

INNOVATIVE FINANCIAL MECHANISMS FOR SUSTAINABLE SECTOR FINANCING

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EXECUTIVE SUMMARY

A growing financing gap and the building up of unmet demands for improved quality of service and expanded coverage forced governments and public utilities to seek private capital, at home and abroad, through both debt and equity participation by the private sector. At the same time, technological progress and institutional innovations made possible wide private sector participation, ranging from management contracts through concessions to full-fledged privatization of energy, water and sanitation utilities and state-owned public transport companies.

During this time, the financial markets also evolved in conducive directions by developing new and innovative financing instruments that made possible the tapping of new sources of financing—insurance, pension funds and a variety of other institutional investors. The emergence of new forms of credit guarantees, the availability of instruments to finance private and municipal projects without sovereign guarantees, and the proliferation of new modalities for private-public sector partnerships opened up opportunities for resource mobilization and risk sharing which were not available to most developing countries a decade ago.

While these innovative financing mechanisms have accessed new, previously inaccessible sources of funds for sector investments and, in combination with a more realistic pricing of services, have enhanced the financial sustainability of sectors such as power, water, sanitation, and transport, they have not necessarily enhanced environmental sustainability. Furthermore, despite the obvious similarities in the innovative financing instruments in these four sectors, there are also significant differences arising from both different sectoral features and historical reasons.

This paper explores innovative instruments for sector financing, focusing particularly on energy, transport, water, sanitation, and forestry. It identifies the similarities and differences between different sectors, analyzes their implications for sustainable development and the potential for replicability in other sectors.

INTRODUCTION

TRADITIONALLY governments have been the primary source of financial resources for investments in sectors such as energy, public transport, water, sanitation and forestry. The first four of these sectors were considered natural monopolies—the service was provided by a state enterprise, usually at a subsidized price, and the state contributed and/or mobilized the financial resources for investment in maintenance and supply expansion. A second reason why state control and public provision was thought to be the appropriate model was the public good feature of clean water and sanitation in terms of public health, as well as the environmental externalities of energy and water resource development and use. A similar rationale was employed in asserting state ownership over tropical

forests and in providing for their management and conservation.

The experience with the traditional model of public provision and financing has been disappointing in terms of quality of service, coverage and costs. Furthermore, the traditional sources of financing dried up as public utilities piled up larger and larger deficits due to poor cost recovery, governments faced increasingly tight fiscal constraints and official development assistance (ODA) failed to keep up with expanding needs. A growing financing gap and the build-up of unmet demands for improved quality of service and expanded coverage forced governments and public utilities to seek private capital, at home and abroad, through both debt and equity participation by the private sector. At the same time, technological progress and institutional innovations made possible wide private sector participation, ranging

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from management contracts through concessions to full-fledged privatization of energy, water and sanitation utilities and state-owned public transport companies.

At the same time, the financial markets evolved in conducive directions by developing new and innovative financing instruments that made possible the tapping of new sources of financing, such as insurance and pension funds and a variety of other institutional investors. The emergence of new forms of credit guarantees, the availability of instruments to finance private and municipal projects without sovereign guarantees, the proliferation of new modalities for private-public sector partnerships, such as build-own-operate (BOO), build-operate-transfer (BOT), build-own-lease-transfer (BOLT), and build-own-operate-transfer (BOOT), and joint ownership, opened up opportunities for resource mobilization and risk-sharing which were not available to most developing countries a decade ago. At the same time, institutional changes in developing countries, such as decentralization of government and devolution of taxing power to local governments and municipalities, created the opportunity for sub-national entities to access the global capital market without the need for sovereign guarantees from the central government (for example, through the issuing of municipal bonds or the floating of shares of municipal utilities on domestic and international stock markets).

While these innovative financing mechanisms have accessed new, previously inaccessible sources of funds for sector investments and, in combination with a more realistic pricing of services, have enhanced the financial sustainability of sectors such as power, water, sanitation, transport and forestry, they have not necessarily enhanced environmental sustainability. Furthermore, despite the obvious similarities in the innovative financing instruments in these five sectors, there are also significant differences. The differences become more pronounced when we consider the fifth case, the financing of the forest sector, which is an equally important part of sustainable development. Because of pervasive externalities, many of a global nature, forest-sector financing presents particular challenges but can also potentially benefit from international environmental conventions and new market developments.

The purpose of this paper is to explore innovative instruments for sector financing, focusing particularly on energy, transport, water, sanitation, and forestry, to identify their similarities and differences and to analyze their implications for sustainable development and their replicability in other sectors.

ENERGY SECTOR FINANCING

The capital requirements of the energy sector are daunting. In the mid-1990s, annual investments in energy supply worldwide reached \$400 billion in 1990

dollars. By 2020, the capital requirements of the sector are expected to reach \$750 billion per annum with about 50 per cent going for power development (WEC, 1995). It would be virtually impossible to generate the needed capital from conventional sources and methods of financing, especially in developing countries. Indeed, the sources and methods of financing energy sector development have changed dramatically during the 1990s and the trend is expected to continue and accelerate.

The conventional sources of financing energy projects have been: (a) the utility's retained earnings from revenues; (b) supplementary government contributions; and (c) for developing countries, multilateral and bilateral agencies in the form of ODA. To a limited extent, some funds were also mobilized from local and international commercial banks. All external borrowing was mobilized by governments under government guarantee and the funds, being in foreign currency, were used to pay for imported capital equipment and technology. In contrast, domestically generated funds were in local currency and were used to pay for the local costs of energy development.

While the sources of funding still include domestic and foreign banks and multilateral and bilateral agencies, there are now many more actors (for example, insurance and pension funds) in the domestic and international capital markets. With the introduction of new facilities, the direct participation in funds, and the development of bond markets, the role of domestic commercial banks has been reduced considerably. In contrast, the role of international commercial banks in energy sector financing remains strong, despite the emergence of the international bond market as another major source of energy sector financing. Another major development is the introduction of new facilities by multilateral and bilateral agencies that finance private projects without sovereign guarantees from host governments.

In the meantime, the relative roles of the utility's retained earnings and the government's supplementary contributions (capital subsidies) have diminished as a result of regulated (low) utility tariffs and tight fiscal constraints. Consumer subsidies have not only led to low retained earnings but also to poor credit ratings and difficulties in raising capital from commercial sources. At the same time, ODA, far from being able to fill the gap, has diminished steadily from over \$70 billion in the mid 1980s to under \$60 billion in the late 1990s. During the 1980s, multilateral banks and bilateral agencies invested \$8 billion per year in the power sector of developing countries; in the 1990s their contribution was lower absolutely (even in nominal terms) and relatively insignificant by comparison both to the need and the role of other sources, especially foreign direct investment.

Two fundamental questions may be raised here: Will these financing changes continue into the future, or are they temporary responses to capital and fiscal

constraints? Are there, or will there be, similar changes in the financing of other sectors, such as transportation, water and sanitation? To answer these questions, we must examine the causes behind these dramatic changes: the restructuring of the energy sector and the evolution of financial markets.

Concerns about economies of scale and protection of consumers from “natural monopolies” in the 1950s and 1960s and concerns about the security of energy supply in the 1970s resulted in governments around the world either assuming ownership of energy utilities or introducing stringent regulations, including control of energy price increases. With energy prices kept low, utilities could no longer mobilize sufficient funds to finance supply expansion, and inevitably the government assumed responsibility for providing a major share of the needed expansion capital or mobilizing it with government guarantees. By the late 1980s, the combination of cash-strapped energy utilities, fiscally constrained governments, and a lagging supply capacity expansion behind rapidly growing demand (stimulated by falling real energy prices and rising incomes) convinced governments that the old system was no longer tenable or sustainable. In response, governments around the world began privatizing state energy utilities or letting them take responsibility for their own financing and economic viability while utilities which were already private but highly regulated were, at least partially, deregulated. These changes have three consequences for financing energy sector investments: (a) the government is no longer responsible for providing or mobilizing funds for capital investments; (b) the energy utilities are free to seek financing in domestic and foreign capital markets, but to do so they must convince investors that the financial risks are acceptable and expected returns are comparable to those from other investments; and (c) energy prices – gradually freed to reflect the full cost of supply – become the ultimate source of financing of investments in supply expansion.

