PROMOTING PRIVATE SECTOR FINANCING OF COMMERCIAL INVESTMENTS IN RENEWABLE ENERGY TECHNOLOGIES

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EXECUTIVE SUMMARY

Too much investment is directed towards conventional energy technologies, even where commercially available energy efficient and renewable technologies are technically feasible and economically attractive. The fact that renewable energy technologies (RETs) account for only a modest proportion of the world's (commercial) energy demand means that there are barriers to their implementation. These barriers (either financial or non-financial) need to be identified and addressed in order to design innovative policy approaches for the international and domestic sector financing of RETs. It is clear that a strategy to increase the market share of renewable energy should address the full spectrum of barriers.

Since the use of renewable energy contributes to all dimensions of sustainable development, particularly in developing countries, one of the challenges for energy policy is to ensure that environmentally sound technologies, including RETs, have a fair opportunity to compete for resources required for the provision of energy services.

The coming together of the renewable energy industry and the financial sector cannot yet be regarded as a marriage made in heaven. There is considerable suspicion and misunderstanding on both sides which permeates all RET sectors, as well as most levels of financial institutions. In order to overcome the "understanding gap" between the worlds of renewable energy and financing, various initiatives have been launched recently to bring these two together. Innovation in financing mechanisms to advance RET projects can be as important as technological breakthroughs.

For renewable energy to make a dent in conventional energy markets, it is necessary that a part of the private sector investment in the conventional energy sector gets diverted to RETs. The profitability investment in RETs thus becomes a key issue.

The paper gives an overview of barriers RETs face in the market place; it shows an international review of RETs support mechanisms (including Non-Fossil Fuel Obligation and Renewables Portfolio Standard), and presents examples of successfully implemented RET projects. It shows the importance of innovative financial mechanisms to enable RETs to overcome the market barriers, and concludes that to overcome the wide array of barriers, support mechanisms should be designed in a way that is compatible with market forces, and that the role of government is crucial in order to provide the right package of incentives for a level playing field for (commercial) energy production from renewable energy resources, particularly in developing countries.

I. INTRODUCTION

Energy is essential for economic and social development. Roughly ninety per cent of the world's (commercial) energy supplies are provided by fossil fuels; the associated emissions cause local, regional and global environmental problems. Most energy projections show that current and expected future global energy demand patterns are not sustainable. The demand for energy also increases more or less in line with the level of economic activity. Projections to 2050 indicate that world energy demand may increase dramatically, with most of this increase taking place in developing countries. These trends show that, in order to comply with the necessary conditions for the three dimensions of sustainability (economic, environmental and social) with respect to energy production and consumption, a decoupling of economic activity from fossil fuel primary energy consumption must be achieved and new and renewable energy technologies with low impact on the environment have to play a greater role in the future energy mix to arrive at low-carbon energy systems. At the same time, fossil fuels should be used efficiently, not only in the technical sense, but also in the economice sense respecting inter-generational efficiency.

Too much investment is still directed towards conventional energy technologies, even where commercially available energy-efficient and renewable technologies are technically feasible and economically attractive. The fact that renewable energy accounts for only a modest proportion in meeting the world's (commercial) energy demand means that there is a missing link in their potential and their implementation - the barriers to their implementation. These barriers (either financial or non-financial) need to be identified and addressed in order to design innovative policy approaches for the international and domestic financing of RETs.

Financial institutions evaluate applications that have a renewable energy technology (RETs) component[1] in the traditional framework that does not take into account full economic and environmental advantages of investments into RETs and view them – often incorrectly - as being too risky, based on outdated or incorrect information. Because banks fail to support RET projects, these technologies are penetrating the market at rates slower than is socially desirable. Benefits, including rural electrification and a reduction of greenhouse gas emissions as mandated by the United Nations Framework Convention on Climate Change (UNFCCC), go unrealised because of a lack of information, appropriate evaluation framework and skills on the part of investment officers in lending institutions.

Governments have a central role to play in shaping a business environment that encourages the increasing use of environmentally friendly technologies. But financial innovation by market participants is also required. This is particularly the case in developing countries.

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II. IMPORTANCE OF RETS FOR SUSTAINABLE DEVELOPMENT

The provision of energy services can be made cleaner and more efficient, often also with considerable cost savings. RETs can, in many cases, play an important role in the attainment of sustainable energy development. Since renewable energy contributes to all dimensions of sustainable development (social, economic and environmental), one of the challenges for energy policy is to ensure that RETs have a fair opportunity to compete with other resources required for the provision of energy services. In many cases, renewable energy is the most economic solution; for example, in providing energy to remote and widely dispersed rural populations that are not connected to the grid, where traditional energy supply is costly and unreliable or, if based on fuelwood, destructive and polluting. Also, there is a growing literature and documentation of the risk management benefits of RETs.

Renewable energy provides many attributes in support of the public interest and in enhanced economic efficiency. Among these are increased local employment and income; enhanced local tax revenues; a more diversified resource base; avoided fuel supply and price risks; provision of infrastructure and economic flexibility by modular and small technologies; creation of more choice for consumers; contribution to overall system reliability; furthered important local and national energy goals; and the potential to eliminate pollution associated with the provision of energy services.

The environmental characteristics of renewable energy systems and the energy security brought about by increased use of indigenous energy sources are the most common reasons cited for renewable energy promotion, although energy flexibility and diversity issues, economic concerns such as regional development and the export potential of renewable energy technology in emerging markets are also

[1] RETs use non-depleting sources of energy, such as the sun or wind, and so are generally more environmentally benign than conventional (fossil fuel based) energy technologies. RETs can provide either electricity or heat; examples include biomass boilers, hydropower generators, solar thermal and wind power plants, and photo-voltaic systems. RETs are supply-side technologies in that they supply energy. Those that generate electricity can either be used on-grid, thereby offsetting energy produced from conventional sources, or off-grid, to provide power in remote locations.

important.[2] In particular, the capacity of renewable energy sources to provide greenhouse-gas free energy is increasingly cited as an important driver for renewable energy use. For example, many industrialised countries explicitly present their plans for renewable energy development in terms of the CO_2 reductions that would result (International Energy Agency, 1997a).

