Renewable Energy Financing; What Can We Learn from Experiences?

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Why Focus on Financing?

Estimates for the contribution of renewables to world energy supply vary widely. In the IEA estimates, for example, in the business as usual scenario (with the continuation of present government policies and no major breakthrough in technologies) renewables usage grows but their share in total energy supply declines to 12.5% due to relatively higher growth of the energy demand. However, in an Alternative Policy Scenario, that considers new energy and environment policies in OECD countries, the share of renewables increases to 25.4% by 2030.

Studies indicate significant growth potential for renewables, particularly in scenarios where environmental constraints are imposed, for example on CO_2 emissions:

- World Energy Council: Business as usual scenario: growth from 18% to 21% of world needs by 2020. In an ecologically-driven scenario: growth from 18 to 30% of world needs by 2020;
- United Nations: growth to 30% of world needs met by renewables by 2025 and 45% by 2050;
- Wuppertal Institute: increase of renewable energy share in the world's energy mix to more than 60% by 2050.

Thus, the world market for renewable energy systems can be expected on the order of several billion U.S. dollars annually (WEC, 1997). The World Bank estimates that developing countries will need 5 million megawatts of new electrical generating capacity over the next four decades. With the world's current installed capacity at about three million megawatts, this represents more than doubling of the capacity. In financial terms, this represents an investment of about 5 trillion dollars. The investment potential is huge even if renewables were to capture only 3-5% of this market. When investment in distribution channels and end user financing is added to this, the investment requirement multiplies manifold.

Wiser and Pickle (1998) find that one of the key reason that renewable energy technology (RET) 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 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.

What are the Barriers?

Given the huge potential opportunities in renewables, why are entrepreneurs and financial institutions not rushing to cash on the opportunity? The 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 renewable (Painuly, 2001; Martinot and McDoom, 2000; G8 Renewable Energy Task Force, 2001; IEA, 2003; Wohlgemuth, 2001; Davidson and Turkson, 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 typically 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 which 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. But 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 programs 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; Sawin and Flavin, 2004).

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Supply Side Financing

Investment subsidies. Investment incentives are often used to reduce project developers' capital costs and can take various forms such as; (a) direct subsidies that can be capital subsidy as per kW of rated capacity or as a percentage of investment, (b) tax credits, based on investment made in the project, (c) others such as duty exemption or lower import duties on equipments for RETs, accelerated equipment depreciation, property tax reductions, and value-added tax rebates. Some drawbacks of these type of subsidies include vendors inflating equipment prices to capture a higher subsidy in case of (a), abuse of tax credits and complexity and distortions inherent in manipulating the tax system.

Operating Incentives. One of the most important and sought after incentives is creation of market through power purchase agreements for an investor in electricity generating capacity through renewables. This includes access to transmission and distribution grid. It is also most important to obtain finance from financial institutions. For example, the 1978 Public Utilities Regulatory Policies Act (PURPA) in the United States which mandated that utilities purchase all independently generated power at their avoided cost. Operating incentives are normally performance based, as these are paid per kWh of electricity generated. Although superior due to their link with performance, these can be risky for investors as against investment subsidies that are paid up-front. The UK, Spain and Germany have been paying operating subsidies on a per kWh basis. However, the level of subsidy is determined differently; in the UK, it is through a competitive auction, while in Germany it is administratively set. In the United States, existing renewable electricity projects are paid an administratively determined operating incentive, while new projects must competitively bid for the per-kWh incentive (CEC, 2000). Operating incentives are also paid as a production tax credit per kWh basis. This strategy was employed by the United States since 1992, for example, in promoting wind and biomass energy.

Fixed higher payments upon delivery. A fixed payment per kWh of electricity generated is made, depending on technology used. The approach has been used successfully in Germany (Krewitt and Nitsch, 2003). Small-scale investors can also enter the market in this case. The overall impact on renewable energy development would depend on the level of price paid. This approach ("feed-in tariffs") has, in many cases, proven highly effective in stimulating investment in RE.