As a result of these changes, power companies have shifted their sources of financing from public to private sources and from bank loans to the bond market. Competition in power supply was introduced through the emergence of independent power projects (IPPs) that are non-utilities, such as industrial firms that construct new power plants to provide electricity to their own establishments and sell the additional output to the grid or directly to customers, with the power companies providing the transmission and distribution services.

The new and innovative methods of financing draw funds from a much wider range of sources than conventional financing. In terms of debt finance, most of the capital comes from institutional investors such as insurance and pension funds and the domestic and foreign bond market. In terms of equity, most of the financing comes from floating shares of public utili-

ties on domestic and international stock markets and from resources mobilized by IPPs and independent co-generators. Another feature that accompanies the move to private sector power is the increasing reliance on foreign resources, which may increase risk exposure if energy prices are not raised to cover the full supply cost. This has been the case with many countries in Latin America. In contrast, in Japan and other East Asian countries, high energy prices ensure that both capital and operating costs are covered, a key feature of sustainable financing. China is the single largest actor in the demand for energy sector financing pursued through the establishment of power development funds (in partnership with private investors and multilateral banks), issuance of corporate bonds, floating of public power plant assets in international stock markets, and foreign investment in BOT power projects. While the range of sources and methods of financing of power sector development has multiplied with the emergence of innovative mechanisms, the bottom line remains the same for all private investments: long-term user charges must be high enough to cover capital and operating costs. A combination of deregulation of electricity prices and introduction of competition through IPPs ensures that capital and operating costs are minimized and prices are raised to cover them fully. This combination ensures both access to innovative financing mechanisms to resolve cash flow problems and the overall financial sustainability of the energy sector.

However, the new financing mechanisms for the power sector are not without problems with regard to environmental sustainability. Deregulation and privatization means the government surrenders control over the fuel mix: the new financial incentives favour thermal power over hydro and nuclear, and within thermal, conventional coal over imported gas and clean coal technologies. This has to do with the capital intensity and long construction time of nuclear, hydro and importing facilities for natural gas versus the modest up-front investments of conventional coal and oil fired plants.

The financial incentives to investors favouring conventional thermal power and low energy prices for consumers (as a result of competition) favouring increased energy consumption may increase the environmental impacts of energy use at a time when there is a heightened concern about the health effects and climate change risks of fossil fuel combustion. To prevent this from happening and to ensure environmental sustainability along with financial sustainability, environmental costs must be fully internalized into energy prices and the financing and bidding process must be designed to encourage private bidders to take into account the environmental benefits of natural gas and of renewable energy.

Another factor that affects sustainable energy is scale. Many of the most promising technologies for advancing sustainable development (for example, so-

lar, wind-power, biogas, geothermal and energy efficiency improvements) require investments in small-scale energy production systems and technology upgrading, which are not well served by existing capital markets that provide large quantities of capital on the scale required for conventional power sector development. Furthermore, consumers tend to choose less energy-efficient technologies because they involve lower initial investment compared to more efficient – but initially more costly – sustainable energy technologies. This problem may be solved through innovative financing mechanisms that convert the capital cost into operating costs which are aligned with the stream of benefits accruing to the user. Micro-financing is another innovative instrument whereby households and small businesses are given access to loans for small investments under flexible lending and repayment conditions (for example, India, Bangladesh, Indonesia). Yet another innovative instrument is the aggregation of small investments into an umbrella energy service company, which finances end-use efficiency improvements in exchange for a share of the resulting energy savings (Reddy and others, 1997).

WATER SECTOR FINANCING

The capital requirements for water supply and sanitation in developing countries have reached \$35 billion (in 1990 dollars) per annum and are expected to double by the year 2025. Financial resources of this order of magnitude are far beyond the capacity of cash-strapped public water utilities or fiscally-constrained governments to provide. A combination of technical, financial, institutional and environmental problems of public water utilities has resulted in unreliable service, unsatisfied consumers, poor cost recovery, financially insolvent systems, unnecessary environmental damage and unacceptable health hazards. An assessment of public water supply and sanitation by Idelovitch and Ringskog (1995) identified the following problems (which are shared to varying degrees by other public services such as power, telephone and transport):

- Low-quality service and inadequate coverage (50-75 per cent for water, 30-50 per cent for sanitation); inability to cope with expanding population; the intermittent, low pressure water supply is mirrored in the power sector by frequent brown-outs and a variable electric current;
- Inefficient operational practices and poor maintenance resulting in large water losses, unaccounted-for water and power losses as high as 40-50 per cent, compared to 10-20 per cent for well-managed systems;
- Excessive and wasteful use: for example, water consumption may reach 500-600 litres per capita, which is twice the norm in metered and well-

managed water supply systems; this is largely the result of water pricing, non-marginal cost pricing, and lack of metering. In the energy sector, underpricing leads to energy intensities (energy use per unit of GDP) that are two to three times the norm for full-cost priced energy;

- Poor cost recovery and financial problems arising from underpricing, limited consumption, metering, irregular meter reading and billing not based on actual consumption. Water and electricity tariffs typically do not reflect the incremental costs of future supplies, which results in inadequate funds for expansion. Poor maintenance resulting from poor cost recovery results in a vicious circle of falling revenues and deteriorating service;
- High labour costs and low labour productivity because of excess staff, generous benefits and lost skills. For example, public water companies often employ 5-10 employees per 1,000 water connections compared with only two to three employees per 1,000 connections for efficient water companies;
- Poor management and inability to attract management talent and qualified technical staff due to non-competitive wages, political appointments, high turnover, lack of a disciplined labour force and lack of incentives to attract qualified managerial and technical staff;
- Large and growing state subsidies that benefit mainly the middle class and the wealthy who are large consumers of water and power, while the poor are either not connected or are too small as users to benefit as much from untargeted subsidies;
- Lack of clear regulatory responsibility and conflict of interest between the regulator and operator functions of the public utility. Underperformance or under-compliance is often dealt with by lowering standards rather than by improving operations;
- Public service monopolies are usually among the largest sources of environmental problems, for reasons that range from soft budget constraints and inefficiency to low tariffs and bureaucratic shielding. Water tariffs rarely include environmental costs. For example, water rates do not cover the cost of collecting and treating waste water. Moreover, contamination of shallow aquifers by sewage deposited in septic tanks is often a major problem of urban water supply.

The poor performance and mismanagement characterizing publicly-owned and operated water utilities gave the impetus for considering private sector participation. A second and equally important catalyst has been the increasing needs of urban water supply and sanitation and the inability of the public sector to mobilize the needed resources. Declining ODA, unsustainable levels of budget deficits and ex-

ternal debts, and the need to maintain fiscal discipline to control inflation and spur economic growth have convinced governments to seek private sector resources.

Private Sector Participation

The promise of the private sector lies in (a) improved management and higher efficiency and (b) increased access to private capital for maintenance and expansion. The two are related since greater efficiency results in cost savings and greater availability of funds for investment; improved management results in easier access to private capital; and investment of private capital constitutes an added incentive for operational efficiency.

While the potential benefits from private sector participation are clear, the obstacles are often formidable. Infrastructure investments tend to be capital intensive and lumpy and have long gestation and even longer payback periods. In water and sanitation, the ratio of investment in fixed assets to annual tariff revenues is 10 to 1. This means that private financing is contingent upon the existence of long-term capital markets and the guarantees and rewards offered for high perceived risks. These private sector risks are many and varied: demand for the services provided may turn out to be lower than expected; tariffs may be too low and not permitted to adjust to reflect costs; the condition of infrastructure may turn out to be worse, delays of construction longer, and costs higher than anticipated. Other risks include the financial risk of currency devaluation, legal risks in dispute resolution, and the political risk of asset appropriation. As a result of one or more of these risks, the private contractor may be unable to recover costs and earn a reasonable profit. Indeed, how these risks are quantified and mitigated turns out to be the key to private sector participation in infrastructure projects. The principle is that whoever controls a particular risk best should assume it and be compensated for it.

