

Renewable energy financing - what can we learn from experience in developing countries?

**JYOTI PRASAD PAINULY & NORBERT
WOHLGEMUTH**

ABSTRACT

Renewable energy (RE) has been considered as one of the stronger contenders to improve the plight of nearly two billion people, mostly in rural areas, without access to modern forms of energy. Although the economics of renewable energy technologies (RETs) have yet to reach a stage where these could replace fossil fuels on a significant scale, many experts argue that technologies such as solar, wind, and small-scale hydropower are not only economically viable but also ideal for rural areas. The mismatch between the potential and actual use of RE can be attributed to barriers in its implementation. Among others, a lack of financing has been one of the important barriers adversely affecting the widespread use of RETs. In developing countries, a majority of initiatives have focused on financial incentives. There are successes as well as failures from the models adopted. The paper discusses problems related to financing RETs, by focusing on small-scale off-grid RETs in developing countries, and reviews some of these models to bring out the lessons that we can learn to accelerate the availability of finance to RETs.

Keywords. renewable energy; financing; policy instruments.

Jyoti Prasad Painuly is a Senior Energy Planner at UNEP Risø Centre on Energy, Climate and Sustainable Development, RISØ National Laboratory, Roskilde, Denmark. j.p.painuly@risoe.dk.

Norbert Wohlgemuth is Associate Professor at the University of Klagenfurt, Department of Economics, Klagenfurt, Austria. norbert.wohlgemuth@uni-klu.ac.at

1. WHY FOCUS ON FINANCING?

The World Summit for Sustainable Development's decision to hold a conference on renewable energy can be considered a breakthrough in the deepening of international cooperation in supporting a global transition towards a more sustainable energy development (Spalding-Fecher et al., 2005; World Bank, 2005a). The objective of the discussions on financial dimension of the RE (beside the political and policy, and human and institutional dimensions) in the Bonn 2004 conference was to increase private and public financing in order to secure a reliable supply of RE. In the broader context, financing has been identified as a key issue in achieving development. The role of energy in that process has only recently been officially acknowledged. For developing countries, there is a clear connection between access to modern forms of energy and development; a fact which is reflected in the recent agenda of the UN Commission on Sustainable Development also.

Wiser and Pickle (1998) find that one of the key reasons that RE policies are not more effective is that project development and financing processes are frequently ignored or misunderstood when designing and implementing renewable energy policies. Many RETs are no longer considered experimental; they have proven to work well in commercial settings throughout the world. In many countries public policies and government regulations change market conditions, making it easier for non-conventional technologies to compete. Even though many sustainable energy investments are "bankable", the financial community overall has been slow to provide financing for projects (Sonntag-O'Brien and Usher, 2004).

Decision-makers receive mixed signals from the investment literature about the issue of when it is appropriate to develop RETs as substitutes for fossil fuels. In the case of renewable energy investments, cautious financial institutions often overestimate the risks and decide against extending loans or providing other forms of financial support for otherwise sound projects. In the end, projects that might be good investments and yield a global environmental benefit fail to go forward because of a misperception of the risks involved (UNEP, 2004).

Given the huge potential opportunities in renewables, why are entrepreneurs and financial institutions not rushing to cash on the opportunity? One answer is that renewable energy technologies (RETs) have to overcome a series of barriers before they can penetrate the market. The barriers have been discussed in detail in the literature on renewables (Reddy and Painuly, 2004; Painuly, 2001). In the initial stages of development, technical barriers predominate. In order for a technology to become cost-effective, market barriers such as inconsistent pricing structures have to be overcome. Then there are institutional, political and legislative barriers which

hinder the market penetration of technologies, including problems arising from a lack of awareness of, and experience with new technologies and lack of a suitable institutional and regulatory structure. Finally, there are social and environmental barriers which result mainly from a lack of experience with planning regulations that hinder the public acceptance of a technology. A sound strategy to increase the market penetration of renewables will need to address all these barriers.

