based on an assessment of the five closed projects that sought to reduce GHG emissions and for which some data are available, three projects met or nearly met their appraisal targets, and one project, in Tunisia, exceeded them. The one project that failed to achieve the expected reductions and fell far short of doing so (in Indonesia) was severely impacted by the Asian economic crisis of the 1990s (see table 4.5).

The Sri Lanka ESD Project reduced GHG emissions by a total of 514,000 tons. Although this is greater than the appraisal figure of 140,000 tons, it did not include the targeted reduction from mini-hydro projects. The Indonesia SHS Project sought to mitigate GHG emissions by

replacing household kerosene and diesel use with PV systems. Due partly to the economic crisis the country experienced, the number of SHSs installed was far below the level targeted at appraisal. As a result, though the goal was to reduce fossil fuel use by about 546,000 kiloliters, only about 3,700 kiloliters were conserved.

For the India Renewable Resources Development (RRD) Project, the carbon emissions avoided were estimated at about 5.4 million, 1.1 million, and 94,000 tons over the lifetime of the subprojects for small hydro, wind, and PV, respectively. The emission reductions achieved for solar PV were below predictions (appraisal documents did not present emission-reduction target figures for each of the RETs separately, but provided a figure for wind and PV combined).

The Lithuania Geothermal Project also failed to reach the level of carbon reduction set at appraisal. However, the project surpassed its targets for reducing SO_2 and NO_x. Table H.1 helps explain the gap between targeted and actual reductions in GHG emissions, in that the physical installations of RETs achieved in several key projects also fell below their targets. Only the Tunisia project had unqualified success, as it surpassed its targets for carbon reductions.

The four projects for sustainable wood fuel management and forest conservation, unlike those that sought to reduce GHG emissions, were successful overall in meeting their environmental objectives.

Evidence on the environmental performance of the portfolio is partial. Owing to poor M&E systems in the projects, more than a third have either insufficient or no information on the achievement of their environmental objectives. Fifteen of the 27 closed projects examined included a component for RET installation or improvement.[1] However, nine of these either failed to provide information on their environmental impacts or did not have clear targets for GHG or wood fuel use reductions, or both. In most cases, neither targets nor specific impacts were provided.[2] The evidence thus far indicates that the quality of environmental impact monitoring across the portfolio was quite uneven and that adequate M&E is required to know the full extent of the environmental benefits from NRE projects.

Table H.1: Global Environmental Goals and Achievements of Wood Fuel Management Projects

Project	Environmental goals	Achievements
Chad Household Energy	• Bring 300,000 ha of forest under sustainable wood fuel management.	• 500,000 ha brought under sustainable community management.
Niger Energy	• Promote a more effective management of natural forest cover and firewood conservation.	• Conserved the forest resource base, developed rural wood fuel markets, and established a sustainable supply of wood to urban areas.
Mali Household Energy	• Reduce wood fuel consumption by 330,000 tons/year. • Cover 720,000 ha of forest with sustainable management.	• Wood fuel consumption decreased by 400,000 tons/year. • Only 320,000 ha brought under sustainable management.
Senegal Sustainable and Participatory Energy Management Project	• Annual sustainable wood fuel production of 300,000 tons/year. • Reduce wood fuel-related deforestation by 20,000 ha/year. • Reduce CO_2 emissions by 500,000 tons.	• Sustainable wood fuel production of 400,000 tons/year. • Wood fuel-related deforestation reduced by 29,000 ha/year. • CO_2 emissions reduced by 1.2 million tons.

Note: ha = hectares.

According to the GEF Climate Change Program Study (GEF 2004), the contribution renewables have made and will be able to make to global climate change prevention is not substantial. For the Bank to expect the direct impacts of its NRE projects to play a major role in reducing GHG emissions is unrealistic. Photovoltaic systems, which feature heavily in the Bank's off-grid electricity provision and rural electrification projects, have a low impact on GHGs. In the renewables subsector, the systems that have had the largest effect on carbon emissions and the potential to make the largest contribution in the future are grid-connected ones.

The global and local impacts of NRE can be greater in the long term if projects catalyze the creation of sound markets for NRE, as the environmental benefits will come not so much from the number of systems that projects install, but indirectly and in the future from the instruments they create. Considering this, it is important to recognize that the Bank has achieved its greatest emission reductions from its GEF-cofinanced investments in energy efficiency (GEF 2004).

ANNEX I: PRIVATE SECTOR DEVELOPMENT IN THE BANK'S NEW AND RENEWABLE ENERGY PROJECTS

The Bank's effectiveness in pursuing the EBRS objective of promoting private sector development (PSD) was substantial overall and high in recent projects. In practice, the Bank focused on commercializing NRE technologies; involved diverse public, private, and civil society stakeholders; and was flexible in its approach to strengthening local financial institutions to provide long-term financing for rural energy businesses. Most of the electricity-oriented NRE projects used complementary interventions to commercialize NRE technologies as follows:

- Promoting private competition
- Encouraging cost-effectiveness through economies of scale
- Mobilizing financial resources through public-private partnerships
- Providing output-based aid for gradual phase-out
- Verifying and improving the technical performance of NRE systems to ensure quality standards in the market and to boost consumer confidence
- Demonstrating the commercial viability and utility of NRE
- Using sales models for RET delivery
- Involving the beneficiary communities.

Most of the electricity-oriented projects have used several of these interventions as components that complement one another.

