SUPPORTING INNOVATION IN THE DELIVERY OF ENERGY SERVICES TO THE RURAL POOR:
OFF-GRID ELECTRIFICATION VIA CONCESSIONS IN RURAL SOUTH AFRICA

A review of international literature of ESCOs and fee-for-service approaches to rural electrification (solar home systems)

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1. Introduction

This report constitutes one of the outputs of the project: *Supporting innovation in the delivery of energy services to the rural poor: off grid electrification via concessions in rural South Africa*.

It is estimated that in 2000 there were some 1.3 million solar home systems (SHSs) installed in developing countries. About one third of these were distributed with subsidies from donors and government-funded programmes, and this is where the focus of the paper lies. About two thirds were distributed through commercial dealers (Niewenhout et al 2000). Internationally there have been four primary types of delivery models:

- cash sales: Kenya, Zimbabwe and China and South Africa until the mid-nineties;
- donations: India and Mexico and a small project in South Africa;
- credit schemes: Bangladesh, Bolivia and Indonesia;
- fee-for-service: Kiribati, South Africa and Argentina.

Barnes and Halpern (2001: 33) categorize these differently, as dealer, concession and retail models, while Cabral et al (n/d) include leasing and hire-purchase as a separate delivery category. There is growing experience and, perhaps more importantly, documentation of experience, of the use of SHSs in households throughout the developing world. Whereas previously projects and programmes were limited to tens or hundreds of installations, in India there are now 200 000 VP lighting systems installed (Ministry of Non-conventional Energy Sources: www.mnes.nic.in), while in China there were 70 000 SHSs installed by the end of 1997 (Wallace, Jingming & Shangbin n/d). The numbers of installed systems does begin to provide economies of scale for producers of SHS components and those interested in assessing the viability of SHS as a means of addressing rural development and poverty alleviation. However, despite these figures neither of these countries has been able to address the rural electrification backlog of their vast populations.

In 1999 (NER 2000) the South African government introduced a concession model to non-grid rural electrification with a fee-for-service approach. Originally, seven consortia were selected through an open tendering process which granted each consortium a permission area. The licensing agreement entitles the concessionaire to install and maintain non-grid electricity technologies in allocated rural areas. Currently five of the original seven consortia are operating in their respective areas. With the exception of one utility that distributes gas and paraffin, they have limited their services to the provision of 50 Wp solar home systems.

Concessions and fee-for-service are relatively new approaches, although there is growing international interest in both concession and fee-for-service models, which have been implemented in Argentina, Bolivia, Kiribati and India, with local interpretations and accommodations at each site.

This objective of this paper is to examine, record and compare international experience in concession and fee-for-service models, in order to highlight both best practice and pitfalls in this regard. In particular, the project to which this paper contributes is interested in exploring and defining the institutional environment that is needed for, and best supports, a concession and fee-for-service energy service delivery model. It is not the task of this paper to evaluate the economic viability of SHSs. The numerous collapsed projects would indicate that the financial feasibility of creating a substantial and sustainable rural market has yet to be proved. On the other hand the installation of nearly a million systems on a commercial basis (Niewenhout et al 2000) indicates that there is a niche market among those rural residents who can afford the systems. This market is clearly not the rural poor who require subsidies in order to be able to afford such systems, and definitely not the 'poorest of the poor' who continue to be excluded from such projects (Barnes & Halpern 2001). In addition, in countries or small island states where capacity and reach of the grid is limited, and clusters of houses are relatively dense and easy to service, then SHSs may contribute to an economically viable electrification programme.

Although there is a growing literature which describes concession and fee-for-service *projects*, there is very little literature which documents the details of the institutional environment required to support the implementation of such approaches. The policy framework in which such endeavours are best implemented, the contractual arrangements which ensure that the country government's development goals are met, the monitoring necessary to ensure the satisfaction of the customer, while at the same time ensuring the installer's initiative and sustainability, these arrangements, legal obligations and structures are seldom discussed in published project reports. Nonetheless, such contractual and institutional details are extremely important since it is agreed that most projects fail, not only because of some technological difficulties, but because of a lack of institutional capacity and supporting infrastructure (Barnes & Halpern 2001; Wade 2002).

There are several levels of institutional support and capacity that may be important to national programmes where the provision of SHSs makes a contribution to a national effort. It may be that once-off, localised projects need less national support and can be sustainable with national approval and local capacity building and support. At the macro-level the key issues concern the type of policy framework and dedicated resources that are required to implement and support delivery of energy services to rural areas. At least two ministries could be involved: the ministry concerned with energy delivery, and that concerned with finance, subsidies and the budget for the programme. The rationale for the project, and the approach and subsidy disbursement, should be agreed by both ministries. Oversight of the project at national level requires considerable capacity to plan, implement quality standards, draw up tender documents and contracts, and oversee implementation, establish the necessary monitoring, evaluation and regulation of the installations. Few developing countries have such capacity or resources. Energy and finance departments are frequently understaffed and/or lack the expertise required by the project and expected by the donor organisation. National government responsibilities extend from the macro-level to regional and local levels too. At the regional level structures need to demonstrate capacity, willingness and ability (according to the policy), to oversee and monitor the installation of SHSs. The demands on capacity to communicate and deliver at local level are substantial too. Energy service companies (ESCOs) and/or other public-private partnerships must have the willingness and capacity to work with targeted communities, build awareness and capacity and ensure satisfaction and successful implementation.

The channels of communication between the customer/household and the supplier/ESCO/energy utility are particularly important. The customer must be able to contact the supplier rapidly and easily if there is a problem, and the supplier must be able to respond quickly and re-assuringly. The literature suggests that at the local level customers are generally forgiving if technology failures can be reported and corrected promptly (Barnes & Halpern 2001). In addition they are likely to complain to their neighbours and community about their problems thus perpetuating the negative sentiment about SHSs. Non-payment, un-used and damaged systems and unenthusiastic reception lead inevitably to project failure and lack of financial viability.

Technology problems are rife. At least a quarter of the systems do not work, although this may be an underestimate in some areas. For example, Morgenstern (1998) estimated that about 50% of systems in Mexico had malfunctioned. The most frequent technical problems are associated with charge controllers, batteries and lights.

Commonly reported financial problems include the high initial costs, difficulties in accessing consumer credit (in credit-purchase delivery models), high transaction costs (e.g. in collecting small payments from dispersed households), inadequate financial provision for maintenance, and situations where the costs of replacement batteries are not anticipated and cannot be paid for when they are needed.

These are some of the common problems reported in SHS projects, and thus the task of the paper is to examine various approaches which are similar to South Africa's, and, within the limited documentation of the issues, attempt to make some recommendations about the support structures required to promote success.

The key issues arising out of the international literature review on concessions and fee-for-service approaches are

- the rationale for (the objectives of) using a concession approach;
- the design and allocation granted by the concession including questions of monopoly rights and market privileges;
- the extent and allocation of regulatory tasks;
- technical service and standards;

- subsidies levels and allocation procedures; and
- systems for monitoring, reporting and assessment.

Each of these is dealt with in turn in this review, bearing in mind that, as previously mentioned, literature pertaining directly to these questions was difficult to find, although there is a plethora of project descriptions available.[1]

2. Rationales for using energy service companies and fee-forservice approaches

The high costs of rural electrification call for innovative solutions. Utilities are accustomed to providing a service for a fee, so the challenge is to offer them a market more appealing than rural ones usually are. Internationally the ESCO model is attracting considerable interest as an approach which meshes well with trends towards establishing public/private partnerships to deliver services previously deemed to be public service responsibilities. It is thought that ESCOs may provide the solutions to delivering SHSs on a sustainable basis. The ESCO, which may be a private distribution company or a electricity utility, allows for arguably affordable (Villavencio 2000: 31, 43) payment schemes and can reach a larger market than commercial sales or ownership schemes. In the fee-for-service approach, the ESCO generally owns the system and charges the customer (usually a household) a monthly service fee. The ESCO is then responsible for the service and the maintenance of the systems in its demarcated area of operation.

Some of the main advantages of using a fee-for- service approach are said to be that:

- costs to the user may be defrayed;
- difficulties in obtaining and operating small-scale consumer credit finance can be reduced;
- there is access to the ESCO's capital;
- if sizable, the ESCOs may be in a position to offer more affordable payment schemes than small companies can, and thus able to reach a larger customer base than other credit delivery schemes;
- if so, and particularly if there is substantial subsidy assistance (as is often the case), the enlarged market can provide opportunities for scale economies, bringing supply costs down.

Further, where an ESCO operating a fee-for-service payment scheme is responsible for the maintenance and reliability of the equipment, it is believed that this helps to reduce the problems of maintenance and replacement of parts, which have bedevilled many SHS projects and commercial sales approaches.

The forms that ESCOs, concessions and fee-for-service take are evolving, and approaches change, even while projects are underway. For example, lessons learned by the World Bank in Argentina, Bangladesh, Dominican Republic, China, Morocco, Sri Lanka and other countries were reviewed and the most promising models were incorporated into the Bolivian approach as it was being designed. In South Africa, changes are being made as the concessionaires become established and conditions, which were previously assumed, become better known and understood.

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[1] Reports and documents were sourced from a variety of individuals, libraries, internet sites and email conversations with experts. Many of the SHS projects have been funded directly or indirectly by the World Bank and the Global Environmental Facility (GEF), and thus much of the literature can be found on the World Bank website. World Bank projects have also been critiqued and this literature is included where possible. In Appendix A, several project reviews are quoted verbatim for ease of purpose (sources are referenced).

It was intended that the emphasis would be on recent literature and projects, but the reality is that many projects have been started within the last five years, and it takes a while to evaluate even the first phase and write it up. Herb Wade has been researching this field for three years and will be producing the most complete and thorough review of fee-for-service approaches available towards the end of this year. He has evaluated only those programmes that are five years or older. I thank him for the draft copy of the review which is cited here.

3. Design and allocation of concessions

The primary reason for using a concession model is to offer the utility a protected market until it becomes commercially viable to operate competitively, and offering concessions is thought to be one way of doing this. The ESCO may be granted a monopoly concession regulated by the government to serve specific geographic regions (as is the case with Argentina, Benin and Togo), or it may operate competitively without monopoly status but with market privileges (as in the Dominican Republic). In Cape Verde the ESCO started with a monopoly concession and over time opened up to market competition, thus offering a model for combining the two models above (Martinot et al 2000). In South Africa the geographic monopoly model has been implemented and SHSs supplied by the concessionaire in designated areas are eligible to receive a capital and operational subsidy. SHSs may still theoretically be purchased on a commercial basis without subsidies, although the anecdotal evidence is that the commercial market collapsed when subsidies were introduced.

By granting concessionaires exclusive rights to a specific geographic area, it is believed that economies of scale are addressed and risk is reduced in the creation of a market with sufficient critical mass to be commercially sustainable. Although the Cape Verde example has demonstrated the creation of a market, the conditions of this market are specific to the locale (and depend largely on tourism). Concessions may be granted through negotiation, (as the first area in South Africa was), or by open tender as was the case in Argentina and for the remaining four concessions in South Africa. Concessions may grant access to subsidies and/or market privileges without monopoly rights. Twenty years is the time period most frequently granted to concessionaires, but subsidies are usually guaranteed for only five years, and it is anticipated that concession areas will become self-sustaining within that period as in Benin and Togo.

4. Regulatory responsibilities

In most developing countries the institutions required to conduct regulatory oversight of SHS installation do not exist and have to be established prior to or simultaneously with the implementation phase. In the case of donor-influenced projects, this is usually at the request of the donor agencies. It is often not clear to developing countries what regulatory tasks should be performed and whether one body can take responsibility for all regulatory tasks pertaining to energy service delivery, or whether there should be separate organisations. In South Africa, a National Electricity Regulator was established, but it has been determined that all energy services should be regulated by one umbrella body, and the organisation is being changed accordingly.

