

# **Renewable Energy at the Energy Sector Management Assistance Programme**

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## **Overview of ESMAP**

The Energy Sector Management Assistance Programme (ESMAP) is a global technical assistance program and knowledge partnership financed by a group of donors including Canada, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, the United Kingdom, the United Nations Foundation, the World Bank, and the United Nations Development Programme (UNDP). ESMAP is managed by the World Bank.

ESMAP involves local and international public institutions, nongovernmental organizations (NGOs), and businesses in the formulation and implementation of knowledge activities. Through technical assistance, pilot projects, studies, and knowledge dissemination, ESMAP strives to expand the global knowledge base for addressing energy issues to the benefit of developing and transition economies. It concentrates on issues not yet mainstreamed in the operations of development partners, and in the private sector.

ESMAP's main strategic objective is to help developing and emerging economies improve their overall energy security in order to (a) expand access to modern energy services to the unserved poor in rural and peri-urban areas; (b) address the energy and environment nexus at the local, regional, and global levels related to energy production and consumption; and (c) promote the development of efficient energy markets.

## **Objectives of the ESMAP Renewable Energy Program**

The objective of the Renewable Energy Thematic Program is to develop renewables amongst least cost supply options of energy services:

- to increase access to modern energy services by the poor and the un-served;
- to diversify the primary energy supply portfolios as means to improve energy security; and
- to contribute to the global shift to a low carbon economy.

ESMAP was one of the pioneers in assisting with the development of renewable energy policies, institutions, and projects. The International Conference on Renewable Energies in Bonn in June 2004 provided the opportunity to capitalize on its work, and generated tremendous interests, commitments, and action plans from governments in both industrialized and developing countries, multilateral agencies, civil society, and the private sector to scale up renewable energy. Particularly, the World Bank Group committed to a target of at least 20 percent average growth annually in both renewable energy and energy efficiency lending over the next five years. ESMAP seeks to support the implementation of the commitments and action plans made at the 2004 Bonn Conference by the World Bank and many other development partners.

## **ESMAP's Renewable Energy Portfolio**

Over the past eight years, ESMAP supported more than 40 renewable energy projects at a total cost of approximately US\$9 million. Of these projects, 62% were in the Latin America and the Caribbean (LAC) Region, 17% in the East Asia and Pacific Region, 9% in the Sub-Saharan Africa Region, 5% in the South Asia Region, 4% for global projects, 2% in the Middle East and North Africa (MENA) Region, and 1% in the Europe and Central Asia (ECA) Region. Two large programs in Bolivia — the Bolivia Country Program and the National Biomass Program, totaling US\$4.2 million — accounted for a large share of the LAC Portfolio (ESMAP-The World Bank, 2004a).

A number of lessons have been drawn from the implementation of this portfolio of activities, in particular on the key barriers to scaling up renewable energy (RE) in developing countries. These are less technical and more regulatory, financial, and institutional, such as the lack of transparent legal and regulatory framework for renewable energy, the high upfront costs which also create major financing bottlenecks. Evidence suggests that people are usually willing and able to pay for higher-quality energy services, but rural consumers or entrepreneurs often do not have access to financing because of a lack of collateral, poor creditworthiness as measured by conventional commercial bank assessment, and, more generally, the unavailability of long-term lending facilities in domestic commercial banks. International experience also suggests that many renewable energy projects fail because of a lack of a sustainable local institutional infrastructure, such as energy service providers, and weak policy and planning institutions, which often require extensive technical assistance, training, and advisory services.

To address these barriers, ESMAP has financed projects focused on five critical areas:

- 1) developing RE policy and action plans;
- 2) demonstrating RE business delivery models;
- 3) piloting RE innovative financing mechanisms;
- 4) linking RE with productive use applications; and
- 5) generating and disseminating new knowledge on RE.

### ***Renewable Energy Policies and Action Plans***

ESMAP has provided technical assistance to assist governments in developing RE policies, regulatory frameworks, and action plans. An ESMAP project in Mexico, for example, worked with the national government on policies and strategies for the large-scale promotion of renewable energy in Mexico (ESMAP- the World Bank, 2004b). The project also included (a) an economic analysis to compare the costs of renewable energy development with those of thermal power plants, accounting for adjusted capacity factors, the value of portfolio diversification, and environmental benefits; the study concluded that the development of renewable energy can be a competitive energy choice; and (b) an optimal energy portfolio diversification scenario, which recommended to substantially increase the share of wind and geothermal in Mexico. Finally, the project analyzed financing options, and recommended an auction-based, least-cost subsidy mechanism as an incentive instrument to attract private investors. This ESMAP work

laid the foundations for a US\$25 million World Bank–GEF project, which is under preparation.