Encouraging private competition has been a characteristic of the NRE portfolio in general. Among closed projects, it was most evident in the Indonesia SHS Project, the Sri Lanka ESD Project, and the Sri Lanka RERED Project. It was also a key strategy in a number of active projects in Argentina, China, and Uganda.[1]

The Argentina project, for example, has required that private concessionaires compete for the exclusive rights to serve an entire province with SHS, off-grid mini-hydro, and small wind units. The project's goal has been to involve a small number of large and capable private actors, given that a conducive regulatory environment largely exists from prior energy sector unbundling and privatization at the federal level.

Together with fostering competition, the Bank also laid the groundwork for promoting economies of scale to achieve greater cost-effectiveness in NRE provision. The Argentina project is a good example of this approach. By providing exclusive rights over a province to a few private concessionaires with the necessary organizational and financial resources, the project has expected them to achieve reductions in equipment, transaction, and operation costs. The project also promoted scale economies to ease public sector administration and regulation, cover a large and dispersed population effectively, serve consumers over a long period, and enable good private sector investment returns with minimal subsidies. Other projects using economies of scale to serve a large population and meet institutional and productive needs are the Uganda Energy and Rural Transformation Project and the Sri Lanka RERED Project.

The Bank supported the creation of public-private partnerships to mobilize financing for RETs. In India, where the Bank has made some of the largest

investments for renewable energy, a public-private partnership was created to mobilize financing for RETs. The India RRD Project sought to strengthen the capacity of a specialized public institution, the Indian Renewable Energy Development Agency, to finance private developers of wind energy, solar PV, and small hydro. This strengthening aimed to support NRE commercialization.

The follow-up Second Renewable Energy Project has continued this strategy of strengthening the agency to promote private investments in small hydro (IEG 2003a). These partnerships are also evident in the Sri Lanka ESD Project, discussed in several places elsewhere in the report.

Output-based assistance (OBA), financed through GEF grants, was used to ensure that RET installation and service met dissemination volumes and quality standards. This review focused on the Bank's contribution to creating an investment climate conducive to NRE commercialization and the mechanisms to bring this about, instead of on the rationale for subsidies, which have been the subject of much previous analysis.

GEF subsidies are being phased out in Bank/GEF-cofinanced projects such as those in India and Sri Lanka. In these projects, the GEF grant has been provided after independent verification, audits, and performance monitoring. The specific arrangements, however, have varied across projects. In the Indonesia SHS Project, a relatively early one in the portfolio, SHS dealers received a small grant for each unit sold and installed. Modifying the use of OBA, later projects were designed for the phase-out of subsidies to place the private actors on an independent footing and encourage the development of a fully commercialized NRE market.

The Sri Lanka ESD Project, for instance, included a one-time grant to developers to reduce their capital and planning costs for off-grid RETs (IEG 2004). To limit private sector dependence, the Argentina RERM Project provides concessionaires with a limited time subsidy, channeled through the consumer and used to pay the tariffs, after the concessionaires have financed the costs of equipment and installation on their own.

OBA appears to have played a role in increasing consumer confidence in the private provision of NRE, although evidence is limited because of the lack of M&E on private sector activities. Some projects have explicitly sought to boost consumer support and demand for renewables by improving the technical performance of RETs. In the China Renewable Energy Development Project, support has been provided to improve SHSs. As well, the technology standards the project has set have already had the effect of increasing consumer and investor attraction for these systems and have raised competition and reduced prices. Improving the technology standards of SHSs was also an important component of the Indonesia SHS project.

While pursuing the installation of RETs, the Bank has also sought to demonstrate the commercial viability and long-run economic potential of NRE technologies through pilots. For example, in the Sri Lanka ESD Project, a pilot grid-connected wind energy component was implemented.

To encourage private investment and minimize notions of risk, developers have also been provided with market information on renewables. At the same time, RET demonstrations and promotional campaigns have been conducted for rural consumers, as was done in the Argentina project for wind energy, to educate rural residents on the benefits of NRE technologies and thus increase demand for them.

To deliver RETs to consumers through the private sector, Bank projects have used different sales models. Projects have employed PV sales models using either cash sales or various forms of credit, such as dealer credit, end-user credit, and lease or hire-purchase schemes. Examples are Indonesia SHS, China Renewable Energy Development (RED), India RRD, Sri Lanka ESD, and Uganda Energy for Rural Transformation (ERT). In the Indonesia SHS

project, dealer credit was used—private enterprises sold SHSs and extended credit to rural consumers through hire-purchase schemes. The PV dealers accessed credit on normal commercial terms from participating local commercial banks, which refinanced their loans from the Bank.

A smaller number of projects have explored concessional, fee-for-service models, but these have been less successful than sales models. Regulated concessions, using fee for service, have been part of the Argentina RERM Project and Cape Verde Energy and Water Sector Reform and Development Project (1999). Although the likelihood of reaching more poor is greater with this model, the approach has been problematic in Argentina, and very few PV systems have been installed there.

In China, a fee-for-service model was considered unworkable and was rejected early in the project design, partly because no appropriate authority existed in the electric power or agricultural/rural sector to regulate concessions. The Sri Lanka ESD Project demonstrated the failure of a fee-for-service model in that country. It was found that monthly collection expenses under the scheme were too high. Experience with fee-for-service models is still insufficient to point to real successes (GEF 2004).