Regulatory tasks usually include ensuring concessionaires comply with the conditions of their contract, that tariffs are in accordance with policy, and that technical standards are established and met on a consistent basis. A regulatory body able to carry out such tasks would have to be staffed with people either competent to carry out their tasks or being trained to do so. Donor organisations are usually in a position to offer this training and assistance, and the transfer of skills should be stipulated in agreement with the government in question. It would appear that in South Africa the full extent of the task, and particularly the legal aspects of granting concessions and drawing up contracts, were not fully understood until the programme was underway. The re-structuring of the ESI (common in developing countries) has added to the complexity of defining the regulator's task and the concessionaire's rights, it has made the contractual arrangements more complicated, and delayed implementation.

It is said that a stable regulatory system will reduce the risk for investors and provide an enabling environment for programme objectives (Barnes & Halpern 2001); however, donor organizations frequently have to assist in establishing such stability through capacity building (as in Benin and Togo).

5. Technical and service standards

Questions of technical and service standards arise in every SHS project. It is clear that not all systems are tested in the field before they are installed, and that where they are, and local adaptations are made (for humidity, salt, wind, high temperatures, etc), suppliers and customers benefit from the field trials. Batteries and charge controllers seem to fail most often, but lights are also frequently fallible.

Appropriate and sound technical standards for the SHS components play an important role in improving the reliability of components, and system performance. These can be exercised during a tendering process, where SHS technical specifications can also be implemented as conditions of tender. Some countries develop their own standards, while others draw mainly on international sources. The setting of standards and subsequent monitoring needs to be appropriate to the locale and project, with an emphasis on simplicity and cost effectiveness. In South Africa, standards for SHSs and SHS components have been developed over many years, with international collaboration. However, it is said that scope remains for adjustments and improvements, in the light of experience and innovations by the companies participating in the concessions.

The quality and consistency of SHS installation and household wiring are also important contributors to system reliability or malfunction. This can be difficult to monitor in dispersed rural areas, and is easier to achieve in projects that reach a certain density level. It depends to a large extent on the training of installation staff. It is said that a fee-for-service approach increases the incentives for an ESCO to ensure good quality, reliable installations, as otherwise payments could be threatened or maintenance/replacement costs increased, at the company's expense.

Service standards can take various forms, such as power availability, requirements for any reported SHS problems to be addressed within a certain time limit, accessibility of service/payment centres, etc. Again, such standards need to be backed up by capable, regular and cost-effective monitoring (which is not always easy to accomplish).

6. Subsidies and allocation procedures

The design and implementation of subsidy instruments is closely connected with the objectives of the SHS programme and the service delivery mechanisms available in any particular country. Subsidies could serve two main functions: to bring down the costs to customers, and thus directly benefit those households; and to enlarge the customer base, thus spreading the benefits more widely, and potentially encouraging economies of scale on the supply side.

Barnes & Halpern (2001) suggest that the delivery model is as important as the subsidy, and that the approach implemented strongly determines the degree to which potential service providers are able and willing to enter the market, put their capital at stake, and respond to local demand. They also argue that the delivery mechanism strongly influences the ongoing costs of the operation and the choice of subsidy instrument itself (Barnes & Halpern 2001: 33). There is little potential business in remote rural areas without offering subsidies, especially where residents are not familiar with SHSs, and in areas where the very poor are targeted. Thus subsidies are imperative if the project is to be made attractive to the private sector, and some guaranteed customers such as schools, clinics or other government facilities, play an important role in the assessment and development of commercially viable areas for off-grid electricity.

Barnes & Halpern (2001: 37) also argue that:

> One overriding lesson emerging from recent experience is that the design of subsidies and the concomitant service delivery models need to be orientated towards providing business incentives to serve rural communities who would not otherwise be served. The challenge is doing so in a manner that does not distort energy markets and must also be practicable within the financial and human resource endowments of the country in question.

The dangers of 'distorting markets' are strongly upheld by some, including commercial companies that are sidelined by a subsidised project or programme, finding it difficult or impossible to compete against others that benefit from subsidy assistance. Avoiding market distortions while at the same time removing 'market barriers' has also been a recurringly dominant theme in the recommendations of some multilateral finance and aid agencies. However, critics such as Villavicencio point to anomalies here – for example, between efforts to have duties, tariffs and taxes on SHS components removed (which could be considered a removal of market barriers), while at the same time 'externally driving projects on local markets' through grants, preferential loans, etc (which could be considered ways of forcing and distorting the local market for SHS). He notes (2002: 34):

> It is interesting to observe the surprise U-turn of multilateral development agencies with regard to subsidies. After more than a decade of strong advocacy for eliminating subsidies, these institutions have rediscovered the virtues of subsidies as [a] mechanism to assist the poorest segment of the population in obtaining higher quality energy services.

Zhou & Mogotsi (2001: 8) identify the key anomaly in the privatisation of off-grid electrification:

> An interesting extrapolation from consultations indicates that often governments expect to improve rural development through commercialisation. Apart from other considerations, the two are, however, in conflict, as commercialisation requires full cost recovery, while rural development requires some subsidy.

This is an important area for conflict, for the manner in which one understands and resolves the conflict of interests may determine the development paradigm for rural electrification. Is it to establish private companies that will deliver energy services to areas too difficult for the government to deal with, or is it to deliver energy services to the poor? Are these goals compatible?

Subsidies on capital expenditure range from 20% (Cape Verde) to 65% (Argentina) and 80% in Peru. They generally have a limited planned lifespan, for example decreasing over the five years for which they have been granted. The important question to ask after the five year periods will be whether the subsidies accomplished what was intended.

7. Objectives of SHS installation

The objectives of the SHS programme are important in clarifying the type of institutional support required and how it should be implemented. The international literature suggests that, if the objectives of the programme do not gel with those of the people or the government, then the institutional support necessary will not be put in place. For example, if the objective of a programme to install SHSs is greenhouse gas mitigation, and greenhouse gases are not of concern to the local government or the people, then it is unrealistic to expect that a supportive policy framework will be in existence or developed to support SHSs. In fact, the country government may support SHS installation for development without supporting greenhouse gas mitigation – there may be no reason why the project cannot function efficiently with sufficient technical support and political will. If poverty alleviation is a goal of country government but energy services are not perceived as contributing to poverty alleviation, or electrification is not a priority, then the necessary institutional support for successful SHSs may not be available. If, however, as in the case of South Africa, the SHS programme constitutes part of the electrification programme to ensure energy services for all, then the required institutional support may be more readily found and/or argued for.

The international literature provides many reasons for installing SHSs in rural areas of the developing world. These almost always include several of the following:

- the distance of rural homesteads from the national grid and their dispersion, which makes extension of the grid expensive;
- the poverty of rural households which is reflected in the low-uptake of electricity from the grid making extension of the grid not financially viable;
- the inability of a national utility to meet current national demands, let alone consider new demands from rural customers;
- the obligation to improve the quality of life of the rural poor;
- the need for rural development; and
- the need to use renewable sources of energy rather than polluting fossil fuels.

Among the reasons that are not documented but are often raised in conversation is that there is donor money available to fund SHS installations through bi- or multi-lateral agreements and/or a variety of large institutions such as the UNDP, GEF and the World Bank. In addition, the threat of climate change and the need to curb greenhouse gas emissions and/or swap them for credits under Clean

Development Mechanism agreements, has seen renewed interest in a technology which has been the subject of many failed projects, and of which Gerald Foley said some fifteen years agao (Foley 1988: 4):

> As for renewable energies, it is obvious that the fad for them is passing. The various gasifiers, biogas pits, solar pumps, windmills, and other devices which were attracting so much attention five to ten years ago have shown themselves almost totally irrelevant to the household needs of most African countries. There is no prospect of such renewable technologies having any noticeable impact on household energy consumption patterns in the near or medium future. Only in very special circumstances is the promotion of renewable energy technologies worth considering as an element in demand management strategies at the present stage.

The inclination to accept funding for SHS arises out of various local conditions, and does not necessarily illustrate a demand. Much of the SHS literature includes in its ‘Lessons learned’ that the installation of SHSs should be demand-driven. But in very few case studies is it at all clear that a project had been initiated by a community demanding SHSs. The commercially successful sale of SHSs in Kenya, Zimbabwe, and South Africa (until the 1990s), were all demand-driven in so far as they catered for a market which was inaccessible to grid electricity and largely able to pay cash (and carry the system home). These were largely rural households which could independently afford a SHS. This excluded the majority of poorer rural households, and limited the market and penetration, but the system did serve particular customers successfully. In addition, a gradual process of familiarization occurred so that once SHSs had been introduced in an area further demand was created in adjacent locations where individual households and/or businesses could afford the cash and carry systems. Thus the commercial delivery of SHS meets some of the energy needs of those rural households that can afford non-subsidised systems. However, the dissemination of SHS as a means of contributing to rural development and/or poverty alleviation, is a rather different project. It has involved thinking about ways to reach the rural poor and provide access to energy services which are, if not equal to those in urban areas, at least equivalent and/or will contribute to poverty alleviation. The literature shows that subsidised systems meet some of the energy needs of a greater number of rural households (than commercial sales), but not all, and the poorest of the poor remain excluded.

8. Conclusion

The international literature makes it clear that where SHSs function efficiently, they can make a substantial contribution to development in terms of improved lighting, convenience, and entertainment, where radio and/or television reception is good and ownership is common. However, it is equally clear that the technology is still evolving, that few systems are tested in local conditions before they are installed, that reliability problems are experienced in many projects, and that installation practices and post-installation customer care and service are not yet up to standard either – if middle class people were to receive the poor service delivered by SHS from their appliances in the same price range, it is unlikely that the supplier would survive in the business world. There appear to be few guarantees or minimum standards set for most SHSs in developing countries. In the all-too-frequent cases where systems fail and response to the call-out is not forthcoming, customers use their own ingenuity to correct the problem, and/or stop paying.

If efficiently implemented, the fee-for-service approach should be able to overcome many of the above problems and deliver a satisfactory level of service to the customer. In particular, the fee-for-service model may be successful as an instrument to enhance development through constant interaction with the customer; capacity building and information dissemination. It should also be a means through which to educate customers on what to expect from service delivery, and how to use channels of communication to ensure their rights to efficient and reliable delivery.

Fee-for-service requires considerable investment in human and material resources and, as such, the best approach is likely to be one in which the supplier has an assured market, at least through guaranteed market privileges if not a monopoly concession. Competition should be introduced only if the potential market is sufficiently large to sustain it, or, as in Argentina, it is part of the ‘concession culture’ and has been used in other sectors. It is important for there to be the political will to support the implementation of a SHS programme, ensure smooth installation and assure investors of a secure environment. The level at which SHSs should be regulated depends very much on the specific location of sites and capabilities at national and regional level. If only one area in a country is likely to receive SHSs, then it may be sensible to locate the regulatory authority close to site as long as it operates independently and transparently. The most appropriate forms of contract between the parties involved, and who in each case is ultimately responsible for what tasks and administration, still needs documenting, comparison and analysis. International understanding to date will be greatly enhanced by the documentation and analysis of the South African experience which is part of this project.

Evidence shows customer support for fee-for-service approaches (Wade 2002), but some concessionaires are finding it difficult to meet all the challenges of working in rural areas. It is clear that good infrastructure (roads, reliable communications systems) could make the fee-for-service approach more viable. The initial capital cost of a SHS is high in comparison with fossil fuel alternatives and in proportion to its life-cycle costs (Cabral et al 2001). Operating and maintenance costs are relatively low in comparison to fossil fuel alternatives. Duties and taxes on PV system components raise the financial costs of SHSs, whereas subsidies for grid connections and/or kerosene lower the costs of the competing energy options. Duties and taxes are levied on PV components in Sri Lanka, India, Indonesia, Kenya (Cabral et al 2001). It has been difficult to calculate the comparative cost of SHS components, customer service and standards, because there is such a wide variety of these and because most of the calculations are done to prove that SHS are economically viable (Ruffini 2003). Costs of projects and systems are given in US$ in Appendix 1. However, a more appropriate measure may be in relation to monthly income, which is seldom provided. Generally the smaller the system the higher the cost per Watt peak installed. The installed cost of a SHS of between 20 and 150 Watt peak is typically in the region of US$10-US$12 per Watt peak (Areed website, www.areed.org).