RET benefits can be summarised as follows (International Energy Agency, 1998a):

Environmental benefits include:

(a) Emissions reduction by displacing fossil fuel. By 2020, depending on the scenario, up to 9,000 Mt of CO_2 emissions could be avoided. This corresponds to 40 per cent of current energy-related CO_2 emissions;

(b) Improved water quality. In many regions, a shortage of potable water damages human health. Hydroelectric schemes can improve water supplies. Small wind turbines already pump water from underground reservoirs. Growing energy crops (particularly in areas that overproduce) can reduce soil erosion. They require lower levels of agrochemicals. Some energy technologies can be used to treat waste so that it no longer constitutes a pollution threat to water courses, while others offer the prospect of producing water through desalination;

(c) Reclamation of degraded land and habitat. Growing energy crops on land degraded by previous agricultural practices can help to improve soil conditions and enhance wildlife diversity;

(d) Abatement of pollution from transport. Road transport contributes to both national emissions of atmospheric pollutants and to local air quality problems, especially in urban areas. Some RETs can reduce urban pollution through the use of alternative fuels (for example, ethanol) or by providing power for electric vehicles;

(e) Electricity distribution. The modular and distributed nature of renewables can reduce the need for upgrading electricity distribution systems or for building new line capacity, thereby reducing eyesores, transmission losses and the emissions associated with such losses.

Socio-economic benefits include:

(a) Diversifying and securing energy supply, thereby promoting price stability;

(b) Providing job opportunities in rural areas thereby slowing urbanisation;

(c) Promoting the decentralisation of energy markets, by providing small, modular, rapidly deployable schemes;

(d) Developing economies by reducing their dependence on fuel imports. When most communities buy energy, they are importing it and exporting money that is not invested in their communities. If that money could be invested locally in renewable technologies, these communities would benefit economically (International Energy Agency, 1999a);

(e) Accelerating the electrification of rural communities in developing countries.

It is often said that more than two billion people in the world have no access to electricity. At least another half billion people have such limited or unreliable access that for all intents and purposes they do not have access. It must be kept in mind that these people live in regions of the world where population is growing most rapidly. If we are to make a difference in these people's lives, we have to provide them with a connection to the electricity grid or provide them with power sources suitable for off-grid applications, such as renewable electric technologies. When people have no access to electricity, even a small wind turbine or a low wattage photo-voltaic panel combined with battery storage can make a very large difference in their lives. Many examples can be given. Light becomes available at night for children's education. Electricity makes communication possible, and refrigeration available. Lives can be

[2] In many countries, the underlying reasons behind renewable energy promotion may be mixed, that is. encompassing energy, environmental and other objectives. This can complicate the evaluation of such policies, as the costs associated with increased renewable energy use (often borne by public energy budgets) bring benefits in energy and non-energy sectors. For example, increasing farmers' income via subsidies for biofuels may help to maintain a country's food production capability, increase regional development, maintain rural employment levels and reduce emissions of CO_2 as well as increasing renewable energy use.

transformed, particularly those of women and children in developing countries, who carry most of the burden associated with fuel gathering and energy use (International Energy Agency, 1999a).

A. Status of RETs

The technological potential of RETs is enormous. Although limited by climatic and organisational conditions (for example, available amounts of water, wind, biomass, structure of urban development and land use), RETs could theoretically provide a multiple of current world energy requirements (Johansson and others, 1993). Their development is, therefore, an essential ingredient in the realisation of a sustainable energy system.

Several RETs are emerging. They include solar technologies (mainly direct conversion through photo-voltaic (PV) cells, or solar thermal schemes for hot water or power generation), biomass, geothermal resources, small hydro and wind. It can be shown that the cost of most of these technologies has come down significantly over the past 10 years, thus bringing them close to, if not at, commercial viability.[3] Additional attractive features have made them interesting to investors: (i) modularity that renders them more suitable for large than for small-scale applications and more flexible in meeting forecast demand; (ii) short lead times, which reduces risk and financing charges; (iii) potential for market expansion and rapid dissemination, particularly in developing countries, that has attracted private sector interest; and (iv) favourable land-use features (for example, solar plants in desert areas and multiple use of land in windfarms). While these technologies could be seen as future promising alternatives to conventional electricity generation, they were not - and still mostly are not – fully competitive in an unregulated market, and consequently policies were set up to secure fair prices of electricity produced and to support the technologies through various kinds of government support. These systems are sometimes known as "decentralised", "distributed", "localised" or "embedded" systems because they can produce electricity near the consumer (Smeers and Yatchew, 1998).

PV presents a particular challenge to financial institutions because of the relatively small level of installed capacity at individual sites and its highly distributed nature (Derrick, 1998).

Some of the stand-alone RETs (for example, PV and wind) are becoming more cost-competitive with conventional (diesel) generators and grid extension in many (rural) parts of the developing world. Many developing countries have very low electrification levels. Distributed RETs, therefore, have good potential to provide electrification in these regions, which, in many cases, is a key development issue.

Renewable energy sources currently supply somewhere between 15 per cent and 20 per cent of total world energy demand. It is estimated that in 1990, all renewable energy sources produced nearly 2,900 TWh, accounting for about 24 per cent of the world's total electricity supply (International Energy Agency, 1995). If traditional uses of biomass were also taken into account, then renewables would supply nearly 18 per cent of global energy demand (World Energy Council, 1993). Most of the renewables' contribution to current electricity supply is provided by hydroelectric schemes, a large proportion of which has been in place for a considerable time. However, the importance of the newer technologies is increasing. From a small base in the 1970s, the 'new' renewables (that is, biomass, geothermal, PV, small-scale hydro, solar thermal electric and wind) have grown proportionally more rapidly than any other electricity supply technology (World Energy Council, 1993). Again, most regions of the world have contributed to the exploitation of these new resources.

The International Energy Agency projects that, without new policy initiatives, fossil fuels will account for more than ninety percent of total primary energy demand in 2020 (International Energy Agency, 1998b). Looking even further into the 21st century, the World Bank has estimated that developing countries alone over the next four decades will require five million megawatts of new

[3] Photo-voltaics, the use of semiconductor materials to convert sunlight directly into electricity, has seen costs come down from approximately US $1 per kilowatt-hour (kWh) in 1980 to 20-30 cents per kWh today. And with increasing scales of manufacturing and increasing emphasis on thin-film devices, it is expected that electricity costs from PV will fall below 10 cents per kilowatt-hour early in the next decade. Current annual world production has reached 150 megawatts peak (MWp), and is growing at more than twenty percent per year. Wind is the fastest growing energy technology in the world today. Today's highly reliable machines provide electricity at under 5 cents per kilowatt-hour at selected sites with above average wind speeds of seven metres per second. The cost of wind power decreased from 15 to 4.6 cents per kWh between 1984 to 1996 in Denmark, and by a factor of five since 1989 in Germany. Similar results were observed in case of Netherlands, UK and US.

electrical generating capacity to meet anticipated needs. To put this number into perspective, the world's total installed capacity today is three million megawatts. Thus, even if the World Bank's estimate is too optimistic, we will essentially have to double the world's installed capacity during the next forty years. In financial terms, this much new capacity will require approximately five trillion dollars of new investment. While it is true that renewables can anticipate capturing only a fraction of this market, every one percent of that market in developing countries represents approximately US$50 billion of investments. If renewables can capture several percent of that market, we're looking at a potential for several hundred billion dollars of renewable technology sales world-wide and the creation of many new jobs over the next decades.[4]

Major international studies indicate significant growth-potential for renewables, particularly in scenarios where environmental constraints are imposed, for example on CO2 emissions (International Energy Agency, 1997b):

(a) International Energy Agency: 7.5 per cent to 8.5 per cent annual growth in the commercial use of energy from 'new' renewables to 2010;

(b) World Energy Council: Business as usual scenario: growth from 18 per cent to 21 per cent of world needs by 2020; Ecologically driven scenario: growth from 18 to 30 per cent of world needs by 2020;

(c) United Nations: growth to 30 per cent of world needs met by renewables by 2025 and 45 per cent by 2050.