The public sector that invites private sector participation in areas that have been traditionally reserved for the state also faces risks: procured services may be substandard or costs may turn out to be higher than those charged by the public utility. There are also political risks arising from public opposition, especially by labour unions. Water supply, sanitation, and power (as well as other utilities) are natural monopolies; it is uneconomic to duplicate the water and sewage pipes or the power lines in city streets and therefore competition is difficult to achieve. Moreover, regulation is necessary to protect against monopolistic practices. Regulation is also necessary to control externalities related to public health and the environment; as the social benefits exceed private benefits, investments must be promoted above what is privately profitable.

Options for Private Sector Participation

There is a wide spectrum of options for private sector participation in infrastructure and public service provisions that vary in the respective roles of the public and private sectors as they concern ownership, management financing, risk sharing, duration and contractual management with the users (see Annex I). These options may be classified into two groups:

- those that retain public ownership of the assets while contracting out management, operation, and even investment, and
- those that involve at least partial or temporary private ownership of assets.

The first group includes service contracts, management contracts, lease arrangements, and concessions. The second group includes BOOT, and its variations, BOT and BOO; reverse BOOT (whereby the public entity builds the infrastructure and progressively transfers it to the private sector); joint ownership or mixed companies; and outright sale or divestiture.

All options promote to differing degrees commercial viability, operational efficiency, increased competition, improved cost recovery and performance-based compensation (in most cases). The wide range of options allows flexibility and the potential to move from less risky arrangements without private sector investment to riskier arrangements involving a progressively larger share of private investment as credibility and confidence among the parties grow. As BOOT contracts involve gradual transition to the public authority or to the private contractor, they constitute a useful transitional mechanism for countries without prior private sector involvement. Joint public-private ownership is a risk-sharing arrangement that helps attract private sector involvement. For an innovative and fairly successful private sector concession in water supply and sanitation with important lessons for other countries, see Annex II.

Sub-national Government Borrowing for Infrastructure Development Projects

A number of new financing instruments have been developed in recent years for urban infrastructure projects, particularly water and sewage systems, based on the security provided by intergovernmental transfers, taxing authority and user fees. An interesting instrument for securing bank loans, known as the "tax revenue intercept", emerged in Latin America. For example, provinces in Argentina used their share of tax revenues from federal income and value-added taxes, collected by the federal government and distributed to them through the National Bank, as security for loans from private and state-owned banks. Lenders, whether local or international, have a first

lien on the tax revenues of the province. If the borrowing province (or municipality with provincial guarantees) defaults on their debt service payment, the creditor can activate the "intercept" mechanism by requesting the national bank to pay the debt service directly to the creditors account at the bank out of the province's tax revenues.

The concept of tax revenue intercept has been employed in Mexico to secure financing of concessional waste water treatment plants through a credit line established at the state development bank, BANOBRAS. The concessionaire can draw on this credit line in case the municipality fails to pay for the treated water. Indeed, during the financial crisis, Mexico used this mechanism to secure payments for waste water treated by the concessionaires.

In Colombia, another version of the intercept concept works through the Findeter program (Financiere de Desarrollo Territorial, S.A). The revenues from water tariffs or waste water treatment charges are escrowed at the creditor bank, which in turn endorses this lien to Findeter, a "second tier" lender that provides, through first tier banks, loans with long maturities to municipalities investing in infrastructure projects, such as water supply and sanitation. If the municipality defaults on its payment, Findeter has a double recourse: the bank is liable to Findeter even if the municipality defaults; but if the bank defaults too, Findeter can still collect directly from the municipality since it has the first lien on revenues.

Government, states, provinces and municipalities increasingly have direct access to international markets for water/sewer system development and other infrastructure projects. Table 1 provides examples of bond offerings that were issued by public and private entities in emerging markets in 1993-1995. However, most of these issues were by sovereign borrowers, state enterprises and private companies. Only better-known Argentine and Chinese provinces and Brazilian states have directly floated bonds in international markets. A few large cities have also been able to issue foreign currency denominated bonds in Eurobond markets: in 1994 Prague issued \$250 million in five-year fixed rate notes with a "BBB" investment grade rating; in 1996, Rio de Janeiro issued a \$125 million in three-year fixed-rate notes with a "B" non-investment grade rating. Both issues were well received by international investors and other cities followed suit. Rapidly evolving sources of local infrastructure finance in domestic credit markets are general obligation bonds, secured by the tax collection powers of local governments, and revenue bonds, secured by user fees. But the full development of these financing mechanisms would require: (1) predictable fiscal relations between local and central governments; (2) autonomous public utilities with secure recurrent income through reliable services to customers and rational pricing policies; (3) transparent city budgets, credible accounting systems, and independ-

ent audits; and (4) well specified creditors rights and seniority of claims over municipal assets. Furthermore, credit rating and bond insurance would further stimulate the development of municipal bond markets for urban infrastructure development in developing countries. A credit rating by a recognized rating agency would provide to potential investors information on the local government's ability to service debt from its tax and other revenues and its credit track record. Bond insurance, while not a substitute for the creditworthiness of municipal bonds, would help increase their marketability, or reduce their cost.

From Municipal Development Funds to Infrastructure Banks

Water supply, sewage treatment systems and similar local infrastructure investments require debt financing from both domestic and international markets. In response, some developing country governments established "municipal development funds" to channel municipal credit. Such funds are, in effect, substitutes for government grants or vehicles for borrowing at home and abroad with sovereign guarantees from the central government and lending to municipalities through local banks. As such, they do not constitute new and innovative sources and mechanisms for financing infrastructure, but simply different vehicles for the same funding.

According to El Daher (1997, 4), a "challenge would be to move this concept further along commercial principles and assess the feasibility of establishing 'infrastructure banks' that could issue 'market-based' long-term debt (neither guaranteed nor subsidized by the government) for viable, revenue-generating infrastructure investments." Such infrastructure banks, analogous to the US "State Revolving Funds" with a built-in diversification portfolio, would be able to provide more security and credit quality, offer bond insurance and be open to smaller borrowers (El Daher, 1997).

Financing Instruments Specific to Water and Sanitation

Water and sanitation investments exhibit similar financing problems as many other local infrastructure projects, which have been addressed either through increased access of state companies and municipal governments to the local and foreign capital markets or through concessions and privatization. Regardless of how the overall financing is arranged, three micro-financing issues are also confronted. First, while low-income water users are usually willing to pay the water tariffs, they may face capital constraints in paying the connection charges. Second, full-cost pricing may be considered "unaffordable" for low-income users and the government may wish to supply water to them below cost. Third, while most

Table 1. Bond Offerings by Emerging Markets (1993-1995)

Country	No. of issues	Amount in \$ billion
Mexico	103	20.0
Argentina	106	15.2
Thailand	78	7.1
Indonesia	39	4.5
China	23	4.0
Brazil	155	13.8
Philippines	28	3.2

Source: Darche (1997)

users are willing to pay the full cost of water supply, they are not willing to pay the full cost of sanitation and sewage treatment. Unless these three issues are resolved, the sustainable financing of the water sector cannot be ensured.

The connection financing problem is usually solved by amortizing into monthly payments and including it into the monthly water bills. For example, in Bolivia concerns that lump-sum connection fees might discourage households from connecting to public water supply prompted the regulators to allow the concessionaire, Aguas de Illimani (AdI), some flexibility in pricing its services. While the "conversion contract sets maximum tariffs and connection fees for water and sewer service, it does not prevent the company from lowering prices or offering financing schemes to increase demand for in-house water and sewer concessions" (Komives, 1998). AdI gave households the option of paying a reduced connection fee in exchange for supplying labour for the connection. Eighty per cent of the households receiving connections avail themselves of this option. At the same time, AdI offered low-income water users a 3-5 year financing plan to pay their connection fees, and for people in remote areas it offered a subsidized interest rate (8 per cent, compared to the normal 12 per cent). The innovation here that ensures that sustainable financing can be attained despite long financing periods and subsidized interest is that these are not mandated by the concession contract but encouraged by the pricing flexibility that the contract allows.

