Knowledge Exchange: Online Consultation and Project Profiles from the South Asia Practitioners Workshop

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Preface

1. What critical changes need to occur in order to scale up modern energy service delivery; and what best practices have emerged to date? Throughout April 2003, the Technical Secretariat of the Global Village Energy Partnership (GVEP)[1] solicited responses to these two questions, using both an online consultation and a project profile form. The Secretariat invited responses from all partners of GVEP, which currently includes over 250 organizations operating in the private, public, energy and non-energy sectors, as well as all those participating in the South Asia Practitioners Workshop (SAPW)—a three-day event for off-grid and mini-grid electricity service providers held in Colombo, Sri Lanka in June 2003[2].

2. Sixty-six contributions were made to the online consultation and 28 project profiles were received, which are featured in the following pages. These contributions have become the building blocks for GVEP's Knowledge Exchange, a repository of information on modern energy services, and served to shape the agenda of the South Asia Practitioners Workshop.

3. In both the online consultation and the project profiles, respondents emphasized the pressing need for policy reform, particularly with reference to subsidies, in order to scale up modern energy service delivery. The overall consensus was subsidies should be targeted to service providers and end-users unable to pay and phased out over time. Other recurring themes included community involvement, namely the need to have well structured community involvement in project development and implementation. Appropriate financing instruments for both consumers and suppliers was also highlighted in numerous contributions.

4. GVEP is not only showcasing this material. The Partnership is also using the material, along with the findings from four regional workshops in Africa and Latin America, to inform work on the ground in a series of developing countries. Finally, the participatory approach, which defined both the online consultation and the project profile solicitation, has become the hallmark of the Partnership; only through engaging the vast array of stakeholders will lasting improvements occur in modern energy service delivery.

1.1

1.2 GVEP Technical Secretariat

1.3 November,2003

[1] GVEP is a voluntary partnership launched at the World Summit on Sustainable Development (WSSD) to increase modern energy services and currently housed at The World Bank/UNDP Energy Sector Management Assistance Programme (ESMAP).

[2] The proceedings for the SAPW are being published separately under ESMAP.

1

Online Consultation Overview

1.4 The online consultation was held during the last two weeks of April, two months before the South Asia Practitioners Workshop (SAPW) in Sri Lanka. The main objectives of the consultation were to debate and identify the issues that are important in tackling the challenge of scaling up village energy services, and develop themes to be discussed at SAPW. As the starting point of this dialog, participants were asked to respond to two primary questions:

i) To scale-up existing successful schemes or projects to reach those under and unserved by modern energy services on a sustainable basis, what critical changes need to occur?
ii) What best practices and principal lessons have emerged from your experience to date, that could be replicated elsewhere?

1.5 There were 40 responses to the first question, and 26 for the second. Respondents included rural entrepreneurs, government officials, nongovernmental organizations (NGOs), equipment suppliers, academics, donors, and financial institutions. These responses ranged from brief comments to detailed project profiles. Based on their direct experiences in the field, the respondents came up with a number of lessons and suggestions on what needed to be done to scale-up the village energy services, which are summed up below. The full text of the online consultation is published independently as an ESMAP Technical Paper.

Scale-up considerations

?? There is a need to maintain technology neutrality in designing interventions, unlike in the past when there was too much push for Solar PV. A rational application of RE technologies should be promoted matching the specific requirements.
?? Emphasis should be on energy rather than electricity, and it is possible to link up non-electricity RE technologies with economic development.
?? While community participation is a desirable goal and a prerequisite for sustainable projects, it is important to understand the intra-community dynamics and address those in project implementation.

- While shifting from traditional to modern energy services, there is a danger that women may become dis-empowered. It is critical to prevent this gender bias by consciously dealing with it.
- It is high time to bring non-energy practitioners (from health, education, agriculture, small industry, ICTs, etc.) into the village energy services delivery framework so integrated planning and implementation could occur.

Policy issues

- There is a need to develop or revisit the national and regional energy policies to ensure reflection of energy-poverty linkages, clear endorsement of off-grid energy solutions, and development of a framework that would encourage public-private partnerships and offer appropriate incentives.
- There should be a clear endorsement for private sector involvement and there should be an enabling regulatory regime that would encourage the private sector through clear incentives to enter the rural energy sector.
- Many developing countries lack clear legal framework to enable off-grid projects to become mainstream energy solutions. The new policies should clearly lay down the legal framework.

Financing and subsidies

- Donors should not dump funds and exercise undue influence over project implementation. Rather, resources should be channeled directly through local entrepreneurs and NGOs.
- Subsidies are necessary to scale-up in view of the low purchasing power of the rural poor, but they should be tapered off gradually by improving the economic situation through focus on productive uses of energy.
- There is need for innovative financing mechanisms like guarantee funds to mitigate the risks associated with RE sector, so that micro finance institutions (MFIs) and banks can offer financing in this field.

Economic development and quality of life

- Integration of energy services with productive uses that lead to income generation is imperative if off-grid solutions are to be accepted by the local communities of users.
- Local institutions such as self-help groups of India should be actively involved in village energy programs to empower communities as well as initiate income-generating activities.
- It is necessary to educate the policymakers and politicians so that energy development policies and programs are not hampered by short-term considerations.

Ensuring customer satisfaction

- Developing and implementing strict quality standards in equipment and maintenance is critical for long-term sustainability. There should be rewards and penalties to maintain standards.
- Multi-level capacity building for different stakeholders, especially the practitioners and consumers on the ground, is important.
- Providing adequate information on programs and technologies is important to ensure against unrealistic expectations and consequent disappointment.
- Credit delivery mechanisms should be easily accessible to consumers to keep the response time and transaction costs low.
- As can be seen from the themes covered at SAPW and the deliberations that took place, the online consultation was useful in identifying the key issues. Finally, it should be noted that the Global Village Energy Partnership is maintaining this online forum to encourage information exchange among practitioners.

2

Questions for the Online Consultation

Questions

2.1 April 3 to 11: In order to scale up existing successful schemes or projects to reach those under and unserved by modern energy services on a sustainable basis, what critical changes need to occur?

- ?? Please answer with regard to at least one factor; below are several suggestions that may prove helpful in structuring your answer.
- ?? Appropriate policy and legal frameworks and rationalization of subsidy policies are necessary to extend services to the broadest segment of rural consumers.
- ?? Financing, i.e. appropriate financing mechanisms, such as pre-investment, pre-feasibility and feasibility support, credit guarantees, access to credit (with longer maturities), credit delivery agents that are closer to customers, need to be developed.
- ?? Technical support.
- ?? Reaching and servicing the customer base, i.e. practitioners need assistance in reaching the customer base, support for investment in income generating end-use technology is needed so that customers can afford to purchase modern energy services.
- ?? Markets, i.e. markets need be further developed to ensure ongoing growth.

2.2

2.3 April 15 to 25: What best practices and principal lessons have emerged from your experience to date, which could be replicated elsewhere?

Please answer with regard to at least one factor; below are several suggestions that may prove helpful in structuring your answer.

- ?? Key policy and legal reforms that helped develop your business/market, including fiscal measures.
- ?? Appropriate and innovative financing mechanisms, including risk mitigation measures.
- ?? Public-private partnerships that worked.

- Technical assistance for capacity building, technology development/improvement or other specific areas.
- Type(s) of support from international agencies or from local or national governments.
- Involvement of community organizations and their roles.
- Links to income generating activities that generate the cash to purchase improved energy services.

Question 1

In order to scale up existing successful schemes or projects to reach those under- and un-served by modern energy services on a sustainable basis, what critical changes need to occur?

Adam Friedensohn, Himalayan Light Foundation, Nepal
adam@lotusenergy.com

Donor focused support to the private sector to accomplish remote area electrification using RETs on a sustainable basis is critical along with loans to villagers, and subsidies and loans to companies to help them scale up and meet village energy demand. Although E&Co and the Solar Development Foundation do excellent work to assist companies, they are not sufficient in scale to meet the demand from large number of companies requiring assistance, and their conditions for providing assistance do not always match well with the private sector requirements of speed or form. Efforts such as E&Co must be replicated and expanded. However, most such programs still neglect conditions of the poorest people, their remoteness, the cost of remoteness and their social structures. NGOs have a critical role in the battle to reach these 400 million non-electrified homes in LDCs since they work towards the goal of meeting villagers' needs appropriately and creatively. Current successful and appropriately framed funds such as GEF SGP (Small Grants Program) are few in number and need faster scaling up. A fast throughput fund like GEF SGP with higher project limits (US$100,000-200,000) would make a smooth bridge between the SGP (US$50,000) and MSP (Medium Scale Project) amounts (US$750,000) for NGOs to access speedily. Finally, whereas talks on productive end uses abound and these are essential to draw vital auxiliary revenue streams into RET dissemination and to improve village life, bilateral and Multi lateral donors do not assist small and local NGOs for these field activities on any scale and rely instead on cumbersome and ineffective governmental conduits that rarely meet the ground they were intended for. Direct interface and encouragement of the hard working NGOS in the field in a mass approach is the only way to assure remote area coverage of the social concerns and interface required for RETS to take root among the poorest of the poor. Donors must see the need to pay and channel funds accordingly to reach furthest remote areas with the least parasitic activity.

Luis Ruben Bautista, STDS, Argentina
lrubenbautista@hotmail.com

Reaching the poor

The best characteristic of the subsidized system it is that it allows the installation of photovoltaic systems to users that otherwise could never access electric power. Given that such users have little or no purchasing power, it is difficult to move them away from subsidies.

To overcome this economic barrier, it is necessary, in a second stage, to motivate the final user's productive capacity, favoring the creation of productive enterprise, enabling the user a progressive independence of the government subsidies.

Establishing direct contact among the final user and the technical teams (practitioners) can be a way to speed up the tasks to reach this objective, since at the moment there is a lot of distance among the prospective users, technical teams and the financing sources.

If the objective is to achieve sustainable communities, it is necessary to favor the creation of productive enterprise in the rural towns, attacking unemployment, one of the critical problems among the rural communities of Latin America, leading to multiple social problems (migration of young to the urban centers, prostitution, delinquency, and labor exploitation in the big cities.

Technical/programmatic issues

The projects executed without the final user's active participation, commonly meet with the problem of lack of knowledge on the part of the user on the advantages and limitations of the implemented solution creating false expectations and the consequent deceptions, culminating in a total rejection to the solution that is technical and economically viable in principle. Therefore, it is important, in order to ensure the success of the project, to create proper awareness among the users, provide continuous maintenance of the installed teams, and undertake appropriate training to the users. Though this seems obvious, it is not always included in the project since it would increase the project cost.

Project in Jujuy County in Argentina

Some families residing in the small towns have electric power with 8 or 24 hours of service from micro hydro turbines, diesel gensets, or diesel/photovoltaic hybrid. For these, electricity is subsidized. But in the rural areas, many families have no service. It is possible here to carry out productive activities at the family level based on Garment manufacture from sheep wool. Presently, these people sell their handmade produce to the occasional tourist, but they are aware that they can sell at better price, with added value, if they have regular power and necessary equipment, and they could combine the production of several families. But they do not know where to locate the production, and they do not have information on the standard of quality.

A possible solution to this is to set up an independent sales team, comprised of educated people who can sell the garments in large commercial centers, and bring the technology and equipment to the producers. This team also brings information to producers on the standards of quality, and it picks up the production of different producers for sale, to obtain the volumes required by the market.

When beginning the productive activity, this team gives to the rural producer (final user) the necessary work tools to carry out the productive activity. This equipment is not a gift, but the rural producer would pay for the equipment with produce (if the producer knits 10 blankets of sheep wool per month, they receive income for 8 blankets and two blankets are part payment for the equipment). Thus gradually, the payment capacity of the family would increase and the rural producer would have some money to improve the quality of life, for instance sanitary hot water with solar water heater. The installation of systems would be done with the final user's active participation. The operation and the maintenance of solar water heaters would be carried out by a team formed by people, with appropriate training.

In this scheme, honesty and transparency of the technical group in charge of the market search and sales is fundamental for the success of the productive activity, so that the operation could be carried out as a pure commercial transaction without interference from government.

Availability of initial financing is also necessary to establish and demonstrate the potential for the productive activities. Rural tourism (ecotourism) is another productive activity that can make use of the renewable energy.

These are the elements of the model program launched in Jujuy and the first results are encouraging. Experiences and lessons from similar programs in other countries will be of great help for us in implementing this program.