Competition. With the introduction of competition into electricity markets, RE funding has in some instances also been organised competitively in order to promote economic efficiency. The experience with tendering models has, however, generally been disappointing (Sawin and Flavin, 2004).

Green pricing and green certificates. In this case, competition is supplemented with the possibility for consumers to select their supplier according to environmental quality criteria. Consumers get an opportunity to support renewables by paying a premium for electricity generated from renewables. The approach creates a market niche for renewables. Bird et al. (2002) give an overview of international green power markets. In a variation of this concept, the supplier of renewable electricity gets a "Green Certificate" that can be sold in the market. However, this requires development of a market for such certificates. Nielsen and Jeppesen (2003) give an overview of tradable green certificates in European countries. In analogy to green certificates there are also black certificates (representing carbon credits) and white certificates (representing energy efficiency credits).

Carbon tax. Some countries such as The Netherlands, Sweden, and Denmark levy a carbon tax on fossil fuels due to the greenhouse gas emissions from use of these fuels. Since this is a tax on competing fuels, it helps renewables become competitive.

Preferential Financing for Renewables. Special financing terms such as lowered interest rates or longer repayment horizons are offered in this case. The result is reduction in project costs. For example, special funding agencies created by governments in Germany and India provide loans for renewable energy projects at below-market interest rates. The risk perceived by financial institutions is higher in the case of renewables (Wiser, 1997), making financing costly compared to conventional energy investments. Special financing facilities reduce this cost and may bring it to a normal or below normal level.

End-user Financing

Although supply side regulation and financing are relatively less cumbersome, end user financing mechanisms have become more popular in developing countries for reasons such as targeted financing (e.g., the poor can be subsidised), promotion of decentralised systems, etc. Some of the mechanisms include (Derrick, 1998):

Revolving funds. A fund is created specifically to support one or more renewable technology, which lends money to end users. The interest charged covers the cost of running the fund. Targeted subsidies can also be provided through such funds; donors provide grants to the fund and the fund lowers the interest rates for the targeted segment. An example is a fund created to lend for purchases of solar home systems (SHS) in India.

Renting, leasing and hire purchase schemes. In case of renting, a community or entrepreneur can own the facility and rent it to users, for example a photovoltaic (PV) charging station to charge batteries. Hire purchase schemes by sellers makes credit available to the end user, but mostly for a short term. Interest rates on such credit tend to be high. Leasing is also an option, for example, solar electrification companies could lease SHS. Users pay a monthly lease rental in this case.

Credit through Co-operatives. A loan is made available to the co-operative and borrowers are members of the co-operative. Default in such cases is low as the track record of the co-operatives can be checked. This mechanism has been particularly successful to provide credit to the poor. For example, lending by Grameen Bank in Bangladesh, and in India by various rural banks to self help groups. Self help groups are formed by poor households, and are similar to co-operatives in functioning. There are several success stories

of lending by banks through self help groups, that have benefited the poor and the banks had practically no defaults.

Lessons from Case Studies

Revolving Funds / Soft Loan Windows

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 (IDB) and ITDG-Peru, an 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 $700,000 was given, which leveraged $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 organizations 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.

Seed Funding For Solar Home Systems in Bangladesh

Grameen Bank in Bangladesh set up a not-for-profit subsidiary, Grameen Shakti (GS), which is involved in the marketing, sales, servicing, credit provision and other activities related to PV Solar Home Systems (SHS) business. GS had started operations in 1996 and planned to install 100,000 SHS 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, all contributed to the high transaction costs of operating the rural PV business (G8 Renewable Energy Task Force, 2001). In 1998, International Finance Corporation (IFC) provided access to GEF funds through its Small and Medium Enterprises (SME) program, which enabled GS to offer better credit terms to their customers and their sales figures reached 2000 systems by the year 2000. The financing scheme that started with 50% of the system price as down payment and the remaining 50% in 6 months in six equal monthly instalments was modified from time to time and now requires only 15% of the system cost as down payment and the remaining 85% can be paid within 3 years time in equal monthly instalments with 12% service charge on the outstanding amount. GS plans to introduce 4 to 5 years financing scheme for the poor rural people. PV systems are also used for income generation activities such as for lighting in shops, clinics, restaurants, sawmills, rice mills, etc. and for cellular phone service. GS activities, besides providing credit, included training of local people to install and maintain PV systems, training of customers in application and maintenance of PV 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. Grameen Shakti is also involved in development of wind power and biogas.