As Barnes and Halpern (2001: 37) suggest, delivering electricity services to the very poor, particularly in rural areas, remains a considerable challenge in terms of developing appropriate incentives for private companies or utilities to become involved and ensuring that subsidy mechanisms reach the (poorest of the) poor. They are quite clear that subsidies should be for capital, not recurring, costs. Once recurring subsidies for operation and maintenance are provided it is virtually impossible to get people to pay the full cost. In the Tuamotu group the people simply refused to pay and opted to change to diesel rather than be forced to pay even subsidised fees for maintenance. At the same time, subsidies to operating costs may jeopardise the long-term sustainability of a SHS programme. Barnes and Halpern (2001: 34) are of the opinion that the welfare benefits for poor rural people are considerable, and that an electric light bulb is far superior to kerosene lamps and candles. They admit, however, that getting the private sector to take on the risks associated with financing renewable systems is difficult.

More broadly, the employment of large-scale high-level subsidies for SHSs, and other parallel support measures (development of technical standards, building institutional and human capacity, reductions in tariffs, etc), particularly in a government-organised concessions framework, could be viewed in different perspectives, such as

- reducing market barriers;
- establishing sufficient subsidised market demand to attract profit-making companies; or
- achieving the aims of a controlled government programme intended to deliver benefits to poor rural householders on a wide scale.

To some extent, these may be complementary, while in other respects there may be some contradictions or conflicts of purpose which need to be faced in such programmes.

APPENDIX 1
Fee-for service approaches

1. Argentina

Project: Argentina Renewable Energies for Rural Markets (PERMER)
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Beginning in 1999 and 2000, PERMER is a federal project aimed at providing electricity access to rural dwellers, where possible generated from local renewable energy sources, especially solar and wind power. The beneficiaries of PERMER are mostly low-income families living in isolated areas, far from the conventional electrical network. At the initial stage (first three years) there will be around 54 000 homes receiving electric power, and this number may reach up to 87 000 homes if other Provinces with similar socio-economic profiles participate. Around 2 000 isolated rural schools, health dispensaries, police stations, and similar public buildings will also have this service.

The main primary motivation for the project is greenhouse gas mitigation. The environmental effects expected will come from the development of SHS markets in the provinces involved, and through which conventional household energies (candles, lamps) will be replaced by renewable technology. The project is financed by the World Bank ($30 million loan), the Global Environmental Facility (GEF) (a $10 million grant), and the provincial governments (in an amount similar to the first two sources taken together). The companies that provide the rural electricity service contribute with one third of the initial investment in equipment and civil works. The concessionaire recuperates his investment through the users' monthly payments for the service. The amount of these payments are up to $10 per month – a substantial reduction from the $20 per month currently spent in average by rural homes in satisfying lighting and social communication needs.

Franchise rights are being granted to concessionaires that offer the lowest subsidy to service rural households and community centres. In Argentina the level of subsidy for rural communities comes through a bidding process. Given that over 90% of the households in Argentina already have electricity, it is the poorest regions that that will receive the subsidy, so it is well targeted. Depending on the competition involved in the bidding process it may or may not be cost effective. Also, the subsidies do not go directly to the population with service, so there can be questions about effectiveness. Thus the 'success' of subsidies in the concession model as applied in Argentina is clearly dependent on the level of competition for the service territories (Barnes & Halpern 2001: 34). Concessionaires can select from a wide range of off-grid technologies, although solar PV is anticipated to be a cost-effective choice in many cases. Users pay a connection tariff and a monthly service fee (set by the government), and a declining subsidy is provided to the concessionaires based on the provisions of their contracts (Barnes & Halpern 2001: 33).

The users are being provided with enough energy to satisfy, at least, basic lighting and social communication needs. It is expected that the project will improve the quality of rural life, and will have a positive impact on education, productivity, and overall social development. The project is increasing the economic activity of the private sector and creating local jobs in the target areas through the demand for renewable energy equipment, its manufacturing, and the associated operation and maintenance business. Another activity concerning distance learning in rural areas is about to be implemented, as a result of the agreements originated in Washington talks. This segment will be conducted in close collaboration with the Argentine Education Ministry.

A number of different companies are involved in different regions of Argentina. BP Solar is exporting solar energy equipment to rural Argentina with the help of a $753 090 medium-term loan that is guaranteed by the Export-Import Bank of the United States (Ex-Im Bank). The financing will enable BP Solar to sell 1 500 photovoltaic energy panel systems to Empresa Jujena de Sistemas Energeticos Dispersos, SA (EJSEDSA), a private utility that is responsible for supplying electricity to rural areas of Jujuy province. The transaction will provide financing for the purchase of units for individual homes and will be supplemented by a grant from the World Bank and the Global Environmental Facility to the government of Argentina. EJSEDSA is subsidized by the Argentine government to distribute energy to the sparsely populated Puna Jujena region of Jujuy province where currently there are 50 000 residents without electricity. Solar panel units for individual homes is the most efficient and cost-effective method of delivering electricity to the region, which is heavily forested and unsuitable for land power lines.

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Relevance to South Africa

The equipment used by the concessionaires must adhere to World Bank guidelines. The subsidies will be decreased over six years, but there will be a review every year to see if costs and markets have changed substantially. Presumably the sustainability of the subsidy, and/or the project without the subsidy will be considered at these meetings.

2. Benin and Togo

The projects in Benin and Togo are both funded by the World Bank and GEF and are similar in that they both use a monopoly concession approach. In Benin a long-term monopoly concession system was introduced in 1998/9. In both countries at least two private-sector companies will receive rights to serve specific geographical regions for 15 years which may be renewable up to 40 years. These companies are selected through a competitive selection process. Unlike in Argentina, the government of Benin determines the technology to be used, and owns the equipment. The government then leases these assets to two private-sector the concessionaires. The concessionaires will be responsible for installing and maintaining systems and collecting fees from customers. Each project aims to install 5 000 SHSs over five years, using 20Wp and 50Wp systems.

In each country an Agence d'Electrification Rurale will be responsible for the administration of the project. This will include preparation, concession management and regulation, accounting and finances, capacity building, monitoring and evaluation tasks including issuing and enforcing a code of conduct, technical standards, setting accreditation standards for technicians and conducting surveys on consumer satisfaction. These structures are being set up as part of the project.

Subsidies are awarded to end-users to reduce the initial fees and charges. A complex set of procedures will ensure that subsidies decrease over time and fall away altogether after five years, when a full cost recovery tariff will be in place. It is not yet clear how this will affect the project viability or sustainability.

Reference

Wade H 2002. Survey of RESCO projects. Draft report prepared for OPRET, Fiji Department of Energy. Fiji.

Relevance to South Africa

The experiences of the regulatory body which is being established alongside the implementation of the programme, and the sustainability of the programme without subsidies.

3. Bolivia – concessions, subsidies and credit

Project: Rural Electrification with Renewable Energy – United Nations Development Program/ Global Environment Facility
Contact: Julio Patiño, jpatino@energia.gov.bo

About 40% of Bolivia's population live in rural areas, but are very sparsely scattered (eight people per square kilometre). Only 16% of these households were electrified in 1997, but this increased dramatically to 24.5% in 2001 when the Vice-Ministry of Energy and Hydrocarbons (VMEH) established the National Rural Electrification Programme (PRONER). PRONER guidelines emphasize private-sector participation based on the awarding of contracts to those operators who require the least subsidy

In 1999 the VMEH and the United Nations Development Programme agreed to promote a rural electrification initiative designed to remove institutional and financial barriers for widespread use of renewable energies for rural electrification. The programme's goal is to facilitate the installation of 3 000 photovoltaic systems as well as three micro hydraulic generators in rural areas of the country by mid-2003. An additional element is related to current climate change initiatives, as the long-term view of the project is designed to reduce greenhouse gas emissions.

The PV portion of the project is designed to be implemented using a scheme whereby local resources are combined with UNDP/GEF funds, through a public sector and banks that specialize in small loans. The credit concept consists of identifying a group of pre-selected potential PV users that have joined together under an 'umbrella proposal' to acquire PV systems. Once the proposals have been reviewed and qualified by the VMEH, these are channelled to first story banks. A credit analysis of each individual is performed in order to determine who qualifies for a loan under the conditions established by this line of credit. Each operation is designed around the income stream of each individual and is adjusted such that terms of repayment are similar to the costs that each family would have had by purchasing other forms of lighting (i.e. batteries, kerosene, candles, etc).

As sustainability is also an aspect of significant importance in the development of this project, the credit scheme underway secures a contractual agreement between the credit entity and the system supplier ensuring that the latter will provide parts and maintenance thru the duration of the users credit. The first phase of the project calls for a total investment of $US1.3 million (for 1 500 PV systems), of which the local counterpart contribution will be $US522 000. The balance will be covered through UNDP/GEF funds. At present the project is entering the implementation phase.

Although rural electrification coverage has increased substantially (as above, from 16% to 24.5% in four years), there has been a significant disconnect between the national strategy (PRONER) and the decentralised implementation (www.worldbank.org project PO73367). This is intended to be corrected through a new programme (PLABER) launched in 2002, which has the objective of contributing to the socio-economic development of rural areas through access to electricity and its efficient and productive uses (www.worldbank.org). PLABER plans to increase electricity coverage from 24.5% to 45% in the next five years. While building on the guidelines of PRONER it is also the intention to establish a clearer institutional link between national policy and decentralized implementation.

The PLABER programme has two aspects. Its objectives are to expand and improve delivery of electricity and ICT services through private-sector led mechanisms as a catalyst for development of rural areas in Bolivia. Phase I activities will be confined to increasing access to rural electricity and ITC services by using innovative, output-based, decentralised service delivery models with increased private sector participation and community involvement (www.worldbank.org). The second phase will be concerned with defining and implementing improvements in policy, regulatory and institutional frameworks, and strengthening the respective key institutions (www.worldbank.org). The third phase will work at identifying and developing productive and social uses of ITC and electricity. The fourth phase will intensify the marketing and training of local users and the fifth phase will involve monitoring and evaluation programmes.

The rural coverage expansion component aims at direct expansion of electricity and phone services to rural areas through a competitive award of subsidies to private sector operators. The solar PV component, which will implement private-sector led off grid service delivery models, will provide up to 20 000 new rural households, SMMEs, schools and clinics with a variety of decentralised energy services. As a result of a willingness-to-pay , users will be offered SHSs from 10 Wp to 100Wp.

The project management component will focus on monitoring and evaluation, including the development of indicators, baseline and methodology, periodic evaluation towards targets and final evaluation.

The PCU, established under the supervision of the Vice-Ministries of Energy and Communication, will have overall responsibility for the project management including the bidding process. Contracts will be awarded to the private-sector to install, operate and maintain rural infrastructure (PV systems and cell phones), on the basis of minimum subsidy required, with output based incentives. The project will also actively involve rural users in implementation, evaluation and monitoring. Subsidies will be transparent, efficient, and targeted to the poor. Subsidies will be linked to outputs and minimized through bidding. All clients will have to pay for a battery, charge controller, appliances, and internal installation, 'to ensure that they can afford replacements in the future'. Long-term sustainability is expected without subsidies for recurring costs.

Reference

Bolivia Decentralized Energy, Information and Communications Technology for Rural Transformation (www.worldbank.org project PO73367)

Relevance to South Africa

- This programme has combined the delivery of SHS, ICTs and productive uses of electrification in a manner which should provoke interest and consideration in South Africa.
- Policy, regulation and institutional frameworks are being developed alongside the implementation process – much as they are in South Africa, and detailed comparison, in particular around methods for long term sustainability, could be mutually beneficial.

4. Botswana

By 2000 about 80% of households in Botswana were not connected to the grid. The government has made attempts to disseminate PV technology but for various reasons has not been very successful. A survey done in 1996 revealed a potential market which has since been pursued more vigorously and a number of solar PV dissemination efforts are underway in Botswana. A GEF grant to remove the barriers to PV dissemination in Botswana began in 2001. Among the projects currently underway are the National PV Rural Electrification Programme (NPVREP), the Motshegaletau centralised PV system, the PV Master Plan Project sponsored by the Japan International Corporation Agency (JICA) and the GEF PV project.