However, the largest barrier to greater renewable energy use is its cost, despite the cost reductions achieved over recent years. Other obstacles, particularly for the increased use of renewable electricity, include subsidies and other support for competing conventional fuels (especially coal and nuclear power). Lack of full cost pricing when determining the cost of competing energy supplies also hinders the development of renewable energy since the cost of environmental impacts are usually not included in energy prices. High discount rates and competition on short-term electricity prices, as seen in electricity markets undergoing a change in regulatory framework, may disadvantage projects with high capital costs but low running costs, such as renewable electricity systems - unless governments set up schemes designed to replace and substitute for estimated deficiencies of the market place. The high cost of renewables and perceptions about the technology make it difficult for RETs to access finance. As a result, financial barriers appear to be most prominent for developing renewables. Several financial support programmes have been taken up by international agencies and public as well as private funds have been created to provide access to finance (Wohlgemuth and Painuly, 2002).

This paper is structured as follows. Chapter two gives a generic overview of mechanisms in the “finance continuum” used in developing countries to support renewable energy. Case studies are presented in chapter three and chapter four presents lessons learned from these case studies.

2. RENEWABLE ENERGY FINANCING APPROACHES

In industrialised countries, there is already of lot of experience with financial instruments to promote RE for electricity generation (see for example the publications of Bolinger et al., 2005; Menanteau et al., 2003; Mitchell and Connor, 2004; Ringel, 2006; Sawin and Flavin, 2004).¹ In principle, there are several classifications for mechanisms to financially support RE. One classification would be along the development chain of RETs. According to this classification, RETs can be supported at the R&D,

¹ The International Energy Agency maintains a database of financial instruments applied to promote RE. It can be accessed at <http://www.iea.org/textbase/pamsdb/jrlist.aspx>

the investment, the production and the consumption stages. Another classification would be whether supply and/or demand or price and/or quantity of RE are supported. Finally, differentiation can be made whether regulatory or voluntary and/or direct or indirect mechanisms are employed.

Success or failure of a project needs to be assessed with reference to the objectives for which it was established. The optimal set of instruments to promote renewable energy depends on these objectives (Komor and Bazilian, 2005; Gaunt, 2005). Various objectives for promoting RE as seen in the literature include energy access to the poor, promotion of clean energy, promotion of sustainable energy sources, reducing dependence on imported fossil fuels, reducing greenhouse gas emissions and shifting to zero or low greenhouse gas emitting sources (Goldemberg, 2004; World Bank 1996; World Energy Council, 1996; Blyth and Lefevre, 2004). Although sustainability of a project and wide-scale adoption of RE is an implicit objective of most of the RE projects, commercialisation does not figure as an objective in many cases. However, commercialisation is one of the most important requirements for large scale implementation of RE, and hence a successful financing model should eventually lead to commercialisation or near commercialisation (considering still high cost compared to conventional energy in many circumstances) of the RE it seeks to promote. It implies that a successful project should be able to promote use of renewable energy with minimal efforts after its completion.

Beside the objectives, it is not immediately clear what criteria should be applied to assess the success of a project or programme. Possible criteria according to which support mechanisms can be judged include: effectiveness (e.g., total capacity installed or total kWh of electricity generated), cost-effectiveness (kW/€, kWh/€), short term economic efficiency (short term cost minimisation), long term economic efficiency (incentives for innovation), equity (fair distribution of costs and benefits), certainty for industry, transparency, transaction costs, and market conformity (especially important in liberalised electricity markets). Sonntag-O'Brien and Usher (2004) classify the financing models based on the stage at which financial support is provided. Their categorisation is followed here with some modifications to bring out the lessons.

- ❖ Start-up capital support to meet up-front costs for raising capital, building market awareness, and transaction costs, which are generally high for renewables. Business development grants and seed capital financing fall in this category. E+Co support for development of energy enterprises is an example of this type of support.

