

# Renewable energy markets and the Global Environment Facility

**One of the results of the Earth Summit in Rio in 1992 was the Global Environment Facility, intended to support projects promoting sustainability. One focus of the facility has been renewable energy, and 41 such projects have been given grants by the GEF. Though most of these projects have not yet been completed, lessons have already been learned, and these are being fed back into GEF policy, resulting in more responsive and flexible action.**

## **Eric Martinot**

The Global Environment Facility (GEF) became a vehicle for sustainable development as a result of the United Nations Conference on Environment and Development (the “Earth Summit”) in Rio de Janeiro in 1992. Governed by a 32-member council of both donor and recipient countries, the GEF funds projects implemented by the UN Development Programme, the UN Environment Programme, and the World Bank Group. Under its climate programmes, the GEF is focusing on renewable energy and fostering projects that include the private sector in the development of markets for renewables in developing countries, thereby ensuring the sustained growth of the industry in these regions. Such is the intention, anyway – as practice is gained, the lessons being learned are being fed back into GEF processes and are improving support for the private sector.

From 1991 to 1999, the GEF approved \$480 million in grants for 41 renewable energy projects in 26 developing and transition countries (see table). Total project costs exceed \$2.5 billion, since the GEF grants have leveraged financing and other resources from governments, other donor agencies, regional development banks, implementing agencies and the private sector. Direct project beneficiaries and participants include government agencies, private-sector firms, utilities, non-governmental organisations, community organisations, and households. Projects are developed by recipient countries with attention to development and social objectives. The portfolio continues to grow as new projects are approved quarterly by the GEF Council.

GEF renewable energy projects fall into two categories. “Barrier removal” projects develop and promote markets for commercial or near-commercial technologies. “Cost-reduction” projects conduct research, demonstration and commercialisation activities to lower long-term technology costs. Projects target one or more technology applications, as shown in the table. In every case, one of the aims of GEF has been to promote the development of markets for renewable energy.

Market development can mean many things. Projects support private firms by providing financing, technical and business assistance, equipment subsidies, and marketing support. This support helps firms expand their business, innovate new business models, and lower costs. Projects build capacities of government agencies and NGOs to promote renewable energy development, often in conjunction with studies, resource assessments, and market characterisation. Projects create new

# Renewable energy projects with GEF grants

Project (year approved by GEF)	Responsible agency	GEF contribution (\$mn)	Total project cost (\$mn)	Barrier-removal						Cost-reduction				
				PV home systems for rural off-grid markets	Village scale power from PV, biogas	Commercial, public and agricultural off-grid PV	Wind farms for utility markets	Mini-Hydro and geothermal power plants for utility markets	Biomass and geothermal power plants for utility markets	Solar hot water for home, public and commercial	Solar thermal central-station power plants	Biomass integrated gasification/gas turbine power plants	Distributed grid-connected PV	
India: Alternate energy/renewable resources development (1991)	WB	26	186	☀		☀	☀	☀						
India: Development of small hydel in hilly areas (1991)	UNDP	7.5	15		☀									
Maritius: Sugar bio-energy technology (1991)	WB	3.3	55						☀					
Philippines: Leyte-Luzon geothermal (1991)	WB	30	1334					☀						
Zimbabwe: PV for household and community use (1991)	UNDP	7	7	☀										
Brazil: Biomass integrated gasification/gas turbine (1992)	UNDP	8.1	8.1										☀	
Costa Rica: Tejona wind power (1992)	WB	3.3	31				☀							
Mauritania: Decentralised wind power for social and economic development (1992)	UNDP	2.3	2.3		☀									
Tunisia: Solar water heating (1993)	WB	4	21							☀				
Small and Medium Scale Enterprise programme (1994)	IFC	1.6	4.8	☀										
Indonesia: RE small power project (1995)	WB	4	141					☀	☀					
Indonesia: Solar home systems (1995)	WB	24	118	☀										
Uganda: PV pilot project for rural electrification (1995)	UNDP	1.8	3.6	☀	☀									
Brazil: Bagasse and waste for power generation (1996)	UNDP	3.8	6.5										☀	
Ghana: renewable energy-based electricity for rural, social and economic development (1996)	UNDP	2.5	3.1	☀	☀									
India: Solar thermal electric (1996)	WB	49	245								☀			
PV Market Transformation Initiative (1996)	IFC	30	120	☀	☀	☀								☀
Renewable Energy and Energy Efficiency Fund (1996)	IFC	30	130	☀	☀	☀	☀	☀	☀					
Sri Lanka: RE capacity building (1996)	UNDP	1.5	1.5				☀	☀						
Sri Lanka: Energy services delivery (1996)	WB	5.9	55	☀	☀		☀	☀						
Argentina: renewable energy in rural markets (1997)	WB	10	120	☀	☀	☀								
Bolivia: Rural electrification with RE (1997)	UNDP	4.5	8.5	☀	☀									
Brazil: Biomass power commercial demonstration (1997)	WB	40	122										☀	
China: Capacity building for RE commercialisation (1997)	UNDP	8.8	28	☀	☀		☀			☀				
Lao PDR: S. provinces RE pilot (1997)	WB	0.7	2.1		☀									
Benin: Decentralized rural energy (1998)	WB	1.1	5.7	☀										
Cape Verde: Energy & water sector reform and development (1998)	WB	4.9	65	☀			☀							
China: RE development (1998)	WB	35	445	☀		☀	☀							
Peru: PV based rural electrification (1998)	UNDP	4	9.2	☀										
Solar Development Corporation (1998)	IFC	10	50	☀		☀								
Togo: Decentralized rural energy (1998)	WB	1.1	5.7	☀										
Guinea: Rural energy (1999)	WB	2	10	☀	☀									
Hungary: Szombathely CHP/biomass (1999)	WB	2.5	28						☀					
India: Biomass energy for rural India (1999)	WB	4.2	8.8		☀									
Malawi: Barrier removal to Malawi RE programme (1999)	UNDP	3.4	10.7	☀		☀								
Mexico: Hybrid solar thermal power plant (1999)	WB	49	178										☀	
Mexico: Renewable energy for agriculture (1999)	WB	8.7	26			☀								
Morocco: Developing solar water heater markets (1999)	UNDP	3	5.4							☀				
Morocco: Solar based thermal power plant (1999)	UNDP	43	114										☀	
Philippines: CEPALCO distributed generation PV (1999)	IFC	4	8											☀
Thailand: Removing barriers to biomass power/CHP (1999)	WB	6.8	73						☀					