The NPVREP programme is targeted at rural households and operates on a credit scheme which concludes in system ownership. Customers have to pay a commitment fee, a deposit of 15% and the remainder 85% over four years at an interest equal to the prime rate. In 2001 there were 300 SHS in 86 villages, and about 75 further systems are installed annually. A Code of Practice for installers of PV systems has been developed.

The Motshegaletau centralised system installed in 1998, offers the customers a fee-for-service electricity at the same rate per unit as the grid for the domestic sector (about US$0.06/kWh). Users reportedly want more than lighting, and point out that grid connections cost less and offer more options.

The JICA project to promote solar energy started in 2000 with the development of a master plan and a large survey of willingness-to-pay in ten villages in seven of Botswana's ten districts. This is being followed up by a pilot project to test the market and establish the most effective institutional framework for providing PV-electrification in three villages. JICA will test a fee-for-service model, with the fee set at US$006/kWh. Experience in the Philippines showed that fee-for-service tariffs may be as high as US$1.5/kWh unless the government of Botswana subsidises the consumers. Systems will range from 50Wp to 1000Wp with relatively substantial repayments. The Botswana experience indicates that the fee-for-service model is only attractive when the customer base is large (typically above 1500) (Zhou & Mogotsi 2001: 8). Since many villages are small and scattered, a concession arrangement would be favoured for these conditions. The Botswana experience also indicates that it is feasible for national utilities to initiate fee-for-service approaches since they can absorb long payback periods, and move the SHS if/when the grid reaches the area (Zhou & Mogotsi 2001: 8).

Reference

Zhou, P & Mogotsi, B 2001. Solar PV dissemination efforts in Botswana. In Wamukonya, N (ed) Experiences with PV systems in Africa. Summaries of selected cases. UNEP Report, Denmark.

Relevance to South Africa

Zhou and Mogotsi identify a minimum size for a customer base – 1 500 – which would be interesting to test in South Africa.

5. Brazil

Contact: naper@npd.ufpe.br (27.03.2003)

In the rural areas of Northeast Brazil less than 20% of rural households receive grid electricity. It is argued that extending the grid to this population, estimated at 20 million, may not be the best option because of low population density, difficult access and low electrical energy demand. The state of Pernambuco has a rural sector characterised by small villages and small farms that use little modern technology and only a few of which are electrified. The reason for solar electrification of these rural households would be primarily for the improvement of the quality of life and well-being of the population. The Nucleus for the Support of Renewable Energy Projects devised a strategy for the management of sustainable photovoltaic solar energy in the semi-arid region of the State of Pernambuco. This included developing a participatory model for sustainable installations which takes in account the best practice and lessons learned internationally.

The equipment used in the project is expected to last for at least the life of the photovoltaic generator; an estimated 20 years. This is a new project to be observed for its participatory approach.

6. Cape Verde

The programme in Cape Verde involves both water and energy services. The World Bank and GEF are funding the Energy and Water Sector Reform and Development Project which will select and grant concessions for the delivery of rural energy services. These concessions will be granted in two areas, but are not geographic monopolies; other operators may come into the area and the concession may compete with grid-electricity if desired. Concessions are awarded by competitive tender.

Concessions are granted for 10 years, by which time investment costs should have been recovered. The project – and that means subsidies – will last for only four years, after which time the project is expected to be self-sustaining.

Concessionaires are expected to sell non-grid electrification systems for cash or credit; and to sell electricity services in a fee-for-service arrangement to customers, as well as manage publicly owned equipment and act as agents.

Up-front grants will be provided for 20Wp and 50Wp systems. These will be largest in the first year and decrease over the four year period. International technical standards will be adhered to by this small nation which does not have the capacity to set its own. Following reform and privatisation of the power sector, an independent regulator will monitor the concessions.

Reference

www.worldbank.org

Relevance for South Africa

Cape Verde has set comparatively harsh conditions for concessionaires with much more expected of them than in South Africa. The GEF grant does contribute to market development activities (market studies, business plan, establishing sales network, staff training, promotional activities) for first two years.

7. Chile

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From 1994-2000 the government of Chile increased rural electrification coverage from about 50% to 80%. Various technology options, including renewable technologies were incorporated into this programme (known as PER), and, more importantly, according to McAllister (1999: 1), into 'an evaluation methodology which prioritises potential electrification investments based on long term cost/benefit analysis form both economic and financial perspectives'. There were a number (about twelve) of small PV companies operating at the time. A high failure rate of batteries (90%) and original lights provided and learning ground but not an example for implementation.

The new programme was driven by President Frei's rural infrastructure investment drive. From 1996-1998 a number of projects using renewables were implemented, in particular one which Emelectric installed 120 residential PV systems. Emelectric provides a service for a monthly tariff which is expected to cover basic maintenance but not capital cost recovery. Over 90% of the original costs were subsidised. Service quality has been quite good (Mcallister 1999: 7). Costs were about US$8 for a 160 Wp system. However, initial consumption has been lower than anticipated, and the systems have not replaced original energy services as expected. For example, most users continue to purchase dry cell batteries for their radios. By the MIDEPLAN methodology this would have rendered the project socially infeasible (and not to be subsidised). Over time, efficient fixtures are installed as part of the utility-approved home wiring.

Concessions are not geographically defined and up to three utilities may compete in the same area. This competitive approach makes it difficult to obtain costs and technical experiences from utilities. The programme is financed by Chilean government and an Inter-American Development Bank loan. Initially there was no explicit focus on new or off-grid technologies, but from 1995 exploring alternative technology options was encouraged. 'In many areas of Chile the average monthly consumption of the lowest socio-economic stratum is around 25-30kWh per month per family, for a grid connected installation' (McAllister 1999: 4). This is the equivalent of a lighting load with a few other small loads, and an equivalent level of service could be provided by renewable systems. Tariffs in rural areas are generally higher than those in urban areas. The key to the funding process is an evaluation methodology developed by MIDEPLAN. This methodology is used to determine subsidy awards. The definition of an electrified household in Chile incorporates high standards of supply, but the methodology does not register all benefits or improved quality of service. The utilities are not convinced that renewables provide a real alternative to the grid.

Another barrier to successful implementation identified by McAllister (1999: 11) is the institutional challenges posed by 'the incorporation of decentralised technologies within centralised institutional structures typical of electricity utilities'. Communication within rural areas is often difficult and 'disconnect here compounds the negative effects of technical issues which might arise'.

Reference

McAllister J 1999. Renewables in the electrification mix: The Chilean rural electrification programme. Paper presented at the SYLEFF Forum on Decentralised Energy Services in Africa (DESA) – Cape Town, 2-6 June.

Relevance to South Africa

- Chile provides an example of transparent subsidies channelled through regional governments to local utilities, which constitutes a sound starting point for discussions of mechanisms for funding rural electrification generally.
- In Chile as elsewhere renewable energy technologies are being used to fill a gap, and are being implemented at the local level.
- Policy needs to be developed which allows renewables to compete more favourably with the grid.
- It is essential that during this period that Chilean utilities receive the 'windfall profits' from the broad subsidy programme, that they learn proper management techniques for the technologies and devise ways of making the programme sustainable over time (Mc Allister 1999: 12).

8. China – foreign investment

A press release in 2001 announced that Phocos AG (Germany) acquired key manufacturing operations in China and India, that is, the solar manufacturing and distribution companies in China and India, from Steca GmbH (Germany). Steca India and Qingdao Steca (China) became 100% owned by Phocos AG and Phocos shareholders. The companies were renamed Phocos India and Phocos China to reflect the change in ownership. Both, it was said, will continue to manufacture and distribute solar charge controllers, high efficiency CFL and LED lamps, solar lanterns and other specialized products for use in renewable energy systems. Phocos plans to increase its activities in Asia and will introduce new products to the Asian market including Solar/Fuel Cell hybrid systems and solar refrigerators.

Reference

Wallace W, Jingming L & Shangbin G n/d. The use of photovoltaics for rural electrification in Northwestern China. DOE, Washington

Relevance to South Africa

Consideration of the implications of this type of foreign investment is called for. An analysis of incentives and disincentives for local industry is called for. Is this what we want when we call for the manufacture of solar panels and job creation in South Africa?

9. Dominican Republic: fee-for-service and credit sales

In the Dominican Republic alone, 60% of the rural population – about 400 000 people – is without access to electricity. The high cost of taking power lines to distant villages has prevented the government from electrifying all but the largest towns. Even Sosua, a popular beach centre on the country's north coast, was not fully electrified until 1996. Rural communities rely on solar energy for everything from pumping clean water from aquifers, to recharging cell phone batteries. Different approachs to solar electrification have been adopted and all claim relative success.

In 1984 Rich Hansen introduced the inhabitants of Sosua to solar energy by setting up a 36-Watt solar panel demonstration model. Thereafter he installed the country's first commercial solar system in the home of a family that lived on the outskirts of town. By 2001 Hansen's company had installed more than 3 500 solar panels on the island, and now competes with other firms for clients. Soluz both sells SHSs and rents them out in a fee-for-service model. He argues that solar energy is much cheaper than dry-cell batteries which cost about $45 per kilowatt hour to use and kerosene which costs about $15 per kiloWatt hour. In comparison, a solar system costs about $1.50 per kiloWatt hour. Customers get a 10-year service guarantee and the company recycles their old batteries.

In a country where the average wage is less than $200 a month, few Dominicans can afford to purchase the solar systems, which range from $600 to $1 500, depending on the amount of energy produced. Instead, most of Soluz's clients rent them for $10 to $20 a month. A typical system consists of a 40-Watt PV panel which will power a TV, radio, and three fluorescent bulbs, and costs $12/month.

An ESCO and fee-for-service approach has been implemented with variations in different areas. The Solar Electric Energy Delivery (SEED) operation aims at serving 5 000 rural customers in Dominican Republic. It has made available four different sizes of unit, from 15-50 Wp, and has set monthly fees of up to $20 per system.

In the case of Enersol, donor agencies have provided business with technical assistance in order to develop a programme to install PV systems in rural service areas. Each area is served by a technician who is responsible for installation, maintenance and collecting fees. Customers must pay full capital, installation, and market interest costs with monthly payments over two to five years. Thus a key component of the Enersol model is a network of locally managed NGO credit programmes to finance systems which use revolving loan funds capitalized by external donor. The default rate for these credit programmes is less than 1%, although late payments are not uncommon.

Some rural residents are able to pay cash; in other cases suppliers provide informal three- to six-month loans. The project claims to have built the capacity for household systems, and to have created a programme to help communities finance and implement PV water-pumping and community-lighting projects.

It is reported that Soluz-Dominica has been developing a fee-for-service model since 1996 (Cabral et al 1996; Niewenhout et al 2000: 29), and by 2000 had 1000 systems installed and a positive cash flow. Soluz established an excellent maintenance and after sales service and allows users to put monthly fees in locked collection boxes at various convenient points. Soluz is also quick to act on non-payment by re-possession of the system.

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Scheeres, J (n/d). Sunny isles seizing the power. At www.wired.com/news/technology/0,1282, 44784,00.html.

Relevance to South Africa

Commercial sales and fee-for-service are possible in same country – in the way that commercial sales may be re-introduced in areas outside the concessions in South Africa.

10. Fiji

In April 1999, the village of Naroi on Moala island in the Lau Group, Fiji, was equipped with efficient, individually metered photovoltaic generators. Naroi is a large village by Fiji standards and the administrative centre of Moala Island. The village includes primary and secondary schools, a dispensary staffed by a doctor and nurses, a bank/post office/ telephone exchange, airfield and police station. Various options for electrification were considered, and individual solar generators were recommended as the most suitable. This was in response to government rural electrification policy which provides for basic household lighting. Important considerations included minimal maintenance requirements, a breakdown affects only one system, there is no need to purchase, transport and store fuel, the light produced is clean, efficient and safe (Abbass 2000: 61).