- ❖ Operating capital support, which includes lines of credit, credit enhancements for loan provision, and small and medium scale energy enterprises growth capital funds.
 - Lines of credit refer to creation of credit windows in national or local banks, with support from international finance institutions/donors, for lending to RE enterprises. For example, the India Alternate Energy Project, initiated by the World Bank/Global Environment Facility (GEF) in 1991, provided lines of credit to Indian Renewable Energy Agency to promote renewable energy.
 - Credit enhancements refer to various subsidies provided by international finance institutions/donors to soften loan financing, either for the lender or the borrower through risk sharing or interest-rate reductions. These assume the forms of (i) partial risk guarantees, which ensure debt-servicing payments to the lender, and (ii) partial credit guarantees, which are used to extend loan repayment periods, improving the project's cash flows in the process. The guarantees can motivate banks to lend for projects they perceive as risky.
 - Credit enhancement can also be achieved through interest rate subsidies which lower the cost of financing for the borrower. The credit risk in this case remains with the local bank/institution providing the credit, and hence can be applied only if the market potential is big and ripe for development. The approach has been successfully applied by the Government of India for solar hot water systems, and recently UNEP applied the same approach for photovoltaic solar home systems in India. Credit enhancement leads to access to business finance to the RE enterprises, one of the major objectives of several World Bank/GEF renewable energy projects. In some cases, they combine credit enhancement with support to the manufacturers and/or dealers to meet a part of their business development costs in initial stages, with a view to develop the supply side of the RE market. In yet other cases, they combine the credit enhancement with subsidies tied to the performance (for each unit sold) to lower the high initial costs of the RE equipments with the view to develop the market, which, in turn, is expected to lead to lower the cost of RE equipment through economies of scale and learning.
 - Growth capital funds are similar to seed capital financing but use a mix of commercial capital and donor funds, and reduce the risk of investors by financing the project through equity or debt. Experience with these funds has been mixed. The Asia Alternative Energy

Programme² of the World Bank, one of the largest financiers of RE and energy efficiency in developing countries (World Bank, 2005b), is an example of a successful fund. It has exceeded the target of 10 percent share of alternative energy in its Asian power sector loan portfolio. The trend continued and Asia Alternative Energy Programme increased the lending portfolio for alternative energy projects from about US\$ 2.0 million in 1992 to over US\$ 1.3 billion between 1993-2004.

- ❖ End user financing has several variations, including:
 - The supplier credit model, in which the RE enterprise provides a short term (3-12 month) credit to the end user for purchase of the RE equipment/system. The equipment manufacturer could also extend credit to the RE enterprise for this purpose.
 - The consumer credit (or micro credit) model, in which local finance institutions provide loans to users (households, for example) to buy the RE system. RE enterprise in this case transacts on commercial basis with the users. Credit enhancements, using partial guarantees and interest rate softening, have also been applied with consumer credit.
 - Several World Bank solar home systems projects have used what they refer to as a 'dealer sales model', which uses the consumer credit approach with credit enhancement. In this model, the dealer sells the system to the end user, which can be sometimes on credit. The dealer is provided support through access to business financing. Some additional support (performance based subsidy to dealers) has also been provided to develop the market. The model has been applied in Indonesia, India, Sri Lanka, Vietnam, Bangladesh and China by the World Bank. A part of the cost in this case was covered by the project, which involved dealer training and dealer business financing. Consumer credit (supplemented with credit enhancement) has been experimented through three channels in World Bank projects: in Bangladesh and Indonesia, a dealer-credit model was applied, whereby dealers provide credit to the end user, and commercial financiers provide business financing to dealers. In the case of Bangladesh, International Finance Corporation, the private sector arm of the World Bank, provided loan to the dealer, Grameen Shakti, under their Small and Medium Scale Enterprise Program, who, in turn, extended credit to customers. Dealer credit was tried but rejected

² <http://www.worldbank.org/astae/>

by the dealers in Sri Lanka in favour of consumer credit through Sarvodaya, a micro finance organisation, which in turn borrows from commercial financiers. A development finance institution provides the credit to consumers through an NGO in Vietnam. The consumer micro credit model has also been applied by UNEP for solar home systems in India in a United Nations Fund funded project, in partnership with two commercial banks, Syndicate Bank and Canara Bank.