In Cambodia and Vietnam, for example, ESMAP adopted a participatory approach — object-oriented project planning (OOPP) methodology — to assist the governments in developing renewable energy action plan aiming at accelerating the large-scale development of renewable energy for rural electrification (ESMAP- the World Bank, 2001 and 2000a). This methodology identified the key barriers to renewable energy development by eliciting ideas from stakeholders during brainstorming sessions, and by creating consensus among stakeholders on problems and solutions. The participatory approach has been highly successful in securing the interest and ownership of all stakeholders of the action plans.

### ***Renewable Energy Business Delivery Models***

ESMAP pilot activities demonstrated several business models to deliver off-grid renewable energy services. For example, an early ESMAP project in Bolivia (the World Bank, 2003a) tested a fee-for-service model, where local firms deliver solar home systems (SHSs) on a fee-for-service basis to rural consumers, backed up by multinational photovoltaic (PV) manufacturers. The project, however, found that it is not realistic to solely rely on the private sector to deliver energy services in the most remote areas of Bolivia, even with substantial incentives. Therefore, the project tested a non-governmental organization (NGO) model, in which local NGOs would assist in setting up mutually agreed, community-based systems for billings and collections. These delivery models have provided key inputs and lessons learned to the World Bank-financed rural electrification project -- “Decentralized Infrastructure for Rural Transformation Project” which is currently under implementation.

In Comoros, ESMAP tested an innovative “concession” model that invited competitive bidding from the private sector to participate in the solar market (the World Bank 2000b). At the beginning of the project, there were no firms selling solar equipment in Comoros. The ESMAP project provided a revolving fund of US\$100,000 for the exclusive use of the selected private firm for a two-year period, through a competitive bidding process. The fund was managed by the government, and the company was responsible for installation and maintenance of solar equipment at its own risk. The government also granted the firm a three-year grace period on taxes and duties. As a result, this project jump-started the solar market in Comoros by convincing a foreign firm to invest, which would never have happened otherwise. The company installed 16 kilowatt of solar home systems during the first two years and was able to repay the provided financing.

### ***Renewable Energy Financing Mechanisms***

Demonstrating innovative financing mechanisms for both suppliers and consumers has also been part of ESMAP activities. In Kenya, ESMAP successfully piloted micro-finance models that provided credit to rural consumer groups interested in installing SHSs, one of the first such efforts in Africa (ESMAP- the World Bank, 2000c). The

project worked with financing partners, technical partners, and rural consumer groups that wanted to acquire SHSs. The financing partners made loans available to qualifying households and small businesses. A technical company was contracted to ensure that all systems were well designed, installed, inspected, and maintained. The third, and perhaps most important, player in this model were the selected rural customers who were organized to obtain group loans and purchase bulk packages of SHSs. As a result, this project increased access to financing for consumers who appreciated the opportunity to be able to afford SHSs and increase their access to electricity. The local financial institutions gained sufficient experience to scale up the effort, and the solar business loans became fully mainstreamed by one of the local micro-finance institution.

To test how best to finance local entrepreneurs interested in the renewable energy business, ESMAP helped set up a biomass fund in Bolivia (the World Bank 2003b), a village power fund in the Philippines, and financing women micro-enterprises in Bangladesh (ESMAP- the World Bank, 2004c). While these efforts increased the initial access to capital for local enterprises, the sustainability of such financing mechanisms proved to be a challenge. ESMAP experience demonstrated that lack of access to financing from domestic financial institutions that make renewable energy project financing their business, is a particularly difficult constraint in the rural areas. For future work, ESMAP is now planning activities that will engage the local financial institutions and leverage domestic capital markets.

### ***Productive Use Applications of Renewable Energy***

The scaling up of energy services based on renewables can contribute significantly to achieving the Millennium Development Goals (MDGs), in particular, in linking the application of services to income generation activities or to other activities that improve people's livelihood. Through a series of pilot activities, ESMAP demonstrated, for example, that passive solar heating for rural schools in Bolivia, information and telecommunication (ICT) services via solar-powered packet radio transmission in Honduras, and ice-making services from micro-hydro in the Philippines lead to increased access to educational material, better market prices, and increased incomes. The Honduras project demonstrated a least cost renewable energy-powered internet and phone access in remote, un-electrified rural areas (Lallement, et al. 2004). This project assisted remote villages in setting up rural information centers (RICs), which will provide internet-based educational services for youth and business development services for such rural micro-enterprises as agriculture, the flower business, and ecotourism. The results of this ESMAP activity is used in the design of the renewable energy component of a US\$8.5 million project funded by the Inter-American Development Bank (IADB) in Honduras. These activities also demonstrate that business development of productive use applications is difficult in remote areas with low ability to pay and low population density, and that significant subsidies are required.