financing vehicles like revolving funds, credit lines, and contingent business loans that are forgivable under specified conditions. And projects develop or strengthen regulatory frameworks for grid-based independent power producers, transparent power-purchase tariffs, and off-grid utility concessions that provide energy services to rural areas using renewable energy technologies.

Ultimately, GEF projects will only be successful if the firms, business models, capacities, financing mechanisms, and/or regulatory frameworks developed remain sustainable after project completion and are replicated on larger scales.

### **Emerging project lessons**

Lessons from these projects are just beginning to emerge. Of the 41 approved projects, only four have been formally completed and a few others are close to completion. The volume of available information is still small relative to the potential for future project assessments as the portfolio matures. Virtually nothing is available on post-project sustainability because it is simply too early.

Below are emerging lessons from some of the most prominent projects. Many of the important impacts and emerging lessons from GEF projects concern indirect influences, which may not be explicitly targeted in projects, or may arise from a mix of project activities. In these cases it is often difficult, or even impossible, to discern the degree of influence from GEF's activities.

*Zimbabwe.* The Zimbabwe photovoltaic (PV) home systems project, one of the first to be completed, has directly resulted in 10,000 PV home systems and substantial growth of the domestic industry. However, a number of conditions have to be met for this success to be continued. About half of the systems were sold with concessional consumer credit provided by a revolving fund, which must now be sustained. Dealers receiving per-system subsidies and marketing assistance under the project now must be able to make profit without such assistance. Waiver of a 40% import duty on PV components begun during the project must continue. And quality standards established under the project must be maintained. None of these conditions are certain, and some observers are worried about industry shake-outs. This experience shows how market gains may be difficult to sustain.

*Sri Lanka.* The Sri Lanka project, begun in 1997, has financed 21 MW of independent-power-producer (IPP) schemes and is also developing IPP regulatory frameworks and power-purchase tariffs. For PV home systems, slow uptake under original schemes has been turned around by a promising new approach, in which micro-finance organisations provide consumer credit. Independently of this, Shell International Renewables has entered the market and a nation-wide department store chain has begun to sell PV systems, though observers say that these moves were indirectly influenced by the GEF project. This project has shown the importance of flexibility in implementation, so as to work with the grain of the market and develop suitable business and regulatory models.

*Argentina.* The project to develop rural energy service in Argentina (see RER 3/6) requires the selection and regulation of concessionaires. Concessionaires must provide service to rural households upon demand but are free to select the best technologies (PV and hybrid village-power systems are targeted by GEF support). Numerous issues are being resolved for such a scheme: setting tariffs, finding and attracting capable bidders and conducting competitive bidding procedures, plus ensuring service quality and regulating concessions on an ongoing basis.