The Bank involved rural communities in household energy projects aimed at commercializing wood fuels. All of the household energy projects sought to engage rural communities as private sector actors in the supply of wood fuels to urban consumers: the Niger Energy Project (1988), Mali Household Energy Project (1995), the Senegal Sustainable and Participatory Energy Management Project (1997), and the Chad Household Energy Project (1998).

These projects were designed so that the system of regulated wood fuel markets and village-based, sustainable forest management benefits the communities and thus provides them with the incentive to participate. Electricity-centered projects have sought to engage communities as well, such as the Sri Lanka ESD Project and Bangladesh Rural Electrification and Renewable Energy Development Project.

The private sector has been involved in the development of renewable fuels, and private firms have participated in efforts to create improved cookstoves. The Bank, in partnership with a firm in Zimbabwe, developed a low-cost, biomass-based ethanol gel fuel as an alternative to petroleum-based products and has conducted consumer tests and market assessments in Ethiopia, Malawi, Mozambique, Senegal, and Zimbabwe. For more efficient use of wood fuels and to shift use to conventional household fuels, such as liquefied petroleum gas, the Bank has involved private firms in the Niger Energy Project (1988), Mali Household Energy Project, Senegal Sustainable and Participatory Energy Management Project, and Chad Household Energy Project for the development and dissemination of improved cookstoves and interfuel substitution.

The Bank's effectiveness was modest with respect to the EBRS goal of good governance and creation of regulatory environments conducive to NRE. More recent projects and ESMAP assistance have started to address the issue. Regulatory improvements conducive to NRE commercialization have been the orphans of energy reforms, and this works against the Bank's own NRE goals. That is true because privatization and competition in power markets tend to weaken interest in serving rural markets, lead to a preference for petroleum-based fuels, and shorten time horizons for fuel choices.

The Bank focused on the reform of large utilities and gave inadequate attention to the critical issue of reforming regulatory and policy environments for NRE, particularly during the early to mid-1990s, to create objective, transparent, and nondiscriminatory regulatory mechanisms aimed at leveling the playing field for renewable energy. Renewable energy competes—and is stunted—in markets with distorted prices for conventional energy sources,

often through government subsidization of petroleum products.

Additionally, where privatization and unbundling of the energy sector have not occurred or are incomplete, the true costs of grid-based rural electrification remain hidden because the implicit cross-subsidies in the electricity subsector are not transparent. Thus, the fact that off-grid NRE systems can be more cost-effective does not emerge. Leveling the playing field for renewables within the broader energy sector therefore becomes important for renewable energy promotion.

Neglecting NRE while energy sector reforms are being designed and implemented can have important negative consequences that are slow and hard to reverse. This can be seen in the India RRD Project, which, while seeking to commercialize small hydro, did not address the regulatory uncertainties. The project could not do so because of inconsistencies between national and state-level frameworks, reform backsliding in some of the states, and the absence of a clear policy framework and future plans for renewable energy. Consequently, the small hydro development was adversely affected (IEG 2003a).

When the India Second Renewable Energy Project was designed, the Bank was slow to learn the lesson from the RRD Project and did not pursue a nondiscriminatory regulatory environment for NRE. As a result, the continuing government policy shifts and uneven state adoption of national legislation deterred private actors from investing in renewables.

Only in the late 1990s did the Bank begin to emphasize the promotion of policy and regulatory environments that are conducive for its NRE projects. The design of the Argentina RERM Project, for example, took into account the opportunities provided by the country's advanced privatization in the energy sector and had a sound regulatory framework. In the Uganda ERT Project, the Bank took this one step further. In its first phase, before major private sector investments were solicited, the project aimed to develop and strengthen certain aspects of the regulatory and policy framework for RETs. The planned framework is innovative in that the goal is to vary tariffs by region according to consumers' ability to pay and to be higher for less-viable areas. Furthermore, smaller grid projects will come under lighter regulation.

The Bank has had some early successes in resolving regulatory and policy uncertainties. In the Sri Lanka ESD project, a standardized Small Power Purchase Agreement (SPPA) was developed under the project and employed to resolve a tariff determination issue between the Ceylon Electricity Board and developers. As a result of the agreement, there was significant growth in the number of both mini-hydro and wind power developers (IEG 2004).

Prior to the SPPA, purchasing energy from small power producers often required lengthy bureaucratic processes and involved high costs, which ultimately made these arrangements unviable. The SPPA was a standardized, legally binding agreement between the national utility, the Ceylon Electricity Board and small energy producers (<10 MW). It involved a non-negotiable, formula-based tariff structure, based on avoided cost for the Energy Board, the lack of which had impeded small grid-connected power development. The SPPA eliminated market uncertainty and created transparency. Furthermore, the SPPA included transmission, distribution, and performance obligations, thus helping normalize the participation of small power producers in the electricity sector.

The contribution of the SPPA to the project was seen directly in the significant growth it brought in both mini-hydro and wind power developers. The experience of the project illustrates that even when renewable energy by small power producers is profitable and long-term financing is available, an SPPA and a predictable purchase rate are essential elements of a successful renewable energy development program (Ferrey 2004).

The Bank's analytical and advisory assistance (AAA) in the Mauritius Sugar Energy Develop-

ment Project (1992) helped establish a policy framework for private sector involvement there as well, in bagasse-based power generation. The project supported the policy of private power generation based on bagasse as a substitute for imported fuels.