By 2100 the capital stock of the global energy system will turn over at least twice, offering the opportunity to increase the contribution of renewables significantly. World Energy Council/International Institute for Applied Systems Analysis scenarios for global energy consumption indicate a large contribution from renewables by 2050, equivalent to total fossil fuel and nuclear in 1990, and three times this amount by 2100. However, this requires substantial expenditure on research and development (R&D) and support for initial deployment, estimated to be $15 to 20 billion by the World Energy Council.

B. Barriers to RETs Penetration

RETs have to overcome a number of barriers before they can penetrate the market. 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 the 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. It is clear that a strategy which aims to increase the market penetration of renewable energy should address the full spectrum of barriers (OECD, 1997).

The largest barrier to greater renewable energy use is its cost, despite the cost reductions achieved over recent years (International Energy Agency, 1997a). 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. Furthermore, the development of competitive markets has not reached such a stage yet as to provide a market value for the extra diversification and security of supply brought by the introduction of renewables (World Energy Council, 1998). 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. In addition to cost-related barriers, non-cost barriers can also

[4] A preliminary analysis by Solar International Management, Inc. indicates that between 1998 and 2010, the global market for PV will require $3.7 billion invested in PV manufacturing facilities, $3.8 billion invested in the distribution channels, and $38 billion in end-user financing. Clearly, the major challenge, by a factor of 10:1, is end-user financing (Eckhart, 1999).

inhibit the greater use of renewable energy. This is particularly the case with the imperfect flow of information and the lack of integrated planning procedures and guidelines.

There are numerous causes for imperfections in energy markets which constitute a hindrance for the socially optimal penetration of RETs:

(a) *Insufficient public information and lack of knowledge and exposure to RETs and concepts:* Developers and financiers are often simply unaware of the technical and financial viability of RETs;

(b) *Financial willingness and feasibility*: The user may not have the willingness to pay or the possibility to afford the additional investment on RETs equipment. An additional difficulty is that conventional credit does not fit well with the specific conditions for investment in RETs. Renewable energy systems are capital-intensive and require larger up-front investments and longer repayment periods than other energy technologies. Investors therefore may prefer to invest in sources with shorter payback periods, thus lowering their long-term risk exposure, even if those sources are more expensive on a long-term life-cycle basis;

(c) *Chicken and egg situation*: The various RETs are not uniformly mature or cost effective. However, most renewables still have a significant way to go before they are competitive with fossil technologies, especially for power generation purposes. This will demand intense further R&D efforts. However, at present many renewables are in a classic chicken and egg situation - financiers and manufacturers are reluctant to invest the capital needed to reduce costs when demand is low and uncertain, but demand stays low because potential economies of scale cannot be realised at low levels of production. Renewables need to gain the confidence of developers, customers, planners and financiers (IEA, 1997a);

(d) *Perception of risk - high discount rates:* Financial institutions evaluate applications that have a RETs component in the traditional framework that does not take into account full economic and environmental advantages of investments into RETs and view them – often incorrectly - as being too risky, based on outdated or incorrect information;

(e) *Relatively small size of RET projects:* Technological constraints usually limit the project size. As a result, projects often have low gross returns, even while the rate of return may be well within market standards of what is considered an attractive investment. *Transaction costs* of smaller projects are disproportionately high, compared with conventional projects. Transaction costs are relatively inelastic with respect to project size. Consequently, pre-investment costs (including financing, legal and engineering fees, consultants) have a proportionately higher impact on the total costs of RETs projects. Public agencies can make grants to cover the costs associated with establishing collaborative arrangements which, if successful, can be converted into an equity or royalty stake. The resulting financial return can then be redeployed as grants for successive projects. The Rockefeller Foundation has an ambitious programme of this kind aimed at stimulating private-sector investment in renewable energy and energy efficiency[5] enterprises across the developing world. RETs projects typically range from $500 000 to $10 million. This also means that they are often unable to tap the international financial markets or other sources of private capital such as that available from the International Finance Corporation, the arm of the World Bank that is the largest source of direct private-sector financing in the developing world. Except in Sub-Saharan Africa, the IFC does not usually consider projects smaller than $20 million (Schmidheiny and Zorraquín, 1996);

(f) *Energy price distortions:* Often energy prices do not reflect the full societal cost of energy. This can be due to subsidies that reduce the market price of energy and a lack of internalisation of external costs caused by pollution or other by-products of energy use (Rabl, 2000). In the early 1990s average electricity tariffs in developing countries were less than US¢4 per kilowatt hour (kWh), even though the average cost of supply was around US¢10 per kWh. Such subsidies are

[5] Energy efficiency measures can play an important role and are desirable from economic and environmental points of view; however, these measures alone cannot bring about a reduction in carbon emissions, given the pressures to satisfy unmet energy demand, particularly in developing countries.

harmful in a host of ways (International Energy Agency, 1999b). They constitute a huge financial drain[6] (World Bank, 1996);

(g) *The "free rider" or "public goods" issue*: individual consumers might be unwilling to pay for RETs because their environmental benefits are shared equally by everyone, regardless of who pays;

(h) *Lack of commercial guarantees to enable project financing:* Even if long-term contracts are successfully negotiated with developing country public agencies, these agencies are not considered investment-grade without commercial guarantees. In many cases, foreign government agencies are encouraged to privatise and adopt market-based pricing structures at the same time as they are required to provide sovereign guarantees to secure long-term debt from the private sector. As a result, the liability for the project does not shift from the government's balance sheet to private project sponsors. Given the limited amount of exposure any government can credibly assume, RE projects are often unable to compete with other development priorities that receive sovereign guarantees;

(i) There is one obstacle in particular that discourages companies from providing supplies to rural areas: high start-up costs. Extending an electricity grid to a remote village can be very expensive, specially if only a few households are to be connected. Until more households join the network, the cost of electricity can reach US¢70 per kWh, seven times the typical cost in an urban area;

(j) Even setting up a solar electricity system for a single home can cost between $500 and $1,000, a large sum to spend in one lump. The problem here is not necessarily that people are unwilling to pay. Evidence suggests that people will spend a significant proportion of their incomes on better energy, which improves their quality of life or enables them to become more productive. In Bangladesh even the poorest people are connecting to the grid when the service is available. In rural China, many people without easy access to cooking fuels are investing in efficient stoves and tree planting. The problem is that rural customers often cannot get affordable credit. That makes it difficult for them to pay the high start-up costs of improving their energy supplies. One solution may be to establish a local member-supported bank to make small loans (such as the Grameen Bank in Bangladesh, which lends mainly to women and poor people). Another is to promote companies that lease basic equipment to consumers, communities, and local energy suppliers (World Bank, 1996).