*India.* In India, GEF support for wind power occurred in parallel with the explosive market growth of the mid-1990s fuelled by favourable investment tax policies. By 1998, almost 1,000 MW of wind capacity had been installed in India and dozens of wind turbine manufacturers had emerged. During

the 1990s, the World Bank/GEF project directly financed 41 MW of wind turbine installations in India. The project strengthened the capabilities of the India Renewable Energy Development Agency (IREDA) to promote and finance private-sector investments, and more than 270 MW of wind projects were financed through IREDA. The project also promoted the acceptability of wind power among investors and banking institutions. As a result, along with favourable market conditions, many sources of finance became available for wind power. One lesson here is the impossibility of separating the influence of GEF interventions from other trends and forces at work.

*Mauritius.* The completed project in Mauritius never constructed a planned demonstration bagasse/coal-fired plant. Instead, the project financed efficiency investments in sugar mills to provide surplus bagasse for power generation. And the project led to an institutional and regulatory framework for private power generation in Mauritius and greater private-public dialogue and partnerships. Indeed, several sugar mills have completed or embarked upon bagasse power plant investments on their own. The lesson again is indirect influence--on private investment in the bagasse-fired electricity generation industry-- here without the need for demonstration facilities.

*China.* The World Bank wind and solar project in China was approved in late 1999 (see RER 5/26). Four new wind companies, jointly owned by the State Power Corporation and provincial or municipal power utilities, will construct 190 MW of wind farms and enter into commercial power-purchase agreements. This investment would practically double the installed wind capacity in China and would fund the largest single wind farm to date, 100 MW in Inner Mongolia. Most wind power investments in China have come from bilateral aid and have been small – less than 20 MW. This project demonstrates that China's utilities and officials now take wind power seriously enough to make investments on commercial terms. Lower installed costs are also expected, due to economies of scale from large wind farms and international competitive procurement.

The GEF publishes an annual *Project Performance Review*, a series of *GEF Lessons Notes*, and operational reports that provide project status reports and emerging lessons. The GEF is currently conducting a review of all 20 photovoltaic home-systems projects that will provide further details on emerging implementation lessons from this segment of the portfolio. Other evaluations are expected as the portfolio matures.

## **GEF and the private sector**

Private firms participate in GEF projects as manufacturers and dealers, local project developers, financial intermediaries, recipients of technical assistance, technology suppliers and contractors, and project executors. For example, private project developers receive financing and technical assistance in addition to benefiting from improved regulatory frameworks. Or manufacturers receive direct support – an example is the China wind and solar project mentioned above, which includes a \$90 million technology improvement component to assist domestic wind-turbine and photovoltaic manufacturers to innovate, improve quality and reduce costs – with both technical assistance grants and production investment loans. This project also includes \$3.6 million to promote private-sector development of wind farms, including preparation of pre-investment packages.

Despite such support, opportunistic private firms have often viewed the GEF project development process as slow and inaccessible. GEF projects typically require up to two years to prepare from initial concept through final approval, and then several more years to implement. Projects must be developed and approved by recipient governments. Because the GEF is a public agency, competitive elements must exist when the private sector is involved. Economic development and other social priorities factor strongly into projects.

The International Finance Corporation (IFC), the private-sector affiliate of the World Bank, is implementing four private-sector GEF projects that respond to these concerns: the Small and Medium Scale Enterprise Programme (SME), the Renewable Energy and Energy Efficiency Fund (REEF), the Photovoltaic Market Transformation Initiative (PVMTI), and the Solar Development Corporation (SDC). These projects are pre-established conduits for rapidly providing business financing to firms meeting established eligibility criteria or to eligible projects, along with business advisory services. Of these four, only the SME programme has any implementation experience yet. Three photovoltaic-home-system businesses have received SME finance and have installed more than 6,000 systems under different business models: in the Dominican Republic with monthly fees-for-service, in Bangladesh with cash sales and dealer-supplied credit, and in Vietnam with cash sales and credit from a local development bank. The PVMTI project is just starting in its three target countries – India, Kenya and Morocco.

New approaches to private-sector involvement are appearing. In its May 1999 meeting, the GEF Council endorsed a document prepared by the GEF Secretariat entitled “Engaging the Private Sector in GEF Activities”. This document considers both project and strategic involvement. Examples include non-grant (contingent) financing, financial guarantee mechanisms, support for investment feasibility studies, increased dialogue with the private sector, effective communication of GEF procedures and requirements, and long-term partnerships. The GEF Council requested “the Secretariat and the Implementing Agencies to proceed in preparing projects that incorporate [these] approaches”. Thus it is now up to the agencies to put these ideas into practice.