The project thus used GEF loan financing to support a project which was unable to obtain commercial financing due to high risk perception, and is expected to provide significant growth and scale-up for commercialisation.

PV Market Transformation Initiative (PVMTI) in India

The PVMTI was launched by the International Finance Corporation (IFC) to provide financial support to private sector ventures that encourage further market development for PV. Of the total US$25 million of GEF funds available for investment for projects in India, Kenya and Morocco, US$15 million was allocated to India. The PVMTI is aimed at accelerating the sustainable commercialisation and financial viability of PV technology and addresses market barriers by making available appropriate financing to stimulate business activity. The activities include; (i) providing finance to sustainable and replicable commercial PV business models, according to individual business plans through a competitive bidding process; (ii) financing business plans with commercial loans at below-market terms or with partial guarantees or equity instruments and; (iii) provision of technical assistance to PV businesses on planning, financing operations and technology. Seven investments had been approved by 2001, of which four in India.

The Solar Development Group

The World Bank and IFC along with a number of charitable foundations and the GEF, have developed the Solar Development Group (SDG). SDG is structured to be both a financing window for small PV enterprises in developing countries which will leverage private sector funds into this emerging sector and a business advisory service (G8 Renewable Energy Task Force, 2001). The SDG 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. PV would be taken up by the SDG first due to its increasing demand in developing countries. SDG will consist of two separate programs: (i) Solar Development Capital (SDC) which is an investment fund of approximately US$ 30 million for financing private sector PV or PV-related companies and financial institutions; and (ii) Solar Development Foundation (SDF) which is expected to disburse approximately US$ 20 million in grants or "soft" loans both to companies and programs that further SDG's mission. A total of 10 local PV companies have already received financial support through SDF and another 12 are expected to be funded during 2001.

A pipeline of over 200 companies in 57 countries have been identified and are under evaluation for possible support.

PV Solar Home System Financing in India

Financing Solar Home Systems is a four-year project funded by the United Nations Foundation (UNF) and Shell Foundation, designed to help accelerate the market for credit to finance the Indian rural solar energy sector. The project is being implemented by Syndicate Bank and Canara Bank, two of India's major banking groups.

The project helped develop credit facilities in the banks to build up lending portfolios specifically targeted at financing SHS in regions of South India poorly served by conventional financial institutions. The project uses the funding to "buy-down" the cost of financing a SHS at the retail level - in effect, a subsidy that lowers the interest rate on a loan taken by a customers to purchase a system. This relatively new approach differs from the traditional program that offers a subsidy on the capital cost of purchasing a system, which can lead to price distortions for systems. The target is to finance about 20,000 SHS over a period of three years. A US1 million dollar support is expected to leverage bank funds to the tune of $6-7 million.

The approach is designed to offer concessional finance that will become unnecessary once the barriers faced by mainstream financial institutions – such as perceptions the technology will not work as designed – have been addressed and the credit-worthiness of rural solar customers proven.