- In the fee-for-service model, customers pay for the energy service that is provided to them by an energy service company. It makes the energy affordable and minimises the long-term risks for the customers as the ownership and maintenance of the equipment lies with the energy service company. The World Bank used this model in Argentina, Benin, Togo, Dominican Republic, and Cape Verde. The World Bank project aimed at establishing energy service companies for solar home systems installations in Benin and Togo, and also to provide business financing and support for initial market development. The energy service company model was also tried out in Sri Lanka but given up after initial problems in favour of the consumer credit model. In the World Bank energy service company delivery models, financing for energy service companies was provided through either government or multilateral sources, but channelled through commercial financiers in many cases.
- The lease model is similar to the fee-for-service model as the ownership of the equipment lies with the leasing company, which typically are specialised financial institutions. It has been used for big, mostly on-grid power, generation equipment.

3. CASE STUDIES

A number of initiatives to promote RE have been supported by international finance institutions and donors, as most of the developing countries either did not have necessary infrastructure and expertise, or did not consider it desirable to adopt regulatory models used in developed countries. Several initiatives are of recent origin and it is too early to give a verdict on their success in promoting renewable energy. Even where projects have been completed, in absence of independent assessments or even objective assessments by project sponsors/implementers, in most of the cases it is difficult to judge success of the applied models.

Some of the case studies presented in this chapter use more than one approach; there may be support to the renewable energy entity from donors or international financial institutions, and the entity in turn may be using one of

the above end user approach to support customers. There are many other encouraging projects that could be presented. However, the broad message and lessons are similar to that emanating from the case studies covered below.

3.1 Energy Enterprise Development by E+Co

E+Co has been engaged in promoting small and medium scale energy enterprises through seed finance. Working on Rural Energy Enterprise Development (REED) project initiated in 2000 by UNEP, E+Co provided support to 25 energy enterprises in six developing countries in areas such as start-up financing (in the form of debt and equity), enterprise development services such as business planning, management structuring and financial planning, and assistance in securing later-stage financing. The countries include Ghana, Mali, Senegal, Tanzania, Zambia and Brazil with enterprises covering crop drying, charcoal production, biofuels, wind pumps, solar water heating, and efficient cook stoves. E+Co started operations in 1994 and its overall portfolio had reached, by March 2005, about 11 million dollars with 112 investments in Africa, Latin America, and Asia, of which more than 85 per cent is debt. The leverage has been more than 10, with additional investment in these enterprises at US\$ 120 million. E+Co experience has been that money is not always the problem; it is the link between money and the good ideas that is often missing in this sector. Their opinion is that the need to promote and strengthen private enterprises is a key element to overcome these issues.

3.2 Seed Funding For Solar Home Systems in Bangladesh

Grameen Bank in Bangladesh set up a not-for-profit subsidiary, Grameen Shakti, which is involved in the marketing, sales, servicing, credit provision and other activities related to photovoltaic solar home systems business. Grameen Shakti started operations in 1996 and planned to install 100,000 solar home systems by the year 2000 (Lewis, 1997) but found the process of building customer confidence in systems time consuming and costly. In addition, long distances, poor transport infrastructure, impassable roads during monsoons, low literacy rates, cash-and-barter based transactions and lack of technical skills contributed to the transaction costs of operating the rural photovoltaic business (G8 Renewable Energy Task Force, 2001). In 1998, International Finance Corporation provided access to GEF funds through its Small and Medium Scale Enterprise Program, which enabled Grameen Shakti to offer better credit terms to their customers and their sales figures reached 2000 systems by the year 2000. Grameen Shakti picked up after 2000 and had installed 23,500 systems by April 2004 and plans an

installation base of 100,000 by 2008 (Barua, 2004). The financing scheme that started with 50 per cent of the system price as down payment and the remaining 50 per cent in 6 months in six equal monthly instalments was modified from time to time and now requires only 15 per cent of the system cost as down payment and the remaining 85 per cent can be paid within 3 years time in equal monthly instalments with 12 per cent service charge on the outstanding amount. Grameen Shakti plans to introduce a 4 to 5 years financing scheme for poor rural people. Photovoltaic systems are also used for income generation activities such as for lighting in shops, clinics, restaurants, sawmills, rice mills and for cellular phone service. Grameen Shakti activities, besides providing credit, included training of local people to install and maintain photovoltaic systems, training of customers in application and maintenance of photovoltaic systems (Barua, 2001).