### **Lessons Learned**

ESMAP projects on grid-connected and off-grid renewable energy policies have highlighted the importance *of establishing a clear legal and regulatory framework* in

the power sector to enable a level-playing field for all technologies including those for renewable energy sources. To increase grid-connected renewable energy investments, the establishment of competitive wholesale power markets can indeed provide good opportunities (Martinot, 2002). However, the private sector are reluctant to invest in renewable energies because of their capital intensity, as found in the ESMAP Nicaragua study (ESMAP - the World Bank, 2005a), and private utilities hesitate to purchase intermittent renewable energy resources unless there is a clear tariff framework to recover their costs from the consumers.

Various incentive models for power suppliers have been developed to date. The most widely applied include: 1) quantity-based renewable energy portfolio standards, which require that a minimum share of power or a minimum level of installed capacity in a given region be met by renewable energy; this approach is used in Australia, Denmark, Italy, the Netherlands, and some states of the US, etc.; 2) price-based feed-in tariff, which require mandatory purchase of renewable energy at a fixed price; this approach is used in Germany, Spain, and France; and 3) competitive tendering mechanism, which allows the power suppliers to competitively bid for renewable energy obligations, such as the British Non-Fossil Fuel Obligation. The challenge for developing countries is to adapt the various models to their own conditions.

Another lesson from ESMAP's work is the need to incorporate all options, renewable energy and conventional thermal options into ***least-cost energy planning in order to optimize energy portfolio diversification*** ; the analysis enables to weight the various options on a life-cycle basis, that includes fuel price and availability risks (ESMAP- the World Bank, 2005a). Renewable energy options can indeed also reduce off-taker risks, and lead to "green power" sales in some countries.

For off-grid renewable energy investments, ESMAP projects demonstrated that it is difficult to attract private sector investments in remote poor areas, because of the additional investment costs and the limited effective demand – both in terms of load and ability to pay for services. Given the dilemma between meeting the energy needs of the poor and the cost of providing sustainable energy services, various subsidy schemes have been tested. Some of the lessons learned include that the subsidy schemes should be designed to achieve clearly stated objectives rather than spoil the market. In general, ESMAP studies suggest that subsidies should be applied to upfront capital costs, not to operation and maintenance costs (ESMAP- the World Bank 2004a). The subsidies should be reduced over time with a clear exit strategy; incentives are needed to develop the renewable energy market and reduce costs, including building a local service provider industry, and addressing the affordability issues for the poor. The rules for subsidy schemes should be fair and transparent allowing competition among all parties, including both large international companies and small local enterprises (ESMAP - the World Bank 2000d). ESMAP plans to conduct a further in-depth study on best practices of subsidy schemes for decentralized energy systems.

Other lessons from ESMAP projects relate to the difficult in raising financing for renewable energy schemes. In most countries, unless the domestic capital market is used

to leverage available international financing, both through local commercial banks and other financial intermediaries (FIs) and micro-finance institutions (MFIs), there is limited chance to reach the investment goals announced at the Bonn Conference -- approximately 70 GW up to 2015 estimated to amount up to \$120 billion (the World Bank 2005b). Some successful examples exist, in Bangladesh, India, Kenya, the Philippines, Sri Lanka, etc. which can be used and replicated elsewhere (ESMAP Survey 2005c). The availability of consumer financing is another important success factor, as was demonstrated in Kenya, where the local MFIs which had no prior experience with SHS loans, partly because SHS were not used for income earning activities, were trained effectively by ESMAP technical assistance, and developed what has become a very successful market (ESMAP- the World Bank 2000c).

One final lesson: the need to diversify the renewable energy-based appliances in order to include low-cost, small-scale, renewable energy systems that are affordable for the low-income population. In China and Kenya, for example, the most popular SHSs delivered on a cash sale basis without any donor funding are those small-scale solar modules of 10-20 Wp, not the standard SHSs of 50 Wp which are promoted in most international aid projects (the World Bank 2000e).

## **Conclusions and Future Plans**

Renewable energy has been central to ESMAP's work over the years, and the outcomes of this work has been to raise the profile and mainstreaming renewable energy solutions in many developing countries. ESMAP activities have been instrumental in fostering policy changes, securing political support and leveraging investment financing from the World Bank, other donors, and the private sector. ESMAP projects also demonstrated the close linkages between the availability of sustainable energy services, environmental protection, and poverty reduction.

ESMAP is also known as a "knowledge clearing house". Good examples include its publications of best practices of small-hydro development (ESMAP-the World Bank, 2000d); a renewable energy toolkit and business handbook, intended for the World Bank and other practitioners, is under preparation.

ESMAP's future plans are to expand its renewable energy program. The 2005-2007 Business Plan has renewable energy as one of the four thematic programs with specific application on the following elements:

- Best practices on legal and regulatory issues to enable renewable energy solutions;
- Advisory services on renewable energy policies and sector planning;
- Implementation of innovative financing mechanisms with domestic financial intermediaries, including targeted subsidies, and the design of innovative risk-mitigation and credit-enhancement instruments;
- Implementation of innovative and replicable business models for public private partnerships activities with active participation from local players.
- Capacity building of renewable energy entrepreneurs and service providers.

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