The equipment for the project was supplied from France by Total Energie. Maintenance of the solar generators will be carried out every three months to co-incide with water meter readings. The Public Works technic ian will check all fittings and electrolyte levels and top up batteries with demineralised water as required (Abbass 2000: 62)

All 170 households in the village were equipped with a 100Wp solar generator. Each consisted of two 50 Watt solar modules mounted on standard treated pine poles, with utility grade galvanized aluminium and stainless steel fittings. All connections were in sealed, weatherproof junction boxes. Wring from generators to each house is by conduit. The solar modules charge an Oldham 6MLTS 12-volt, 140 amp, open cell, deep discharge, lead acid storage battery. Batteries are fitted with gas recombination vent caps to reduce electrolyte evaporation. Charge regulation is provided by Total Energie RMP 15 amp microprocessor charge/discharge controller with circuit breaker protection (Abbass 2000: 61).

Connected to each regulator is a Suncash prepayment credit code power meter. Lighting in each home is supplied by three high efficiency Solagen 11 Watt PL fluorescent light fixtures and a 2 watt light. Wiring is to European standards and all lights are equipped with wall-mounted switches. Both the regulation unit and prepayment meter are sealed with steel wire and leads security seals to discourage tampering. User maintenance of systems is strictly prohibited (Abbass 2000: 61). These solar generators are projected to have a lifecycle of over twenty years, with a battery replacement expected after about eight years. Fees collected will be used to cover maintenance costs, battery replacement and installation of new systems as the village grows.

Suncash is the solar version of the Cashpower prepayment meters installed by the Fiji Electriicty Authority ELCOM in Papau New Guinea, EEC and Enercal in New Caledonia and other PPA member utilities. Suncash prepayment meters were incorporated into the initial design in accordance with the principle that a fee, even a symbolic fee, is fundamental to the success of solar projects (Abbass 2000: 62). Prepayment at the local post office enables the customer to enter a credit code on an integrated keypad on the meter, thereby receiving one month of service. Flashing lights warn when credit is low, and when the meter expires it automatically cuts off service without the need for a technician (Abbass 2000: 66)

Abbass (2000: 66-67) reported that a visit to the island a year after installation revealed that all lighting systems were performing satisfactorily and that customers were satisfied. The prepayment metering systems appears to be working well. The villagers do not pay if they do not use the service (are away or whatever). The monthly fee is low (F$4.40 or US$2.25) (not given as a proportion of income). However the energy account is benefiting. The Naroi project provides a useful model for village lighting projects in other Pacific Island Countries (Abbass 2000: 66).

References

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Relevance to South Africa

A fee-for-service approach similar to the one in South Africa, which seems to be working well. A key difference is that the government is closely involved in implementation, with a government official responsible for maintenance.

11. Ghana

The availability of Spanish, GEF and UNDP funding made the installation of SHSs an attractive proposition in Ghana where several projects, all of which follow a fee-for-service model, have been undertaken. Two of these are reported by Abavana and Togobo in Wamukonya (2001) and the information here is taken from these the reports. The third is taken from the Regional News, Solar Energy Project for 3 Regions on Thursday 20 March 2003 (www.ghanaweb.com).

In the late 1990s the overall electrification level in Ghana was 61%, but 'a significant share' of the rural population remained unelectrified. The government's policy is to make electricity widely available to all communities by 2020. The National Electrification Scheme (NES) and the Self-Help Electrification programme have made progress in electrifying and rural communities since 1990. However there are still significant areas without access to the grid, and a project was started in 1998 to establish, through pilot demonstration, the conditions necessary for integrating PV systems into the NES. The Spanish government provided the funding (US$5 million) for the implementation of an Off-Grid Solar PV electrification Project. The project is being managed by the Ministry of Mines and Energy (MME), and is financed through a mixed credit facility made up of 50% concessional loan and 50% export credit from the Spanish government (Togobo 2001: 57). The first two years were for installation, and the MME will undertake monitoring of the project for five years to establish the conditions necessary to integrate PV into the NES. The project targets ten remote communities which were selected with the national electrification plan, remoteness from the grid and the ability to pay for services.

The project objective was to demonstrate the viability of PV for rural electrification on a fee-for-service basis, with a view to identifying key issues that need to be addressed in order for a comprehensive policy on the role of PV n the NES to be enacted (Togobo 2001: 57). A variety of systems in sizes from 50Wp to 50,000Wp were installed in households, hospitals, schools and for water pumping, and a battery charging centre was established. In total 2 194 systems were installed by 2001. 'To ensure effective management of the systems at local level, the MME, in close co-operation with the local and district council, established solar service committees in each of the ten communities. These committees undertake basic maintenance of the systems and also collect the tariff on behalf of the MME. A team from the MME undertakes quarterly visits to the communities to monitor the impact on the use of the systems' (Togobo 2001: 58). The fee-for service approach means that systems are rented to consumers at a subsidised rate of US$2 per month. This is, however double what their counterparts pay for grid electricity (Togobo 2001: 58).

Entrepreneurial beneficiaries, including bars, stores and music shops, have reported increases in income of between 30-150% after installing the systems (Togobo 2001: 58). These users have been generally willing to pay. However customers without income-generating activities have paid less frequently. Schools and clinics appear to have benefited (Togobo 2001: 58).

Tobogo notes that:

- It may be cost effective to use solar systems in rural areas.
- In communities of over 4 000 most customers are not satisfied with SHS and want grid connections.
- By-passing the charge regulator is common and damages the battery.
- The fee-for-service model may be viable but some form of subsidy is necessary.
- Collecting payments is labour intensive and costly; seasonal payments are common.

The Ghana Renewable Energy Services Project (RESPRO) was started in 1999 with funding from GEF and the and the Ghana government. The objective of the three-year project was to establish the path and learn the lessons necessary for a public sector company to efficiently provide rural energy services (Abavana 2001: 52).

RESPRO begun by installing solar PV systems in thirteen communities in the East Mamprusi District and expanded into adjoining districts to reduce costs and spread the use of PV systems (Abavana 2001: 53). RESPRO is building technical capability in the design, installation and maintenance of PV systems and equipment and PV/wind hybrid systems, combining private and public sector interests. Towards this goal, RESPRO has drawn up a programme to train electricians in each of the districts it is extending into. The technicians will be certified to install and maintain PV systems under the supervision of RESPRO technicians. In 1999 an average of twenty systems were installed monthly (Abavana 2001: 53).

RESPRO operates on a fee-for-service basis. All systems are owned by RESPRO. Prospective customers apply for systems in the same way as they would for grid supply. Two sizes are available 50Wp and 100Wp (US$630 and US$950 respectively). A US$100 fee is charged for installation and the monthly rate is fixed at US$3 and US$5 for the two sizes. Special requirements can also be met. As part of its contribution to community development, the government has provided some water pumps, street and school lighting. As the project expands it will include an option to purchase systems (Abavana 2001: 53). New customers on the fee-for-service conditions will have to employ a certified electrician to wire their households (as grid customers have to) (Abavana 2001: 53).

The implementation of the project has been rather slower than expected. The lack of involvement of the two local utilities has meant that the cost of hardware, which the government normally bears for rural electrification through grid extension, does not apply to PV systems, and the lifeline tariff which benefits all grid customers is not extended to PV-users who are obliged to pay full cost recovery rates. Affordability is a big issue and willingness to pay is low – partly because of the promise of the grid by politicians. The initial enthusiasm about SHS was not maintained when households had to pay for their systems. To date (2001) about 430 systems had been installed (Abavana 2001: 53).

With one year of the project to go the RESPRO will have to

- demonstrate commercial viability of PV-based electricity services;
- influence government policy towards the development of a market for rural electricity services based on renewables, especially photovoltaics;
- develop and produce a private sector power contract framework for the provision of off-grid and rural electricity services with specific incentives to encourage private sector participation.

Some of the lessons learned are that:

- the establishment of ESCOs has inherently high overheads;
- There are high operating costs associated with small projects in remote areas;
- a mix of strategies should be used to implement PV programmes;
- appropriate policy frameworks with appropriate financing mechanisms are necessary to encourage wider participation (Abavana 2001: 55).

Despite efforts to extend electrification, only 17% of rural households have access to grid electricity. In March 2003, at a meeting of the RESPRO, the Ghanaian Minister of Energy announced that the government, in collaboration with the UNDP, is funding a $2.9 million project to provide solar energy to three northern regions and some parts of the Brong Ahafo Region (Thursday 20 March 2003 www.ghanaweb.com). RESPRO is mandated to explore renewable energy sources to replace fossil fuels for rural socio-economic development, particularly in isolated communities. Solar systems are being installed to increase rural households' access to electricity. Previous RESPRO projects have provided important lessons towards the poverty reduction strategy of the government, and have demonstrated that solar energy can be a viable alternative to grid electricity. At the launch the Minister and the UNDP officials were optimistic about the potential of reliable electricity to promote the growth of agro- based industries and create employment, thereby increasing the productivity and the wealth of rural people. The UNDP representative said RESPRO had demonstrated the solar energy can be a viable alternative to the national electrification grid, and called for integration of the solar system in the country's energy programme. He also appealed to the government to initiate discussions with the Public Utilities Regulatory Commission (PURC) on how to ensure that the beneficiaries of the solar energy RESPRO also benefited from the cross subsidisation given to rural communities who were connected to the national grid. The project will include solar systems which would benefit 1 871 homes, 42 schools, six clinics, 24 street lighting systems, and a water pumping machine. The impact of this project is still to be measured.

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Solar energy project for 3 regions www.ghanaweb.com: Regional News of Thursday 20 March 2003

Relevance to South Africa

Despite the smaller than anticipated demand and the slow installation, the government has gone ahead with SHS roll-out, anecdotal evidence is that all is not well with the programmes. In communities of over 4 000 people, most are not satisfied with SHS and want grid connections. The affordability of systems was in question since customers paid less for grid connections and SHS customers have not yet received subsidies.

There are high operating costs associated with the fee-for-service model, and a mix of strategies may be best.

12. India

India has a long involvement with renewable energy sources and SHSs. India has been engaged in a rural electrification process since the early sixties, nonetheless the extension of the grid is neither possible nor economical in about 18 000 villages (Bhattacharjee & Das Gupta 2002: 10). In 1989 Mudumbi Varadarajan was responsible for setting up a PV module-making facility in Hyderbad for the manufacture of solar cells, modules and systems (*Reps Vision* 2002: 16).

The Government of India set an objective of providing power-to-all by 2012 and in 2002 launched Mission 2012 – Power For All (Bhattacharjee & Das Gupta 2002: 10). The Ministry recognises that there are problems in extending rural electrification, and these have been categorised into financial, technical and administrative, and include low demand and power theft as well as corrupt practices (Bhattacharjee & Das Gupta 2002: 10). In order to overcome to combat inefficiency and corruption and to build confidence, Bhattacharjee and Das Gupta have suggested that commercial aspects of SHS projects, such as meter reading, billing, collection of payment against consumption etc, should be handed over to the villagers. This, they suggest, could be done through *panchayats*, cooperatives or village committees. Wherever necessary, SEBs should support such committees in terms of technology for smooth operation of the system. In such an arrangement, the villagers should take care of the administration including unpleasant jobs to wipe out theft and malpractice. This model has been successfully adopted by BSES Limited Orissa. Successful commercial management of solar power plants in the Sunderbans in West Bengal is another example. The Ministry of Non-conventional Energy Sources reports that in 2002 there were 200 000 SVP lighting systems, 428 000 solar lanterns and 1180kWp SPV power plants installed to take care of decentralised energy requirements in India (Ministry of Non-conventional Energy Sources; www.mnes.nic.in)

An interesting fee-for-service approach used by an NGO body was reported in Khuller (2002). A charitable organisation called Don Bosco in the tribal village of Pavur, Kerala, India, believed that two solar lights in each house could improve the lives of the poor, and set about investigating better lighting for women basket weavers in the village. Although there was a demand for baskets, women could not take advantage of working at night because the dim kerosene lamps did not provide sufficient light for this skilled task. In addition the villagers had health problems from inhaling smoke and suffered eye problems. The Don Bosco organisation had experience with PV electrification from Bangalore but realized that the Pavur people could not afford PV systems (Khuller 2002: 19).