Art Lilley, Community Power Corporation, USA
Artsolar@aol.com

While community involvement is desirable for the success of any village level energy intervention, it is important to understand that rural communities are seldom cohesive. It is sad that community participation happens to be the most commonly used but seldom-used-in-practice jargon in the development sector. Let us not fool ourselves by believing that communities are groupings of enlightened souls who care for nothing but good for all! Every community has its own factions and politics. An outsider will not see these or could not help being involved in it during the project. This factor has much wider ramifications than any other in project implementation.

In a former pilot project, we did everything by the book, and got caught in the crossfire of two powerful groups. Unfortunately, the ones who suffered were the low-

income people we were trying to help. We have since modified our productive use business model to avoid getting caught up in a similar situation.

Stephen Karekezi, AFREPREN/FWD, Kenya
stephenk@africaonline.com

Talking from the perspective of sub-Saharan African countries, I noticed that the emphasis in this consultation has been on electricity technologies with limited discussion on bio-fuel technologies for cooking. The coverage of non-electrical technologies for productive uses has been limited. I am aware that the focus of this discussion is institutional but I believe some debate of technology choices would be beneficial.

Experience from sub-Saharan Africa demonstrates that electrical technologies often do not reach a large portion of the rural poor (particularly poor women). There are a large number of non-electrical rural energy applications for productive uses that have registered embryonic success and should be priority candidates for wide dissemination.

Examples of non-electric applications include the following:

- Low cost efficient hand tools, pedal powered water pumps and animal drawn implements, which increase the agricultural productivity of rural Africa.
- Low cost but more efficient biomass-based combustion technologies (e.g. improved institutional bio-fuel stoves, efficient charcoal kilns, brick making kilns, fish smokers, tea dryers and wood dryers).
- Ram pumps for irrigation, which increase agricultural output thus generating income to the rural farmer.
- Solar dryers that can reduce post-harvest losses and enable the rural farmer to market his produce when prices are higher.
- Wind pumps for agricultural irrigation.
- Pico and micro hydro for shaft power that can be used for processing agricultural produce to increase its value.

Some energy analysts question the extent to which some of the above technologies can be considered energy options. This concern is a minor issue as one can draw very useful lessons from field experience of disseminating the aforementioned technologies. The successful example of the pedal powered water pump in Kenya deserves special mention (http://www.approtec.org/tech_irrigate.shtml). Documented impact of the small scale water pump include the following:

- 24,000 pumps in use by poor farmers.
- 16,000 new jobs created.
- US$30 million per year in new profits and wages generated by the pumps.
- 70% of pumps managed by women entrepreneurs (surprisingly high figure!).

- 4 manufacturers producing pumps in Nairobi and Arusha .
- 180 retailers selling pumps in Kenya and Tanzania.

Key characteristics of the aforementioned non-electrical rural energy technologies include the following:

- Very low cost thus affordable to the poorest of rural farmers (especially poor rural women) and entrepreneurs without requiring difficult-to-establish credit or subsidy systems.
- Short pay back periods (typical 3-6 months roughly equivalent to a single harvest season).
- Can be locally manufactured and maintained thus generating jobs and creating upstream rural micro, small and medium-scale enterprises.
- Does not require access to convertible currency and can be operated and maintained using skills that are usually available in rural areas.
- Piggyback on existing rural retail and agriculture extension networks.

These technologies are low-risk (from financial and technological perspectives) and would provide the ideal launching pad for moving to more advanced and higher cost rural electricity technologies. For more discussion on the advantages of above technologies, see http://www.afrepren.org/spskr.htm and http://www.afrepren.org/spskwk.htm).

The rural energy community could draw very useful lessons from work done by rural agriculture and health colleagues who have concentrated a significant amount of their efforts on disseminating small and low cost technologies that are available in the public domain. Examples in the agriculture sector include low-cost water pumping technologies and simple water harvesting techniques. Well-known examples in the rural health sector include ORT and treated mosquito nets. I believe that the rural energy community needs to identify and disseminate similar sets of energy technologies and the aforementioned list could provide a starting point.

Rachel V. Polestico, Appropriate Technology Center, The Philippines
rpolesti@xu.edu.ph

Delivery of Energy Services to the Unserved or Underserved

Those whom we consider unserved or underserved in fact already generate their own energy for their needs. For cooking, heating, and lighting, they use fuelwood that they can gather from their biomass resources, domesticate draft animals or harness water/wind power for their mechanical energy needs. They use the same sources of energy for productive purposes such as agriculture and food processing.

There is wisdom in the experience shared by Stephen Karekezi of AFREPREN/FWD showing how improvements of existing energy technologies do indeed increase income and the wellbeing of the community. South Asia also has this Gandhian tradition of harnessing local resources and improving on existing technologies.

The convenience of just flipping a switch to get the comfort we want cannot outweigh the dependency created, debt burden, and payment obligations imposed on the unserved and underserved by the different modes of energy service delivery. The strategy should be to enhance existing energy technologies, harness them for productive purposes, and with extra income, the families can then afford modern energy services.

Modern energy services and gender discrimination

When fuelwood is changed to bottled LPG, or draft animals by tractors, the women who used to generate and manage the traditional energy services are replaced by men. Justified by the claim that these are ultimately for the benefit of women, control of modern energy services is relegated to men because of their perceived technical expertise to handle these technologies.

I share the concern over the gender implications of transition from traditional to modern energy services. There has been apprehension raised regarding the need for community participation in energy ventures, but women's participation (capacity building, employment and decision making) should argue for community participation otherwise this very important dimension is lost in the drive for speed, efficiency, and profitability of the delivery of modern energy services.

Holistic view of the energy needs of the poor

In most of the modern energy delivery services, there is a focus on one form of technology - electrical grids, solar photovoltaic, LPG, etc. However, observations in households would show rational uses of these energy sources. There may be grid electricity available, but it is only used for lighting and for powering electrical appliances but cooking will still be done largely using fuelwood (as attested by the presence of "dirty kitchen" in even the wealthy households). LPG is used mostly for cooking and rarely for lighting or refrigeration. Solar PVs are used mostly for lighting.

In rural households, the needs for cooking, heating/cooling, lighting, and mechanical energy can be responded to by using different renewable energy sources within a farming system. Biogas digesters can now be cheaply constructed to generate gas for cooking, solar home systems can be popularized for lighting, wind/water whenever available can be harnessed for mechanical needs, fodder and grass can be raised for draft animals. A farming system can be designed so as to make the household energy generating as well as self-sufficient.

These energy sources can also be used for productive purposes. The biogas produce fertilizer that can improve home garden production, solar home lighting systems can be used for battery charging and increase time in producing handicraft or off-farm

products, draft animals, or mills, or turbines can be used for food processing, it also frees human labor that can be devoted to capacity building and for other productive activities.

Experiences of the Appropriate Technology Center and other Organizations

The Appropriate Technology Center has been conducting training for farmers to improve their energy technologies (cooking stoves, biogas digesters, hand or animal drawn mechanical technologies, etc). It also assists different communities in developing and installing appropriate technologies that could be useful for their communities. ATC engages in advocacy work to protect the indigenous capacities to drive their development processes and to enhance their capacities.

ATC linked with the Department of Energy of the Philippine government through the Affiliated Non-Conventional Energy Centers (ANECS) in order to develop the capacity to promote, install, and upscale the use of renewable energy systems such as biogas and solar photovoltaics for remote communities. The process includes organizing communities to install and maintain the systems and for the local government units to provide counterpart contribution for the installation of these facilities.

The VACVINA organization in Vietnam has been active in promoting holistic farming systems that increase farm production through rice-fish-poultry-vegetable-biogas systems. The upscaling of this model has been done through massive campaign, training, demonstrations, and working with the mass-organizations in Vietnam. Publication of successful cases has also increased the adaptation of the techniques.

Bikash Pandey, Winrock International, Nepal
bpandey@winrock.org.np

The issue is not commercialization vs. subsidy. There is a middle path between full commercialization and partial subsidy provision, which needs to be pursued due to the following considerations:

i) Commercialization alone is not going to get services to the millions of unserved and underserved, especially in South Asia with substantial numbers of people with incomes of below US$1/day (in Nepal that is 60-70% of the rural population). At best, commercialization without subsidy will cover a small fraction of the wealthier in a rural community.
ii) Subsidies need not distort the market if they are provided consistently, transparently, and over the long term. Well-designed and administered subsidies should leverage high quality installations and real market competition. Subsidies, which do not provide this leverage will indeed distort the market and will prove to be worse than a waste of resources; they can kill a fledgling market.
iii) Subsidies provide an important handle to bring suppliers to the table to play by a fixed set of rules through which quality control and market competition

can be assured. In a complete free market situation, where the rural customer cannot decipher quality, competition often degenerates into price-cutting at the cost of quality and results in poor performance, and ends up giving the technology a bad name and hence limiting the size of the market.

The Biogas Support Program in Nepal is a good demonstration of how best to combine commercialization and subsidy. Their achievements over the last 10 years are impressive:

- Around 20,000 systems are installed each year by 40 competitive commercial companies. A total of 100,000 high quality systems (97% reliability) are serving around 2.7% of all rural households in the country. Additional 200,000 plants are planned in the next six years. Subsidies currently cover around one third of plant costs but will be reduced to around half of this in six years.
- Real prices reduced by around 30% through effective competition; subsidies reduced in real terms by over 40% since start of program.
- Differential subsidies and penalties used to encourage companies to build smaller plants with higher feeding rates, to connect toilets to plants, and to extend business to more remote districts.

Nepal's micro-hydro and SHS programs are following similar policies but cannot boast such success yet. The real challenge is two-fold: to be able to implement a well-designed program independently but with support from the government, and to find funders with commitment and stamina.

Binu Parthan, IT Power India Pvt Ltd. India
bp@itpi.co.in

Some of the changes considered to be important based on our limited experience in developing and implementing programs/projects in modern energy services are:

- *Shift of Emphasis to Economic Activity:* While scaling up the modern energy service levels, there is a need to ensure that a significant (50-70%) share of the energy is directed towards economic activity, which results in actual income generation.
- *Policy and Legal Framework*: The policies governing the electricity sector should change to facilitate level playing ground/technology neutrality, encourage electricity businesses in the community/private sector and provide legal backing for controlling thefts/pilferage.
- *Development of Service Delivery Models*: Energy service delivery models that could facilitate initiatives to upscale the activity level should be promoted. The model should be based on a commercial framework and

managed by the community or the private sector to ensure long term financial sustenance, innovation and customer satisfaction.

- *Development of Capacity and Partnerships*: It may be necessary to ensure that capacity of the local technical support and financing sources are developed to contribute to the process. Also needed are the linkages to partners who would provide technical and financial support (manufacturers, banks, teachers, technicians);
- Change in Financing Approach: A change in the current financing approach from financing generation and T&D systems to financing economic activities/end-uses, infrastructure for energy service delivery and O&M, enterprise development, rural credit risk management etc.

Chris Lucas, N2Solar
lucas@infonetz.com

Somewhere in here we must make a quantum leap of faith that having Solar power in rural areas is worth the investment by both the World Bank and the UN, whether other sources of funding appear or not. I think they will in time. In terms of approach, a new mode of thought is needed that stresses the installation of Solar energy systems and not how to finance it. This approach involves the creation of multiple teams that are sent to desired locations, provided with all the necessary equipment to install as well as the means, and then turn them loose. For the moment forget all the bureaucracy except the most basic for liaison with each targeted location in analyzing present and future needs and relations with the local elders. Perhaps a basic standard package will result that allows for more cost effective purchasing. After an appropriate percentage of total solar systems to be installed are completed then go to a revolving loan fund to cover costs of maintenance and future equipment replacement. I propose this since due to the stated scope of the GVEP, too many cooks in the kitchen in the form of government bureaucracy, NGOs, and finance organizations will waste both time and money that could have paid for solar systems and their installation. The point of this program is to get power to those without and soon. How an area changes post power will shed a lot of light on its economic future ability to pay to maintain the electric service. Lastly, as wonderful as having power will be, it won't mean much unless the provision of clean drinking water is equally included for a host of reasons, and that is a whole issue in itself and of equal if not greater importance. All this is the KISS (Keep it simple stupid) method of development.

Gerry Collins, Canadian International Development Agency, Canada
info@acdi-cida.gc.ca

Political will, sound legal and regulatory frameworks and strong local participation are necessary conditions, which must exist before the finance schemes are put in place.

The debate about decentralized versus grid electricity is not relevant. In most developed countries, electricity systems started as decentralized systems, which were interconnected as demand grew and economies of scale were recognized. In most cases they started with private sector funding, with cross-subsidies from urban to rural consumers, and generally with subsidies for the extension of grids to more remote communities (nationalization of many of these utilities came later.) In 1999, CIDA funded a study of Canada's rural electrification, which took place over a 40-years period from 1920 to 1960 and the lessons learned are still applicable.