Renewable Energy Support Mechanism in California

A renewables support mechanism has been adopted to collect a total of US$540 million from electricity customers between 1998 and 2002 to support existing, new, and emerging RETs for electricity generation (Wohlgemuth and Madlener, 2000). These funds are to be collected by the utilities through a non-bypassable charge on distribution service ("system benefits charge"). California Energy Commission (CEC), who is responsible for administering the fund, has divided the funds into the following four primary categories:

- *Existing Technologies.* This is to provide support to already existing projects which continue to require financial support to remain operational. The existing technologies are further divided into three tiers, in which Tier 1 includes biomass and solar thermal projects (currently least cost-effective technologies), Tier 2 includes wind, and Tier 3 includes geothermal, small hydro, digester gas, landfill gas, and municipal solid waste (currently most cost-effective). Target prices and incentive caps (on per kWh basis) have been stipulated for each Tier.
- *New Technologies.* For new technologies funds are to be allocated *on a simple auction basis*, with funds with least support requirement as criterion for allocation. However, there is a cap on production incentive on per kWh basis.
- *Emerging Technologies.* The $54 million in the Emerging Renewable Resources Account is used to fund the "Buydown Program", a multi-year program of payments to buyers, sellers, lessors or lessees of eligible electricity generating systems that are powered by emerging renewable resources. (CEC, 2000) Emerging technologies eligible to participate include PV, solar thermal electric, fuel cell technologies that utilise renewable fuels, and small wind systems of not more than 10 kW. To ensure that the costs of these systems decrease over time, the level of buydown payment declines in five steps.
- *Consumer Credits.* Consumer credits are meant to help stimulate an active retail market in which consumers choose to purchase electricity from renewable energy suppliers. Consumers who choose such green power can receive an incentive on their electricity bills based on fund availability and renewable component in the electricity.

Energy Enterprise Development

African Rural Energy Enterprise Development (AREED) Initiative

The United Nations Environment Programme, in partnership with E&Co, have set up the AREED Initiative with funding support from the United Nations Foundation. The AREED initiative seeks to develop sustainable energy enterprises that use clean, efficient, and renewable energy technologies to meet the energy needs of the poor, thereby reducing the environmental and health consequences of existing energy use patterns. AREED provides enterprise development services to entrepreneurs and early-stage funding, in the form of debt and equity, to help build successful businesses that supply clean energy technologies and services to rural African customers. Services include training, hands-on business development assistance and, for promising businesses, early-stage investment and assistance in securing financing. AREED currently has a pipeline of more than 30 projects.

In each country, AREED is partnering with a local NGO or development organisation to which it will seek to transfer the technique of energy enterprise development so as to support long-term rural energy enterprise development. AREED has found that effectively transferring the technique of energy enterprise development to local organisations requires a significant time commitment.

Multipurpose Funds

Dutch Green Fund System

The Green Fund strongly promotes investments in new (green) technologies and projects by providing soft loans with low interest rates. The general public investing in the Green Funds receives an income tax exemption on the income from the investment, making an investment in a Green Fund more or less competitive with other funds. The projects for funding by a Green Fund are screened on their economic, environmental and social merits. The Government awards green certificates to the projects thus implemented, and also audits the system. Initially only projects in the Netherlands were eligible for funding, but in 1995 the scope was extended to projects in developing countries and economies in transition (Kwant, 2003).

The Green Fund System has been a successful program with active involvement of the financial sector and general public (G8 Renewable Energy Task Force, 2001). In the be-

ginning, the public heavily subscribed to the Green Funds and pushed the banks to set up more Green Funds. Between 1995 and 1999 over 1400 projects were issued with green certificates, to a value of over 1.8 million EU. This included over 300 sustainable energy projects and nearly 700 wind turbines.

Renewable Energy and Energy Efficiency Fund (REEF) for Emerging Markets

Launched by the International Finance Corporation (IFC) together with support from the GEF and several other private and public sector groups, REEF 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. REEF will operate in emerging market countries worldwide and consider investment in projects with total capitalisation requirements of between US$ 1 million and US$ 100 million.