There was a strong general consensus among both private and public evaluation respondents that, although the Bank's contribution solely in financing terms was small and its involvement by completion minimal, its advisory and "honest broker" role was critical in facilitating the launch and implementation of the country's Bagasse Energy Development Program. The Bank's nonfinancial AAA during supervision missions related to PSD—as well as the economic and sector work on the theory and best practices for energy pricing based on the avoided-cost principle—were often cited by stakeholders as specific examples of the value the Bank added.

In recent years, ESMAP—through its AAA—has helped establish the regulatory frameworks for rural electrification, as has been evident in Argentina, Bolivia, and Nicaragua.[2] This AAA has helped establish appropriate and coherent regulatory frameworks regarding off-grid electrification; it covers tariff setting, quality of service, delivery service obligations, technical standards, and other matters. The project also assists regulatory agencies enforce and supervise off-grid rural energy policies and develop detailed regulations in the context of national energy legislation.

The results of the project are being incorporated into the design and implementation of the rural electrification projects in these countries. An additional feature of this ESMAP assistance is that it has involved and promoted the exchange of information and experience among policy makers in these countries.

The Bank's effectiveness was substantial in pursuing the EBRS goal of supporting local financial institutions for RET commercialization and establishing markets for renewables. The Bank successfully promoted the role of local commercial and development banks in financing private developers, as was evident in the Sri Lanka ESD Project. As a result, private sector involvement grew significantly, and a strong NRE industry in the country now exists. In 2004, there were 11 mini-hydro developers, 9 accredited solar companies, and 20 active village hydro developers. A large number of consultants and trainers have also emerged.

Through using innovative financing mechanisms, the project illustrated that the risks involved in NRE are manageable and was able to make the local financial institutions more responsive to the market. Another outcome was the growth in the number of financial institutions interested in lending for NRE. In the follow-up project, a higher number of participating credit institutions are involved, and several that are not involved are financing renewable energy subprojects as well. Finally, the ESD project also engaged and strengthened a microfinance NGO to make SHSs more affordable to rural consumers (IEG 2004).

The India RRD Project helped change the public sector dominance in NRE financing to one characterized by PSD and more private developers. As a result, competition has improved and additional multilateral and bilateral support for commercializing NRE was mobilized (IEG 2003a).

But in some cases, institutional weaknesses have been constraining factors. Public partners have been weak, and private investors lacked experience and readiness. Following the India RRD Project, the Indian Renewable Energy Development Agency still lacked financial strength and institutional capacity to promote NRE commercialization on a sustainable, cost-recovery basis. It continued to accumulate nonperforming assets and have higher financial risks, limited capital availability (because it is not a financially competitive institution), and noncompetitive terms and processes. The agency also lacked the management and operational principles and practices to meet clients' needs and simultaneously mitigate risks. The agency had not been

fully effective in facilitating NRE development and had only partial support of the various stakeholders (IEG 2003a). These weaknesses affected its performance at the start-up of the India Second Renewable Energy Project.

Argentina's economic crisis had a significant adverse impact on the RERM Project. But the lack of success in transferring rural electricity provision to the private sector has also been due in large part to an insufficient number of qualified firms bidding for concessions. Moreover, the performance of provincial bodies in regulating the NRE systems has been unsatisfactory. This is despite the country's prior experience with privatization at the national level, the privatization of provincial markets, and training provided in the project on regulation. (An insufficient number of qualified firms and an inability to transfer energy provision to the private sector were seen as substantial risks at the onset of the project.)

The Uganda ERT Project (2001) sought to ensure that the public and private entities involved have the necessary capacity to undertake their respective roles before substantial investments are made in subprojects. Business development services will be made available to private sector firms, while technical assistance will be provided to public regulatory agencies.

However, major delays in these activities have unfortunately delayed the establishment of a process to commercialize NRE. Some of these delays have been in (i) preparing the proposed renewable energy development framework, which has contributed to uncertainty over the regulatory environment, particularly tariff setting; (ii) establishing a renewable energy database for the private sector; (iii) having capacity-building activities for the public sector on the regulatory framework; and (iv) establishing the financing institution (that is, the Renewable Energy Fund).

As a result, private sector investments to meet the project's Phase One initial targets have been low. The risks that the private sector will consider—that (i) Phase One incentives are not significant, (ii) the Renewable Energy Fund will not function effectively, and (iii) the new regulatory framework will not work properly—remain as substantial as they were at project initiation.

Growing evidence points to the private sector's effectiveness in delivering rural energy services—but only through public-private partnerships that include community organizations and consumer groups. The private sector working alone cannot directly improve energy access for the poor. In the Sri Lanka ESD Project, solar companies were to receive financing to provide credit to consumers. Yet they were unwilling or unable to offer this service, so market development for SHS was initially slow. Adapting to the situation, the project at the midterm review designed and implemented a microfinance model with a key NGO[3] to expand the reach of the SHS component in low-income, rural areas by making the units more affordable. Meetings that the project held with the full range of stakeholders also helped develop an arrangement for the NGO to assist in financing a few small electricity cooperative societies to build, own, and operate village hydro projects (IEG 2004).

The India RRD Project (1992) relied solely on the private sector to increase energy access to the rural poor. But it was unclear at the outset how to work with which private investors. Although the Indian Renewable Energy Development Agency accredited a number of rural credit organizations, its credit policy tended to favor larger enterprises and assisted smaller-scale entrepreneurs only to a limited extent, despite these entrepreneurs being better suited to serve the rural poor. Also, the agency's complex procedures and requirements discouraged small to medium-size start-up companies, which could have played an important role in the introduction of SHS.