III. REVIEW OF RETS FINANCING SUPPORT MECHANISMS

Apart from a favourable regulatory environment, financial innovation is also required to promote a shift towards more investment in RETs. Examples include investment guarantees, energy service companies, convertible grants, venture capital, sub-licensing, leasing and carbon offsets.

Most policies to encourage renewable energy are moving in the following directions (Piscitello and Bogach, 1997):

(a) Incentives are clearly intended to be temporary measures;

(b) Performance-based incentives are being used to encourage efficient projects;

(c) Competition is being explicitly or informally integrated into the implementation of financial incentives, to promote reduced technology and project development costs;

(d) The size of financial incentives is being targeted to match incremental life-cycle financial costs;

(e) Incentives are being developed with consideration of the potential for changing market conditions.

Several innovative financing mechanisms have been developed by various organisations to promote RETs. Some of the approaches convert the capital cost into an operating cost for first cost sensitive investors so that payments are aligned with the stream of benefits received. This type of "micro-

[6] It is estimated that government subsidies for conventional energy were of the order $350-400 billion in early 1990s, but decreased to $250-300 billion per year by mid 1990s. The subsidies are both on the production and consumption sides.

financing" (Economic Commission for Africa, 1998) can also be achieved through innovative institutional mechanisms such as the Energy Service Company (ESCO). Small investments required to be made by the end users are aggregated through ESCO, which has risk-taking capacity and access to financing. We review some of the innovative financing mechanisms that have helped RETs develop.

1. International level

The World Bank

(a) The Asia Alternative Energy Program (ASTAE) was established in 1992 to promote renewable energy and energy efficiency in Asia through the World Bank's power sector lending operations. To support this goal, ASTAE works with both Bank staff and client country decision-makers to incorporate alternative energy options into the design of energy sector strategies and lending operations for all the Bank's client countries in Asia. Since its inception, ASTAE has generated substantial momentum, increasing the lending portfolio for alternative energy projects in Asia from about $2.0 million in financial year 1992 (FY92) to over $1.2 billion (FY93-FY00). These investments will result in over 1.6 gigawatts (GW) of avoided fossil fuel-based capacity through renewable energy capacity additions and energy efficiency demand reductions;

(b) The Solar Development Corporation (SDC), conceived as a free-standing, commercial enterprise, is being established by the IFC. Its primary objective is the development of viable, private sector business activity in the distribution, retail and financing of off-grid PV applications in developing countries;

(c) The Prototype Carbon Fund (PCF) has also been launched by the World Bank after Kyoto. The fund will buy carbon offsets at a competitive price and ensure that buyers and sellers of off-sets receive a fair share of the value added. The price of the carbon offsets would cover the cost of additional emissions reductions and also include a margin to share the benefits from the offset between the investor and host;

(d) The IFC's Renewable Energy and Energy Efficiency Fund (REEF) is expected to be the first global fund dedicated to investing in private sector renewable energy and energy efficiency in developing countries. The fund is expected to provide $150-210 million of private and IFC capital for financing on/off-grid projects of less than 50MW;

(e) The Photo-voltaic Market Transformation Initiative (PVMTI) is a $30 million fund operated by the IFC. This will be used to accelerate the growth of PV markets in India, Kenya, and Morocco by providing leverage to private companies on a competitive basis;

(f) The Small and Medium Scale Enterprise Program (SME) is a $21 million activity of IFC supported by GEF. It finances biodiversity and/or climate change projects carried out by small and medium scale enterprises in GEF-eligible countries. Contingent, concessional loans are provided to financial intermediaries (FIs). These FIs then finance the SMEs. Two PV projects and one efficiency project have been approved to date.

The World Bank has moved from the traditional government and subsidy centred approach to promoting renewable energy to the new, market-oriented approach in which consumer-side financing or fee-based service is the key issue. The Bank's focus is on three models of commercial financing of RETs, that emerged from past experience. The most common dealer model refers to cash or credit-based sales by the RET equipment dealers. For example, more than 100 thousand households use PV systems in Kenya and the systems are sold through existing rural sales points such as general stores. This model is now being pursued by the Bank in the Indonesia World Bank Solar Home Systems Project, although in this case, sales are credit-based that is, first costs are lowered and deferred through a credit mechanism arranged for customers by dealers through the banking system. The average monthly payments with solar systems is less than the monthly costs of conventional energy systems. The concession model depends on regulation by contract and is geared to provide large scale-economies. This is being tried out in Argentina where concessionaires that offer bids with the lowest subsidy to service rural house-holds and community centres will be given franchise rights for rural service territories. Choice of an appropriate cost-effective off-grid technology rests with the concessionaires. Partial financing of the start-up costs will be provided and payment for the services will be made by consumers. The importance of concessions models can also be observed in wind energy resource development, proposed as an instrument to harness wind energy resources concentrated in regions far from electricity markets (as in the US and China). The model can help in achieving economies of mass production and reduce transaction costs by increasing the market size. The World Bank has employed another model, the retailer model, in Sri Lanka and Laos. In this, a community, organisation, or entrepreneur develops a business plan to serve local demand for electricity and is given a loan. The cost is recovered through a fee-based service arrangement with the community/consumers. This approach may involve significant local involvement (World Bank, 1998).

United Nations Environment Programme

UNEP activities include a programme on Sustainable Production and Consumption. A component of this programme is to reduce the environmental impact of energy utilisation. UNEP encourages environmentally sound energy policies and technologies to achieve this objective. RETs are supported by UNEP through different mechanisms and in partnership with organisations such as GEF, UNDP, the World Bank, other regional and specialised UN agencies, bilateral and multilateral funding agencies, national governments and NGOs.

The UNEP-GEF project "Redirecting Commercial Investment Decisions to Cleaner Technologies – A Technology Transfer Clearinghouse" will influence investment decisions by providing advisory services to private sector clients beyond those a borrower might take on his own. By working directly with banks and their clients, it will overcome informational barriers in the financing of energy efficient and renewable energy technologies. Through carefully targeted appraisals of alternative technologies the project will increase loan officers' familiarity with energy efficient/renewable energy technologies investments. Knowledge and perception barriers, once removed, are unlikely to return. This permanent change in the institutional capacities developed through the project will favour replication of its activities by the participating lending institutions after the project ends.