Issues of social security or affordability of water services are often dealt with through block pricing and cross-subsidization. For example, in the Bolivian case above, two cross-subsidies are provided for in the conversion contract: (a) industrial, commercial and government users subsidize domestic connection, and (b) a lower tariff applies to low volume users and a higher tariff applies to high volume users. Most households use less than 30 cubic meters per month and pay a tariff well below the marginal cost of supply. This tariff structure may actually have perverse

financial incentives inducing the concessionaire to service first industrial and commercial users and to leave poor residential areas for later. On the other hand, the need for political support for privatization and the desire to maintain access to other lucrative opportunities may counter these perverse incentives.

The water users' documented unwillingness to pay for off-site sanitation and sewage treatment has created financing problems for sewer-related investments which have been resolved by unifying the water and sewer tariff. By bundling an unprofitable service with a profitable one, it is possible to ensure sustainable financing of both. However, where all households pay for sewer services but not all households are connected to the sewer network, the unified water and sewer tariff creates a perverse incentive for the concessionaire to not expand the sewer service since expansion imposes additional cost but brings in no additional revenues (Komives, 1998).

Yet another instrument that is used in the water sector (and occasionally in the electricity sector) in order to ensure the financial sustainability of the provider is exclusivity of service or prohibition on free entry. The rationale for such a prohibition that limits competition and is out of line with recommended policy toward other sectors has to do with three concerns: (a) difficulty in attracting private capital; (b) inefficient duplication of facilities; and (c) possible adverse impacts on safety and environmental quality. A study by Ehrhart and Burdon (1999) argues that exclusivity is only justified for countries with low administrative capacity and high risk, where mechanisms to hedge risk are difficult to obtain as an instrument for encouraging private sector participation. The only other case where exclusivity may be justified is where safety and environmental concerns are of great importance or there is a risk of over-pumping of aquifers and/or pollution of aquatic environments; in such cases policy makers may use exclusivity to prevent competitive pressures that could lead companies to cut corners in terms of safety or environmental protection.

In all other cases, free entry must be encouraged. In particular, where monopoly water utilities provide low quality service at high cost and investment funds are lacking, free entry would provide alternative solutions, as the cases of Pakistan's Orangi Pilot Project and Paraguay's *aquateros* demonstrate. After years of inaction by the municipal utility in 1980, a charitable group developed a low-cost approach to pipe-sanitation in the Orangi settlement in Karachi. With low costs and high expected benefits in terms of health improvements and property value appreciation, households and neighbourhoods mobilized the funds among themselves and financed the construction of pour-flush latrines and sewage lines covering half the settlement by 1993. In Paraguay, 300-400 water vendors (*aquateros*) have been supplying quality piped water to areas not served by public supply, with the added financing incentive of allowing payment of connection fees by instalment (Ehrhart and Burton, 1999). In Bolivia, Aguas de Illimani – despite its contractual exclusivity of water service provision – has permitted water delivery by truck to some areas and even initiated a similar service for households without access to public supply and, with the regulator's permission, delayed the metering or removal of communal standposts.

TRANSPORT INFRASTRUCTURE FINANCING

The annual capital requirements for transport infrastructure developments are expected to more than double over the next 25 years, from \$23 billion (in 1990 dollars) today to over \$50 billion in the year 2025. Not only is existing transport infrastructure inadequate, but it is poorly maintained and public transport services are generally of low quality and financially unsustainable without state subsidies. In an effort to improve maintenance, quality of service and financial sustainability, a number of innovative financing mechanisms have been used in recent years. We will illustrate these new approaches with two examples: (a) Africa's road maintenance initiative; and (b) Rio de Janeiro's urban transport sector reform.

The Sub-Saharan Africa Transport Programme

According to the World Bank (1998), almost one-third of Africa's \$150 billion road system has been lost to disrepair, while half the region's paved roads and 70 per cent of the unpaved roads are in fair to poor condition. Lack of funding has not been the cause of poor maintenance; institutional and policy weakness have. State-owned public road maintenance companies used their large and under-used capital stock to ensure employment rather than road maintenance *per se*.

In 1987, a group of African transport ministers launched the Sub-Saharan Africa Transport Pro-

gram, with major emphasis on road maintenance. The root causes of the poor maintenance were identified to be institutional rather than technical or financial. Existing institutional arrangements were too weak to manage and finance road maintenance, despite the availability of financial resources (Heggie 1994). Africa's road maintenance initiative had two components: (a) it brought together policy-makers and transport users to better understand the problem; and (b) the institutional weaknesses arising from maintenance being part of the general civil service were addressed by establishing institutional and financial autonomy for road agencies. Institutional autonomy was needed in order to have a more flexible employment policy and a more focused mandate on road maintenance. Financial autonomy was needed to ensure reliable financing. Despite the public-good aspect of roads and the inability of maintenance companies to recover costs through user charges, financial autonomy would enable the structuring of vehicle and fuel taxes to "closely approximate 'prices' for road construction and maintenance." (World Bank, 1998, 114).

Despite the usual arguments against earmarking, several countries established "road funds" for earmarking taxes and fees for road maintenance. According to the World Bank, this arrangement has several benefits: (a) it improves tax collection, as road users are more willing to pay taxes when they know they are used to improve roads; (b) it ensures a steady flow of funding and a sustainable financing source; and (c) it results in a more efficient use of funds as road users sit along with government officials on the boards of these funds. Increasingly, road maintenance is outsourced from private sector companies, thereby introducing an element of competition in road maintenance that helps to contain costs.

The Rio de Janeiro Urban Transport Sector Reform

Rio de Janeiro's public transport system received large subsidies — \$350 million per year (or 10 per cent of state revenues) — and carried 67 per cent of the 13 million person trips made daily in the metropolitan region. The lack of integration between the metro and the rail network discouraged more rail trips and encouraged the use of more buses and cars, resulting in heavy congestion and waste of commuters' time. Commuters from low-income areas spent on average 2.5-4 hours on crowded buses and a fourth of their personal income on transit fares (Rebelo, 1999). Finally, congestion and poor maintenance contributed to air quality problems and frequent road accidents.

To address these issues and to improve the supply of urban transport services, the Rio de Janeiro State Government, under the leadership of the State Secretary of Planning, introduced a reform program aim-

ing, among other objectives, to (a) improve financial management, (b) recover cost through tariffs, (c) target subsidies for the poor, and (d) increase private sector participation in both investments and operations. The reformers' expectation was to eventually eliminate subsidies to all public transport except rail. In the meanwhile, a new financing mechanism – a surcharge on the vehicle ownership tax – would provide the needed revenues for the operating subsidy and the capital for expansion.

By 1998, Rio de Janeiro's urban transport system was fully privatized. Concessions for the metro, rail (Flumitrens) and ferry service (COPVERG) were awarded through competitive bidding, and other smaller state enterprises related to transport were sold or liquidated. The Rio de Janeiro urban transport reform holds some important lessons for sustainable sector financing. First, even systems that suffer from large losses and require huge state subsidies can attract private sector interest and yield a positive and substantial concession fee in a public bidding. Contrary to the results of consultant studies and the experience of Buenos Aires, the State of Rio de Janeiro was able to privatize its urban transport system without operating subsidies.

The privatization of Rio de Janeiro's urban transport system is considered a successful example of new and innovative financing mechanisms of sustainable development. Financially burdensome and environmentally damaging subsidies of \$355 million (or \$400 per resident actually using the service) given to public transport companies were eliminated. Private capital, both domestic and foreign, for rehabilitating trains and the overall transport infrastructure was injected into the sector. There are already signs that the service is improving and the demand for the service has increased, at least for the metro and ferry transport. Improvements in the train service are underway. Congestion and pollution problems are expected to ease as the improved public transport services, combined with increased taxation of private vehicle ownership and use, induce more commuters to shift from private driving and buses to an improved, integrated and expanded public transport system.