For the problems of scaling up today, we need to look beyond the energy sector for solutions. We need to avoid the technology-push approach, which will only divide us. And we need to understand the local needs before defining a solution. I believe that most of us who are involved in this discussion have a strong grasp of the realities in the sector and of how energy services are necessary if we are to achieve the Millennium Development Goals. Our challenge is to ensure that our counterparts in the health, education, agriculture, water, and small enterprise sectors are brought into the debate. When they understand that energy services are necessary for them to achieve their program goals, they will probably be indifferent as to whether the energy is fossil or renewable, grid or decentralized, or what the policy and legal aspects are. They will want it to be safe, reliable, affordable, and sustainable and that is where our challenge lies.

Joy Clancy and Shirish Sinha, University of Twente, Netherlands
J.S.Clancy@tdg.utwente.nl

The transition towards modern energy forms is slow. Low capacity end users remain dependent on biomass energy even in areas where physical availability of modern energy is not an issue. Our evidence from Gosaba (West Bengal), Kalahandi (Orissa) and Bastar (Chatteesgarh) in India shows that the transition to electricity is more rapid than that to LPG. In part, this can be attributed to the way in which households perceive the benefits of the energy carriers and to whom within the household the benefits accrue. Electricity provides energy services that can be enjoyed equally by all household members, for example, lighting and television. Electricity is also appreciated where it can provide increased income (farming and service providing households). However, LPG is seen as consumptive and only of direct benefit to one household member, the woman. Food would appear on the table irrespective of the energy source used to prepare it. Scaling up needs to take into account that the price charged for energy has to match the

customers' ability to pay, not only in terms of their disposable income but also in a manner that matches cash flows within the household. Our evidence is that electricity and LPG are marketed in a manner that does not match those patterns. For example, single light point connection holders, who are amongst the poorest households, are still billed on an annual basis. The cost of LPG cylinder refills would be quite significant for low-income households around 10% of household monthly income. We can find no evidence of significant electricity use for productive purposes outside of the agriculture sector (irrigation and milling) and services (lighting in shops and entertainment). This reminds us of the well-known dictum: it takes more than energy to generate income. Who then is going to pay for modern energy in rural areas? What about the unserved? Is their welfare (clean water, smokeless fuels) only to be provided for when they have become entrepreneurs? In the context of India, if the un-served are not able to get access to energy even with subsidies then this situation is not likely to improve with the current energy sector reforms, which aim to remove all subsidies.

What we can also not ignore is the electricity sector reform and how it has so far made an impact on access to electricity by the unserved and the underserved. Here we bring the experience of electricity distribution in the case study areas and the different institutional arrangements, which we could analyze. On one hand we had the Electricity cooperative in the Gosaba islands, decentralized and distributed generation based on a 500 KW biomass gasifier. On the other hand we had the electricity grid managed by a private distribution company in Kalahandi, Orissa. If we are looking for experiences in managing electricity distribution in the rural areas and scale up these experiences, then we should look into the problems from both the demand and supply side.

The experience of privatizing the power distribution in Orissa shows that rural electrification has become the worst casualty of the reform process. In the absence of any significant change in the situation of rural electricity in Orissa, the notable development as a result of the distribution privatization has been the formation of Village Electricity Committees or Bidyut Sanghas (VBS), as a solution to managing electricity distribution at the local level. There is no doubt that as a result of formation of VBS, there has been some improvement in terms of revenue collection, reducing losses and thefts to some extent. But the real question is: are these changes happening because rural electricity consumers are suddenly sensitized by the formation of VBSs? The answer is no. The changes, which we are seeing in selected rural distribution areas of Orissa are due to the presence of a dedicated team of professionals managed by XIMB (Xavier Institute of Management, Bhubaneswar) under the project, which are being formed into franchisee in a phased process. Once the franchisee starts operating the VBS would simply fade away. VBS are a useful entry point into the villages and nothing beyond that. So if one has to look at scaling-up based on the limited experience in Orissa, then it is the next step of forming electricity franchisees for an electricity circle or for group of villages, which is the pointer to success.

The Electricity cooperatives are similar to the Electricity franchisee. For example in West Bengal, Singur Haripal Electricity Cooperative has been managing rural power

distribution for nearly 20 years now, in two blocks of Hooghly district on behalf of the state electricity board. Similarly, there are the electricity cooperatives in Sagar and Gosaba islands. Sagar cooperative manages a PV power plant, whereas the Gosaba cooperative manages a biomass gasifier power plant. Both of these are supplying electricity for more than 6 years. In Gosaba the rural domestic users pay Rs 3.25 (7 cents) per unit for 6 hours supply, with minimum monthly electricity bill of Rs 80 (US$1.6). Early this year in Sagar they have even introduced pre-paid cards system, which matches the low income households' purchasing pattern.

We would argue that it is not "public versus private" management that is the key issue. Rather it is individual competences and the freedom to manage in a way that best suits market conditions that is the most likely to deliver energy services to the un-served.

Ganesh Ram Shrestha, Centre for Rural Technology, Nepal
ganesh@infoclub.com.np

There should be a strong emphasis on the need for ownership of energy interventions by the beneficiaries especially by women from the start of such initiatives. There is no short cut approach and such intervention has to be process oriented. At the same time, if such energy initiative is to succeed, it must be part of a strategic planning approach and community led participatory rural development process that contributes towards capacity enhancement, strengthening social institutions and create economic base for rural communities, specially their women. In many projects implemented by CRT/N, this comes to be the key lesson to be taken into account if the scale up has to take place. See Annex 6 for the profiles of these case studies.

Dipal C. Barua, Grameen Shakti, Bangladesh
dipal@grameen.com

In order to scale up the existing successful schemes, Grameen Shakti (GS) believes that commercialization is the only way to scale up of any product-oriented business. Appropriate policy and legal frameworks are essential to develop any such business but only policy and rationalization of subsidy cannot sustain the program. Direct distribution of subsidy led to serious misuse at end user level. It is rather useful to provide this financial strength to the organizations, which have been involved in the capacity building and enriching quality of life by promoting renewable energy services. Once an organization gathers a critical mass for sustaining the program, there will be no need for subsidy for further development. Once the organization develops a big volume of market then it can negotiate the price and quality so end users will be benefitted from this.

Chantal Toutain, Electricite du France, France
chantal.toutain@edf.fr

Appropriate policy and legal frameworks and rationalization of subsidy policies are necessary to extend services to the broadest segment of rural consumers. This is certainly the key element. The provision of rural energy services is currently not a profitable activity for private investors. At the same time there are positive (global and national) side effects in terms of social health, education and general development (positive externalities). A top-up mechanism out of central fund replenished by national and international donors needs thus to be devised to make the playing field attractive for private investors.

Ellen Bomasang, Winrock International, USA
ebomasang@winrock.org

Local or community participation is crucial to the success of off-grid projects. It ensures "project ownership"on the part of the communities involved, promotes improvement of local capabilities, strengthening of community relations, and aids in cost recovery. For a renewable energy program to succeed, the appropriate institutional structures in place must also be effective and the policy framework must be conducive. Commitment by the government is very important, and this should be reflected in its willingness to ensure consistency among national and sectoral objectives, e.g. making sure renewable energy can compete with other technologies on a level playing field.

Establishment of strategic and working partnerships among different sectors, i.e. government, utilities, banking, private sector, and non-governmental organizations can make a huge difference in the success of a project. Under the WB/GEF-supported Sri Lanka ESD project, the involvement of a wide range of stakeholders who could best get the job done under the different components of the project resulted in all project targets being attained and even exceeded. For instance, in the component involving installation of SHS, the accreditation of a micro-finance institution as a participating credit institution led to a sudden upsurge in SHS installations because it was able to better perform the credit provision functions that vendors were originally expected to do (in addition to the task of selling the systems) in the original project design. Also in the SHS component, "smart" subsidies provided by one of the provincial governments triggered high sales in their particular area by lowering the high initial costs of acquiring a solar home system. The important role of the private sector cannot be overemphasized. Experiences under different projects have shown that private companies can effectively and profitably perform the role of service provider.

Investment in market development activities is also crucial to the success and sustainability of a rural energy/electrification program. This can take the form of technical assistance directed at enhancing the capacity of the private sector, concerned government agencies, NGOs, etc to first, learn about the technologies and the associated issues, and then how to properly implement and monitor projects.

Finally, micro finance institutions are a crucial element in successful rural energy service provision as they are more experienced in rural outreach vis-a-vis the commercial banks. They also incur lower transaction costs and are basically more capable of handling financing within the rural context (rather than say, dealers/energy service providers).

It bears repeating that economic development is not guaranteed by providing access to energy alone. For rural economic development to take place, the necessary infrastructure needs to be developed, and there should be a focused effort on the development and promotion of specific income-generating activities. Under many rural electrification projects, although the general lifestyle of the beneficiaries improves with the provision of service, the general economic benefits that can be directly linked to the project are often difficult to pinpoint or quantify. The promotion of livelihood-generation activities is thus an area that should be separately addressed.

Adelia Branco, Brazil
adeliabranco@terra.com.br

The provision of energy services needs to encompass health, education community development and income generation. The provision of energy services should therefore be thought as a very important means to reduce poverty as most of the unserved population forms the most destitute sector of society. In order to achieve success and promote change, this has to be taken into account at the macro policy level. By doing that, a focus on gender should receive high consideration. It is largely known that women are severely affected by the lack of access to energy services or have access to poor services. Yet, only recently they have been thought of as important actors. In many parts of the world, women-headed households are often among the poorest of the poor. By considering the important role the provision of energy services plays in poverty reduction, it should definitely relate to income generating activities. The active participation of women and men, at the community level, in regards to the service they receive, is another important aspect. This is not only a way of empowering them, but is also essential for promoting viability and sustainability.

Sheila Oparaocha, Energia, Netherlands
energia@etcnl.nl

Credit delivery agents that are closer to customers need to be developed. Credit and finance is noted as one of the key areas for enabling women's participation in improved energy equipment. Cecelski 2002, notes that although credit is already a focus of efforts to scale up rural electricity access, women do not have the same access to credit as men do, receiving about 10 percent of credit from formal institutions (see Cecelski's article on www.energia.org). This poses a problem to the up scaling of women productive enterprises as women need access to credit to improve energy efficiency in their micro-enterprises and perhaps as energy entrepreneurs. This also has an impact on the family subsistence because women use additional income from their enterprises for food, school fees, clothes and other basic needs for their households.

A study by Women's World Banking identified a number of financing programs that have been successful in providing micro-credit to women: poverty-focused programs within commercial banks; poverty lending banks; non-governmental organizations; and affiliate network institutions. The average loan size is in some cases in the right order of magnitude for solar home systems, for example. And the repayment rates are quite high, mostly in the high 90s percentiles. However, the effective use of micro-credit requires complementary resources - land, skills, capital - which many poor women lack. Scaling up modern energy services especially to rural areas thus confronts the issues not only of poverty alleviation, but of women's empowerment, as a necessary condition for real development.

V N V K Sastry, Environmental Protection Training and Research Institute, India
vnvk@eptri.com

Problems vary depending on the location of the habitation. Energy crisis has relationship with degradation of natural resources, loss of common property resources, poverty and over exploitation of resources, problems of access to LPG and affordability, forest legislations which hinder provision of conventional power, small and scattered nature of the habitations in remote areas, high cost of non-conventional energy devices, lack of training for maintenance of existing systems etc. are the issues to be addressed. Location specific solutions should be developed. Reducing the burden, improving the economy and health should be the three goals.

Geoff Stapleton, Global Sustainable Energy Solutions, Australia
gses@bigpond.com

Any developing country needing a scaling up of energy services will need to have a supportive national energy policy, which includes renewables among the technologies to meet the energy needs. Such a policy should be based on identification of the real needs of the rural people and what technologies can meet these needs, through feasibility studies.

This policy must be supported by an education program throughout all the relevant government departments (energy, health, primary industries etc) on how renewable energy can provide the services that are needed in the rural areas. This education must discuss that supplying power via Solar Home Systems is not a substitute to grid electricity but a substitute for kerosene, disposable batteries, etc. If supplying energy services in rural areas is required for income generation then larger central hybrid systems might be required to provide sufficient power to small businesses. Political parties must be persuaded that "promising" grid power prior to elections, which will never be installed is disruptive to having a long term energy policy that will provide services to the rural people.

Subsidies is always a sensitive issue but if a country is currently subsidizing energy services then either these should be removed (not very likely in many situations) or subsidies should also be included in supplying the most cost effective energy service to the rural areas.