The Bank exacerbated this bias by preferring to finance consumers directly instead of providing direct working capital loans to public or private developers. As a result, the project did not

adequately facilitate energy access, particularly through SHSs, for the rural poor (IEG 2003a).

The Argentina RERM Project has not been able to involve the private sector in providing energy services to the rural poor to the degree expected, largely because the provincial regulatory authorities and concessionaires have had difficulty reaching participation agreements for serving the dispersed market. Concessionaires have been reluctant to serve rural areas because of the uncertainties that a freeze instituted on tariffs for the concentrated electricity market raises for their contracts.

The result is that two years before project closure, fewer than half the concession contracts targeted for serving dispersed markets with NRE systems were in effect. This has led to doubts that provinces with important dispersed markets will be served through the project. It has also led to a substantial risk that the transfer of rural electricity service to the private sector will not be accomplished.

While private concessionaires have lacked the incentive to serve dispersed, rural areas, cooperatives and public distribution utilities have shown interest, even during the economic crisis, in serving the rural market. On the borrower's suggestion, the project was amended to allow these institutions to apply as concessionaires for the installation and maintenance of NRE systems. Moreover, the Ministry of Education offered additional financing to support PV installation in rural schools. The Bank showed flexibility and supported the participation of these new institutions. This outlook has the potential to improve the project's level of achievement in reaching poor, rural areas.

Learning on the part of the Bank that NGOs can play vital roles in private sector-led renewable energy provision also appears to be reflected in the Bangladesh Renewable Energy and Rural Economic Development and Uganda ERT projects. To promote the use of SHSs in rural areas, the Rural Electrification Board and the Infrastructure Development Company Limited (IDCOL) have been serving as the two implementing agencies. While the Electrification Board provides SHSs on a fee-for-service basis, IDCOL's role has been as a financial intermediary to make longer-term refinancing and grants available to NGOs, MFIs, and SHS suppliers, so that these entities can provide financing to consumers for SHS purchases.

In mid-2004, there were nine participating organizations, and they have installed roughly 19,700 systems—nearly twice the number targeted for this year at appraisal. Furthermore, the collection of consumer installments by the organizations has been quite good. What have made this component successful are the quality management of IDCOL and, most likely, the long experience of many NGOs and MFIs in Bangladesh with micro-lending to the rural poor.

In Uganda, village banks were given a revolving fund, which they use to lend to consumers at reduced rates with flexible repayment schedules. This mechanism was developed after it was discovered that dealer and consumer credit that development banks offered reached only the wealthiest households.

The Household Energy Projects in Niger (1988), Mali (1995), Senegal (1997), and Chad (1998) demonstrate that where low-income rural communities constitute the private sector, in the case of these projects in the wood fuel trade, PSD was most successful. The significant level of community engagement can be attributed to the incentives the projects offered to the villages of gaining economic benefits.

The final outcome of full NRE commercialization with no subsidies has not yet materialized. But if the Bank's desired interim outcome is to mainstream and scale up a process in that direction, the scorecard is satisfactory overall, particularly in recent years.

Market penetration of NRE technologies has been more successful in projects that combine elements of policy, finance, and business development, such as the Sri Lanka ESD Project. In general, however, the creation of a sustain-

able market for NRE faces a number of obstacles, especially where NRE (in cases where it is the economically least-cost option) remains financially more expensive and less accessible than conventional energy sources.

Nevertheless, increased use of NRE is emerging in countries with more developed renewable energy policy environments and financing capacities. Although major target groups, such as the very poor, still cannot afford PVs (or conventional grid electricity unless very low lifeline tariffs and household connection subsidies are offered), some PV-oriented projects have been successful in niche markets, such as clinics, schools, and high-value applications, and where households have disposable income. Grid-connected renewable energy systems might be viable where adequate policy and regulatory support is available.

The recent China RED Project has been quite successful in helping establish a process for NRE commercialization. This project has led to the emergence of a sustainable market for SHSs in the western region. OBA has been helping PV companies meet working capital needs and finance consumers. Moreover, in some cases, PV companies have invested in strengthening their financial management and human resources and developing products and distribution networks.

A key component of the project is support for technology improvements and standards being set to increase performance and reduce costs. These improvements have had a direct positive impact on market development: new products have been developed, greater competition has emerged, and prices have decreased. Most market participants recognize the project's standards as being a key factor in the market's development.

Twenty-five companies are now competing (up from 16 at project commencement), and additional companies, mostly small and medium-size enterprises, are in the process of qualifying. In terms of physical targets, 410,000 SHSs have been sold (compared to 363,000 at appraisal). But more importantly, the main financial, institutional, price, and technological barriers to large-scale commercialization have been removed.