The project will have the following results: additional lending directed at energy efficient and renewable energy technologies; upgrading of skills in loan officers in developing country financial institutions; and reduced emission of greenhouse gases.

United Nations Development Programme

UNDP has an Energy and Atmosphere Programme (EAP), a component of which is focused on energy issues including the promotion of renewable energy and energy efficiency through such activities as the joint UNDP/World Bank Energy Sector Management Programme (ESMAP); the FINESSE (Financing Energy Services for Small-scale Energy-users) programme; and building linkages with the UNDP-GEF unit on energy efficiency, renewable energy, and greenhouse gas issues. UNDP's involvement in the RETs is also through various agencies and mechanisms such as GEF, UNDP, World Bank, other regional and specialised UN agencies, bilateral and multilateral funding agencies, national governments and NGOs.

The EAP completed the *UNDP Initiative for Sustainable Energy (UNISE)* in 1996. UNISE is based on the fact that traditional approaches to energy make energy a barrier to socio-economic development and are not sustainable. Renewable energy was one of the focus areas in the UNISE. Other global programmes and initiatives related to RETs within the EAP included operationalisation of UNSIE in various countries through different projects, and renewable energy and rural electrification programme to disseminate and commercialise renewable energy to provide rural energy services. Renewable energy issues are also addressed in other programmes as a part of the promotion of sustainable energy policy by UNDP. RETs are included in UNDP's regional and country programmes as well; for example, UNDP's Regional Bureau for Asia and the Pacific launched a study with the United Nations Department of Economic and Social Affairs (DESA), on the commercialisation of renewable energy, while Northeast Asia will have a specific sub-regional programme on renewable energy technology. Similarly, at the country level, China has a major programme on sustainable energy, and Vietnam has a programme on rural renewable energy. EAP also provides technical expertise and services to UNDP country offices on RETs.

Joint Initiatives by International Agencies

(a) The Global Environment Facility (GEF)[7] funds the projects that provide global environmental benefits and local development gains in developing countries. The GEF provides grant financing to mitigate greenhouse gas emissions and projects covered in this component are targeted at lowering barriers to the success of renewable energy and energy efficiency technologies. The World Bank, UNDP and UNEP are the executing agencies for the GEF projects;

(b) The Energy Sector Management Assistance Program (ESMAP) is a global technical assistance programme sponsored by UNDP, the World Bank and bilateral donors. Renewable energy projects are an important component of the ESMAP. The programme also features innovative financing mechanism such as the solar PV concession systems for Argentina. ESMAP has also reached to the poorest in Africa through its micro PV lantern demonstration projects;

(c) The Renewable Energy Partnership (REP) Programme is being proposed by the World Bank and the GEF to provide increased and more flexible Bank and GEF funding to emerging market countries that make serious commitments to renewable energy development. The key to the eligibility will lie in making renewables-friendly policies, regulatory changes and other steps to foster renewable energy development.

Kyoto mechanisms

The UNFCCC envisages private and public sector investment by organisations outside of their own countries that reduce greenhouse gas (GHG) emissions in order to offset GHG emissions in their home country.

The new climate change regime also offers an opportunity for RETs as they meet the two basic conditions to be eligible for assistance under the UNFCCC implementing mechanisms: they contribute to global sustainability through GHG mitigation; and they conform to national priorities by leading to development of local capacities and infrastructure. Further, with the Kyoto Protocol,[8] the Parties to the UNFCCC are taking steps towards internalising the external costs of the GHG emissions. While the Kyoto Protocol has not yet proposed any binding emissions limitation commitments for developing nations, flexible instruments such as the Clean Development Mechanism and the possibilities of emissions trading are likely to provide economic incentives for significant emissions abatement in developing countries. The altered competitive dynamics should also prove favourable for RETs (Flavin and Dunn, 1998).

The GEF is examining ways to spur the growth of carbon offset markets and to accelerate foreign investment in sectors offering the opportunity for low-cost GHG mitigation. The project finance is proposed to be linked to carbon emission reductions at the project level. This is also expected to leverage and mobilise private capital into more RET projects.[9]

2. National level

European Union

The European Union (EU) committed itself to reduce the Union's greenhouse gas emissions by 8 per cent by the target period 2008 to 2012, from the base year 1990. One strategy of reaching this ambitious goal is to change the energy system towards an increased reliance on low carbon fuels, such as natural gas, and by supporting renewable energy (European Commission, 1997).

[7] This facility, reflecting world-wide concern with global environmental degradation, has raised about US$ 2 billion to provide incremental funding on a grant basis for projects that have substantial long-term environmental benefits. Four areas of environmental concern are covered by GEF: (i) ozone layer depletion; (ii) ocean water pollution; (iii) loss of biodiversity; and (iv) global climate change. About 40 percent of these funds are allocated for projects that reduce GHG emissions into the atmosphere and, hence, alleviate concerns for global climate change.

[8] Of most interest to RETs is Article 2, subparagraph iv of the Kyoto Protocol: "Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced innovative environmentally sound technologies" (UNFCCC, 1997).

[9] http://solstice.crest.org/efficiency/cef.

There have been several conferences and meetings in the EU on financing RETs. The financing schemes and projects were reviewed by Langniss (1999) under the project "Financing Renewable Energy Systems" (FIRE). The financing schemes in the EU have been categorised as follows:

(a) Private finance, which is mainly concerned with smaller projects and financing, comes from personal savings or bank loans secured by private assets. A subsidy component is usually present. The financial structure varies across projects in terms of equity, soft loan/debt, and subsidies, but overall, equity and subsidies make up the most significant part of the project costs;

(b) Corporate finance refers to the case where the investor is a company. The equity component is usually below 50 per cent. In most cases, subsidies are available and companies make use of the subsidy to earn a reasonable rate of return on investment;

(c) Project finance implies a specific company founded for the purpose of the project. The investors are not generally users of the energy, but sell the energy though contract arrangements (Mills and Taylor, 1994). High cost projects are normally financed through this route. Debt is observed to be a major cost component in this case;

(d) Participation finance is similar to project finance but the number of investors is large, for example, a co-operative. Involvement of the locals as equity holders is quite common in such projects;

(e) The Third Party Finance model refers to a contractual arrangement where a third party, other than the energy user, develops, finances and operates the energy system. The energy consumer pays the third party as per the contract to cover costs and a reasonable margin. The project may consider hire purchases, leasing or any other mode for repayment of the investment costs. The ownership of the project may get transferred to the user at the end of the contract.