FOREST SECTOR FINANCING

Forest sector financing needs arise with regard to (a) national forest conservation; (b) reforestation and afforestation; (c) sustainable timber management, and (d) sustainable forest management. (The terminology employed in this section is mainly from Pearce, Putz and Varclay, 1999). In all these areas there are interesting financing issues for two main reasons. First, there is a temporal separation between investments and returns, which creates serious cash flow problems as well as uncertainty. Second, not all benefits are captured by the investor. Many benefits are in the form of positive externalities

or public goods, local or global, that accrue to distant beneficiaries that were not part of the investment decision and do not share in the costs. Financing investments with a long lag (decades) between investment and returns, and/or only partial capture of the benefits (due to non-exclusivity) creates a serious financing challenge for private investors, financial institutions and developing country governments. Of course, such financing problems do not arise with conventional logging of mature forests because, indeed, unless one is concerned with sustainable timber management, neither of the two problems identified above arises. To the contrary, conventional logging liquidates large quantities of natural capital that have accumulated over the past decades without any investment by the concessionaire and ignores any external cost imposed on others.

Sustainable timber management (STM) and natural forest conservation (NFC) are the two polar extremes of forestry sector financing. While STM faces only the temporal separation between investment costs and returns, NFC faces only the externality problem, the spatial and "institutional" separation between investment costs and returns. Both problems involve valuation, internalization and capture. Distant returns can be captured through longer-term concessions that encompass the next harvesting cycle. This does not guarantee sustainable timber management, since the present value of future returns may fall short of investment costs (which include both forgone current harvest revenues in cases of selective logging and management costs). However, long-term concessions ensure that the returns for future harvests are considered, valued and, if worthwhile, can be captured by the concessionaire/investor. If the present value of future harvests does not justify current investment costs, STM collapses to conventional "extractive" logging. Various studies (most notably Sedjo 1994) have shown that sustainable timber management at any reasonable discount rate is at best a "marginal" investment. For example, clear cutting and abandonment of a tropical forest concession in Indonesia, which is no investment in any form except protection from encroachment, was found to yield a net present value from future harvests of about \$3 per ha in 1988 prices; any investment in forest management other than protection would yield negative returns. STM could be more profitable if either discount rates are lower or timber prices are expected to rise over time and/or timber volumes grow faster.

Most projections of timber price growth do not exceed 1 per cent per annum (for example, Brook 1996; Sohngen and others, 1997; Panayotou and Ashton 1992). Estimates of annual timber growth range from 1 to 3 cubic meters per ha or a 1-3 per cent growth rate. If we take 2 per cent as the average volume growth rate for STM (see Rice 1998) and 1 per cent as the annual price increase, STM would only be justi-

fied at real discount rates well below 5 per cent. Yet researchers such as Whittington and MacRae (1996) found long term discount rates in developing countries to hover above 10 per cent and to reach as high as 30 per cent per annum. Under these circumstances, STM would not be profitable and hence financially not viable, unless somehow (for example, through reduced import logging and higher seeding densities) volume growth rates are raised significantly and/or discount rates are dramatically reduced. Pearce and others (1999, 6) speculate that "STM could easily result in volume increments of commercial species that are 2-4 times higher than after CL (conventional logging)."

Recognizing the "poor economies" of STM, governments have sought to impose it by dictating selective logging (for example, Indonesia) or requiring the posting of a performance bond by the concessionaires to ensure regeneration and future harvest (for example, Philippines). The results have not been encouraging; indeed, they led to perverse outcomes such as high grading, illegal logging and relogging, and intentional forest fires. We may conclude that unless we go beyond timber to the other products and services of tropical forests and replace STM by sustainable forest management (SFM), sustainability will remain elusive and more the exception than the rule. Correspondingly, financing for STM will continue to be scarce or subsidized; but public subsidies make no economic sense unless non-timber services or the externality and public good values of forests are taken into account. We do this by considering first the extreme case of natural forest conservation (NFC), the setting aside of natural forests as protected areas, such as national parks, wildlife sanctuaries and wildlands.

Natural forest conservation involves costs in terms of demarcation and protection from encroachment, which could be enormous for mature forests; there is also the opportunity cost of the land, which in poor developing countries is by far the most important economic asset and source of livelihood. In contrast to its substantial costs, NFC generates no direct returns or cash flows to recoup its investment costs. At face value, NFC investments are not financially viable and are unlikely to attract any private capital, domestic or foreign. They can only be financed by the state from tax revenues or, if borrowing is involved, sovereign guarantee and security against tax revenues would be necessary. But are such investments of scarce public funds by developing countries justified? From an economic perspective, it makes no difference whether such investments are actual outlays for the establishment and protection of conservation areas or simply forgone revenues from non-harvesting and non-conversion to other uses: from a financial perspective, of course, it makes a difference, since only actual outlays need to be financed; but forgone revenues do not, unless the land is privately owned.

Whether the expense of public funds or the creation of national debt for forest conservation investments is justified depends on the magnitude of the benefits generated and to whom they accrue. The benefits of natural forest conservation consist of (a) watershed protection services (water, soil, downstream impacts); (b) micro-climatic benefits; (c) increased resilience to natural disasters and pest outbreaks; (d) recreation and tourism; (e) wildlife and biodiversity protection; (f) carbon sequestration and (g) regional and global climate benefits. None of these benefits are private, only the first three are national, the fourth ranges from local to global and the last three are regional or global. Since all costs for setting up conservation areas are incurred by the country that owns the forests and sets up these areas, and since a great deal of the benefits accrue to non-nationals and the global community and exclusion is not possible, we would expect that natural forest conservation areas would be underfinanced and underprovided, even if the host country fully appreciates the local environmental benefits and can mobilize the resources to invest in them.

Biodiversity conservation and carbon saving or sequestration are global public goods that should be financed by global public revenues. Contributions by international environmental NGOs, some bilateral and multilateral development assistance and the Global Environmental Facility have in recent years served as partial sources of financing of the provision of these public goods, but they have been grossly inadequate relative to the global demands for conservation of tropical forests and biodiversity. (It is not clear whether such demands are effective demands; that is, if they are backed by sufficient willingness to pay to finance the cost of provision).

The world until recently lacked global institutions, global value-capture instruments and financing mechanisms to fund global public goods in general and global environmental services in particular. In recent years, certain innovative instruments have emerged that are of particular relevance to the conservation of natural forests. First, the rapid growth of international ecotourism (faster than conventional tourism) has enabled countries to capture some of the global use value of tropical forest conservation. Second, debt-for-nature swaps have enabled some countries (most notably Costa Rica) to capture part of the global non-use value (option/bequest/existence values) and to generate substantial financial flows for forest conservation. In this case, secondary foreign debt is cancelled or converted into local currency in exchange for a commitment to conserve a certain forest area or use the local currency generated for conservation purposes. Third, bioprospecting contracts have enabled developing countries (such as Madagascar and Costa Rica) to capture part of the global use value of the biodiversity by licensing investors to extract genetic information from their forests in ex-

change for investments in conservation, participation in biotechnology ventures and/or profit sharing arrangements for any products developed based on this information. Fourth, joint implementation and now the Clean Development Mechanism (agreed upon as part of the Kyoto Protocol) provide vehicles for forest conserving/reforesting countries to capture the global climate value of their investments by selling carbon-saving or carbon-sequestration services as offsets to countries that assumed carbon-reduction commitments under the Kyoto Protocol. The Clean Development Mechanism offers the opportunity for private investors to invest in tropical forest conservation (and reforestation) and recoup their investments in the form of marketable carbon offsets.

Thus, an entirely new market has been created and new economic instruments and financing mechanisms have emerged to finance, value and capture global benefits from forest conservation. If a sufficient part of the revenues from carbon offsets, bioprospecting contracts, debt-for-nature swaps and ecotourism find their way to those that pay the cost of forest conservation, conservation would be achieved. This is critically important, as is the maximization of the captured value. For example, countries around the world fail to properly price entrance to national parks and the collected revenues often are not dedicated to park management but flow to the treasury. Surveys in Central America and Southwest Asia (see TDRI, 1996; DeShazo, 1999) have obtained estimates of willingness to pay by foreign visitors to national parks that are 3-5 times (for the existing level of service) and 5-20 times (for improved level of service) the entrance fees currently charged, while the parks remain underfinanced and underprotected. Furthermore, respondents, including non-visitors to national parks, expressed considerable willingness to pay into a trust fund to ensure the protection and continued existence of conservation areas; yet to date there are very few such mechanisms in place for capturing such non-use values and reinvesting them in nature conservation.