Building on the RED project's pilot wind energy component, the preparatory work for the proposed China Renewable Energy Scale-Up Program is being implemented to facilitate wind energy scale-up. The project also provided much of the information for the drafting of the Renewable Energy Law, which would require that a certain amount of China's energy be supplied by renewables. This case illustrates a new attention on the Bank's part to ensuring an environment conducive to renewable energy.[4]

Regulatory uncertainties in India and the uneven nature of the frameworks across the states have kept NRE commercialization from reaching its full potential. However, in some states real achievements have been made. These can be attributed to the stakeholder consultation and negotiations processes that the first two projects (the RRD Project and the Second Renewable Energy Project) set in motion. One issue was tariffs: there was discord between tariffs set at the national level and those proposed by the states, and lower state levels provided a disincentive to NRE developers. In Tamil Nadu and Karnataka states, however, the state electricity boards and private developers have reached a mutually acceptable agreement on tariffs. It will enable electricity supply from renewables despite this tariff level being lower than the national figure.[5]

M&E of PSD outcomes in renewable energy projects needs to be improved soon and significantly, particularly for projects with OBA components that link financial incentives to delivery of specific performance indicators. The Bank's renewable energy projects even up to the late 1990s have been somewhat experimental. As the Project Appraisal Document of the Argentina RERM Project states, "…as more international experience in… different delivery mechanisms is obtained, it is anticipated that not one but several delivery mechanisms will be found effective, depending on the particular country context."

However, it is too early for any conclusions to be made on the success or failure of different commercialization approaches because M&E of the impact of Bank interventions has been inadequate overall. For example, in the India RRD Project, M&E within the implementing and financing body was weak, but the Bank did not make the necessary effort to strengthen the institution's capacity (IEG 2003a). Similarly, although capacity building in M&E of the private sector was one of the activities in the Argentina RERM Project, there is little evidence from the project documents on whether the M&E that was conducted provided information on the success of the concessionaire approach that was used.

Another example is the Indonesia SHS Project. Although the Bank claims that a lesson from the project is to scale down performance-based grants to facilitate the transition of companies to commercial operations, there is insufficient information available from project documents regarding the effect of the OBA on private operations to make this conclusion. Effective M&E of projects with OBA components is especially critical, given the rapid increase in performance-based operations and the importance of enabling comparisons across projects to sift through what works and what does not in OBA schemes.

M&E of NRE commercialization and PSD in project- and country-specific contexts are essential for learning what type of private actors to involve, determining and revising subsidy levels and OBA mechanisms, and mitigating investor risk in the renewable energy subsector. The results would also provide signals to investors whether transparency and predictability in the regulatory framework for renewables are being achieved. M&E systems will need to be strengthened if the Bank is to (i) learn from the successes and shortcomings of its NRE approaches in diverse contexts and (ii) derive from these lessons the basis for scaling up its support for NRE.

ANNEX J: IMPACT OF ANALYTICAL AND ADVISORY ASSISTANCE

The relevance and efficacy of the Bank's new and renewable energy AAA is high. Effective AAA has been a key factor of performance in successful NRE projects. Almost all NRE projects had AAA associated with their preparation and appraisal. AAA is defined broadly to include NRE-related studies, technical assistance, training, workshops, pilot activities, and study tours.

In some cases, formal economic and sector work also addressed NRE issues. Throughout the NRE portfolio, it was evident that AAA played an important role in supporting both project design and implementation by addressing a wide range of issues, including the following (among others):

- Pre-investment assessments, market assessment surveys, feasibility studies
- Selection and strengthening of the project implementing agency
- Technical design of project components
- Development of standardized SPPAs
- Design of financial intermediation mechanisms
- Analysis of economic pricing and tariff-setting options
- Implementation action plans, road maps for scaling up
- Technical standards
- Practitioners' workshops (for example, quality processes and control)
- Analysis of regulatory requirements for NRE commercialization
- Monitoring and evaluation methodologies and associated country case studies.

The direct, positive impact of AAA on NRE promotion is substantial, and country beneficiaries have been diverse. This conclusion is based on the literature review and a small survey. A number of Bank-GEF projects have contributed directly to the development of renewable energy policies by drafting or revising national renewable energy strategies and action plans: in Indonesia (1997), China (1999), India (1992), Sri Lanka (1997), Uganda (2001), and Argentina (1999). However, very few of the projects explicitly focused on power sector reform.

Another area where Bank-GEF AAA and projects have been successful is in establishing standards, codes, testing, and certification related to PV systems. China has adopted a national standard and testing procedures for SHSs, which the Bank project helped to develop. The standard has played an important part in improving the quality and reliability of PV systems to the benefit of the market and consumers. Other projects (for example, Argentina) also aim to develop standards. In Indonesia, the project helped develop a domestic testing and certification laboratory that has obtained international accreditation for PV component testing.

Examples of AAA for specific projects are shown in table J.1. In several documented cases, the AAA interventions were instrumental in resolving serious project implementation issues. The Sri Lanka and Mauritius cases illustrate problems that were resolved through AAA at the critical juncture of the midterm review.

In addition to the NRE community of practice within the Bank, target audiences have included government officials, private companies interested in NRE investments, commercial banks and MFIs, the academic and research community, NGOs, and energy consumers.