The experience at Grameen Shakti indicated that the process of building customer confidence and demand became less time consuming after a critical mass of installations and they believe that after three to four years of profitable growth they will be able to obtain additional financing from commercial banks.

3.3 The World Bank/GEF India Alternate Energy project

The World Bank/GEF India Alternate Energy project (also known as India Renewable Resources Development project), with co-financing from three other agencies, provided low-interest loans to wind farm developers in the nineties. At the same time, favourable investment tax policies and a supportive regulatory framework resulted in unprecedented market growth for wind power. Investment tax credits, supportive power purchase tariffs, provision for wheeling, permission for third-party sales, power-purchase contracts with local utility and possibility of power “banking” contributed to the development of the market. More than 1200 MW of wind capacity had been installed by the private sector by 2000. Of this, direct financing by the GEF project was only 41 MW. Manufacturing of wind turbines had started with several companies operating in this area. Several local financial institutions also started financing wind farms which continued thereafter also as capabilities had been developed and a supportive regulatory framework had been established.

3.4 Sri Lanka Energy Services Delivery project

Implemented between 1997 and 2002, the Sri Lanka Energy Services Delivery project provided commercial financing through banks and micro finance institutions for private sector provision of on-and off-grid renewable

energy services. This included mini hydro plants (grid connected), community hydro schemes (off-grid) and solar home systems. The Sri Lanka Energy Services Delivery project resulted in an installation of 31 MW of grid-connected mini hydro power by mid 2002 by the private sector against an original target of 21 MW. The progress continued after completion with addition of 7 MW by 2004, 41 MW under construction, and letter of intents for another 200 MW (Nagendran, 2004). Off-grid community owned village hydro schemes also performed satisfactorily.

Concerning solar home systems, the project has also been considered successful with about 21,000 systems installed by four companies through Sarvodaya (a micro finance institution) by 2002, against an revised target of 15,000 (original target 30,000). After completion of the Sri Lanka Energy Services Delivery project, another 24,000 systems had been added by March 2004.

3.5 Photovoltaic solar home system financing in India

In 2003 UNEP initiated a credit facility in Southern India to help rural households finance the purchase of solar home systems. Two of India's largest banks, Canara Bank and Syndicate Bank, along with their eight associate Regional Rural Banks (or Grameen Banks), established a Solar Loan Programme through their branch offices across Karnataka State and part of the neighbouring Kerala State. Previous to this programme, only about 1400 solar home systems had been financed in Karnataka. In addition to providing financial support in the form of interest rate subsidies for borrowers, the programme provides assistance with technical issues, vendor qualification and other activities to develop the institutional capacity for this type of finance. As of January 2005, the programme had financed nearly 12,000 loans, through more than 2000 participating bank branches. Sales volume had reached 1000 systems per month. The fastest growth in loans is currently in rural areas, thanks in part to the increasing participation of the Grameen banks. The three-year Programme with US\$ 1 million in support to banks is on target to finance between 20,000 and 25,000 solar home systems, making it one of the largest solar home systems loan programmes globally. In response, other Indian banks have recently launched competing solar home systems loan programmes. The programme is supported by the United Nations Foundation and the Shell Foundation.