A variety of incentives were offered in the renewable energy projects reviewed under FIRE. These included investment subsidies, soft loans, energy taxes, tax advantages and higher tariffs for electricity produced through RETs. In Germany, the Electricity Feed Law provides for guaranteed prices for electricity fed to the grid from certain renewables. Hydro power, electricity from biomass, wind and solar electricity are paid guaranteed prices by the utilities. In Italy, distribution companies are obliged to purchase energy from renewables. In the Netherlands, subsidy programmes are being replaced by fiscal measures. Exemption from regulatory energy taxes (REB), and free depreciation of environmental investments for green investment schemes are its features. Spain has the Royal Decree that allows electricity from renewables to be charged at the long-term avoided costs of the distributing utility.

Rate of returns for various RETs in EU countries have been reviewed in FIRE based on various case studies. The impact of various policies such as different energy pricing levels, energy taxes, income taxes and other taxes on the rate of return has been brought out in the study. The wind farm internal rate of return (IRR), for example, varied from a low of about 4 per cent in UK and Sweden to a high of about 20 per cent in Denmark when only the price levels for wind power fed to a grid were considered. However, the IRR after tax was lowest in Sweden (0 per cent) and highest in Netherlands (19 per cent) when tax policies were also considered. This is because tax policies are favourable for RETs in some countries. These include income taxes, treatment of losses (from the project), depreciation allowances, VAT rules, etc. Similar variations were observed in other RETs such as hydropower, PV, solar thermal and biomass. The net present value (NPV) was negative in all the countries for PV and solar thermal applications even after tax policies had been considered.

Box 1. United Kingdom

In the United Kingdom, the Non-Fossil Fuel Obligation (NFFO) created by the Electricity Act obliges regional electricity companies to buy a certain amount of renewable electricity at a premium price for a specific number of years. The difference between the market and premium price is refunded to the regional electricity companies (RECs) from the Fossil Fuel Levy. The aim of the NFFO is to reach a renewable generation of 1500 megawatts (MW) by the year 2000.

Merits of the NFFO. Though the NFFO was originally established to subsidise the nuclear power industry during the transition to electricity privatisation, it has turned out to be a great boost for renewables. The NFFO demonstrated the ability of a government policy to institute a “market enablement” strategy for developing RE. By setting a goal that 3 per cent (1500 MW) of the nation’s electricity should come from renewable sources, long-term capital investments in new technologies became feasible.

The price of electricity from renewables has fallen dramatically, particularly for wind. The fall in the price paid under NFFO contracts has occurred for several reasons. First, the longer duration contracts allow the initial investment to pay off over a longer period of time - crucial for renewable energy technologies since they tend to have high up-front capital costs. Second, there have been significant technology improvements resulting in decreased costs for RE, especially wind turbines (Wiser, 1997). Third, the cost of financing has declined as both investors and developers have gained experience with renewable projects.

Disadvantages of the NFFO. First, the short duration of the first two tranches resulted in a higher price because developers had to cover all the capital costs before 1998, rather than spreading them over the lifetime of the project. Therefore, the premium price paid was very expensive, giving renewable sources a reputation for high cost. Moreover, projects had to be developed as quickly as possible, resulting in some ill-considered projects. As a result of these lessons, the procedures of the third tranche were altered so contracts were set for 15 years, with an additional 5-year transition period before the contract lapsed. Second, the pricing mechanism sometimes favours less efficient systems. For example, waste incineration plants using co-generation of power and heat have been less competitive under the given pricing system, although compared to those producing power alone co-generation is more fuel efficient.

United States

The approach to financing RETs in the US has been similar to the EU, although the incentive structure varies across states. In California, which succeeded in promoting renewables, utilities were required to issue 15-30 year power purchase agreements with the option of high fixed prices for the initial 10 years for wind energy between 1983-91. From 1992 onwards, a Federal production tax credit of 1.5 cents/kWh and 10 per cent wind investment tax credit were provided. Other incentives included tax benefits, accelerated depreciation, and so on. As a result of various measures, by the early 1990s about 10 per cent of installed generating capacity was provided by renewable energy. Similar incentives were made available for PV.

Box 2. Renewables Portfolio Standard

Under a Renewables Portfolio Standard (RPS), all retail electricity suppliers are required to obtain a certain minimum percentage of their electricity from renewable energy in the form of "renewable energy credits" (RECs). A REC is a type of tradable credit representing one kWh of electricity generated by renewables. Electricity retailers can obtain RECs in three ways. They can own their own renewable energy generation, and each kWh generated by these plants would represent one REC. They can purchase renewable energy from a separate renewable energy generator, hence obtaining one REC for each kWh of renewable electricity they purchase. Or, they can purchase RECs, without purchasing the actual power, from a broker who facilitates trades between various buyers and sellers (Bernow et al., 1998). RECs are, therefore, certificates of proof that one kWh of electricity has been generated by renewables, and these RECs can be traded independently of the power itself. The basic idea of the RPS is to ensure that a certain minimum percentage of electricity is generated by renewables but to encourage maximum efficiency by allowing the market to determine the most cost-effective solution for each electricity retailer: whether to own renewable generation, purchase renewable electricity, or buy credits, and what type of renewable energy to use (Rader and Norgaard, 1996).

Merits of the RPS. A primary advantage of the RPS as compared to the NFFO is that it does not require the centralised collection and dissemination of funds or require state agencies to make decisions about winners and losers. The market makes all decisions regarding which renewable plants to build, where, and at what price - thus, the market can be expected to deliver these results at the lowest possible cost. There are several ways in which the RPS assures least-cost achievement of a country's renewable energy goals. First, the certainty and stability of the RPS policy will generate long-term contracts and financing for the renewable power industry resulting in lower renewable power costs. Least-cost compliance is encouraged by the flexibility provided to generators, who can compare the cost of owning a renewables facility to the cost of purchasing RECs from others. Finally, since generators will be looking to improve their competitive position in the market, they will try to drive down the cost of renewables, perhaps by lending their own financial resources to a renewables project, by seeking out least-cost renewables applications, or by entering into long-term purchasing commitments. This fosters a "competitive dynamic" that is not achieved with policies that involve direct subsidies to renewable generators without involving the rest of the electricity industry. This is essential in a renewable energy market, because it encourages the direct integration of renewable technologies into the existing generators' portfolios.

Disadvantages of the RPS. First, opponents cite the inability to contain costs as one of the main drawbacks to a RPS policy. As originally conceived, the RPS policy does not have an explicit cost cap, instead the market determines the total cost. Thus, costs could potentially be higher than expected to achieve a desired renewable energy level. Second, the RPS places the burden on the retail electricity suppliers who would be required to actively participate in the renewables (or at least the REC) market. The incremental effects on the electricity would differ by retail supplier - giving an advantage to those facilities with higher pre-existing levels of renewables in their portfolios. Third, some argue that once the minimum level for a RPS is reached than there is little incentive to increase the renewables development.