We can now consider the two intermediate cases: sustainable forest management (SFM) and reforestation. SFM requires both a longer time horizon (tenure) to internalize future benefits and a broader geographical, institutional and product/service scope to internalize off-site and off-country benefits. This requires simultaneous solutions to two problems. First, what is the optimal combination of timber and non-timber products and local and global environmental services (watershed protection, biodiversity conservation, carbon sequestration) that would maximize the net present value of the forest, recognizing of course both competition and complementarities (synergies or joint products) between different forest products and services? Second, which instruments/mechanisms can best capture the external (to the management unit) values, whether local or global,

and transfer them in part or in full to the management unit (local stakeholder) to ensure sustainable forestry is economically and socially, as well as biologically/environmentally sustainable? While there is no presumption here that multiple use forestry will be superior to dominant use forestry at the stand level, there are many modifications to conventional logging and to sustainable timber management that can increase the net present value of the forest and its sustainability, moving us closer to sustainable forest management. The various instruments discussed under natural forest conservation can be employed to capture many of the external benefits of practicing sustainable forest management. Such a stream of benefits can be used to secure loans or to issue revenue bonds to finance sustainable forest management.

For example, carbon offsets, bioprospecting contracts or debt for nature swaps can be used to induce and finance a shift from conventional logging, which is highly destructive, to reduced impact logging. Any investment costs involved and any forgone profits can be financed through the sale of carbon offsets, local currency from a debt swap, receipts from bioprospecting fees or revenues from watershed protection charges (such as those in effect in Brazil, Indonesia and Costa Rica, among others). Two specific examples will suffice to illustrate the point. In the mid-1990s, New England Power financed a shift from conventional logging to reduced impact logging in Sabah, Malaysia (by agreement with the local logging company), in exchange for "credits" for the carbon saved (about 36 tons per ha at \$3-\$5 per ton). More recently, Costa Rica has provided \$50 per ha per year incentive to landowners willing to keep their land under (natural) forest. The government financed this incentive by selling the environmental services of the forests through a watershed protection charge on benefiting municipalities, and carbon offset sales directly to countries such as Norway at \$10 per ton or through certified tradable offsets (CTOs) placed at the Chicago Board of Trade. A fuel tax also contributed part of the cash flow for financing these incentives, which are designed to decline over time, as land owners begin to extract products from the forest on a sustainable basis. This approach provides one "simultaneous solution" to both problems of sustainable forest finance: the intertemporal separation of investment costs and return, and the external-to-the-investor nature of many of the benefits occurring from reforestation or establishment of new forests. However, maximum and full capture of the value of sustainable forestry in all its dimensions and manifestations will have to await the further development and "thickening" of the emerging markets for environmental services as well as the resolution of the institutional and property rights uncertainty that surrounds tropical forests.

DIFFERENCES AND SIMILARITIES BETWEEN SECTORS

In this paper, we have reviewed innovative financing mechanisms for five sectors: energy, transport, water supply, sanitation and sustainable forestry. These sectors have several features in common. First, all five are strategic sectors for sustainable development and have all been identified as such in Agenda 21. This means that in addition to their key role in economic development, they are also of strategic importance to poverty alleviation, equity concerns, environmental protection and ecological sustainability. Second, all five sectors have been identified in Agenda 21 as having serious financing gaps that require both domestic and international resource mobilization. Third, all five sectors were, in the past, major recipients of official development assistance (ODA) from both bilateral and multilateral sources; in recent years, they suffered from declining levels of ODA, with the possible exception of the forest sector. Fourth, all five sectors require large amounts of upfront capital investment but generate returns slowly over a long period of time (power, transport, and water supply) or returns that are much delayed (forestry). This feature creates both a cost recovery problem and a cash flow problem. Fifth, all five sectors involve major externalities, that is, benefits and/or costs that are not internal to the decision maker/investor. This creates both an incentive problem and a cost recovery problem, all of which translate into financing difficulties. Finally, all five sectors have been traditionally "monopolized" by the public sector on account of their natural monopoly features and their public good aspects. In all five sectors, there is an increasing realization of the need and opportunity for private sector participation in both financing and management.

These similarities notwithstanding, there are significant differences among these sectors as well. First, power, water, and transport are essentially private goods, whose production and consumption generates certain waste by-products or spillovers (such as air and water pollution, and congestion). The predominantly private nature of power, water and transport services means that individual willingness to pay is potentially high enough to recover costs. Exclusion of those who do not pay is possible and free-riding is less of a problem; therefore there are good prospects for private sector provision and private financing. In contrast, sanitation (including sewage collection and treatment) and sustainable forestry are predominantly public goods with some private good aspects (for example, on-site sanitation and non-timber forest products). The implication is that willingness to pay is low, exclusion of non-payers difficult (and non-advisable), and "free-riding" more the rule than the exception. This means cost recovery is potentially difficult, incentives for private sector provi-

sion is limited and, in the absence of a steady flow of revenues, mobilizing financial resources requires public subsidies and/or government guarantees.

A second major difference is that while energy, transport and forestry have significant global commons implications, water and sanitation have only local effects. The release of CO₂ emissions by fossil fuel combustion, whether for the production of power or for transport, and deforestation add to the concentration of greenhouse gases that increase the risk of global warming. This means that the energy mix of power and transport and the land use changes in one country are of concern to other countries and the global community.

On the other hand, investments in renewable energy, more efficient public transport systems, forest conservation and reforestation generate substantial global benefits that are enjoyed free of charge. This means that there *are* global values to energy, transport, and forestry investments and if they can somehow be captured, they can be used to finance these investments. Indeed the Global Environmental Facility and the Clean Development Mechanism can help capture and reinvest part of these global values. Water and sanitation investments do not enjoy the same global interest but ought also to be of concern since they represent an important component of the social dimensions of sustainability.

A third obvious difference between sustainable forestry, especially reforestation, and all other sectors is that investment costs and returns are separated by many years, indeed decades. This requires long-term bridge financing to resolve a very challenging cost flow problem, especially in developing countries where only short term credit is usually available. Instruments for capturing environmental values, such as ecotourism, bio-prospecting, watershed protection charges and carbon offsets, help generate a steady flow of revenues for securing long term loans, as well as mitigating cash-flow shortfalls.

A fourth difference is that foreign equity in economic assets such as power plants, water supply systems, sewage treatment plants and transport systems is more palatable to developing countries than foreign equity in natural resources such as forests and national parks. On the other hand, forests and water supply systems lend themselves more easily to community ownership and management than mass transport systems and power plants.

Another contrast is between the "beneficiary pays" principle, applied in financing sustainable forest management and conservation through innovative instruments, and the "user pays" principle we employ in recovering costs from investments in water, power, and transport. Sanitation presents an interesting challenge for financing since neither the "user pays" nor the "beneficiary pays" principles can be applied directly. In theory, the right approach would have been the "polluter pays" principle, but because of the

large number of households and small businesses involved it is difficult to collect a pollution charge directly from each source, especially since willingness to pay for outside-the-home sanitation is virtually nonexistent. For this reason sanitation is bundled with water (since waste water is roughly proportional to water use), and sanitation charges on water use are collected as part of the water bill. An interesting analogy in the case of sustainable forest management is the bundling of carbon and biodiversity in what has come to be known as "exotic" carbon for sale at a premium in the emerging global carbon markets.