3.6 Revolving Fund for Small Hydro Schemes in Peru

A revolving fund for financing micro hydro power plants was set up in 1994 through an agreement between the Inter-American Development Bank

and ITDG-Peru, a NGO. The project is an example of a successful financial model that combines subsidised loans and technical assistance through shared efforts between technical co-operation agencies and government institutions (G8 Renewable Energy Task Force, 2001). The project was initiated with the view to provide electricity to remote areas not reachable through conventional grid. The fund has provided loan finance to 15 rural electrification projects of municipalities, 5 projects of the private sector and one project of the co-operative. A loan amount of US\$ 700,000 was given, which leveraged US\$ 2.5 million from government and other agencies to provide electricity to 15,000 people. Technical assistance for proposal preparation was provided and regional and local workshops were arranged to create awareness. The project needed social intermediation, forming pre-electrification committees or other ad hoc organisations to operate and maintain the plant (Barnett, 1998), and required technical intermediation in addition to financial intermediation. Repayment levels have been high but considerable time and effort had to be expended to market both the fund and the idea of hydro power. Overall, the project experience implies that micro hydro is not viable without some support, as households had to be provided subsidised power to make it accessible to them.

3.7 International Finance Corporation projects

Two International Finance Corporation projects are providing business financing for solar home systems to businesses, which may deliver systems under a variety of models. The Photovoltaic Market Transformation Initiative provides business financing for companies in photovoltaic markets in India, Kenya, and Morocco through a competitive solicitation and selection of business plans. Financing has been committed to nine projects so far, totalling US\$ 19 million of the total US\$ 25 million available under the project. The Small and Medium Scale Enterprise Program is providing business financing for dealers in Bangladesh, the Dominican Republic and Vietnam and experiences have been discussed separately. International Finance Corporation is implementing two more projects: The Solar Development Group and Renewable Energy and Energy Efficiency Fund (REEF) for emerging markets. The Solar Development Group is expected to accelerate the development of viable, private sector business activity in the distribution, retail sales and financing of off-grid rural electrification applications in developing countries. The focus is on photovoltaic businesses. Renewable Energy and Energy Efficiency Fund is a private equity fund that seeks to make minority equity and quasi-equity investments in profitable, commercially viable private companies and projects that include electricity generation primarily fuelled by renewable energy sources, energy efficiency

and conservation, and renewable energy/efficiency product manufacturing and financing. It is too early to evaluate International Finance Corporation projects, except the Small and Medium Scale Enterprise Program.

4. **LESSONS LEARNED**

- ❖ World electricity generating capacity is likely to increase by more than 70% by 2030, and this offers an opportunity to develop renewable energy technologies up to a stage where they are fully competitive with conventional technologies. Most of the increase is expected to take place in developing countries (EIA, 2006).
- ❖ Renewables face several barriers today, impeding their deployment on a commercial scale. Cost competitiveness combined with risk perceptions related to new technologies has resulted in a lack of availability of finance to renewables, particularly in developing countries. Financing problems thus represent one of the most important barriers in expanding renewables' usage. Several national as well as international agencies have tried to address this barrier through a variety of measures in both developed as well as developing countries.
- ❖ Direct and indirect investment subsidies, operating incentives through regulatory measures that require higher payment to power generated from renewables and green energy marketing strategies are some of the supply side mechanisms successfully used, mostly in developed countries. The schemes have been carried out through regulatory measures, obviating the need for direct interaction with end users, and thus avoiding high transaction costs. This has worked well in developed countries in introducing renewables for electricity generation. Preferential financing for renewables has also been made available in several countries. Financing mechanisms on the end user side have also evolved; thus revolving funds have been used to provide credit to the end users, renting and leasing schemes have been promoted by utilities or third parties, and hire purchase options have also been explored.
- ❖ Other market based instruments such as green certificates; green funds etc. are also in use. This however has limited utility in a developing country context where major initiatives have been for decentralised options, often at the end user level. End user face the twin problem of access to credit and high cost of credit, even if available, due to risk perception of the financial institutions of the renewable technologies as well as the – often poor - borrowers. The projects such as financing of

solar home systems in India and Bangladesh seek to address these twin issues. However, a favourable regulatory framework, along with credit support and incentives can be instrumental in driving upwards renewable energy capacity, as evidenced in case of India's wind power programme.