Developing Countries

Several developing countries also provided financial incentives to promote renewables. In India, financial incentives for wind energy and PV included accelerated depreciation (100 per cent in the first year), tax holidays, favourable electricity wheeling and banking policies, concessional duties and taxes on equipment and standard buy-back rates for power. (Bakthavatsalam, 1999). Off-grid incentives to promote renewables were also provided in several countries. For example, Indonesia offered grants and Mexico offered subsidies against installed costs for solar home systems (table 1).

Table 1: Financial Incentives for Off-Grid Photo-voltaic Systems

	India	*Indonesia*	*Mexico*
Systems Being Supported	• Solar home systems. • Street lighting systems. • Decentralised power • stations. • Solar lanterns • Solar pump sets.	Solar home systems.	Solar home systems.
Scale of Support	3/92 - 12/96: 4.8 MWp.	• 200,000 systems (anticipated) under Bank/GEF-assisted project. • 10 MWp.	• 24,000 systems (as of February 1996).
Primary Incentives offered	• Subsidies against investment. • Subsidised loans. • 100 per cent accelerated depreciation.	$125 or $75 grant per system sold, depending on location.	Federal and state government subsidies against installed cost (50 and 30 per cent, respectively).
Recipient of Incentive	End-user	Suppliers/dealers.	Private companies and non-governmental organisations hired by electric utility to install systems.
Payment of Incentive	Central government's Ministry of Non-conventional Energy Sources (MNES).	Global Environment Facility.	Central government's National Solidarity Program (PRONASOL).
Implementation / Conditions for Incentive	• Dealers market systems directly to end users. Systems also sold at MNES "showrooms". • State agencies provide subsidies against investment, and monitor implementation including technical performance of systems. • IREDA provides limited annual subsidised loans. • Systems must meet MNES technical specifications. • Subsidies for certain systems limited to designated users.	• Suppliers/dealers receive grant after system is installed. • Solar home systems must meet technical specifications. • Dealers must offer instalment payment plans and a consumer protection package to end-users. • Dealers must provide documentation to a Project Support Group.	• End-users submit application for solar home systems to local government. • Local government forms electrification committee and submits request to PRONASOL. • PRONASOL selects sites on basis of remoteness, distance from grid, and lack of near-term grid connection plans. • Utility contracts with private companies to install solar home systems. • Local governments and participating communities provide 20 per cent of project costs, including in kind resources.

Source: Piscitello and Bogach (1997, 9).

Non-Governmental Organisations

Several international and national NGOs are involved in promoting renewable energy in various countries. They have developed innovative financing mechanisms to support renewable energy on a sustained basis. Some of the initiatives are covered below:

(a) E&Co's mission is "to promote developing country energy enterprises that create economically self-sustaining energy projects; use environmentally superior technologies; and produce a more equal distribution of energy, especially to the poor". To this end E&Co participates in enterprise development to share risk and leveraging funding from conventional sources. E&Co was conceived by the Rockfeller Foundation to address the barriers in promotion of RETs and energy efficient technologies in developing countries. E&Co provides small loans, technical assistance, intermediary services and direct investment for (i) innovative implementation of a proven technology; (ii) technology innovations that are high risk by nature but have a potential for innovation in energy production; (iii) promoting new energy delivery techniques in rural areas where end-users of energy have little ability to pay; and (iv) innovative financing (including credit, loan and equity) of energy enterprises to provide cost effective energy services to potential end-users currently without access to such services. E&Co has financed a variety of renewable energy projects in developing countries; for example, E&Co supported Krishok Bandhu Agro-Systems Limited in Bangladesh, which was established in 1995 to sell treadle pumps and other manually operated irrigation devices, drinking water pumps, and other agricultural inputs to farmers in Bangladesh. The support was in the form of a loan from E&Co to serve as collateral for a local bank loan. In Bolivia, E&Co provided a loan for the construction phase of the Kanata Hydro Electric Project and a loan to Riberalta Biomass Power Plant at a critical stage when the project was in need of funds due to cost escalations. The loan helped the Cooperativa Eléctrica Riberalta Ltda. (CER), a local Bolivian electricity co-operative and owner of the plant to leverage funds from other sources. In Vietnam, E&Co is providing an equity investment to the SELCO-Vietnam, a Solar Electric Light Company that aims to electrify the country's 6-7 million off-grid rural households with solar home systems (SHS). Solar Electric Light Fund (SELF), a US-based NGO, was provided $ 250,000 in 1994 for a 49 per cent equity share in a Chinese-American joint venture company establishing a PV manufacturing facility named the Gansu Photo-voltaic Company. Support was also provided for an independent technical and economic assessment of this facility's operations. This assessment not only reported that the manufacturing facility was up and running, but also reported an increase in the number of units being produced and sold in the marketplace. The Solar Electric Light Company (SELCO), a solar energy services company that markets small-scale PV power systems in southern India to rural households not serviced by the electric grid, was supported in 1995 by E&Co through an equity investment to provide SELCO with the needed working capital to expand its operations. This equity investment of $50,000 resulted in a 5 per cent E&Co ownership share in the company. E&Co also provided a bank guarantee to allow SELCO to access funds for direct consumer financing. As a result of negotiations with the Indian renewable fund Indian Renewable Energy Development Agency (IREDA), SELCO has accessed GEF funds for on-lending to end-users. These funds — the first World Bank/GEF funds for solar home systems — have been guaranteed through an E&Co account in a local Indian Bank;

(b) Enersol Associates, Inc. is a non-profit organisation promoting use of solar energy for rural development in developing countries. Enersol has created a solar fund (Fondo Solar) which helped NGOs in the Dominican Republic and Honduras to raise finance for solar energy development. NGOs can secure commercial bank loans in local currency guaranteed with Fondo Solar funds. This familiarised NGO implementers and rural beneficiaries with credit procedures, and also helped the formal banking sector's forays into this area. Enersol has helped develop a local network of independent local enterprises which sell, install, and maintain solar-electric systems in rural communities of the Dominican Republic and Honduras. The entrepreneurs are provided training and technical assistance. The micro-enterprises (about 15) in the Dominican Republic have installed over 6,000 PV systems which provide electricity to rural homes, farms, schools, businesses, community centres and health clinics. The financing of these systems (over $80,000) was arranged by the NGOs. The Enersol extended its programme to Honduras in 1992. In Honduras, 20 such micro-enterprises installed over 2,000 systems with financing through consumer credits;[10]