CONCLUSIONS

The last two decades have witnessed the development of many new and innovative financial mechanisms and instruments for sectoral financing, as our review of five sectors (power, water, sanitation, transport and forestry) has demonstrated. However, financing mechanisms, no matter how innovative, are not a substitute for full-cost pricing and sound management; they indeed depend on them. Nor is the attainment of financial sustainability a sufficient condition for environmental sustainability. Indeed, increased private sector participation and the proliferation of international financial market instruments that can be accessed for sector financing might externalize some of the public good aspects of sectoral investments unless supplemental environmental pricing or regulatory instruments are employed. On the other hand, the development of international environmental conventions is beginning to internalize some of the traditional externalities and capture hitherto unaccounted global environmental values. ■

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ANNEX I

Annex I. Options for Private Sector Participation in Infrastructure and Public Service Provision

Private Sector Participation Option	Management Contracts			Lease Arrangements			Build-Own-Operate-Transfer (BOOT)			Joint Ownership (mixed companies)			Outright Sale or Divestiture
	Service Contracts	Management Contracts	Lease Arrangements	Concessions	Operate-Transfer (BOOT)	Reverse BOOT	Joint Ownership (mixed companies)	Outright Sale or Divestiture					
Financing of investments	Public sector	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector
Financing of working capital	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector
Contractual relation with users	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private and public sectors	Private sector	Private sector	Private sector
Duration (years)	1-2	3-5	5-10	20-30	Time needed to retire debt	Time needed to retire debt	Time needed to retire debt	Time needed to retire debt	Time needed to retire debt	Indefinite or fixed	Indefinite or fixed	Indefinite	Indefinite
Responsibility for setting rates	Public sector	Public sector	Contract	Contract	Contract	Contract	Contract	Contract	Contract	Public/private	Public/private	Regulated private	Regulated private
Method of payment	Work done/unit price	Cost-plus and productivity bonus	Rates price	Rates	Rates	Rates	Rates	Rates	Rates	Rates	Rates	Rates	Rates
Method of recovering public expenditure	Rates	Rates	User overcharge	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Annual fees by private firm	Annual fees by private firm	Sale price	Sale price
Main objective of PSP	Improve efficiency	Improve efficiency	Improve efficiency	Mobilize private capital	Mobilize capital and efficiency	Mobilize capital and efficiency	Mobilize capital and efficiency	Mobilize capital and efficiency	Mobilize capital and efficiency	Improve efficiency	Improve efficiency	Mobilize capital and efficiency	Mobilize capital and efficiency
Ownership	Public sector	Public sector	Public sector	Public sector	Public sector	Public sector	Public sector	Public sector	Public sector	Public then private	Public then private	Private sector	Private sector
Financing	Public sector	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Public sector	Public sector	Private sector	Private sector
Management	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector
Risk	Public sector	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector	Private sector	Private sector	Public and private	Public and private	Private sector	Private sector

Source: Partially based on Idleovich and Ringskog (1995).

ANNEX II

The Buenos Aires Concession for Water Supply and Sanitation

The greater Buenos Aires water supply and sanitation system, operated by a public company (*Obras Sanitarias de la Nacion*, OSN) was plagued through the years by problems common to public water utilities throughout the developing world. Coverage was only 70 per cent for water supply and 58 per cent for sanitation, while only 5 per cent of the waste water received any treatment before dumping into natural water bodies. The service was of poor quality and unreliable. Infrastructure was poorly maintained and unaccounted-for water was as high as 45 per cent of the water produced. Water meters were installed at only 20 per cent of the connections; meter reading and billing were highly irregular and water consumption reached 400-500 litres per capita a day – twice the norm for metered and well-managed systems. The public utility was grossly overstaffed with 8,000 employees, or 8-9 employees per connection compared with 2-3 by efficiently operating systems. At the same time, population growth and urbanization were expanding the demand for additional coverage. The cost of rehabilitation of the deteriorating system and expansion to reach 100 per cent coverage was estimated at several billion dollars over the next 20-30 years, which was clearly beyond the capacity of both the utility and the state to mobilize.

In 1993, the government of Argentina privatised water and sewage services for Greater Buenos Aires as part of a massive privatization programme that began in 1990, with World Bank support, and included virtually all public services and federally-owned enterprises such as electricity, telephone, railways, airlines, roads and ports. The private sector participation option chosen for water and sanitation was a 30-year full concession that allowed the assets to remain under public ownership while the operation, maintenance, rehabilitation, expansion, and waste water treatment were transferred to a private concessionaire. After a successful process of preparation and bidding, the concession was awarded to *Aguas Argentinas*, a consortium of foreign and local firms led by

Lyonnaise de Eaux-Dumez, that offered a 27 per cent discount to the prevailing public water tariffs. Thus, competition was effective in reducing costs. It also mobilized \$4 billion over the life of the contract to meet the performance targets of the concession, which include 100 per cent coverage in water supply and 90 per cent coverage in sanitation by year 30, a reduction in the unaccounted-for water from 45 per cent to 25 per cent, and an increase in sewage treatment from 45 to 93 per cent. Over the first five years alone the concessionaire will invest \$1.2 billion, or \$240 million a year – 12 times more than the historic annual investment made by the public utility in the last decade. To regulate and control the concession and protect consumers against monopolistic practices, the government established a regulatory agency, *Ente Tripartito de Obras y Servicios Sanitarios* (ETOSS) with participation of the federal, provincial and local government and a budget of \$8 million to be financed through a user surcharge of 2.7 per cent of the water and sewage bill collected by the concessionaire. The regulatory agency also enforces water and effluent quality standards based on international norms introduced prior to bidding.

During the first three years of operation, accelerated rehabilitation of the system led to a reduction of water losses from 45 per cent to 25 per cent, and coverage increased by 10 per cent, with no increase in production. The population receiving sewage services increased by 8 per cent. Prices were reduced initially by 27 per cent, but increased by 13.5 per cent in 1994 to further accelerate rehabilitation provided in the contract clause; still, water prices are 17 per cent lower than those charge by the public utility. The staff was reduced by 47 per cent through severance payments by the government and a voluntary retirement program by the concessionaire. Labour productivity rose and new recruitment is now underway as the concessionaire is responding to increasing demand for water and sanitation services. The table in this Annex summarizes these improvements.

Impact of the Greater Buenos Aires Water Concession

<i>Indicator of Performance</i>	<i>Changes from May 1993 to December 1995</i>
Increase in production capacity (per cent)	26
Water pipes rehabilitated (kms)	550
Sewers drained (kms)	4,800
Decline in clogged drains (per cent)	97
Meters upgraded and installed	128,500
Staff reduction (per cent)	47
Residents with new water connections	642,000
Residents with new sewer connections	342,000

Source: Aguas Argentinas (1999)

While the overall experience has been clearly positive and the model is now being adopted by other Argentine provinces and other countries in Latin America, there have also been teething problems with regard to negotiations with the labour unions and regulation. Indirect labour costs remain high as the concessionaire continues to provide fringe benefits traditionally available to civil servants. The regulatory agency, staffed with former utility employees, find it difficult to give up the state's day-to-day management role and focus on its regulatory and contract enforcement role.

This successful privatization of the supply and sewage services in Buenos Aires contains many important lessons for private sector participation in water and sanitation throughout the developing world. First, privatization must receive the endorsement of major stakeholders, enjoy political commitment at the highest level, and be part of a comprehensive program of economic reforms. Second, political, technical, legal, commercial and financial risks must be assessed and alleviated through appropriate mechanisms. Third, all available options for private sector participation should be considered and the one best suited to the country's political and cul-

tural conditions, and the sector's features, must be selected; the assets need not be privatized to improve efficiency and attract capital.

Fourth, the regulatory framework and regulatory institution must be established, and the technical and financial feasibility of the concession studied prior to bidding. The regulatory entity must be strong enough to regulate an experienced international concessionaire. Fifth, while adequate preparation and time should be allowed to ensure universal bidding, eligibility should be confined to qualified bidders through a prequalification process. Sixth, sensitive staff reduction issues can be effectively dealt with through attractive retirement packages jointly financed by the government and the concessionaire. A final lesson is that the contract should be realistic and specific to minimize conflicts yet be flexible enough to allow for adjustments to unforeseen or substantially altered circumstances.

Source: Idleovitch and Ringskog (1995); Crampes and Estache (1996).

PROMOTING PRIVATE SECTOR FINANCING OF COMMERCIAL INVESTMENTS IN RENEWABLE ENERGY TECHNOLOGIES

*Norbert Wohlgemuth
Jyoti Painuly**

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 suggests that there are obstacles to their implementation. These obstacles (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 range of obstacles.