- ❖ Although supply side initiatives have been around for some time, initiatives on end user side are relatively new and still evolving. With increasing experience, these are expected to improve and address the barriers to renewables financing.
- ❖ The World Bank/GEF projects have also tried to address broader issues related to market development for renewables. This included support for policy development through assistance to regulatory agencies, encouraging inclusion of rural electrification in countries' policy planning, import duty reduction on RE equipment, and power sector reform etc.
- ❖ Need for infrastructure: One of the objectives of the most of the World Bank/GEF projects has been to develop market infrastructure for RE equipments. The other important issue dealt with successfully by the World Bank is development of standards, testing, and certification facilities.
- ❖ Exit strategy: Design of an exit strategy is another important requirement for any RE support project. Grant and subsidies should be phased out smoothly. The market can crash, leaving deep scars as happened in case of World Bank/GEF solar water heating systems project in Tunisia: the market started falling as soon as the project was over and reduced by 50 per cent within two years of project-ending, and continued to fall thereafter also.
- ❖ Implementation experience and role of stakeholders: Experience has been important but still limited with international agencies. It is best summarised by Martinot (2001):
 'Most World Bank Group projects are relatively new and offer little implementation experience so far. Five leading projects in Bangladesh, the Dominican Republic, India, Sri Lanka and Vietnam have installed more than 8,000 systems. There is still a long way to go; installation targets from all projects total more than 500,000.'

This indicates that stakeholders could have been better involved, including in decision making.

- ❖ Importance of building both demand and supply side: While developing the market for RE, stress in most projects has been on the supply side. Even if there is potential, demand may not materialise. Therefore, it is equally important to look at the demand side and design appropriate strategies. In many cases the mechanisms needed may be unique to the type of renewable and socio-economic profile of the end users. That means the projects seeking to develop and test mechanisms should be flexible enough to accommodate specific needs and yet with potential for application in a large area. It is important to note that no single mechanism can succeed everywhere, and therefore a variety of mechanisms on the supply as well as end user side are needed.
- ❖ Capacity Building and awareness raising: Capacity building of financial institutions, investors and other stakeholders depending on their familiarity with the RE technology, awareness raising of stakeholders, including customers of the technology, are other areas of importance, which traditionally have been a part of the strategy in most RE projects.
- ❖ Risk sharing/mitigation: One of the objectives of the financial approaches is risk mitigation or risk sharing with the financial institution in developing countries. In some projects, the approach initially taken had to be abandoned. Therefore, before zeroing on an approach, it is best to consult the stakeholder financial institution rather than passing on the approach as *fait accompli*.

REFERENCES

- Barnett, A. (1998) "The Provision of Access through the Expansion of Micro Hydro and Mini-grids", presented at *Village Power 98 Scaling Up Electricity Access for Sustainable Rural Development*, Washington, D.C., October 6-8.
- Barua, D. C. (2001) "Strategy for promotions and development of renewable technologies in Bangladesh: experience from Grameen Shakti" *Renewable Energy* 22(1-3), 205-210.
- Blyth, W. and N. Lefevre (2004) *Energy Security and Climate Change Policy Interactions. An Assessment Framework* IEA Information Paper, International Energy Agency, Paris.