Don Bosco created a revolving fund, the Solar Basket Fund, which could be used to finance PV systems on a commercial credit basis. The beneficiaries of the lighting systems would pay back the money in instalments, which would be put back into the revolving fund. Khuller (2002: 19) reports that with the fund in place, Don Bosco, in partnership with SELCO India and Winrock International India/ USAID, was able to offer villagers PV systems on a commercial credit basis. Initially Don Bosco used its own funds and seed funding from the international partner, calculating that if the revolving fund could be used to lend out PV systems to other tribal people as well, the total amount would be recovered in just seven years and the area transformed by electric lights.

The project has seen women come into their own and direct what they need. Non-owners publicly put pressure on owners to repay their loans so that the fund remains liquid and their turn will come. The project has seen incomes rise and other social benefits accrue. The SELCO model, known as the Energy Services Model, is used. It is a concept of providing quality product supply and installation and effective after-sales service. The technical specifications of products used in this project are:

Solar panels	20Wp (2 x 9Wp each)
Compact fluorescent lamps	18 W (2 x 9W each ~ 40W incandescent bulbs)
Battery size	12V /40AH
Autonomy	2.7 days (Source SELCO India in Khuller 2002: 19)

References

PV crusader passes away, in *Reps Vision* 21, 2002: 16.

Khuller, A 2002. Making a difference in the homes of a few. *Energia News* 5(2): 19-20.

Relevance to South Africa

- NGO models where community structures are established and used can be very successful in keeping roll-out on track..
- India has vast experience in a variety of approaches to rural electrification which may be worth tapping into.
- India has installed sufficient numbers of SHS to be able to assess the sustainability of a manufacturing industry for SHS and the risks and opportunities associated with this. There is probably too little information exchanged about these issues at a national level.

13. Indonesia – support to dealers and credit

Indonesia faces familiar challenges of electrifying rural areas; homes which are far from the grid and yet which need electrification. Funding from the World Bank and GEF has made the installation of SHSs possible.

In terms of the Indonesia Solar Home Systems Project, a loan from the World Bank will be used to re-finance participating bank's loans to private sector solar home system dealers. Dealers are required to offer instalment payment plans to users, in order to address the barriers created by a lack of credit for end-users. In addition to instalment plans, dealers are required to offer consumer unspecified protection and provide solar home systems which adhere to (unspecified) technical performance specifications.

The Solar Home Systems Project provides GEF grants to dealers for each system installed. Those who use the grant to reduce the price to the end-user are expected to benefit in the longer term. The grants range from US$75-US$125 and are only available after the Project Support Group confirms documentation regarding the system installation. The installer then applies for the grant.

Under the Project, GEF grants are provided:

- to the Project Support Group for verifying dealer's compliance with technical specifications and use of loans proceeds/grant funds;
- to the Project Support Group for offering consumer protection services to existing and potential solar home system end-users; and
- tor preparing a Decentralized Rural Electrification Strategy Study and Solar Home Systems Implementation Plan

Reference

www.worldbank.org/html/fpd/energy .

Relevance to South Africa

The results of this project are as yet untested, but concessionaires in South Africa are beginning to make use of GEF funding; later comparisons will be useful.

14. Kiribati

> Solar generators are used extensively in the Pacific region for remote applications. In New Caledonia and French Polynesia, solar generators are installed by local power utilities whenever grid connection is too costly. Kiribati and Tuvalu have installed extensive solar systems and Vanatu has adopted an ambitious solar electrification policy. Virtually every other Pacific Island country or traditional producer/distributor has installed some solar generating capacity. (Abbass 2000: 61).

In 1989 approximately 90% of the 270 installed PV systems in Kiribati were not functioning (Wade 2002). In 1990 the private supplier was reorganised into an ESCO which JICA agreed to support a pilot project which was completed in 1992 with favourable results. The implementing agency was the Solar Energy Company under the responsibility of the Ministry of Works and Energy of Kiribati, which co-operated with JICA and the UNDP/BPPS/SEED/ Energy and Atmosphere Programme for technical assistance and monitoring. The key issues to be addressed were promoting the use of renewable sources of energy and the participation of women. The primary objective was to assist the Government of Kiribati to meet the basic electricity needs of rural and/or remote communities in an efficient, least cost and reliable manner.

The JICA project spent time training local personnel, including an assistant manager, in design, installation, testing, commissioning, operation and maintenance of photo voltaic systems and preparation of technical specifications, tender documents, and evaluation of tenders. Staff were also trained in management procedures, and attention was paid to the development and/or testing of hardware and software necessary for billing, accounting, spares tracking. JICA ascribes the success of the project to this emphasis on capacity building. The maintenance history has been sound and batteries have lasted up to 8 years. A contract which lays out the supplier and customer's responsibilities is signed. Among the benefits have been that the provision of light has permitted children to study, women to work on income generating activities, and men to fix nets and salt fish. Increased ownership of radios has brought entertainment and information (health, childcare) to the community.

In 1993 the EU funded the phased installation of 300 systems of the same design as the JICA ones, and using the same fee-for-service approach. Inspections three years later showed that systems were functioning well, customers were satisfied and technical maintenance was being done (Wade 2002). However the distances involved in supervising local technicians has presented some difficulties.

In August 2001 the EU Outer Islands Electrification project which will see the electrification of 1400 homes between 2002 -2004, was begun. I

References

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Relevance to South Africa

- The emphasis on capacity building for rural development is key to the success of the project. The ESCO model used in Kiribati is a workable one: lessons learned include that pre-installation surveys are a poor indicator of customer acceptance and willingness to pay.
- Customer fees have to be sufficient to cover repair and maintenance costs.
- Local technicians have to be well supervised.
- Locally manufactured components can provide good reliability if designed and tested for local conditions.

15. Laos PDR

Two communities in Laos developed a business plan for the installation of SHSs. The first year of implementation was 2001, and the results were encouraging (Barnes & Halpern 2001: 34).

16. Mali

In the rural areas of Mali less than 1% of the population has access to electricity. The government has made the electrification of 500 villages over the next ten years a priority, and is determined that renewable energy should play a key role in this. A Danida funded project which began in 1999, seeks to address these problems and to provide PV lighting for schools and public squares, lighting and refrigeration in health centres, and PV pumps for drinking water. Generally previous PV programmes in Mali have not been sustainable over the long term. The previous lack of success has been attributed to system failure and a lack of organisational capacity, for example 60% of 500 water pumps installed are not functional due to technical failures and a lack of appropriate management and support structures (Togola 2001: 50). The challenge is to create management and support structures which can effectively maintain and install hardware (Togola 2001: 50). By 2001 committees consisting of men and women were being established and Women's Associations had been closely drawn into the project, but no SHSs had yet been installed at the time of the report.

Reference

Togola, I 2001. PV experiences in southern Mali. In Wamukonya, N (ed) 2001. *Experience with PV systems in Africa: Summaries of selected cases*. UNEP Collaborating Centre on Energy and Environment, Denmark.

Relevance to South Africa

In Mali system failure and a lack of organisational capacity have been held responsible for failure. In the reported project considerable time and attention was being paid to establish the structures and develop the capacity needed to sustain solar home systems in rural areas. Have appropriate and responsive management and support structures been established in South Africa, so that programmes do not suffer the same fate?

17. Mexico

Over 90% of Mexicans are connected to the grid, but 155 000 communities with populations of under 2 500 were assisted with SHSs. In 1989 the federal government launched the National Solidarity Program (PRONASOL) which included support for rural electrification programmes. The national government-sponsored project used PRONASOL funds to provide rural households with photovoltaic lighting systems. Over 60 000 systems were installed, but two years later less than half of the systems were working. Battery failure and inability to afford a new battery (US$50) were the primary reasons for this. Morgenstern (1998) reported that the need for SHSs may not have been as urgent as the need for land etc. She pointed out that it is essential for users to pay for systems/service. While this excludes the poorest of the poor, it does target those who can use the systems and other assistance may be directed to those who cannot.

Reference

Morgenstern, J 1998. RSVP-List Forwarded message from Joy Morgenstern, 9 June.

Relevance for South Africa

The lessons for South Africa was learned in the Folovhodwe project, where donated systems fell into disrepair. Even a token amount must be paid for customers to retain a vested interest in the maintenance of the system.

18. Morocco

Although Morocco has had a rural electrification programme since 1978, by 1995 only 5% of rural households in Morocco were connected to the grid. Morocco has 40 000 villages with about 50 households in each. In August 1995 the Department of Energy adopted the goal of national electrification by 2010. A long-term programme, the Global Rural Electrification Project (PERG), was developed in collaboration with the National Electricity Office (ONE) (Berdai 2001: 45). The PERG is managed by ONE and financed by ONE, the beneficiaries and communities (Berdai 2001: 45). It involves both grid and decentralised electricity supplies. The number of electrified villages increased threefold from 1997 to 1998. A large PV (SHS) programme started in 2000 and is expected to install 200 000 SHSs within seven years. However Wade reports that Moroccan PV companies are finding it difficult to access the necessary investment capital.

Over the last ten years public and private companies have worked alongside developing the PV market, and establishing appropriate service approaches. The fee-for-service model is being tested using selected service providers. It is expected that every service company selected will, by 2010, install 10-20 000 50Wp SHSs and provide maintenance and after sales service. The National Electricity Company is contributing US$400 for each system, with the balance, approximately US$100, being met by the users (Berdai 2001: 45). The fee-for-service approach is being used because the majority of the unelectrified population can afford this, but less than 15% can afford a direct purchase (Wade 2002). Three sizes of system will be on offer: 50 Wp, 75 Wp and 100 Wp.

Private sector involvement is strengthened with the development of 'energy houses' a new concept of ESCOs developed to improve energy distribution to rural areas. These energy houses offer services in PV electrification and maintenance, gas distribution, sales of improved stoves, and energy and environment awareness campaigns. A similar concept has been introduced in South Africa, the *Integrated Energy Centres.* About 150 ESCOs are being established in Morocco to service the remote areas (Berdai 2001: 46). Morocco has put in place a wide variety of projects which should address technical, organisational and financial aspects to make these ESCOs sustainable. Many of these new structures are private initiatives. More than 20 000 SHSs have been installed, as well as PV for water pumping and telecommunications. International financing has made these projects possible (Berdai 200: 47).

Berdai (2001: 47) reports that important achievements include the mobilisation of important investments with the help of GEF, EU, UNDP, and bilateral co-operation (French, German, Spanish, Japanese, US) which has been a key to delivery achievement, as has the creation of jobs and the strengthening of local expertise and resources. Wade (2002) has a different perspective; he reports that the awarding of tender contracts to foreign consortiums has been a blow to local companies and the RESCO concept

References

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Wade, H 2002. Survey of RESCO projects. Draft Report prepared for OPRET. Fiji Department of Energy. Fiji.

Relevance to South Africa:

Lessons learned include that where there already is a well developed private sector for PV implementation, the entry of large subsidized programs can be seriously detrimental to private sector expansion unless those companies are included on a fair and equal basis (Wade 2002). This observation could be compared with the South African experience where the small but viable private sector market has collapsed under the subsidised fee-for-service roll-out. Other points to note from Wade are that

- electrification should be (but seldom is) demand driven;
- the utility should take responsibility only for the acquisition of initial material;
- customers and the project should share financial costs and operational costs;
- technologies should be tried and proven before being put into the field;
- integrated planning with the grid extension should be conducted, and a mechanism for transition from off-grid to grid established (Berdai 2001: 47).

19. Namibia – several approaches

In Namibia it is estimated that between 8% and 15% of the rural population have access to electricity. The Namibian energy policy has as its goals effective governance, security of supply, social upliftment, investment and growth, economic competitiveness and efficiency and sustainability (Muller & Wamukonya 2001: 36). In accordance with these objectives the government has sought to decrease the gap between urban and rural areas and to extend electrification. In 1993 the Ministry of Mines and GTZ launched a programme to promote the use of renewable energy sources and initiated a market-oriented programme of disseminating SHSs. Credit facilities were provided by a revolving fund financing development projects. Initially only 50Wp systems were available, but this was extended to four different configurations ranging from 50Wp to 250Wp in the Home Power project (Muller & Wamukonya 2001: 36).