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 the 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 provides an overview of the barriers RETs face in the market place; it also provides an international review of RETs support mechanisms (including Non-Fossil Fuel Obligation and Renewables Portfolio Standard), and presents examples of successfully implemented RET projects. The paper 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 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.

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INTRODUCTION

ENERGY is essential for economic and social development. Roughly 90 per cent of the world's commercial energy supplies are provided by fossil fuels whose 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 increases more or less in line with the level of economic activity, and 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 satisfy the three dimensions of sustainability (economic, environmental and social) with respect to energy production and consumption, there needs to be a decoupling of economic activity from fossil fuel primary energy consumption 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 economic 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 their potential is underdeveloped and that there are barriers to their implementation. These financial or non-financial barriers need to be identified and addressed in order to design innovative policy approaches for the international and domestic financing of RETs.

Financial institutions currently evaluate applications that have a RETs component¹ using a traditional framework that does not take into account the full economic and environmental advantages of investments into RETs and view them – often incorrectly – as being too risky, on the basis of 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, the use of inappropriate evaluation framework and the lack of 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 particularly in the case of developing countries.

The partnership between 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 in all RET sectors as well as at most levels of financial institutions. Various initiatives have been launched recently in order to overcome the “understanding gap” between the worlds of renewable energy and financing.

IMPORTANCE OF RETS FOR SUSTAINABLE DEVELOPMENT

The provision of energy services can be made cleaner and more efficient, often 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 on and documentation of the risk management benefits of RETs.

Renewable energy provides many benefits that support the public interest and enhance economic efficiency, including 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, furtherance of important local and national energy goals, and the potential to eliminate pollution associated with the provision of energy services.

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, hydro-power 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.

The environmental characteristics of renewable energy systems and the energy security brought about through the 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 important considerations.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 CO₂ reductions that would result (International Energy Agency, 1997a).

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

Environmental benefits include:

- Emissions reduction by displacing fossil fuel. By 2020, depending on the scenario, up to 9,000 Mt of CO₂ emissions could be avoided. This corresponds to 40 per cent of current energy-related CO₂ emissions;
- 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;
- 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;
- Abatement of pollution from transport. Road transport contributes to both national emissions of

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 CO₂ as well as increasing renewable energy use.

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;

- 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:

- Diversifying and securing energy supply, thereby promoting price stability;
- Providing job opportunities in rural areas thereby slowing urbanisation;
- Promoting the decentralisation of energy markets, by providing small, modular, rapidly deployable schemes;
- Reducing the dependence of developing economies 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);
- 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 to electricity that, for all intents and purposes, they do not have access at all. It must be kept in mind that these people live in regions of the world where the 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 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).

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. These include solar technologies (mainly direct conversion through photovoltaic (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 have come down significantly over the past 10 years, thus bringing them close to, if not at, commercial viability.³ Additional features have made them attractive 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 promising future 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 contribution of renewable technologies 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 electricity 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, essentially the world's installed capacity needs to be doubled 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 \$50 billion of investments. If renewables can capture a small share of that market, this represents 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

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.

⁴ A preliminary analysis by Solar International Management,

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

- 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;
- 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;
- 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.

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. Before a technology can become cost-effective, market barriers such as inconsistent pricing structures have to be overcome. Then there are institutional, political and legislative barriers which hinder the market penetration of technologies, including problems arising from a lack of awareness of, and experience with, new technologies and 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 most significant barrier to greater renewable energy use is its cost, despite the cost reductions achieved over recent years (International Energy Agency, 1997a). Other obstacles, particularly for the increased use of renewable electricity, include subsidies and other support for competing conventional fuels (especially coal and nuclear power). The lack of full cost pricing, when determining the cost of competing energy supplies, also hinders the development of renewable energy because the cost of environmental impacts is usually not included in energy prices. Furthermore, the development of competitive markets has not reached the stage when it can 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 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 can hinder the socially optimal penetration of RETs:

- 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;
- Financial willingness and feasibility. The user may not have the willingness to pay or the ability 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 energy systems with shorter payback periods, thus lowering their long-term risk exposure, even if those sources of energy are more expensive on a long-term life-cycle basis;
- 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

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).

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. RETs need to gain the confidence of developers, customers, planners and financiers (IEA, 1997a);

- 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, on the basis of outdated or incorrect information;
- 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 and 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 efficiency⁵ 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 Zor-

raquín, 1996);

- 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. 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 harmful in a host of ways (International Energy Agency, 1999b). They constitute a huge financial drain⁶ (World Bank, 1996);
- 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;
- 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, RET projects are often unable to compete with other development priorities that receive sovereign guarantees;
- High start-up costs. In particular high start-up costs discourage companies from providing supplies to rural areas. Extending an electricity grid to a remote village can be very expensive, especially 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. 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

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.

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.

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).

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 of these 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):

- Incentives are clearly intended to be temporary measures;
- Performance-based incentives are being used to encourage efficient projects;
- Competition is being explicitly or informally integrated into the implementation of financial incentives, to promote reduced technology and project development costs;
- The size of financial incentives is being targeted to match incremental life-cycle financial costs;
- 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-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.

International level

The World Bank

- 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;
- 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;
- The Prototype Carbon Fund (PCF) has also been launched by the World Bank after the Kyoto Protocol. 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;
- 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;
- 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;
- 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 pro-

ject 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. (a) 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. (b) 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. The 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. (c) The World Bank has employed another model, the retailer model, in Sri Lanka and Laos. In this model, 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 and 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 borrowers might utilise on their 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 (a) the joint UNDP/World Bank Energy Sector Management Programme (ESMAP); (b) the FINESSE (Financing Energy Services for Small-scale Energy-users) programme; and (c) 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 which 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.

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.

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 Viet Nam 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

- 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

⁷ This facility, reflecting world-wide concern with global environmental degradation, has raised about \$ 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.

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;

- 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;
- 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 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.

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 there is little incentive to increase the renewables development.

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

National level

European Union

The European Union (EU) committed itself to reduce greenhouse gas emissions by 8 per cent by the

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>.

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

	<i>India</i>	<i>Indonesia</i>	<i>Mexico</i>
Systems being supported	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> - 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, E.S. and V.S. and Bogach, 1997. Financial Incentive for Renewable Energy Development, World Bank Discussion Paper No. 391, p.9.

target period 2008 to 2012, from the base year 1990. One strategy to reach this ambitious goal is to change the energy system towards increased reliance on low carbon fuels, such as natural gas, and by support for renewable energy (European Commission, 1997).

There have been several conferences and meetings in the EU on the financing of 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:

- 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;

- 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;
- 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 through contract arrangements (Mills and Taylor, 1994). High cost projects are normally financed through this means. Debt is observed to be a major cost component in this case;
- 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;
- 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 a 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.

United States

The approach to financing RETs in the United States 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 per kWh and a wind investment tax credit of 10 per cent 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.

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).

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 Rockefeller Foundation to address the barriers in promotion of RETs and energy efficient technologies in developing coun-

tries. 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, Krishok Bandhu Agro-Systems Limited in Bangladesh 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 Viet Nam, 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 United States-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, 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 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. Enersol extended its programme to Honduras in 1992, where 20 such micro-enterprises installed over 2,000 systems with financing through consumer credits;¹⁰

(c) The 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, 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 between 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 pro-

¹⁰ <http://www.enersol.org/front.html>.

motors have already established one power plant of 100 kW rating which has been in regular operation since 1996. Located in 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, hydro-power, 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, joined 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 because it makes use of tax incentives and low cost funds available from IREDA. On their own, farmers would not have been able to make use of the low cost funds and tax incentives because of 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 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 United States investors. It has also 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 seeks to tap the global capital markets for funds for the PV markets. It is a private institution that acts 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 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;

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

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 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

¹¹ <http://www.ecouncil.ac.cr/devalt/desi.htm>.

¹² <http://www.energyhouse.com>.

¹³ <http://solstice.crest.org/efficiency/cef>.

price for renewables which has been fixed at different levels for the different technologies, 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 mechanisms 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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