### **The World Bank Group’s renewable energy strategic partnership**

In early 1999, the World Bank Group proposed to expand its renewable energy activities through a “strategic partnership” with the GEF, as outlined in its July 1999 policy document *Fuel for Thought: Environmental Strategy for the Energy Sector*. The proposed strategies recognise the experimental, iterative and time-intensive nature of effective models and approaches for market development, along with a need for rapid response to private sector proposals. Four key features of the proposed programme are:

- *adaptable programme loans* that provide long-term policy and investment support (up to 10 years) in a particular country with flexible tranches and adjustable designs;
- a *rapid response envelope* in which the IFC has flexible authority to make quick investment decisions on private-sector opportunities meeting pre-agreed criteria;
- *policy tools* that support grid-connected renewable energy in developing countries, perhaps similar to the “Non-Fossil-Fuel Obligation” used in the United Kingdom or the “Electricity Feed Laws” used in Germany and Spain; and
- *country-based intermediaries* to identify and appraise projects.

As an interim target, the Bank proposed \$150 million annually in GEF resources, leveraged at a minimum of 4:1 with Bank and other sources (representing a total of \$750 million per year).

At its May 1999 meeting, the GEF Council reviewed the strategic partnership proposal and wrote:

*The Council welcomes the efforts to develop a renewable energy partnership with the World Bank, and invites, at its next Council meeting, proposals on a pilot phase basis for country-driven renewable energy programmes that build fully on current mainstreaming efforts in the Bank. The Bank is requested to mobilise co-financing for these proposals exceeding historic norms for climate change investment projects.*

The challenge to the Bank is clear – the Bank’s response remains to be seen. Recent internal reorganisations mean the Bank’s ability to develop renewable energy projects with its client countries may have to be tested all over again. *Fuel for Thought* promises to “promote renewable energy...projects as mainstream activities where they are cost-effective solutions to energy and environmental priorities” and to “expand support for the identification and preparation of renewable energy...projects.” So far, all World Bank renewable-energy projects have been assisted by GEF grants. Institutional limitations and the extra costs of market development activities beyond actual investments mean that the Bank will probably continue to rely on GEF grants. Ultimately, however, “mainstreaming” would mean renewable energy projects prepared without the need for GEF grants.

## **The future**

The GEF continues to explore and adopt new strategic and policy directions. The new approaches proposed for private-sector involvement and the World Bank Group strategic partnership are examples. The UN Environment Programme, under its own strategic partnership, proposes to assess the commercial potential for conjunctive photovoltaic-hydro power generation, map solar and wind energy resources, assess insurance-industry mechanisms for financing cleaner technologies, and promote centres of technology information and expertise. Fuel cells are receiving greater attention and a \$22 million UN Development Program hydrogen-fuel-cell bus project in Brazil was just approved in December 1999. The GEF is also beginning to support projects by regional development banks – the Asian Development Bank has begun to prepare a wind power project in China with GEF assistance and the European Bank for Reconstruction and Development is preparing a geothermal power project in Russia.

GEF funds for accelerating the development of renewable energy markets in developing countries and countries in transition play a role that currently appears unfulfilled by other means. Traditional bilateral assistance projects, while providing sales for donor-country firms, generally have not provided models and capacities for sustained market growth in recipient countries and have even hindered commercial markets. Many countries appear reluctant to borrow from development banks for renewables without added incentives. Private investment is limited by uneven competition from conventional fuels, unproven markets, financing risks, and high transaction costs, among other things. GEF funds can help overcome these barriers if spent in the right ways.

The experience so far has shown the urgent need for capacity building, among donors and recipients alike, to channel funds to good projects, allow recipients more informed choices, and overcome political constraints. The GEF and its agencies have recognised the need for private sector involvement to speed up the flow of funds and exploit opportunities effectively, though as project experience has shown, sustaining markets for renewables is a key issue. Through flexible approaches and other new initiatives, the GEF and its agencies have made market development a priority – one requiring long-term diligence in the face of often indistinct milestones and indirect influences.

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*Further information on the Global Environment Facility (including performance reviews, policy papers, and project proposals) can be found on its website ([www.gefweb.org](http://www.gefweb.org)). “Fuel for Thought: Environmental Strategy for the Energy Sector” can be downloaded from [www-esd.worldbank.org](http://www-esd.worldbank.org). A forthcoming publication “Promoting Energy Efficiency and Renewable Energy: GEF Climate Change Projects and Impacts” by Eric Martinot and Omar McDoom can be obtained from the GEF Secretariat, 1818 H St. NW, Washington, DC 20433.*