Some form of finance will always be required for a successful program to be scaled up. Types of financing that will be required depend on what successful program is being scaled up. If the program is selling systems to the end user then micro-finance is required to be available for the end-user. Existing micro-finance institutions must be encouraged to enter this market. Whoever is supplying the systems in this market (small business or a local utility) will need financing to enable purchase of stock and purchase of vehicles and tools to undertake the installation of systems. If the systems are being supplied on a fee-for-service basis then the company/utility providing the service will require financing to purchase sufficient systems to meet the demand in that region/country.

Scaling up successful programs will require suitable training programs to ensure that there is a well trained work force that can deliver the services. This training must be to an acceptable standard and should be incorporated, to the extent possible, in the existing vocational training system available within the country. Training must be undertaken in the following areas:

- ?? Technical: System Design, installation and maintenance.
- ?? Business: How to provide the “service" as a business.
- ?? Sales and marketing.
- ?? Customer service.

Marketing and/or awareness raising activities of how the energy services can meet the needs of the end user must be undertaken. How this is done must be tailored to suit the culture of that country and what communication mediums are available.

S P Gonchoudury, West Bengal Renewable Energy Development Agency, India
wbreda@cal.vsnl.net.in

There are two ways of providing electricity to the people: device-oriented approach and energy-oriented approach. Traditionally the practice is to get energy, put on the switch and get the light, irrespective of where it is coming from. In power sector we have two types of people - electricity producer and electricity taker. The taker may become producer by purchasing an electricity producing device but ultimately he does not want to continue the same. He feels getting a readymade food is better than making it and eat it. As such for a sustainable rural electrification we need sustainable interface between the two local groups: producer and taker. Small home lighting systems or solar lanterns should not be considered under rural electrification program. Lighting and electrification are two different things - decentralized small power plants to produce grid quality power, and providing the same to the people through local grid against energy charge may sustain in the long run.

Sabina Anokye Mensah, GRATIS, Ghana
sabinamensah@hotmail.com

- Increase the use of renewable energy in the remote and poor rural areas where RE presents the best alternative source of energy. Solar PV lighting is a typical example.
- The contribution of bio-diesel could be increased in the national transportation sector. A level playing field should be created for RETs by removing unnecessary bureaucratic tendencies and other barriers and responding promptly to new challenges.
- Inter-regional co-operation could be enhanced where knowledge developed and implemented could be exchanged.
- Comprehensive energy policies should be developed at the national level.
- It is important to create an enabling fiscal and regulatory environment that would stimulate effective participation and injection of private capital into the renewable energy sector.

Hisham Khatib, World Energy Council, Jordan
khatib@nets.com.jo

The most important consideration is political will by the decision makers (in the government), that is currently missing in many countries, particularly in South Asia. No doubt there is good will, but the translation of this good will into political will is still lacking. Without this happening the outcome and results will remain mediocre. Provision of modern energy services, as a pre-requisite for sustainable rural development, is still not in the mind of most politicians. If it existed, it is not translated into action. Lack of funds is always blamed for lack of action, but is this true? In this regard I shall put forth two points:

i) Funds can be raised by many means, including a levy on energy sales/consumption (mainly urban). This levy should not exceed say 0.1 cent per kWh, or 1% of the cost of gasoline. It is modest, so that its burden will not be significantly felt by large urban consumers, but its financial rewards are handsome and can significantly affect availability of funds for rural energy. Such levy can be utilized for provision of rural energy services (mostly rural electrification). For instance, a levy of 0.1 cent per kWh on electricity consumption in India can raise US$500 million annually, and coupled with a similar levy on gas oil sales it can be quite effective in India's rural energy supplies.
ii) Modern technology has rendered provision of rural modern energy services easier, cheaper and more cost effective. For instance PV for individual household rural electrification and LPG in small bottles are most cost effective.

Are decision makers aware of these potentials?

Fouzul Kabir Khan, Infrastructure Development Company Ltd., Bangladesh
idcol@dhaka.agni.com

In order to scale up existing successful schemes or projects to reach those under and unserved by modern energy services on a sustainable basis, the following critical changes need to occur:

?? Generation cost of renewable energy has to come down significantly; e.g. the price of solar panels would be required to be brought down from the current level of US$ 3-3.5 per W_p to US$ 2-2.5 W_p. Prices of storage batteries also need be reduced.
?? Renewable energy sources have to provide services similar (not identical) to grid electricity. Solar electricity has so far proved not to be very

effective in operating basic fan, cooling chamber, or cooking. To scale up use of solar energy, in tropical countries, solar fan and cooling chambers have to be provided to the households.

- ?? Use of renewable energy in income generating activities needs to be promoted.
- ?? Technical support through training of equipment supplier/ implementing agency staff and consumers has to be expanded.
- ?? Risks should be allocated among various parties e.g. consumers, equipment suppliers, service providers, and financiers in a way such that parties are able to bear it.

The first two activities will require low-cost finance for supporting R&D activities. At present, subsidies/ grants are limited to capital buy-down and technical assistance only.

Jyoti Parikh, Indira Gandhi Institute for Developmental Research, India
jp@igidr.ac.in

Subsidy not given to end-users does not reach them. The companies have not delivered in the past in terms of eventual cost reduction. Moreover, thanks to several undesirable rackets, the governments these days are in no mood to help private companies.

Reduction in prices in the long term, persistence of competitive markets and expansion of markets (demand) are the three ultimate tests to know if the subsidy was well spent. If not, subsidy either distorts market or benefits do not go where they should.

Inderjit Singh Anand, India Power Associates, India
isanand@vsnl.com

The scaling up of successful schemes/ projects may need to have:

- ?? Customizing implementation models to specific situations.
- ?? Strong community participation.
- ?? Micro-financing mechanism to motivate the customers to pay for the services.
- ?? Livelihood generation schemes dovetailed to the energy providing schemes.
- ?? Women groups in villages/areas to be encouraged to own and operate household energy programs leading to better health, sanitation and production oriented long term schemes.

- Manufacturers/integrators to be responsible for operation and maintenance for 5/7 years.

Leonard Tedd, ITDG South Asia, Sri Lanka
leonardt@itdg.slt.lk

The following are the recommendations for scaling up:

- There should be small enterprise development activities on a broad scale to promote income generating activities in villages.
- Standards and institutional framework for enforcing quality control mechanisms should be part of the implementation process.
- R&D is essential to further improvement and to address gaps in rural electrification. The cost of R&D cannot be borne by communities.
- Ensuring legal status of such schemes is important, for example their status with energy sector reform.
- Regulatory bodies should have sufficient outreach to be accessible by communities, and can link with decentralized government priorities.

Teodoro Sanchez Campos, ITDG, Peru
teo@itdg.org.pe

Regarding financing, poor people in most countries cannot afford not only the capital cost, but also the necessary pre-investment costs. Therefore appropriate financial mechanisms are needed, but these should have a strategy to categorize the groups according to their capacity to pay (pre-investment and investment). However, people should pay fully for the operation and maintenance. Also, local capacity building (at village level) is very important in order to reduce costs for operation and maintenance.

Existing organizations, which are already providing some sort of technical assistance should be strengthened in order to be more efficient and reach more villages, successful experiences of this type should be disseminated and visited by those institutions in the field. They need to widen their views and appreciate other realities in order to understand the needs for dissemination of lessons learned.

The issue of markets is perhaps much more important than that of productive uses. People need to know what sort of markets they are aiming to, because productive uses to sell among themselves would be only a part of it. Processed products should go to external markets in the order to bring income to the village.

Khamarunga Banda, Minerals and Energy Policy Center, South Africa
Khamarunga@mepc.org.za

Poverty is central in issues of access and affordability and the feminization of poverty in rural areas of developing countries points to the need for a gender focus in energy services.

On the issue of income generation, there is a need for link with provision of other services (community services, e.g. child care) as increasingly women become involved in income generation and the children, especially girls and the elderly have added burden of childcare and household chores. Therefore a holistic approach is required that examines all aspects of micro level dynamics.

Ibrahim Togola, Mali-Folkecenter, Mali
ibrahim.togola@malifolkecenter.org

While involvement of local population is important at every stage of the project, it is still not the case in many projects. Most of the projects are donor-driven West Africa. When these projects fail, the project reports do not admit the shortcomings of their approach, but usually blame the people and the country, or the specific technology used that was not appropriate. In Mali and other West African countries we have access to technologies such as improved stoves, household biogas plants, plant oil technology like jatropha, solar heaters, etc. But when villages with support of NGOs want to promote these specific technologies, it is not easy to find a financial partner to support the project or program as everyone will refer to the failures of the donor-funded projects. In this situation with local municipalities and population, Mali-Folkecenter is working with the assistance of Malian government and donors to promote household biogas plants, plant oil like jatropha as substitute to diesel for running engines, rural solar training schools for capacity building to local people for maintenance, promotion of local private sector in provision of clean energy services, etc. In all these activities we are considering the lessons learnt from previous projects and programs for making our interventions with local people more sustainable.

In Mali and most of the West African countries, one of the priorities of the governments today is the rural electrification. But electrification will not solve all the difficulties of rural population, so it is important to consider the provision of sustainable modern energy services and not concentrate all the effort on electricity alone. Mali has taken lead in this with the creation of National Agency for Domestic Energy and Rural Electrification.

Peter Davies, DFID, United Kingdom
P-Davies@DFID.GOV.UK

A proper legal and commercial arrangement between the various parties, including end-users, is essential for viability and sustainability, with the power to enforce contracts. Informal arrangements may work on a small scale but will not provide services on any scale.

These commercial arrangements must include economic incentives for the service provider to perform, with rewards for good performance. End users are willing and able to pay for good services. Users are not willing to pay for poor services or the promise of future improvements. (By the way, if the utility is unable to provide a proper customer service, users will take other measures to secure a connection, rather than be left in the dark.)

This is the basis for the rather surprising success of a rural electricity services program DFID has supported in Orissa, India. The first phase was the setting up of village electricity committees, with proper terms of reference. They entered into a formal agreement with the electricity utility, with obligations and responsibilities on both sides. The result was a large reduction in power theft and losses, improvements in revenue collections and much improved services. About 5,000 villages now have this kind of arrangement, which is based on local participation. The second phase is the establishment of local franchises for defined rural areas for all customer services, leaving the maintenance of the "wires" with the utility. The franchise agreement must be carefully designed and includes strong incentives for the franchisee to exceed stated targets for losses and revenue collections within the franchise area. This is an example of a proper commercial arrangement for providing rural energy services. It is a model, which can be tried more widely, adapted to local conditions.

Pradip Jayawardene, Solar Industries Association, Sri Lanka
pradipj@sltnet.lk

A lot of focus has been on making the financing reach the customer. In Sri Lanka, we overcame this problem at Shell Solar Lanka (Formally Solar Power & Light) by creating a comprehensive working relationship with a Micro Finance Institution, SEEDS. This partnership meant that each party could focus on its specialized area to scale up the program. SEEDS concentrates on securing good borrowers and creating the credit approval/collection infrastructure while Shell focuses on sales and service of SHS. In recognition of the value of SEEDS, halfway through the project direct access was given to SEEDS to obtain funds from the WB window.

A second but poorly understood factor is the significant investment required to scale up despite having an effective credit scheme. More than US$2 million was invested in the business for it to grow to its present level. Much of this investment has been used

in stock, which has to be available at village level. Due to the highly decentralized nature of the business, stock has to be available with salespeople in almost a hundred locations, this is further compounded by the fact that the market has been growing rapidly, requiring even higher levels of stock to satisfy customer demand. The main reason for the investors of Solar Power & Light Co., to bring Shell in as an equity holder was access to capital, without which the significant growth in the Sri Lanka market could not have been achieved. Shell is still over 50% of the Sri Lanka market of installed SHS.

The results of both effective rural credit and investment in rural sales infrastructure speak for themselves.

1999 - 400 systems (SEEDS Credit arrangement & Shell Investment starts)
2000 - 1900 systems
2001 - 4500 systems
2002 - 6900 systems

Preeti Malhotra, TERI, India
preetim@teri.res.in

Instead of getting into a debate of grid vs. off-grid, we need to concentrate on what is suitable in terms of providing quality energy services in a reliable and affordable manner. Unfortunately, we in India are still tied up with targets (electrification of “x”number of remote villages with renewables, etc.) and the “markets”are yet to develop in which all forms (fossil, renewable) can compete for providing the best service to the people (the REST initiative of the Ministry of Power, Government of India is worth looking in this context).