In another initiative, the Indian government financed 190 systems in two villages. Villagers have to pay for operational and maintenance costs by contributing to a fund managed by the village committee. The payment is based on a the ability to pay.

In March 2001, SunTechnics and the Namibian University launched a new solar technology, the power can, for rural electrification. There are two configurations, 50Wp and 200Wp. It will be operated on a fee-for-service basis where the customer 'uses the plug to buy credits'. The new utility, Premier Electric, will use the power can to electrify particular off-grid areas (Muller & Wamukonya 2001: 38). The success of the programme was monitored.

The private ownership and after-sales service approach of the pilot project was appreciated and an excellent payback rate was achieved (Muller & Wamukonya 2001: 39). However, the reach of this approach was limited to the better-off households. In recognition of the need to reach the lower-end of rural households, the Namibian utility, NamPower launched an extensive Rural Electrification Master Plan, endorsed by cabinet in 2001, that identifies specific areas for different kinds of electrification. Nampower will test the feasibility of a fee-for-service model in three areas where 50 SHS will be installed per year. The provider remains the owner of the systems and charges the customer a fee for service. For this purpose the revolving fund will be transferred to the respective service provider in due time. However, the option of purchase of a SHS on credit using the revolving fund will remain (Muller & Wamukonya 2001: 39). The MME is developing a regulatory framework for large scale off-grid electrification and is receiving funds from UNEP to facilitate this (Muller & Wamukonya 2001: 39)

References

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Relevance to South Africa

Namibia has been pro-active in trying out various approaches to SHS installations in order to reach the rural poor. Both credit and fee-for-service have been successful within limits, but neither have been able to reach the very poor.

20. Nepal – lighting and education

The objective is to introduce the poor rural people of all countries to a safe, simple, healthy, affordable form of home lighting using white light emitting diodes (WLED). In 2000 134 homes and a Gompa in widely dispersed villages in east and west Nepal were provided with pedal generators, Pico hydro turbine and solar photovoltaic power sources. The goal for 2001 was 300 homes in Nepal plus 100 homes in India, and 50 in a village in Sri Lanka. There will also be an attempt to distribute basic reading and writing material, especially for girl-children. Most homes in Nepal cannot afford Solar Lighting but may be able to afford the WLED torch which would save money and reduce the endemic battery pollution problems.

References

Light Up the World. www.lightuptheworld.org.

www.rsvp.nrel.gov/vpconference/vpconference.html.

Relevance to South Africa

In very poor and remote areas torches are distributed and SHSs installed for lighting – not even radio and television. This lighting appears extremely expensive, but if it results in improved levels of education and improved incomes, it could be cost-effective. Empirical evidence for these claims should be gathered and analysed.

21. Peru

In 1998 the UNDP/GEF Peru Photovoltaic-based Rural Electrification project established a model rural electricity concession company. The project aimed at installing 12 500 SHSs in four years, through pilot concession areas. It is expected that 250 000 small communities without access to electricity and at least 50 households in each will benefit. Local community-based concessions will be encouraged to install, own, operate and maintain energy systems for the community. These concentrations of installations are expected to generate sufficient demand to make the market a worthwhile investment in the future. GEF has financed $4 million of the $9.2 million that the project is going to cost. Monthly fees for operations and maintenance will be determined in each are. In 1998 rural households in the project areas spent about $9 a month on kerosene, candles and batteries, but comparative post-SHS figures are slow in being made available. Barnes and Halpern (2001: 33) comment that the manner in which subsidies have been granted in Peru has led to unforeseen and unwanted results: 'A village without electricity received 100% subsidies on their photovoltaic systems, but a year later it was discovered that many households had sold their systems' (Barnes & Halpern 2001: 33). Similar disincentives have been found in India where subsidies encouraged manufacturers to produce for the government subsidy rather than the customers. Further information is not yet available, although the CADET website recorded that the First Latin America Solar Grid-Connect System was to be implemented in Peru 17 December 2002. Monitoring, evaluation and service standards will be undertaken by the Ministry Energy and Mines.

References

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CADDET. Renewable Energy database cadet.com.au

Relevance to South Africa

- As learned at Folovodhwe, full subsidies are often disincentives for looking after systems.
- GEF funding has made many of SHS projects possible, however the ability to make them sustainable has still to be tested.

22. Philippines

In the Philippines the cost of extending power lines and the difficulty of transporting generator fuel to remote developing areas required an innovative approach to solving the energy poverty problem. The Philippine government, working in conjunction with the Spanish government and international funding organizations, turned to solar as a low-cost way to supply electricity to remote areas and to build the foundation for social and economic advancement in these areas.

In March 2002 an agreement was signed between BP and the Spanish and Philippine governments to bring solar power to 150 isolated villages (over 400 000 people) in the Philippines. Led by the Philippine Department of Agrarian Reform (DAR), the $48 million contract was financed by the Spanish government and will be implemented in two phases. The first was scheduled to begin in September 2002. The first phase of the project will centre on 35 Agrarian Reform Communities (ARCs) in the Mindanao region of the Philippines. Solar systems will be installed in around 70 villages to power:

5 500 home lighting systems
25 irrigation systems
97 potable water and distribution systems
68 schools, 68 community centres, 35 health clinics and 100 communal lights
There will be 35 new AC power supply systems for income generation purposes.

The project will include social preparation, community development, training in project management and installation of 428 packaged solar systems and the training for 200 community organizations.

In the second phase it is intended to provide an additional 44 ARCs with: 9 500 home lighting systems; 44 irrigation systems; 79 schools, 80 community centres, 2 health clinics and 193 communal lights; 44 AC power supply systems for income generation purposes.

The social and development skills and training included in the first phase will be repeated.

There is also a solar lighting project being implemented in the Philippines. Reliable solar powered rechargeable lanterns are being introduced to provide household lighting. An integrated community organisation and development programme is an essential component of the project, which is intended to enhancing the end-users' capacity to pay, and ensure that the electric co-operative attains a substantial cost recovery on their rural electrification investment (Zameco 2002).

References

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www.bp.com/pressoffice.

Zameco II Solar Lighting System, Philippines www.rsvp.nrel.gov/asp/project.asp?IDI=244.

Relevance to South Africa

It is not clear from the reports that this is a fee-for-service approach. However, Tuvalu Solar Energy Company, who are involved, successfully used a fee-for-service approach in Tuvalu. The most significant factors for South Africa is the extent of the roll-out, and integrated approach to development and the inclusion of capacity building in the design in recognition of the role it will play in the successful implementation of the project.

23. Senegal – from project-based to market-based

The majority of the 10 million people in Senegal reside in rural areas where the electrification level is 7%. In 1998, after 11 years of work, a project on the dissemination of PV systems came to a conclusion. The project had delivered 50Wp SHS to 2 300 households in ten regions. In addition systems of localised and decentralised maintenance support were developed. Distribution, supply and after-sales service system was established, as were small rural enterprises offering energy services. Labelling as a quality control measure was introduced and a sound understanding of social issues and the local solar market had been developed (Sarr 2001: 61).

In 1994 the project-based approach shifted to a market-orientated approach which included an increase in product price. Consequently the market shrunk rapidly to exclude all but high-income earners. Subsequently two mechanisms have been introduced to assist households to acquire the systems (Sarr 2001: 61). One in which a credible intermediary guaranteed loans, and a second in which salaried workers could acquire loans from their employers for equipment, and have instalments deducted from their salaries (Sarr 2001: 61). The project has been judged a success because it involved local operators in the production of batteries and accumulators, and village groups in marketing (Sarr 2001: 61). However lack of funds to replace dead batteries and the high cost of systems remain barriers to dissemination (Sarr 2001: 63).

Reference

Sarr, S 2001. Dissemination of family photovoltaic systems in rural Senegal. In Wamukonya, N (ed) 2001. *Experience with PV systems in Africa: Summaries of selected cases*. UNEP Collaborating Centre on Energy and Environment, Denmark.

Relevance to South Africa

The rapid drop in demand once the subsidies were withdrawn and a market-based approach introduced should sound warning bells to South Africa. The mechanisms introduced to promote access to systems do not address the needs of those without jobs or the very poor. This is the group that requires subsidies and welfare most.

24. Sri Lanka – credit programme

In 2002 48% of the Sri Lankan population did not have grid connections (Caron 2002: 38). In March 1997 the government of Sri Lanka signed an agreement with the World Bank and GEF for an Energy Services Delivery (ESD) Project. The key component of the ESD project is a credit programme that provides medium- to long-term financing to private developers, NGOs and community-based cooperatives for SHSs, village hydro schemes and grid-connected mini-hydro plants (Caron 2002: 38). This is a unique project which attempts to deliver renewable energy using a market based approach coupled with an accessible credit line. By the end of June 2000, the availability of the ESD credit programme had seen the construction of 8 village micro-hydro schemes, and the installation of

1 000 SHSs. It is expected that by the end of the programme 10 000 households would have benefited from solar home systems, and the potential customers could number as many as 500 000 from the 1.9 million without electricity (Caron 2002: 40).

The ESD project was awarded a grant of US$24.2 million by the IDA and US$5.9 million in a GEF grant. Other project funding comes from the private sector, and the Sri Lankan government.

Reference

Caron, C. Examining alternatives: The Energy Services Delivery Project in Sri Lanka. *Energy for Sustainable Development* VI(1): 38-46.

Relevance to South Africa

As the Sri Lankan government dismantles its function as a welfare state, it slowly begins to shed its previous responsibilities such as electricity provisioning, and responsibility for providing and maintaining this service has to be picked up by the private sector, individuals or local communities. South Africa is currently expanding its function as a welfare state in some directions (energy subsidies) and contracting its function as a public service provider in others (water, transport). The question of whose responsibility provisioning is, is a challenging one. Caron (2000: 43) quotes an older respondent who believes that people should be encouraged to be self-sufficient and not expect everything from the government, otherwise they just sit around waiting all the time, and others who expect the government to provide. Deciding on subsidies as a means to expand the SHS market (as South Africa has done) is a tricky path to walk. It requires constant monitoring across all sectors with an eye on the poor. Any energy policy needs to explicitly consider the extent to which a policy is designed to take into consideration both global environmental and economic mandates – the people in the ESD project were unaware of the 'environmentally friendly' character of their systems – should they be made aware of this? Many of the South African respondents did not know that their solar home systems were subsidised by the government – should they be made aware of this?

Getting the private sector to take on the risks associated with financing renewable systems is difficult.

Caron (2002: 45) suggests redefining success:

The economic and social diversity between stakeholders clearly complicates project design and implementation. But project longevity and success ultimately depend upon providing users with products which fit their lifestyles and aspirations. Measures of success should be extended to include qualitative indicators such as pride in use and contributions to tradition (such as housing materials) in addition to profit margins and number of installed systems. If 'contribution to increased productivity' is a criterion employed to measure project success, then economic productivity should be considered alongside psychological well-being and intellectual productivity.

Interviews with ESD project stakeholders illustrate how all stakeholders, regardless of their relationship to the project, recognise the need to share in the responsibility of energy generation. The positive benefit from feeling that one is successfully contributing to tackling a national problem is indispensable to project performance and continuity. Positive influences on individual's self-worth and self-esteem can contribute to the development of ideas and opportunities that extend beyond the original project.

25. Tuvalu

Tuvalu has a long history of solar electrification, dating back to 1979 for telecommunications systems and 1984 for the introduction of solar PV lighting kits. The period prior to 1992 was dominated by technical problems – some of the technical quality of the systems was so poor as to be 'an embarrassment to the donors' (Nieuwenhout et al 2000: 124). The period since then has been dominated by management and financial problems. The Tuvalu ESCO, Tuvalu Solar Electric Co-operative Society (TSECS), followed a fee-for-service approach, but the co-operative committees tend to set fees too low to recover costs.

Reference

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Relevance to South Africa

The most successful part of the Tuvalu experience has been the support and back-up provided which have kept suspect systems providing light in remote areas. This service includes monthly visits made to every user by full-time, specialist trained, locally based employees of the organisation who collect fees, check on the system and perform minor, essential maintenance. Senior technicians visit the site at least twice a year to check on local work and solve more complicated technical problems. Established communications channels function well, and users are kept informed of how fees are being used or plans that are being made. Different size systems are available and the organisation is devoted entirely to providing energy services through solar PV power (Nieuwenhout et al 2000: 125).