Table J.1: Examples of Analytical and Advisory Assistance/Economic and Sector Work in NRE Projects

Project	AAA/economic and sector work activities
Sri Lanka Energy Services Delivery	• Development of an SPPA that resolved the tariff issues between developers and the Ceylon Electricity Board and was a key factor in mini-hydro growth • Prefeasibility studies for the project's mini and micro-hydro components to prepare a pipeline of subprojects • Wind prefeasibility study • Survey of residential and commercial energy-consumption patterns • A 250-system pilot project implemented for the solar PV component • Technical specifications developed for the solar and micro-hydro components
India Renewable Resources Development	• A review of the government program on nonconventional energy sources and follow-up preinvestment studies. The review's conclusions that power generation from grid-connected mini-hydro and windfarm systems, and from solar PV, offer commercialization opportunities served as the rationale for the project. • A study on independent power producers helped bring about an important shift in the government's approach to renewable energy development. • Technical studies for the various components
Mauritius Sugar Energy Development	• Research on sugar bioenergy and the policy framework requirements, and an energy sector review • Bank facilitation of public-private consultations and eventual partnerships
Argentina Renewable Energy for the Rural Market Bolivia Decentralized Infrastructure for Rural Transformation	• Helped countries establish appropriate and coherent regulatory frameworks for tariff setting, quality of service, delivery service obligations, and technical standards in off-grid electrification
Nicaragua Off-Grid Rural Electrification (under the ESMAP project Regulatory Issues of Off-Grid Energy Services Delivery as Part of National Rural Electrification Strategies)	• Assisted regulatory agencies with enforcement and supervision of off-grid rural energy policies and with developing detailed regulations in the context of national energy legislation • Results of AAA project have been incorporated into the design and implementation of the Bank's rural electrification projects. • Promoted the exchange of information and experience among policy makers in these countries
Uganda Energy for Rural Transformation	• Conducted a rural electrification strategy study (assessing demand and supply of electricity in rural and peri-urban areas), which served as a basis for the project • The Uganda project plans to develop detailed regulations under the Electricity Act.
China Renewable Energy Scale-Up Program (proposed)	• The program includes the development of a mandated market share for renewable energy.

Cost efficiency has not been established. Although relevant and effective, the cost-efficiency of NRE-related AAA has not been studied to date in a methodologically rigorous manner that compares alternative AAA delivery systems for the same stream of knowledge- or capacity-building benefits. The available data consist of absolute cost figures for each AAA intervention, which, without permitting any comparability, only points to a very wide range of costs for an equally highly diverse set of AAA outcomes.

Many challenges remain in ensuring that the Bank's AAA keeps pace with new issues as the NRE portfolio is scaled up. As a key tool of quality assurance, the Bank should internalize the costs of AAA

instead of depending mainly on bilateral donor grants and trust funds. A complex AAA agenda lies ahead for NRE, as the scaling up of the Bank's NRE portfolio has resulted in the need for AAA to address new and more multifaceted issues. This statement is based on interviews and a small survey.

Three issues (among others) have immediate relevance to developing countries, but little or no analysis has been done to date for them:

- What is the economic and security rationale to move away from the *centralized utility model* (large power stations supplying the traditional residential, commercial, and industrial sectors) toward the *distributed utility concept* (a control center dispatching power supplies from distributed sources, including conventional and decentralized renewable energy options)?
- In planning energy mixes, what are the tradeoffs in adopting a *portfolio approach*, that is, adding the fixed costs of renewable energy technologies to a fossil fuel–based generating mix?
- What is the scope for innovations in power purchase agreements and tariff regimes that would attract commercial private investor financing?

The Bank has depended in large part on external funding to cover AAA costs. Funding sources, although varied, have come mainly from external donors. The Bank's NRE-related AAA has been funded by donor consortium of ESMAP; project preparation funds from GEF or the Policy and Human Resources Development Fund from the government of Japan; various bilateral donor trust funds; and, to a limited extent, project financing. This has created disconnects and time lags between meeting the country clients' needs quickly and fulfilling the procedural and fiduciary requirements of mobilizing external funds, which are intended to benefit the country clients and not substitute for the Bank's internal budget.

To maintain its comparative advantage in the global knowledge market, the Bank should internalize the costs of AAA, particularly those that directly affect project design and implementation and are therefore part of the Bank's own work.

Executive Summary

1. The World Bank's Energy and Water Department commissioned this study.

Résumé analytique

1. Étude réalisée à la demande du Département énergie et eau de la Banque mondiale.

Resumen

1. Este estudio fue realizado por encargo del Departamento de Energía y Agua del Banco Mundial.

Chapter 1

1. This 1997/98 study by the Operations Evaluation Department (now the Independent Evaluation Group) evaluated the application of the environmental guidelines in the energy portfolio at the time when the Fuel for Thought paper (that is, the energy-environment strategy) was being finalized (World Bank 1998).
2. Generally speaking, the Africa Region focused on biomass energy, the South Asia Region on small and mini hydro, and the Latin America and the Caribbean Region on wind energy.
3. A total of 65 projects are listed in the Bank fiscal 2004 and 2005 reports on renewable energy and energy efficiency, but the Bank's project databases do not yet provide information on nine projects that were approved in fiscal 2005. Hence, the study focused on 56 projects that have performance data available, although information was still insufficient for about a third of these.
4. As of June 2005.

Chapter 2

1. The Bank's involvement in NRE dates back even earlier, to 1980, with the establishment of the Renewable Energy Unit in the then-centralized Energy Department. However, formal institutional strategies started only in 1993.
2. The analysis was conducted on an economic basis, excluding transfer payments such as taxes, duties, interest payments (including interest during construction), and subsidies. Physical contingencies are included, but price contingencies are not. The cost comparisons were done in real 2004 U.S. dollars.
3. The cost ranges shown are the result of sensitivity analyses that were applied to the various leveled generating cost components using a Monte Carlo approach. The generating cost is the sum of the capital, operating, and fuel costs, leveled over the economic life of the plant, using a 10 percent real discount rate that is assumed to be the opportunity cost of capital.