We have also looked at energy as the end and not as a “means” to finding solutions to problems in other sectors. It is time that our colleagues working for providing other basic services need to be brought into this debate (the INSTEP initiative of TERI is addressing this).

As far as local participation is concerned, at least some talk has started at the level of the governments. However, the treatment given is only cursory. I don't find many governments participating in this discussion.

Vaidyanathan Ramasubramanian, Sahyadri Energy Systems Pvt. Ltd., India
tell_rams@yahoo.co.in

Financing

i) There is a sudden spurt in sales of four wheelers in India. This has been possible only through the easy finance schemes of the various banks, which have tied up with the major manufacturers. When it comes to renewable energy financing the same banks/institutions don't want to share the risk - they want to pass it on entirely to the customers - making their service very expensive/difficult to procure. There is a need to ease up the procedures.

ii) Financing is the major stumbling block for replicating the renewable energy systems. Though the technology has been proven elsewhere, there is hardly any affordable financing available for micro hydro in south India- especially for pre-feasibility studies. End users don't want to pay for this important step since they can't directly relate to the importance. Technical studies have to be funded by some other mechanism (climate change funds could be an option).

iii) Most of the financing institutions and end users still see this as technology risky as there are not enough examples around.

iv) Financing institutions, which have some experience in at least one of the renewable energy technologies should develop a general policy / framework for other RETs too.

Technical

i) Lack of information (and thus awareness) about this RET (micro hydro) makes many potential customers shy away from further initiative. RET practitioners are at great disadvantage here as they are not able to do this out of their limited capital sources. Assistance in the form of promotional activities like exhibitions/funds will be very helpful. This could be undertaken by the existing state RE agencies in India.

ii) From the initial stages, the customers have to be assured of a good after sales service. This is a typical chicken and egg problem. Unless there is a good number, the practitioner could not afford to have local service centers. Unless he has this in place, he can't have the confidence of the customers. Financing support for such local infrastructure will greatly help.

Community involvement

It is sad that this happens to be the most commonly used but seldom practiced jargon in the development sector. Factions and divisions among communities are a reality and have to be dealt with if their participation has to be ensured. The trick here is to learn how to be neutral to the different sections of the community. More often, the women of a community have a much more honest approach and this is one more reason that their involvement should be made an essential part of the projects.

Veena Joshi, Swiss Development Cooperation, India
veena.joshi@sdc.net

To address this question in the Indian context it is important to have an overview of who are the "well served by the modern energy services", i.e. electricity in this case and how "well" they are served. The well-off in the cities seem to be the "well served". They manage their needs by depending on electric supply, generators, inverters emergency lamps, etc. to cope with scheduled and unscheduled power cuts. As is obvious from this list of how, the needs get adjusted to match the purchasing capacity and what is available. This prompts the question "do we need to look critically at our needs in these modern times to align them more towards sustainability and less towards what is commonly understood as modernity". So only a very small minority is well served by modern energy services at the cost of the large majority.

The majority people's access to modern energy services is constrained by policy frameworks, legal frameworks that seem to limit their growth prospects i.e. lack of policies to promote their growth and not the growth of markets as seen today (i.e. largely as a link to bigger and far-off markets). In the context of this dialogue, it seems important to look into the successful interventions in the lighting sector that have led to enhancement of productivity. Such an examination should be from a market perspective i.e. whether the profitability of the poor increased. Such an analysis may lead to possible initiatives that need to accompany the lighting initiatives that will shape the local markets to benefit the broadest segment of rural consumers. This may also necessitate looking at different market segments and their interrelationships.

Without including strategies to strengthen the local markets it is not possible to reach those whom we desire to reach with modern energy services on a sustainable basis.

Indrani Hetttiarachchy, SEEDS, Sri Lanka
solar678@sltnet.lk

The service should be within reach of the rural community. Therefore the price should be affordable. This could be done in many ways.

i) Government Policy: If the equipment is imported it should be on concessionary import tax or with no import and other taxes. Suppliers should be given incentives to encourage more investment. End user could be served with a subsidy to enhance purchasing power.

ii) Availability of finance - Rural unserved community has low purchasing power. If the service is made available on credit basis, perhaps affordability could be reached.

iii) Service to reach more consumers it is very important to win their confidence. For this it is essential that the scheme and projects should have more stringent measures for consumer protection. Technical soundness on the equipment and good after sales service are very important. More programs should be conducted on client education on new technologies. Equipment and services should be demand driven and not supply oriented.

iv) Capacity enhancement of credit delivery agents is an important matter as the traditional credit providers such as Commercial Banks would not prefer the segment of rural poor in their financing programs. Handling large volumes of credit enforces additional problems such as proper management of risks. Heavy capital expenditure for system development, and transport facilities are the constraints faced by the financing institutions. Financing rural poor is on very thin margins. Therefore improvements are also unlikely to occur unless it is made affordable to the credit providers in different ways.

Udaia Kumar, SHARE MicroFin Ltd. India
sml@sharemicrofin.com

Today different schemes fail to pick up the needed impetus because of several reasons.

Financing

Before we choose to enter into a market, we need to study its characteristics and understand its behavior. Is there need for the product? If there is a need, is it a latent need or a more obvious one? Studying these aspects will make us clear of our direction. The following steps need to be followed:

Market research: This involves market scan, understanding market characteristics, market responses, and market potential. Market Research helps us understand and forecast what the demand could be and how can it be serviced. Unless market research is done, it becomes difficult to gauge the demand for a product.

Feasibility Studies: Feasibility Studies are necessary to see the practical implications of the project. You cannot launch a product into the market without checking for its feasibility. Once the feasibility study is done, action to be taken can be determined.

Create Market awareness: Since the product is new, awareness needs to be created. Awareness campaigns have to be launched initially to create a feel of the product

in the market. Demonstrations of the product can be made in order to promote visibility. Awareness on the usage of the products is very essential.

Action Research Project: The Action research project can be for a period of 1 year where the project can be tested on a full scale. Demonstration units can be set up so that the products can be tested for reliability and usage time. This will help in kick starting the project. At this stage, measures can be taken for problems encountered.

Access to Credit: In order to sell the product to the rural population, there should be credit facility extended to them because the initial investment cost is quite high. The poor should be given access to credit for them to purchase energy services.

All the above activities need financing. This support needs to be extended to scale up operations of NGOs/MFIs who are involved in micro credit and are also interested in promoting energy services through their large member network.

Technical Support

Sources of Funds: Practitioners' need to provide the rural clientele with access to credit for them to make use of the alternative energy resources. The investment in these energy resources should lead to income generation. So, practitioners need to access cheaper source of funds so that they can lend to the end user at a low cost. Practitioners should be able to access funds spread over a longer duration.

Training and capacity building Support: A specialized team from the MFI/NGO should be trained on the various energy resources and how they can be used and what the advantages are. Specialized teams are required to promote the product efficiently.

Training for the end users: The end users of the products also need to be trained because lack of awareness would lead to non-usage. The initial inertia will remain if training is not imparted. The rural consumers should see renewable energy services as an opportunity to increase their productivity and thereby their incomes.

Establish Technical Support centers: After sales service is of vital importance for a new product. Technical support centers need to be set up in rural areas for faster and reliable service.

Markets

Market Awareness: The rural market is still nascent and remains unresponsive to alternative sources of energy. This is due to lack of awareness. So market awareness becomes an important ingredient while promoting a new product. Awareness camps and workshops can be organized for the end users. Newspapers, television, clippings in cinema halls, radio, pamphlets and brochures can be used to create market awareness.

Appropriate Policy, Legal Framework and Subsidies

Development institutions should provide subsidized financial assistance to Micro Finance Institutions by way of soft loans for a longer duration of time so that clients can pay lesser interest spread over a longer period of time.

The government should undertake such projects that commercialize renewable energy supporting income generation. For instance, local charge stations can be established and equipment rented out for a nominal price initially. This would help in promoting the product by increasing users and reducing initial investment costs.

Richard Hansen, Soluz, USA/Dominican Republic
rhansen@igc.org

A critical change needed for scale-up is to clearly target more of the scarce developmental funding to directly support the organizations that will actually deliver modern energy sources. This requires first answering the question: Who will provide rural energy delivery service - government agencies or NGOs or private companies?

In numerous countries, and in most large World Bank projects, the emerging consensus appears to be that, while governments have a critical regulatory and enabling environment role, and NGOs have an important charitable role, especially in heightening social impact, and the private sector is the logical and expected provider of modern energy services. The private sector, it is hoped, will even provide some of the capital needed -- which will necessarily require a pathway to profits. Clearly hundreds of competent, profitable rural energy delivery companies -- REDCOs -- must be developed and many thousands of technicians employed and supervised if substantial scale-up is to be achieved.

Numerous examples of profitable REDCOs are needed to establish a positive track record to spur growth. While most PV projects to date have expected companies to sell, install and maintain the PV systems -- essentially doing the bulk of the hard work to reach the rural poor -- direct funding for REDCOs relative to amount of resources being dedicated to PV dissemination over the past decade has been very limited. Scarce international funds are typically spent on related areas, such as informational seminars, consultancies, policy analysis, government agency support, but little is focused directly where the impact would be greatest: supporting REDCO development to create early successful business models.

RETs are often the least cost option to electrify many off-grid facilities. However, if the only source of funds available to REDCOs -- to develop operational innovations, design appropriate technology applications, build delivery infrastructure and cover related lessons/risks -- is a revenue stream from payments made by the rural poor, then the rural energy delivery business will not be an attractive one and will therefore not grow very fast. Thus a clear focus on supporting pioneering REDCOs is essential. There are four critical pieces to this REDCO support:

- Innovation/Methods/Infrastructure - cost-share type contracts to develop/refine/adapt business models and start-up infrastructure.

Innovation and methods are required for energy delivery operations as well as important applications like income generation.

- Electrification/Energization Rollout - Performance "output-based" contracts for the actual rural electrification to be paid for each customer connection. This would provide incentive for advancement based upon monitored results. REDCOs can also deliver LPG for cooking to their rural customer base with the same infrastructure. Electricity is not efficient for cooking.
- Financing for Assets - Access to appropriate developmental financing to finance the hard energy system assets such as PV modules, wind turbines, pico-hydro turbines, and biomass gasifiers. The financing would have to be appropriately priced -- at least 10-year terms (15 to 20 years is even better) with less than 5% interest rates if in dollars, or even lower-interest loans in local currency.
- Customer Subsidies - A REDCO will, of course, develop a customer revenue stream, but this too may need to be assisted by partial price subsidies to help the REDCO serve the "rural poor" in a well-planned manner. Preferably the subsidy would be for the non-recoverable wiring and BOS (balance of system) installed in the buildings while removable hard assets (such as PV modules) are financed and serve as collateral. This is not promoting "corporate welfare", just solid contractual agreements that assure fair compensation to REDCOs for the value of developing innovative methods and accomplishing the hard work of providing the quality rural energy services that are so important to meeting development goals.

Tom Burrell, Mali-Folkecenter, Mali
tom.burrell@malifolkecenter.org

In order to see a real wide scale adoption of RETs, the policy environment is of course critical, especially if the poorest of the poor are to be brought into the energy supply equation. In Mali the situation is under a period of rapid change, with a large World Bank/GEF/UNDP project about to start which should promote renewables in rural areas, as well as a new concessions system for private sector operators in rural areas.

Already the government of Mali has implemented an exemption on tax for renewable energy equipment, brought forward with the support of the Malian renewable energy private sector and NGOs in the domain. This has so far been for a trial period, after which the policy will be evaluated to see what real effect it has had. Therefore there is pressure on the private sector to pass savings on to consumers, and to widen the market so that the policy will continue in future. That provides a stimulus to activities in general. But it would be great to have a Ministry for Non-Conventional Energy Sources in every country, like India?

The new World Bank / GEF /UNDP project will seek to provide subsidies for rural electrification to operators who want to provide electricity on a fee-for-service basis in rural areas, and for many villages this will mean solar PV domestic systems. Rural electrification in developed countries has largely been achieved through subsidies, so it seems logical to apply this approach in developing countries too. However, care needs to be taken to make sure that it is not only the wealthy regions of a country that benefit from this. In Mali, the cotton producing south of the country with its relatively high levels of income is a far more interesting potential market than the semi-desert and desert in the north. There is a need for mechanisms that will make sure electricity supply makes it into different areas. Perhaps varying subsidies according to regional conditions could be one way of doing that.

It is also important that new initiatives do not strangle existing small businesses who have been working in the field for years, without the benefits of subsidies. These businesses are vital to the development of countries like Mali, providing jobs and incomes. It would be a shame if such companies could not benefit from the new initiatives.