Renewable Energy Investment by the World Bank

The Bank has supported renewables through various projects involving a variety of financing mechanisms. Following Martinot (2001), these can be classified as follows:

Support for renewable energy financing. The examples of such projects include the India Renewable Resources Development project that supported wind power development in India. Supported by a favourable regulatory framework and investment tax policies, by 2000, more than 1200MW of wind turbine capacity had been installed in India. In Sri Lanka, the Energy Services Delivery project provided financing to private-sector small-hydropower developers besides testing microfinancing schemes for installations of rural SHS. The project had supported 21MW of small hydropower by independent power producers (IPPs) through commercial-banks. The issue of business financing for delivery of rural energy services and credit to improve the affordability of those services among rural households was tested through the microfinance model to finance SHS in Sri Lanka (see earlier section for details).

Support for electric power policy frameworks. A sugar bio-energy project in Mauritius indirectly catalysed electricity generation from bagasse. The investment climate for renewable energy power projects encompassing public and private partnerships lead to development of regulatory frameworks for IPPs. In Sri Lanka also, regulatory frameworks evolved for IPPs as a result of private sector participation in hydro power development through the World Bank support. However, tariffs in the Sri Lanka project were related to short-run avoided utility costs and these hampered hydro power development after tariffs crashed to 3.5 cents/kWh in 1999 from 5 cents/kWh in 1997, due to the downturn in oil prices.

Support for rural energy enterprises. This includes Sri Lanka mentioned above, and financing for rural energy enterprises (SHS) under the SME Program in Bangladesh (see earlier section), Vietnam and the Dominican Republic. In Vietnam, a credit delivery scheme was devised to increase sales by the private dealer. In the Dominican Republic, the financing helped develop a fee-for-service business model. 3500 SHS had been installed by 2000.

Financing Energy Services for Small Scale Energy Users (FINESSE). This is a joint UNDP/World Bank program in operation in Asia since 1991. The program focuses on bundling renewable energy projects for funding, selecting appropriate financial institutions to implement the project, and arrange technical assistance. It has been applied extensively in Asia, and lately in Africa.

Summary and Conclusions

The role of renewables in meeting the world energy requirements is expected to increase dramatically due to sustainability and global environmental considerations. World electricity generating capacity may more than double in the next four decades and this offers a huge opportunity to develop renewable energy. Most of this is expected to take place in developing countries. However, renewables face several barriers today, impeding their deployment on a commercial scale. Cost competitiveness with other fuels 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 (through tax breaks, for example), operating incentives through regulatory measures that require higher payment to power generated from renewables, green energy marketing strategies are some of the supply side mechanisms successfully used, mostly in developed countries. 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.

Revolving funds have shown considerable promise with successes in developing small hydro schemes in Peru, expanding use of SHS in Bangladesh, and building up supply potential for SHS in India. In several cases the achievements have been below originally planned levels but it only reflects the challenges that renewables face in dissemination due to their relatively high cost and low paying capacity of end users in developing countries. One of the features of some schemes, for example in case of SHS in Bangladesh, has been modification of schemes based on learning. The schemes in developed countries 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 and modified regulations based on the experience are now being implemented in several countries; for example new renewable support mechanism

in California, Feed Law in Germany and so on. Other market instruments such as green certificates, green funds, etc. are also now being tried out. 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 users face the twin problems of access to credit and the high cost of credit, even if available, due to risk perception of the financial institutions of the renewable technologies as well as the borrower (end users are often poor). The projects such as financing of SHS 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 the case of India's wind power program.

Development of renewable energy enterprises is another activity that received attention from several agencies. UNEP's AREED program in Africa has been successful in developing renewable energy enterprises that promise to multiply in the future once the experience is replicated elsewhere. A beginning has been made with a similar program launched in Brazil. Other such programs include FINNESSE by UNDP and World Bank, SME by the IFC and so on. The efforts in building capacity for small scale energy enterprises in developing countries is in line with the attempt to introduce decentralised and stand alone options (such as SHS, biogas) to provide renewable energy to the customers.

Although supply side initiatives have been around for some time, initiatives on the end user side are relatively new and still evolving. With increasing experience, these are expected to improve and address the barriers to renewables financing. 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. Current initiatives on all fronts are, therefore, a welcome development for promoting renewables.

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