26. Zambia

The reasons for this project are familiar and include that 50% of Zambia's population live in rural areas and only 2% have access to electricity (as compared with 35% in urban areas). It is a goal of the Zambian government to increase this proportion, however the prohibitive costs of extending the grid to remote rural areas has highlighted the need to look to alternatives such as PV to supply energy services to rural areas (Sida 2001: 54). To achieve this the Zambian government needs assistance and is trying to encourage the private sector to participate in rural electrification.

The ESCOs project was begun in 1998, and is being implemented through the DoE, and funded by the Sida with the SEI as the main project consultant. It will be completed in 2003. 'The overall objective is to develop a model through which rural people can access energy services on a sustainable basis' (Nordstrom M & Kalumiana 2001: 19). The hypothesis is that a private company can operate profitably as a provider of rural energy services, that people will pay their dues, and that the generation and distribution systems will be well maintained and technically operational in the long run. The project design was influenced by the failure of previous projects to be sustainable for any length of time, and a new understanding of the importance of energy services rather than energy sources or technologies (Nordstrom M & Kalumiana 2001: 19). In the conception of *energy services*, energy users are more important than technologies.

Three privately owned ESCOs have been set up in the Eastern province of Zambia. A financial and organisational framework for such companies to be integrated into the national rural electrification strategy will be developed (Nordstrom M & Kalumiana 2001: 18). Guidelines specifying the necessary financial and organisational inputs needed for an ESCO operating in rural communities in Zambia were drawn up, with due consideration given to important factors such as information on the ability of the ESCOs to cover the costs of providing services, minimising the risks of the operations, achieving secure access to suppliers of hardware and expanding their scope of service delivery (Nordstrom M & Kalumiana 2001: 18).

The issue of ownership of the systems has been an important one from the beginning. The rightful owner of the systems is the Government of Zambia through their DoE because SIDA provided the DoE with money for their purchase. Mr Anil Cabral and Mr Herbert Wade were contacted to provide information on how contracts between ESCOs and credit providers, and between ESCOs and customers, have been formulated in other countries where ESCOs are being used to sell PV-electricity services. At present the project combines public ownership of the system with private supply and maintenance. The ESCO has an incentive to provide services on a continuous basis and the private business operations vouch for efficiency in operations and management. ESCOs have full control over the operations and receive the benefits. The ESCO customers cover only the costs of servicing and maintenance, including a battery replacement every three years (although the battery life has not been ascertained) (Sida 2001: 15).

It was not considered necessary to award the ESCOs concessionary rights since there were no other actors based in the area to begin with. The ESCOs are subsidised in order to provide a period of grace during which the actual risks involved will be quantified (Nordstrom M & Kalumiana 2001: 20). The initial hypothesis – that local consumers would be able to bear the full costs of the services obtained from the PV systems – has so far not been substantiated (Nordstrom M & Kalumiana 2001: 21). The discussion on how best to accommodate the initial capital costs has to continue In the field there has been a clear discrepancy between potential customers' expression of interest and their ability/willingness to actually sign contracts and pay (even when heavily subsidised). The idea of paying for services only seems difficult to market: customers want and/or expect to be become the owners of the hardware (Sida 2001: 20). A decision has been made to use PV systems with a pre-payment function in the next phase.

Local ESCO technicians were trained by the University of Zambia in conjunction with SEI, Herbert Wade who had experience in the Pacific, and Themba Munyani from BUN in Zimbabwe, where the trainees did field work. Despite this training, the decision was made that the supplier should install the equipment. The supplier-installers were not as well trained as the technicians and the technicians did not get the practice they needed.

The Energy Regulation Board in cooperation with the SEI consultant and UNZA noticed a variety of irregularities in their inspection of the installation. These included faulty positioning, damage to property due to installation work, and several batteries that were not fully charged. The ERB has made some advances towards the governance from the Rural Electrification Fund (Sida 2001: 39) and took part in the ESCO project.

The main motive for an ESCO is for business reasons – to earn money, but this requires a long term engagement since loans are repaid over a long period of time. Nordstrom M and Kalumiana (2001: 2) note that "The guidelines governing ESCOs in rural communities will have to be streamlined into the existing energy sector legislation, and taxes and subsidies will need to be harmonised to ensure competitiveness".

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Relevance to South Africa

The project is different from South Africa's in that the ESCOs have not been granted concession areas, and in that ownership of the systems resides with the DOE rather than the private companies. However the legal and contractual frameworks, and the ability to predict demand and financial sustainability, have resonance in South Africa. Capacity building within the country would appear to be most important and a reliable source of expertise. In South Africa, as in Zambia, it will be important to streamline existing energy sector legislation, taxes and subsidies to include ESCOs, and ensure that guidelines are harmonised so that the sector may be competitive.

27. Zimbabwe – shift to an ESCO approach

Only 5% of the rural population in Zimbabwe has access to electricity, and improving rural life has been one of the main goals of various donor-funded electrification projects (Nziramasanga 2001: 15). For the past twenty years there have been several commercial firms selling PV systems in Zimbabwe, some of which have run successful credit schemes. Very little of this is documented so it has been difficult to assess the technical efficacy (Nziramasanga 2001: 17), however since the sales ticked over for many years, one must assume that a particular niche was filled.

There are two funded photovoltaic power dissemination projects which concern us here. The first is the Global Environmental Facility (GEF) PV Pilot Project launched in 1992, the second, the Japan International Corporation Agency Project (JIKA) project of 1998.

The GEF PV project was intended to reduce emissions from the combustion of kerosene lighting by providing financial support to the suppliers of equipment. The measure of success was the number of systems disseminated, rather than the number of systems remaining in use over time. The target number was reached by installing equivalent systems to the value of 9000 45 Wp systems (Wade 2002). This approach attracted a number of 'fly-by-night' installers who disappeared after receiving the subsidy (Nziramasanga2001: 16). The project competed directly with established local businesses who could not compete and were subsequently put out of business.

The JIKA PV project ran from 1996 in two pilot areas about 80kms apart. One was a commercial farming area, the other a subsistence level of farming. Using an ESCO and fee-for service approach, 50 systems were installed in each area. It proved more difficult to find customers in the poor area. There were technical problems and delays with providing deep discharge rather than car batteries, and many of the controllers were of poor quality and had to be replaced. A local technical college took on the responsibility of training technicians. Young technicians proved to be less reliable than older ones.

Although installation contractors had been certified by GEF, over half the installations required substantial correction after they had been inspected by the JICA team (Wade 2002).

The project was managed by a local NGO, and the subsidised ESCO during the pilot phase. The households and NGO signed a contract which described their mutual responsibilities. Despite efforts to use local components, local businesses were not able to produce the quality of components needed (controllers and batteries). About eight months after installation a survey showed that larger systems (than 25 Wp) were required, and that payment at harvest time was preferred. These adjustments were made.

Once the technical problems were corrected, systems seemed to be proving reliable, and maintenance and payments were regular. However the failing economy and currency problems have led to the stagnation of the project.

Relevance to South Africa

The greatest impact thus far has been to raise awareness of PV technology. The other important need that has been highlighted is for a functional institutional regulatory framework to ensure good practice and customer satisfaction. 'The absence of such a framework was the main factor contributing to the limited success of projects, particularly the GEF one' (Nziramasanga 2001: 17).

The fee-for-service approach may take longer to catch-on and become popular in poorer communities. Considerable effort, research and development has to be invested in local manufacturing and products so that they can be satisfactorily used. In retrospect the need to meet project deadlines (and therefore import) rather than achieving the required manufacturing and technical standards, seems absurd, and against the spirit of development.

APPENDIX 2

Experiences with solar home systems in neighbouring countries

1. Kenya

In Kenya 75% of the population lives in rural areas and only 5% of these rural households have access to electricity. PV has not been considered in the Rural Electrification Programme as an option for rural electrification. However the development over time of a commercial market for PV in Kenya has been well documented (Acker & Kammen 1996). To date there are more than 150,000 SHS installed and current sales total over 20,000 per year (Agumba & Osawa 2001: 28). Analyses of this commercial market have highlighted a number of flaws including continued importation of all solar modules and the lack of consistency in taxing imported system components. Most systems were bought on a 'cash and carry' basis, but Agumba & Osawa (2001: 29) note that this market has reached saturation and it has been difficult to find mechanisms to finance further expansion. An ESMAP project (1997-1999) pointed out improvements to infrastructure and training that need to be made, but failed to establish a viable mechanism through which this could be done. The commercial market in Kenya, although relatively buoyant, cannot reach all rural households.

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2. Lesotho

Only about 3% of the rural population have access to electricity. Efforts have been made since the 1970s to introduce renewable technologies including solar water heaters and SHSs, but the adoption of these technologies remained very slow. In 1993 the Lesotho government commissioned a study to identify the barriers inhibiting the increased use of renewables, and to identify the technologies with the highest potential for adoption. The study indicated the PV solar had the greatest chance of success, and that the factors inhibiting its adoption included 1) the high initial cost of the system, b) the lack of information on the part of the users; and c) inadequate technical capacity in the country (Mokhuts'oane 2001: 24). The government adopted a number of strategies to addressed all three of these. Financing systems remains a significant challenge; it would appear that solar systems have the highest chance of success if linked with productive uses, and are unlikely to meet the needs of the very poor (Mokhuts'oane 2001: 26).

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3. Mozambique – in progress

The design of this project is still in progress. An official, Ron Orozco, was appointed to Mozambique in early November 2000 to assist a World Bank mission in assessment of existing and potential demand for residential and productive use applications of renewable energy as part of a national rural electrification program. A request was made for information on any solar projects that members of SEIA or others are aware of in Mozambique – success stories, failures, and visions were all sought. Several rural areas were visited and specific site information collected. Industry members who have representation in Mozambique were invited to make submissions. Part of his job was to describe the existing delivery mechanisms for RE products as well as identify barriers and potential interventions to increase private-sector participation in meeting the needs of local people. A report has been requested from ronorozco@energiatotal.com.

4. Swaziland

In Swaziland about 67% of the population lives in rural areas and less than 5% of the rural population have access to the grid. The commercial market has expanded slowly over the years but can serve only a limited part of the population. An improvement in rural infrastructure is necessary to support systems installed in rural areas. At present users have to travel to urban areas for sales, and after-sales service.

From January 1999 to July 2000, a World Bank-funded project met its targets in selling portable lanterns and a variety of systems. It was less successful in developing a finance mechanisms for continued delivery. The solar village project at Mphaphati which saw systems installed in classrooms, staff houses and for street lights, has been successful, and largely managed by a Solar Committee. A maintenance contract with the supplier has proved to be extremely important.

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5. Uganda

In the rural areas of Uganda only 2% of the households are connected to the grid or decentralised systems. The government of Uganda has set a goal to increase rural electrification to 10% by 2010 and will use both grid and off-grid methods to do so. The Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE) was started in 1998 by the government, with its primary task being the establishment of sustainable mechanisms for commercialising PV systems. These would include financing, consumer awareness, marketing infrastructure and capacity building (Turyahikayo & Sengendo 2001: 32). The project has produced a number of lessons, among them that micro-credit does not remove the high cost barriers of PV systems, and monthly repayments are burdensome. Marketing and follow-up remains weak, and institutional support has still to be built. Subsidies are being considered by the government, and ways of using PV systems for income generating activities to encourage dissemination are being considered.

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Use the CADDET Renewable Energy database to search for village power projects

http: //wwwcaddet.co.uk/html/register/htm

www.caddet.co.uk/assests/301newsletter.pdf
Village Power Projects
http: //www.synergypowercorp.com/proj9.htm
Read about their projects in Australia, Afghanistan, Indonesia, Nepal, and
the Philippines.
Energy service companies in Eastern Zambia www.ecoharmony.net/hedon/
Rural Energy Supply Models (RESuM) Project
http: //resum.ises.org/
Cash and carry, dealer credit, finance leasing, fee-for-service projects and more.
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