The new conditions for promotion of PV in Mali are expected to create a significant demand for well-trained and qualified rural technicians, capable of operating and servicing installed equipment. Therefore some kind of associated capacity building should be an important element, making sure there are the human resources necessary for execution. Training is an expensive business, and not something that companies prefer to invest in (although it is often necessary). Subsidized training programs or support to existing training institutions could improve the speed with which initiatives can progress.

The question of financing for solar rural electrification is a much-discussed issue. Everyone knows that the high initial investment costs are prohibitive to many people, so there is a lot of interest in appropriate credit facilities for purchase, or on fee-for-service production. There is no doubt that these options put solar energy within reach of a much greater proportion of people, but it is important also that clients are offered a real choice as to how they want to pay.

One interesting idea that has been put forward is that of energy extension services, a model based on that of agricultural extension services. When any new technology arrives, it takes time for consumers to learn to make informed decisions about what suits them best, whether it is in the field of agriculture or energy. Therefore a network of energy extension agents could provide impartial advice to potential clients on technology choice. This could also help ensure a level playing field.

Verónica Potes, Latin American Energy Organization, Ecuador
vpotes@olade.org.ec

The OLADE project is basically aimed at promoting rural energy services. We will engage in pilot projects aimed at development purposes through energy provision. It is a joint initiative between the Latin American Energy Organization (OLADE) and the University of Calgary, Canada. As opposed to previous programs on rural energy that have been directed top-down, we are aiming at what most voices in this discussion have advocated: facilitating communities to find appropriate means of development. This sounds nice and correct but may not always be easy (local politics, legal barriers, what does real inclusiveness means, sustainability issues, local empowerment, gender equity, etc.). At the same time, we will also work on gender promotion both from a project design and implementation perspective and policy making as well. We will have a component that will specifically address indigenous peoples' perspectives on energy for development and conflicts between people and electricity projects (dams, transmission lines). We are going to work in four countries in the LAC (Latin America and the Caribbean) region along a 5-year timeframe. Implementation and follow-up of pilot projects will be the basis for the elaboration of guidelines for rural energy policy for OLADE member countries. For this purpose, scaling up is also a very important issue. We are at the preparation stage of the program.

Kamal Rijal, UNDP, Thailand
kamal.rijal@undp.org

Ownership of any intervention needs to be of the beneficiaries themselves from day one. Realizing the fact that women are the primary beneficiaries in managing household energy systems and involving them accordingly is a key factor for success. Lip service at various levels is not sufficient. Experiences have shown that entry through women's group leads to success, but process may be time consuming. So, many of us tend to follow the shortcut, which is not sustainable. At the same time, interventions need to be strategic and process-oriented rather than target-oriented. Another important critical factor would be - how outsiders (interventionist) present themselves in rural communities or how communities view (read) them. Blueprint approach of replicating "success stories"/ "best practices" has failed so far. Adaptive and innovative approach needs to be the guiding principle.

S Govindarajan, Xavier Institute of Management Bhubaneswar, India
S_Govindrajan%XIMB@nts2.ximb.ac.in

The Xavier Institute of Management, Bhubaneswar has been working in two of the poorest districts in Orissa Kalahandi and Nawapara. In these districts, 65% of the villages having electricity have hamlets, which are barely half a kilometer away and do not have access to electricity. The expansion of the grid to these hamlets will cost close to Rs. 220 million (US$4.4 m) and end up supplying power to consumers who are cross-subsidized by industry. Electricity distribution in Orissa has been privatized. It will be hard for a privatized utility to justify such an expansion of grid to its shareholders. The only solution for grid expansion will have to come in the form of large capital subsidies from the Government or by off-grid solutions. The former remains a perennial question mark both in terms of intent as well as scale of implementation. Off-grid solutions look more viable.

The challenge for ensuring that access to electricity increases is in designing off-grid solutions, which need the lowest amount of capital subsidy and no revenue subsidy. This design will ensure scalability. Models, which depend on too much of capital and revenue subsidy, will remain isolated pilots with low scope of scalability. The key inputs that will be required for kick starting this on a large scale will be access to finance at low cost (which acts as the capital subsidy), clear regulatory parameters for operation, and strong NGOs for implementation.

Even electrified villages in rural India need attention. These areas may not be "unserved" by electricity but continue to suffer from poor quality of electricity. Being classified as a consumer in an electrified village and getting 40 volts of electricity does not make much sense. The intervention supported by DFID in Orissa and other states in India (see Peter Davies's intervention) outlines a model, which has been tested and has scope for replication.

Question 2

What best practices and principal lessons have emerged from your experience to date, which could be replicated elsewhere?

Adam Friedensohn, Himalayan Light Foundation, Nepal
adam@lotusenergy.com

There are two perspectives: i) events that helped private sector do its job in service provision, and ii) events where NGOs paved the way for better service provision. One very effective technology entry vehicle has been when NGOs collaborate with the private sector for a technology introduction demonstration, financial analysis, policy reform and risk mitigation. Without practical demonstration of technologies the private sector will not risk entry whereas NGO front-ended demonstrations pave private sector entry for a new field investment provided the NGO had also affected some positive governmental facilities to encourage the sector. Some examples in Nepal are:

- Solar energy for villages front ended by SELF initial project, then US State Department's support of LEVEL-UP solar program leading to a full fledged industry with over 20 competing companies providing remote solar services, and a tax waiver for manufacturers from the government.
- Electric vehicles based on USAID Clean Three wheeler EV demonstration program resulting in dramatic tax reduction facilities for local EV manufacture (currently 600 units produced and operated by private sector)
- Solar Ozone water treatment systems used for income generation in the Annapurna trekking region.
- By joining hands with 1000 branches of the local Agricultural Development Bank of Nepal, the Nepal government was able to effectively provide credit to a wide geographical base within the country. The existence of such a unique government bank for remotely disbursed populations is noteworthy.
- Himalayan Light Foundation's Home Employment and Lighting Package was GEF funded for proof of concept and is in replication stages proving the value of i) drawing additional revenues into financing schemes for the poorest of the poor, and ii) assuring that the poorest of the poor have access to credit without typical bank collateral.

Government tax reduction on RETs, government prioritization of reaching remote dwellers with electrification facilities, donor responsiveness to align with implementing local private sector are all important elements of success that we have in Nepal.

Lalita Balakrishnan and Pooja Talwar, All-India Women's Conference (AIWC), India
aiwcctc@nda.vsnl.net.in

AIWC has been a Nodal Agency of the Ministry of Non-conventional Energy Sources (MNES), from the early 1980s, to help implement the National Project on Improved Cookstoves (NPIC) and the National Project of Biogas Development (NPBD).

Experience has shown that different tax structures in the 26 states of India impede the growth and progress as each state has its own rules and regulations for the sale of Renewable Energy Devices. There should be uniform tax concessions throughout the country. Anything given free has no value, therefore one should charge a minimum fee even from the poorer sections of the society, otherwise they would not have any respect for what they are getting. In the stoves program it was seen that wherever the beneficiaries had involved themselves from the beginning, i.e. they could choose their own model, the program was successful and long lasting.

Integrating renewable energy programs with micro credit schemes is one way of empowering the poor women, apart from providing them with income. It helps generate self-confidence among the poor and creates dependable support mechanism in any crisis. A good example is the village Nallajerla in Andhra Pradesh state near Kakinada, where poor women from Self Help Groups have taken up the propagation and use of a new permanent cement wood stove model. Twenty women were trained by AIWC in the construction of these stoves and they in turn construct the stoves in the beneficiaries' houses for which they earn a fee. The members of SHGs have used their loan money taken though the micro-credit program to pay their share for the stove, which they have returned in easy installments.

Though women are the end users of stoves, biogas plants and solar devices for cooking and lighting as well as manure for their kitchen gardens/small land holdings, they are unable to procure these systems owing to the following reasons:

- Women do not have the decision making power to select the device; and
- Poor women do not have enough cash flow to pay for the up-front cost of the devices.

Self-Help Groups (SHGs) have been the answer for this all over the Asia Pacific region where women have been empowered through micro-credit, and women are slowly emerging as decision makers also.

Monitoring and training are other crucial aspects in implementing sustainable energy programs in the rural areas. AIWC has conducted a small number of awareness programs for the elected women (under a constitutional amendment in India, women have a 30% reservation in public administration and executive positions at the village panchayat level), but there is a need to expand the program substantially. If enough funds are available, AIWC could conduct these awareness programs throughout the country

through their 500 branches and partner NGOs, integrating important issues like health, education, renewable energy, water and sanitation programs.

B Parthan, IT Power India Pvt Ltd. India
bp@itpi.co.in

Some of the practices and lessons with replication potential based on our association with rural energy (both electrical and mechanical) service programs include:

- Establishment of a guarantee facility to buy down the risk of lending to rural customers by private financial intermediaries. The guarantee facility encouraged the financial intermediary to offer financing instruments for rural was systems, which was otherwise considered as a risky business;
- Improved installation and design practices through an institutional framework for training and certifying design engineers and installers of systems;
- Encouraging good quality system integration and service delivery through a rewards and penalties system linked to an effective monitoring program for service/system providers;
- Ensure superior technical performance in the field through a framework of technical standards, testing, certification and quality assurance system for off-grid system components; and
- Increase ownership and role of community level associations/institutions, compatible with the local environment. Ensure that these entities have a significant role in the project/program development as well as O&M decisions.

Dipal C. Barua, Grameen Shakti, Bangladesh
dipal@grameen.com

From our experience, we found appropriate and innovative financing mechanisms including risk mitigation measure and productive use for income generation like cellular phone operation as well as after sales service is the key of success and which can be replicated in any developing country. Considering the socio-economic situation in Bangladesh, we have adopted innovative financial engineering. We offer solar home systems with 15% down payment and rest of 85% is collected within three years through 36 monthly equal installments. This monthly payment is equal to or less than what they are used to pay for purchasing of kerosene for lighting their home or business premises. We offer to buy back the system if they could not pay the monthly installments or if they get grid electricity. This system instills confidence among the people. At the completion

of the payment after three years, customers receive an ownership certificate with an umbrella as a gift, which is most handy for rural people during summer and rainy season. Ensuring after sales service is a big challenge for solar home systems. As such the systems are installed in remote rural areas where technological development is very poor so to ensure the backup service, dedicated technical people are required. In addition, social motivational work is required for the acceptance of the society. GS employs engineers and technicians to ensure maintenance services, who go on to become social engineer, and take up motivational work, too. Our field offices provide easy access to our users. In addition, we provide training to the customers and local technicians and distribute brochures, posters, etc. for awareness creation. To encourage students who use solar light to study, we introduced Solar Scholarships (50% each for boys and girls) for those who excel in academics.

Chantal Toutain, Electricite du France, France
chantal.toutain@edf.fr

EDF's (and e7) activities in rural electrification have so far been “loss-leaders”, i.e. EDF and other e7 companies have absorbed the full costs of its investment even if these investments were not yielding positive rates of return.

K.M. Dharesan Unnithan, Energy Management Center, India
emck@vsnl.com

Energy Management Centre - Kerala is giving more attention to women population for conservation of Energy, there by reducing the time taken for cooking (mainly using firewood), improving the health conditions, and reducing the per month energy cost. Proper training of rural/urban women in simple conservation methods will lead to significant energy saving. EMC has a unique program called "Energy Clinic", in which trained women volunteers demonstrate the use of energy efficient gadgets like CFL, Pressure Cooker, Nutan Kerosene stove, Thermal cooker, Electronic chokes, etc. to the local women. These programs already gave exposure to over 30,000 women in the last few years.

Sheila Oparaocha, Energia, Netherlands
energia@itcnl.nl

?? Financing energy services and income-generation for the poor, including women - the ENSIGN project of the Asia/Pacific Development Centre and

UNDP, combines micro-credit loans for energy services and for corresponding income-generating activities, co-financed by a revolving fund and national financing institutions such as the Self-Employed Women's Association (SEWA) Bank, with average income growth of 66% in the participating households (Source: K.V. Ramani, "Energy As an Instrument of Women's Economic Empowerment," ENERGIA News April 2002).