(c) Grameen Bank (Village Bank) in Bangladesh is well known for its small-scale rural credit schemes (ECA, 1998). The Bank has now initiated a programme to finance renewable energy in rural areas that constitute 85 per cent of the country's population — most of which is without access to electricity. The Bank has established Grameen Shakti, a not-for-profit rural power company. Grameen Shakti is preparing a financing scheme for development of solar PV systems,

[10] www.enersol.org/front.html.

wind turbines, and biogas. It will also prepare a strategy for the supply, marketing, sales, and testing of RETs;

(d) Decentralised Energy Systems India Private Limited (DESI Power) is experimenting with the concept of Independent Rural Power Producers (IRPPs) in India. The company plans to enter into joint venture agreements with village communities or local entrepreneurs to set up small power plants of 100 to 500 kW capacity utilising local renewable energy sources. It will also be open to financing inputs from socially responsible funding sources and ethical/commercial investors elsewhere. The financial structure of the joint venture IRPPs envisaged DESI Power (26 per cent) and the local community (25 per cent) with controlling interest at 51 per cent, leaving the remaining 49 per cent of the equity and loans to be raised from the public and other sources. The promoters have already established one power plant of 100 kW rating which is in regular operation since 31st March 1996. Located in a small town, Orchha in Madhya Pradesh, the plant supplies power to a hand-made paper factory and other consumers in the neighbourhood;[11]

(e) The goal of the International Fund for Renewable Energy and Energy Efficiency (IFREE) is to promote the sustainable use of renewable energy and energy efficient technologies in less developed and transition economies. The technologies include commercial application of biomass, geothermal, hydropower, natural gas, PV, solar thermal, wind energy, and energy efficiency technologies. IFREE provides a part of the pre-investment funding to share the risk of project development with private sector companies for commercially financed projects. IFREE has funded several pre-investment studies for renewables such as hydro, solar, wind, geo-thermal and biomass power in developing countries.[12]

Other Initiatives

(a) Polyene Film Industries (PFI), a manufacturer of solar PV water pumps in South India, tied up with a local commercial finance company (Nagarjuna Group) to use low cost funds provided by the IREDA and tax incentives offered by the Government of India to make pumping systems affordable to rural farmers. In this scheme, farmers have to pay a one-time upfront payment, which is now affordable. The finance company is able to lower the cost to the farmers as it is able to make use of tax incentives and low cost funds available from IREDA. Left alone, farmers would not have been able to make use of the low cost funds and tax incentives due to the high upfront cost of the system. The low cost funds to IREDA were provided by the World Bank through the Government of India. Winrock international has tied up with IREDA to promote RETs;

(b) Triodos Bank, a Dutch bank, has decided to invest several million guilders in PV technology in developing countries. The investment will be through a new Solar Investment Fund. The objective is to provide solar energy at an affordable cost to rural households and small businesses in developing countries;[13]

(c) SELCO has raised equity funding from Swiss, German, and U.S. investors. The company has lined up an additional $28 million in debt from various lending institutions and investment funds for consumer finance of solar home systems. SELCO will sell and service solar PV household lighting and power systems on a global scale, focusing on emerging market countries;

(d) Solar Bank TM is an initiative by the finance community that will seek to tap the global capital markets for a continuum of funds for the PV markets. The Solar Bank will be a private institution that will act as a secondary lender to existing local primary financial institutions such as banks, co-operatives, credit unions, electric utilities, energy service companies, micro-enterprise lenders, and others who are in a position to finance local PV markets. That is, the Solar Bank will purchase PV loans from primary lenders, and will manage the credit risk and interest rate risk on a portfolio basis. Solar Bank will also finance PV projects directly;

[11] www.ecouncil.ac.cr/devalt/desi.htm.
[12] www.energyhouse.com.
[13] http://solstice.crest.org/efficiency/cef.

(e) Bilateral funding agencies such as USAID, DANIDA, SIDA and GTZ have been promoting RETs in developing countries through various projects. The aim in most of the cases is to address technical, financial, institutional and other barriers through demonstration projects.

IV. CONCLUSIONS

(a) RETs are not being deployed at a sufficiently rapid rate. There is a mismatch between their potential to meet sustainable development goals and the resources being allocated to them;

(b) Renewable energy is generally more expensive than conventional technology. Current low energy prices worsen the problem. Subsidies given to fossil fuels and the absence of policies to internalise the social cost of carbon emissions increase this price disadvantage;

(c) RETs need to move away from the traditional aid/grant culture associated with these technologies. Governments need to recognise the important role RETs can play in contributing to sustainable development. The challenge of increasing RETs penetration is to establish organisational, institutional and financial conditions under which a commercial market for these technologies can develop, especially in developing countries;

(d) In the experience of the developers/bankers, the following strategies promoted by governments have been successful: In some of the developed countries governments have specified that electricity producers need to have a certain progressively increasing proportion of their generation from renewable sources. This provides much needed economies of scale to the renewable equipment manufacturers. To fulfil their commitments, the utilities are forced to invest in these technologies. However, the investment is channelled into the most competitive technology source, thus promoting competition. Hence while providing economies of scale to these technologies, this strategy also promotes competition. Governments need to give clear long-term signals on their renewable policies (South Africa has a White Paper on their policies). In some of the countries the government pays a higher price for renewables which has been fixed for the different technologies at different levels, as necessary. Such policies help technology suppliers plan, put effort in research and development and lower the cost of technology. Certain institutions like IREDA (India) have played a very important role in the development of these technologies. These institutions could be replicated in other countries;

(e) Greater private sector involvement is needed in integrating renewable sources into the energy system;

(f) Despite their acknowledged benefits, the economic future for renewables remains uncertain and there are barriers which must be overcome. There is a need to level the playing field by withdrawing subsidies to conventional fossil fuels and by including externalities in energy prices. Governments can also apply legislation, market measures and temporary incentives to encourage investment by the private and financial sectors. Measures which have proved successful should be replicated, where appropriate, in other countries. In order to provide tomorrow’s technologies, substantial long-term research and development is needed to decrease costs and negative environmental impacts and to increase the reliability and maintainability of RETs;

(g) A central dimension of financial innovation is public-private sector collaboration;

(h) The key financing issue in developing countries is the availability of capital to RET developers and rural end-users, while the key issues in developed countries involve the cost of money, the ease of obtaining low-cost funds, and institutional complexities that hinder financing and market growth. Several innovative financing mechanisms for RET developers and end users have been devised and tested by the international organisations, governments and NGOs to promote renewable energy, specially in developing countries. Some of the mechanism show potential to increase penetration of RETs in developing countries;

(i) Challenges for policymakers will be to develop market and industry structures that promote technological innovation and to ensure that renewable energy can play a prominent role in the provision of electricity services. Since electricity is essential in any society, achieving sustainable development will require “sustainable electricity”.

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