Chapter 3

1. This is in line with the portfolio identified in the Energy and Mining Sector Board's December 2005 report (World Bank 2005e), as well as the immediately preceding report covering 1990–2004.
2. The figures are (closed + ongoing): Africa, 22 (9 + 13); East Asia and Pacific, 13 (7 + 6); South Asia, 12 (6 + 6); Latin America and the Caribbean, 8 (1 + 7); Europe and Central Asia, 8 (4 + 4); Middle East and North Africa, 2 (1+1).
3. In descending order, the number (and percentage share) of NRE projects in each region are: Africa, 22 (34 percent); East Asia and Pacific, 13 (20 percent); South Asia, 12 (19 percent); Latin America and the Caribbean, 8

(12 percent); Europe and Central Asia, 8 (12 percent); and Middle East and North Africa, 2 (3 percent).

Chapter 4

1. Based on the Annual Review of Portfolio Performance for fiscal 2005, prepared by the Quality Assurance Group. The 79 percent figure is without any weighting by disbursements. With weighting, 83 percent of projects were rated satisfactory or higher.
2. India Second Renewable Energy Project, aide mèmoire, supervision mission, October 18–26, 2005; Uganda Energy for Rural Transformation Project, aide mèmoire, supervision mission, May 23–27, 2005; Sri Lanka Renewable Energy for Rural Economic Development Project, aide mèmoire, supervision mission, September 5–16, 2005.
3. The figures for small hydro and wind are averages based on a sample of projects.
4. According to the GEF Climate Change Study, half of the emission reductions of the energy efficiency cluster will be contributed by the Bank-supported China Efficient Industrial Boilers Project alone. Four other Bank-financed energy-efficiency projects in China, together with seven mostly energy-efficiency projects in China supported by other implementing agencies, will account for about 75 percent of the energy efficiency subsector's future reductions.
5. OBA consists of using explicit performance-based subsidies to support the delivery of services to complement or replace user fees. It involves third parties, typically private firms, but in some cases NGOs, delivering services under contracts that tie disbursements of public funding to services or outputs actually delivered.

Chapter 5

1. Notably, the work on risk-adjusted valuations of energy undertaken by Shimon Awerbuch and others (Awerbuch 2006).
2. Laos, Cambodia, Indonesia, Mongolia, Philippines, and Vietnam.

Annex F

1. This includes the Philippines Leyte Luzon Geothermal Project (1994), Philippines Leyte Cebu Geothermal Project (1994), and Lithuania Klaipeda Geothermal Project (1996).
2. These projects were Uganda Power III Supplemental Project (2000), Philippines Energy Sector Project (1990), Rwanda Energy Sector Rehabilitation Project (1993), and Burundi Energy Sector Rehabilitation Project (1991).
3. These were Indonesia Renewable Energy Small Power Project (1997), Indonesia Solar Home Systems Project (1997), Argentina Renewable Energy in the Rural Market Project (1999), and Bolivia Decentralized Infrastructure for Rural Transformation Project (2003).

Annex G

1. As of June 2005.
2. In its evaluations, IEG views a project's objectives as encompassing both the project development objectives (PDOs) stated in project documents as well as key associated outcome targets. This means that whenever the PDOs stated in project documents are so broad and/or generally worded as to preclude any meaningful evaluation, intended project objectives are inferred by the evaluator from key associated outcome targets (and/or project design features as relevant).
3. Some recent projects, such as the Nicaragua Off-grid Rural Electrification Project (2003), are also characterized by this strategy.
4. According to the Project Assessment Documents of nine NRE projects—Mali (Household Energy and Household Energy and Universal Access), Ethiopia (Energy Access), Argentina, Senegal, Nicaragua, Uganda, Bangladesh, Sri Lanka (RERED), and Bolivia—the delivery benefits in terms of quality of life or income to women is an important goal.
5. Increasing the incomes of RET users is a goal of the following projects approved in or after fiscal 2001, according to their Project Assessment Documents: Sri Lanka RERED; Bangladesh, Nicaragua, Uganda, and Mali Household Energy and Universal Access; Bo-

livia and Ethiopia Energy Access. These constitute most of the freestanding projects in the fiscal 2001 to present period, except for Turkey Renewable Energy (fiscal 2004) and Hungary Small Hydro (fiscal 2003), as well as some blended projects, in which the NRE component is significant.

Annex H

1. Rwanda Energy Sector Rehabilitation, Kenya Energy Sector Reform and Power Development, Honduras Energy Sector Adjustment Loan, and Sri Lanka Second Power Distribution did not involve renewable energy installation. Though the Indonesia Renewable Energy Small Power Project did involve installation, it was terminated after a year because of the economic crisis the country experienced.
2. These projects were Indonesia Second Rural Electrification, India RRD, Mauritius Sugar Energy Development, Philippines Leyte Cebu Geothermal and Energy Sector, Burundi Energy Sector Rehabilitation, Nepal Irrigation Sector and Sunsari Morang Headworks, and Niger Energy.

Annex I

1. Argentina Renewable Energy in the Rural Market; Uganda Energy for Rural Transformation; China Renewable Energy Development.
2. The ESMAP project is entitled Regulatory Issues of Off-Grid Energy Services Delivery as Part of National Rural Electrification Strategies.
3. Sarvodaya Economic Enterprise Development Services.
4. Communication with Richard Spencer, Task Manager, China Renewable Energy Development, February 25, 2005.
5. Communication with Antonie de Wilde, Asia Sustainable and Alternative Energy Program Coordinator, February 24, 2005.

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