- In Nepal, enhancing rural livelihoods through decentralized and people-centered development based on the promotion of rural energy technologies, especially micro-hydro as an entry point, has been the focus of the UNDP Rural Energy Development (REDP) Program in Nepal, with a community mobilization process designed to promote gender development for equity and equal access (Source Arzu Rana-Deuba "Nepal: Rural micro-hydro development programme" in UNDP publication "Generating Opportunities; Case Studies on Energy and Women", April 2001).
- Small engines to which a variety of end use equipment can be attached (mills, alternators, oil presses, etc.) are being promoted through women's associations in Mali as a rural enterprise, to address rural women's need both for income and for time saving, and especially to help solve bottlenecks in time and energy intensive multi-tasking activities such as post-harvest food processing (grinding, de-husking, oil extraction) in which rural women presently use only their own labor (Source: Burn, Nalini and Laurent Coche, "The Multifunctional Platform: Decentralized Energy for Gender-aware Poverty Reduction in Rural West Africa," ENERGIA News vol 3 Issue 3, October 2000).
- The Vietnam Women's Union, a nationwide social service organization, has been active in the promotion of solar home systems, supervising motivators who sign up households and administering a revolving credit fund, to meet the electricity needs of the 70-80% of rural households (Source: Everts, Saskia and Bob Schulte. 1997. "Vietnam Women's Union Promotes Solar Energy", ENERGIA News, vol. 1 no. 3).
- Improved cooking stove projects have saved woodfuel, women's time, and costs as well as their health in several countries in Africa. In Kenya, a cost-benefit study showed that users of the Upesi stove saved 10 hours per month on gathering fuelwood, and savings of up to 75% of annual income per year, while reducing smoke emissions by 60%. Household energy programs also produced additional income opportunities for craftspeople and strengthened the confidence and self-help potential in women's organizations (Source: Beatrice Khamati Njeng. "Kenya: Upesi rural stoves project" in UNDP publication "Generating Opportunities; Case Studies on Energy and Women", April 2001).
- In 13 village solar pumping projects in Brazil, women's participation in the maintenance of wells was integrated with education on health matters

relating to drinking water, childcare, etc., and proved a key factor in the trouble-free operation of the solar pumps and effective enhancement of public health in the villages where the pumps were installed (Source: Kennedy, Ellen B. and Rosana Rodrigues dos Santos. 1998. "International Programmes: Focus on Winrock International", ENERGIA News, vol. 2 no. 1).

- Women in the Solomon Islands have been addressing their community needs by using electricity from hydropower. They recognized the value of electricity in providing amenities for young people, which would encourage them to stay in the villages and so retain the social fabric and economic stability of the community (Source: Cecelski, Elizabeth, "The Role of Women in Sustainable Energy Development", National Renewable Energy Laboratory (NREL), Golden, CO, June 2000).
- Women in Bangladesh are becoming energy entrepreneurs. 33 rural women in Char Montaz are engaged in construction and sale of efficient fluorescent lamps. More than 600 lamps have been sold for use with small batteries, lighting houses, shops, fishing boats and mosques. Constructing and selling two lamps per day increases the woman's household income by 100 Taka (approximately US$2) making her earnings comparable to that of a skilled laborer. Not only does her household benefit through increased purchasing power but the woman's social status also improves (Source: Hasna J. Khan. "Bangladesh Battery-operated lamps produced by rural women" in a UNDP publication "Generating Opportunities; Case Studies on Energy and Women", April 2001).
- In Tunisia, the longstanding (mainly grid) rural electrification program appears to have achieved significant benefits for women, by explicitly integrating rural electrification in a national rural development policy in support of education, health, and gender equality. A 2001 study on user perceptions of benefits illuminated a number of positive linkages – according to users - between rural electrification and education, health, and the quality of life. Women and girls in particular appear to have benefited from improved access to education, health services (especially reproductive health), information from TV, and economic opportunities (Source: Elizabeth Cecelski, Ahmed Ounalli, Moncef Aissa, Joy Dunkerley "Rural Electrification in Tunisia: National Commitment, Efficient Implementation, and Sound Finances" report to ESMAP, World Bank, Washington, DC, January 2002).
- In Sonora, Mexico, a group of women from one of the poorest neighborhoods, calling themselves Mujeres Activas, was looking for a micro-enterprise that could help support their families. They had already started using solar ovens in their families, so with assistance from an outside NGO, Mujeres Activas built large commercial-size solar ovens and established a bakery business that provides them with income to buy shoes and clothes for their children and send them to school (Source:

Stone, Laurie. 1998. “Solar Baking Under the Sonoran Sun”, ENERGIA News, vol. 2 no. 1).

- In Uganda, an FAO/UNDP post-harvest program recommended small-scale solar dryers for long-term storage and household consumption of fruit and vegetables. Rural women’s groups were more interested in solar dryers for income generation than for food security. The Fruits of the Nile company was formed in 1992 to link rural producers with the market for dried fruit in Europe. Within three years, more than 50 groups had taken up the solar dryer technology, and, in 1995, the company exported more than 50 tons of dried fruit. The original food security concerns are also being addressed. The women use the solar dryers to preserve vegetables and fruits for home storage and consumption when they are not drying for profit (Source: Okalebo, Jane and Mark Hankins. 1997. “Why Women Adopt Solar Dryers”. ENERGIA News vol. 1 no. 3).

Geoff Stapleton, Global Sustainable Energy Solutions, Australia
gses@bigpond.com

Sri Lanka is a good example of "what is working" at the moment in particular to SHS. The World Bank/GEF Sri Lanka project started in 1997 and one of the components was an Energy Services delivery program. This program moved very slowly in the first few years. The credit facilities were not reaching the end users effectively. At the mid term point (Feb 2000) the aim was for 6000 SHS to be installed but only 723 had been installed. The mid-term review found that the poor performance of the SHS component of the credit program was a result of a number of technical and implementation issues.

- SHS sub loans were too small for the typical Participating Credit Institutions (PCIs) to justify the costs involved in loan processing. Hence there had been no active promotion by the PCIs to encourage the uptake of any SHS loans. The PCIs were not experienced in dealing with small rural borrowers and viewed them as high risk. Therefore they were not using the money that was available.
- The SHS companies were also not experienced at being "banks". In general they did not want to get involved with obtaining the funds from the PCIs and be involved with providing loans directly to the system owners. If companies did look at this option they found that the cost involved in securing the loans and processing micro-loans was too high.

Just prior to the mid-term review, two events occurred, that through their combination contributed to the program becoming successful.

a) Solar Power & Light (SPLC) (a local company that had been operating since the mid 1980s) signed an agreement with the Sarvodaya Economic Enterprises

Development Services (commonly known as SEEDS) where SEEDS would provide credit for all sales done by SPLC. The recommendations from the mid-term review made it easier for SEEDS to become a PCI and therefore have access to the funds available in the ESD program.

b) The Directors of SPLC actively sought out Shell Renewables and arranged for a takeover. This provided capital investment of over US$2 Million to develop the sales, service and product delivery infrastructure around the Island. The company went from a staff strength of 20 (pre-Shell) to almost 400 in two years and created the ability to reach most of the remote SHS customers around the Island. This operation was supported by the establishment of 16 solar centers around the Island.

This encouraged the other companies within Sri Lanka to grow and expand their rural delivery service businesses. The end result was that by June 2002, nearly 18,620 systems had been installed. This success showed how micro-finance to the end user and finance for the companies providing the service is required to help projects to be successful. But these alone would not make a program successful. In addition to the finance availability encouraging the success the following activities occurred to ensure success:

a) The local industry decided to work together to help move the program along and formed an industry association (The Sri Lanka Solar Industry Association). Effective industry associations are abundant in so called "developed" countries so they should also be encouraged within so called "developing" countries.
b) The industry association worked with others sections of the community and implementation agency to promote solar and the program in the rural areas with information days, etc.
c) The industry association developed a training program and employed a qualified trainer who conducted over 25 technical training courses over an 18-month period.
d) Some regional Governments accepted that grid power was not coming to some regions and also actively promoted the installation of systems. Though this program has been successful over the last few years it is important that it is monitored to see where it has not been successful. It cannot be perfect and therefore lessons must be learned from "what has failed" even in a successful program.

S P Gonchoudury, West Bengal Renewable Energy Development Agency, India
wbreda@cal.vsnl.net.in

There are two types of villages in the developing countries. The first are the villages with very small population, generally poor people with no significant economic

activities. They need only light of better quality, which may be catered through a Solar Home Lighting system. In the other category, there are many villages in the remote areas where economic activities are already going on, even if in a crude manner. These villages have health centers, small markets, post office, etc. There is a need for drinking water supply also. In such type of villages small solar power plant with mini grid could be a good solution. WBREDA set up twenty such solar power plants in different parts of Sundarban Islands in West Bengal. The plants are operating smoothly through village level energy co-operatives. The capacity of power plants varies from 25kw to 100kw. During daytime drinking water is supplied through the same inverter. The revenue realization has been excellent. WBREDA took 20% of the project cost as soft loan and the balance was grant. Loan servicing loan is no problem given the high revenue realization. More than 5000 consumers are accessing energy from these mini grids. They are willing to pay because they receive grid quality power.

Sabina Anokye Mensah, GRATIS, Ghana
sabinamensah@hotmail.com

Some of the good practices necessary for scale-up are:

- ?? Creation of focal points in the dissemination of energy technologies to ensure the pooling of expert resources devoid of unnecessary bureaucratic tendencies.
- ?? Repeated organization of gender sensitization workshops for beneficiary groups especially those in rural communities.
- ?? Critical study of cultural practices and a diplomatic approach of breaking the barriers through constant contact of implementers with beneficiary communities not neglecting the important role of district and traditional authorities.
- ?? Literacy programs for illiterate group where illiteracy rate is high
- ?? Organization of technical workshop for beneficiaries especially women where they are the target group.
- ?? A reliable source of back-up spares (local infrastructure) for implemented programs.

Fouzul Kabir Khan, Infrastructure Development Company Ltd., Bangladesh
idcol@dhaka.agni.com

IDCOL is engaged in providing GEF grant and refinancing of loans made to the households by five micro finance institutions (MFI) in Bangladesh. In doing so, we are harnessing the relative strengths of various institutions: i) strength of MFIs in reaching out to households in remote areas without access to grid electricity and their successful track record of providing micro credit and recovery of such loans; ii) strength of private businesses in installation and marketing of SHSs; and iii) our own strength in providing structured finance.

Under our conditional sale arrangements, households provide at least 10% equity (the household becomes owner of SHS after paying off the remaining installments) and MFIs get 80% of their loans refinanced by IDCOL, ensuring that each of the participants has a stake in making the program successful. The GEF grant is divided into two components, capital buy-down grant and grant for institutional development of MFIs. Both components will decrease as more and more systems are installed, paving the way for commercialization. So far, in 3 months, we have financed installation of nearly 2000 SHSs.

Both the grants and refinancing are provided only after random physical inspection of households to ensure that the equipment were approved by our technical standards committee, installed in our approved project areas, and the consumers were satisfied with the services provided by the MFIs. We are also in the process of getting primary school teachers involved in our inspection program. Our involvement in the program by way of providing grants and long-term refinancing of loans made by MFIs to the households has made the installment payment affordable to the households and ensured quality of service.

We provide training for both MFI staff and the consumers. MFIs in turn provide their own training. We also have an ongoing advertising campaign at a national level using TV/Radio spots/commercials, posters, leaflets, billboards, t/shirts and other means.

The lessons based on our experience so far are: i) selection of right participating organizations; ii) allocation of risks among various project participants; iii) awareness campaign targeted at households; iv) strict adherence to technical standards and monitoring of the program, and v) presence of a group of dedicated and qualified workforce willing to function in remote rural areas.

Ieda Correia Gomes, BP Solar, United Kingdom
GomesI@bp.com

BP Solar has been supplying equipment and systems to rural development projects for over 15 years as part of the company's commercial business offer. In remote locations, particularly for poor un-electrified communities, solar products and services can be a highly effective means of meeting essential needs such as lighting for homes, schools and community centers, as well as remote telecommunication, fresh drinking water and vaccine refrigeration. Annex 6 provides profile of three BP Solar projects. The good practices and lessons learnt from these projects are given below:

- An integrated approach has to be adopted to project development, tackling multiple development issues and not just energy. Focus should be on rural energization, rather than electrification. Thus, identification of development needs has to be the starting point for any (solar) project, which can be ascertained only with local community involvement throughout the entire project extending well beyond the implementation phase.
- Participation from communities and individuals in the design, implementation, and maintenance of the project is critical. Communities must get a feeling of ownership and responsibility for the success of the project. For communities to be fully committed to make the project a success, they must see a clear and direct benefit of the project. It is important that the project design incorporates not only community benefits (health, education etc.) but that the project also identifies areas where individuals and companies can accrue direct economic benefits from the project, such as enabling fishermen to navigate or unload their catch at night, or other job opportunities.
- A key success factor is to ensure project sustainability, the simple interpretation of which is that the project elements (technology or equipment, as well as governance and maintenance) should function in 5, 10, 15 years down the road, after the project has been implemented. Thus training of local personnel plays a crucial role in sustainability. Such training would be of different kinds:
- Training for technical capacity to maintain and repair systems.
- Preparation of communities for the implications of the project, raising awareness on the potential and limitations of the project.
- Establishment of local administrative infrastructure to manage ongoing operations and maintenance and collect funds, and
- Training in business planning and distribution networks to maximize use of facilities provided.
- Getting projects off the ground in a very short time, and quickly bring visible pay off is important in building credibility among the beneficiaries.