- Bolinger, M. Wiser, R. and G. Fitzgerald (2005) „An Overview of Investments by State Renewable Energy Funds in Large-Scale Renewable Generation Projects“ *The Electricity Journal* 18(1), 78-84.
- EIA (2006) *International Energy Outlook 2006* Energy Information Administration, Washington DC, available at [www.eia.doe.gov/oiaf/ieo/pdf/0484\(2006\).pdf](http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2006).pdf).
- G8 Renewable Energy Task Force (2001) *G8 Renewable Energy Task Force. Chairmen's Report* available at www.g8italia.it/UserFiles/347.pdf
- Gaunt, C. T. (2005) “Meeting electrification’s social objectives in South Africa, and implications for developing countries” *Energy Policy* 33(10), 1309-1317.
- Goldemberg, J. (2004) *The Case for Renewable Energies* Thematic Background Paper for International Conference for Renewable Energies, Bonn, available at www.renewables2004.de/pdf/tbp/TBP01-rationale.pdf
- Komor, P. and M. Bazilian (2005) “Renewable energy policy goals, programs, and technologies” *Energy Policy* 33(14), 1873-1881.
- Lewis, C. (1997) “Grameen Bank Provides Renewable Energy Financing for Rural Poor” *Clean Energy Finance* 2(2),4-5.
- Martinot, E. (2001) “Renewable Energy Investment By The World Bank” *Energy Policy* 29, 689-699.
- Menanteau, P., Finon, D. and M.-L. Lamy (2003) “Prices versus quantities: choosing policies for promoting the development of renewable energy” *Energy Policy* 31(8), 799-812.
- Mitchell, C. and P. Connor (2004) “Renewable energy policy in the UK 1990 - 2003” *Energy Policy* 32(17), 1935-1947.
- Nagendran, J. (2004) *Developing Small Scale Renewables on Market Principles. Sri Lanka Energy Services Delivery Project* Presentation given at International Conference for Renewable Energies, Bonn.
- Painuly, J. P. (2001) “Barriers to renewable energy penetration; A framework for analysis” *Renewable Energy* 24(1), 73-89.

- Reddy, S. and J. P. Painuly (2004) "Diffusion of renewable energy technologies – barriers and stakeholders' perspectives" *Renewable Energy* 29(9), 1431-1447.
- Ringel, M. (2006) "Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates" *Renewable Energy* 31(1), 1-17.
- Sawin, J. L. and C. Flavin (2004) *National Policy Instruments: Policy Lessons for the Advancement and Diffusion of Renewable Energy Technologies Around the World* Thematic Background Paper for International Conference for Renewable Energies, Bonn, available at www.renewables2004.de/pdf/tbp/TBP03-policies.pdf
- Sonntag-O'Brien, V. and E. Usher (2004) *Mobilising Finance for Renewable Energies* Thematic Background Paper for International Conference for Renewable Energies, Bonn, available at www.renewables2004.de/en/cd/default.asp
- Spalding-Fecher, R., Winkler, H. and S. Mwakasonda (2005) "Energy and the World Summit on Sustainable Development: what next?" *Energy Policy* 33(1), 99-112.
- UNEP (2004) *Financial Risk Management Instruments for Renewable Energy Projects* United Nations Environment Programme available at www.unepie.org/energy/publications/pdfs/RE_Risk_Manag.pdf.
- Wiser, R. H. and S. Pickle (1998) "Financing investments in renewable energy: the impacts of policy design" *Renewable and Sustainable Energy Reviews* 2(4), 361-386.
- Wohlgemuth, N. (2001) "Directing investment to cleaner energy technologies: the role of financial institutions" in Bouma, J. J., Jeucken, M. and L. Klinkers (eds) *Sustainable Banking. The Greening of Finance* Greenleaf Publishing, Sheffield, UK, pp 401-411.
- Wohlgemuth, N. and J. P. Painuly (2002) "Promoting private sector financing of commercial investments in renewable energy technologies" in *Finance for Sustainable Development. Testing New Policy Approaches*. United Nations Publication ISBN 92-1-104512-6, pp 319-334.

World Bank (1996) *Rural energy and development. Improving energy supplies for 2 billion people* The World Bank, Washington DC.

World Bank (2004) *Emerging infrastructure policy issues in developing countries – a survey of the recent economic literature* Washington DC.

World Bank (2005a) *Renewable Energy and Energy Efficiency Financing and Policy Network: Options Study and Proceedings of the International Forum* World Bank Energy and Water Department and Energy Sector Management Assistance Program, Report 303/05, July, Washington, DC.

World Bank (2005b) *World Bank Group Progress on Renewable Energy and Energy Efficiency: 1990-2004* Washington DC, March, available at http://siteresources.worldbank.org/INTENERGY/Resources/335544-1111615897422/Annual_Report_Final.pdf

World Energy Council (1999) *The challenge of rural energy poverty in developing countries.* World Energy council, London, available at www.worldenergy.org/wec-geis/global/downloads/rural.pdf.