- Other tools to ensure sustainability are correctly sized and designed packaged solar system (designed up to long-term performance specifications not down to a price), and a well thought through "Train the Trainer" program that can lead quickly to the establishment of well managed and competent local project management committees. Incentives for trained staff to ensure long-term delivery are also important.
- Projects need to have a budget provision for maintenance after installation, including training and development of local service companies. Projects based upon only the supply of equipment have shown a survival rate of only 15-20% after 3-5 since the installation is completed.
- Financing mechanisms are critical. These should go beyond feasibility studies and pilot project but rather focus on the scaling up of projects to reach a large part of the two billion that live in energy poverty.
- Projects are most sustainable and successful if they deliver direct economic benefits. Programs and partnerships should focus on the economic/income- generating end-use applications of energy provision.

Leonard Tedd, ITDG South Asia
leonardt@itdg.slt.lk

ITDG's development of village hydro in Sri Lanka in the early 1990s was successful because it covered some important aspects:

- The technology was appropriate and affordability issues were addressed by getting donors involved in part funding.
- R&D costs were totally borne by an independent organization (ITDG).
- ITDG worked with communities in designing and planning and ensured community ownership through Electricity Consumer Societies (ECS).
- Community institutional capacity was strengthened through capacity building of ECSs.
- Local technical capacity for maintenance was established.
- Local authorities were involved.

Scaling up was successful because:

- Finances were made available through banks to the community.
- The need for community institutional capacity to manage finance mechanisms was acknowledged.
- Minimum standards were developed and mechanisms to ensure standards were established.
- The availability of finances created interest among many organizations to enter into the sector for providing services.

- The local government (e.g. South, Samaragamuwa) became involved and included micro hydro as a priority in their planning.
- Networking amongst ECSs gave them a stronger voice to raise their concerns.

Issues that currently need special attention are:

- No legal status for the schemes.
- Consumer awareness by the developers does not give enough information to people about potential problems.
- Gaps in institutionalizing standards: quality control is not geared towards long term functioning.
- Measures to balance private sector promotion of systems which are not in the interest of communities.
- Availability of finance can attract the wrong people and communities can end up getting indebted without getting proper services.

Teodoro Sanchez Campos, ITDG, Peru
teo@itdg.org.pe

ITDG-LA is implementing a revolving fund for the implementation of small hydro schemes in Peru for eight years, and we find that while small peasants, farmers, and businesses men in general can be a strong force towards the provision of services in the field, those people are not necessarily creditworthy to access loans from the banking system. Therefore appropriate credit mechanisms are needed, and such mechanisms should necessarily go with technical assistance to provide assistance for energy schemes, especially for productive uses of energy.

Public-private partnerships are important especially for the village schemes. Basic needs are capital and technical assistance. Capacity building of local communities to ensure their involvement is also critical. Providing adequate information is necessary to involve the people.

In our experience developing the income generating activities take mach more time than to implement energy schemes. Income generation is much more related to development in general rather than only to energy and sustainability of energy schemes. Therefore, integrating energy programs with developmental programs is necessary.

Jayantha Gunasekara, ITDG South Asia, Sri Lanka
JayanthaG@itdg.slt.lk

In Sri Lanka there has been some success in reaching un-served villages through strong involvement of local government bodies. Examples of this have been off-grid village-hydro schemes in Southern and Sabaragamuwa Provinces, and solar systems in Uva Province.

To achieve this, provincial councils put proper policies and structures in place. The devolved authority for local government department's role in infrastructure development, and the legal acceptability of off grid and decentralized options had been the key reasons behind this success.

In light of the proposed power sector reforms, there is a lack of clarity of the legality of existing successful projects and a lack of clarity of the role and authority of provincial councils in representing the interests of rural communities. These could both be barriers for scaling up. The regulatory bodies (In Sri Lanka, the Public Utility Commission) should link up with local governments to directly address rural concerns.

Lalith Gunaratne LGA Consultants (Pvt.) Ltd, Sri Lanka
lalithg@sri.lanka.net

In the early years of the development of the Sri Lanka solar PV market, we pursued the government to provide duty concessions for solar modules and also to provide other incentives such as consumer tax rebates (GST/VAT). The government provided import duty waivers but GST/VAT was not removed. There are, however, yet barriers in place, which hamper off-grid market developments. These stem from the Electricity Act, which favors traditional grid extension for rural electrification. With grid extension being a costly option to remote rural areas, the act needs to change to incorporate off-grid options into the energy mix of the country. This would naturally bring about other fiscal policies in line to create a more of a level playing field when it comes to off-grid renewable energy services.

The solar PV business saw its unprecedented growth soon after Sarvodaya (SEEDS) established the micro financing schemes in partnership with the private sector vendors. Here, the vendor would sell and SEEDS would finance the customer. The vendor and the MFI has to develop a certain trust and good working relationship to ensure that good candidates for financing are chosen by the vendors as they sell and the system operates efficiently during the loan payment period. The vendors have committed to remove systems, if for any reason the customer does not continue the repayments. The repayment rate is over 90% with this system, but SEEDS being the only MFI in Sri Lanka lending on a large scale for solar, with the market pressure, leaves them vulnerable as their portfolio for solar PV increases over other rural lending (agriculture, housing,

etc.). As the market grows and the number of vendors now increasing to 9 (from only two in 1990), it will require at least one more major MFI to come into the arena, or it will hamper further market development.

Sri Lanka also has got one provincial council in Uva (south-east) who has initiated a subsidy scheme where the registered vendor sells a system with a Rs. 10,000 (US$100) discount to the customer. Once the system is installed and verified, the amount is reimbursed to the company. The program faced difficulties over the last year due to the economic problems the government faced, but is being revived. It is clear that systems installed under this scheme are better looked after by the vendors as the province has a follow-up program through its own staff. The vendors also have SEEDS financing the systems. So far, about 6,000 systems have been installed making this a pioneering public-private-NGO initiative, which is followed closely by other provinces and the central government.

Much of the market development process happened with the commencement of the World Bank's Energy Services Delivery project, which was established in 1997. There was a US$ 53 million fund complemented by the Sri Lankan government and GEF (provided US$ 100 grants per solar PV system and US$ 400 per kW for off-grid micro hydro) which essentially funded off-grid solar PV, micro hydro and grid connected mini hydro projects. The project also had technical assistance funds for the utility CEB to support off-grid developers by providing grid extension information. The project's establishment also attracted major players such as SELCO and Shell to Sri Lanka. Even though the initial progress of the solar market development process was slow, as soon as SEEDS provided micro financing, the project was able to fund over 20,000 solar PV systems. It also funded about 30 micro hydro projects and 25 MW of grid connected mini hydro in the 5 years. The success of the project has led to the new US$100 million Renewable Energy for Rural Economic Development (RERED) project for another five years from 2002.

All these developed from small ventures initiated by a few committed individuals who were willing to commit time and money to the painful infancy and growth period. Sri Lanka's success comes from a collection of initial pioneers in the solar and micro hydro industry as well as a receptive development and commercial banking community and certain government personnel who envisioned a future with a mix of off-grid and grid based developments. The most crucial partnership has come at the rural community level with SEEDS providing micro financing for solar PV and rural communities mobilizing to develop micro hydro projects (with the support of a few committed consulting companies such as CAPS and ENCO). This was complemented by Asia Alternative Energy Unit (ASTAE) of the World Bank who thought outside the box to finance small-scale energy services. The paradigm for rural energy services was changed with this collective effort.

Michael Eckhart, American Council for Renewable Energy, USA
Meckhart@aol.com

A potential best practice was established in India in the period 1999-2002 for training lenders on the financing of solar PV (SHS and water pumping). The program was initiated by the SolarBank Program and implemented by Winrock International under funding from USAID. The program trained over 1000 rural branch managers and lending officers of the state-owned banks. Lending for PV by those trained increased 600% in the first year.

Key elements of the program included: i) promotion of the program to executive-level bankers by holding awareness consultations in each city, ii) leadership of the program by a retired banker who personally solicited the involvement of bank executives, iii) preparation of the training manual and materials by retired bankers who spoke the banking language, working in concert with training experts, and iv) training the rural bankers in one-day courses that familiarized them with PV systems and economics, and prepared them to ask the right questions when evaluating loan applications, thus establishing a base of technical knowledge and "comfort."

A second part of the program focused on mobilizing micro credit organizations to offer a PV loan product. This involved an intensive effort to bring a major micro credit lender into it. This proved to be "lessons learned" rather than best practices, as it became apparent that a set of factors must exist simultaneously for a successful micro credit program, including but not limited to commitment from the CEO, overhead funds to pay senior staff to work on developing the program, capital funds for on-lending, upsurging demand for the PV systems, and a local competitive PV industry offering quality systems, installation and service. Plus, the many preconditions like favorable policy, etc.

James Durnil, National Rural Electric Cooperatives Association, USA
jbd0@nreca.org

The positive socio-economic benefits arising from Bangladesh's rural electrification (RE) program is a major success story of external development assistance to a developing nation. The advent of electricity has led to the creation of hundreds of thousands of new jobs. It has contributed to a 16% increase in income of electrified rural households. Infant mortality in electrified households is 35% less than the national rural average. New employment opportunities have resulted in in-migration into electrified villages.

Crop yields under electricity-powered irrigation are 24% higher than those relying on diesel. A "basket case" in the early 1970s with widespread famine, Bangladesh is today a country self-sufficient in rice through irrigation. The RE program has opened

opportunities for establishing a variety of industries (small, medium, and large scale) in rural areas, and also contributed in overall expansion and intensification of rural markets.

These findings are among those presented in an extensive socio-economic study recently commissioned by NRECA, with the support of USAID. It was undertaken in Bangladesh where, over the past 25 years, the installation of 4 million metered connections are now serving 25 million people in rural areas. This experience with RE provided the opportunity to more rigorously explore its impact on development indicators than had previously been achieved.

The study relied on lengthy interviews in 3700 households and establishments, evenly dispersed throughout rural Bangladesh-residential, industrial, commercial, and agricultural. In the process, it even assessed the indirect impact of electricity on unelectrified households located in both electrified and unelectrified areas. A qualitative summary below of a few of the findings gives an indication of the nature and breath of the impacts studied.

At the household level, RE contributed to such benefits as fuel savings; reduced fertility rate and infant mortality; improved hygiene and awareness of public health issues; and increased literacy, women's spatial mobility, income, awareness of gender issues, women's empowerment, school enrollment, and immunization coverage.

The spillover effect of electricity on non-electrified households of electrified villages is pronounced. Access to electricity, even for non-electrified households in electrified villages, reduced both economic poverty and human (i.e., education and health) poverty. Furthermore, on average, poor electrified households were found to be better off than even the rich in the non-electrified villages.

The UNDP's Human Development Index (HDI)-composed of life expectancy, adult literacy and Gross National Product per capita indicators-gauges the quality of life in a nation. Bangladesh as a country ranks 145 among 174 nations. If a similar index were derived for a "country" with the same characteristics of electrified rural households in Bangladesh, it would jump up to a ranking of around 115, on par with Egypt, Indonesia, and Honduras.

In the commercial sector, electricity has doubled sales turnover in retail shops, a figure surpassed in wholesale shops. This was due to such factors as extended hours, attracting more customers, and availability of additional goods and services in these electrified markets.

In the agricultural sector, electrically powered pumps increased irrigated coverage and provided certainty of water availability, both of which support cropping intensity and yield when compared to diesel-operated pumps; show increased dependability and reduced operating cost; and have been a major factor contributing to food self-sufficiency in the country.

Industrial activities consume about 40% of energy supplied by rural electric systems. Electrification has reduced the cost of production and increased productivity.

And not only has the electrification of industries increased employment in both absolute terms and in comparison to non-electrified industries, but it has led to a growth of the skilled female labor force that considerably exceeds that of the male.

The wealth of data gathered and analyzed as part of this study points to a broad range of benefits directly attributable to RE. The study also confirmed that electrification plays a major role in increasing the effectiveness of interventions in other development sectors, such as in education and health, employment generation, and agricultural production.

Limited copies of the 660-page study, Economic and Social Impact Evaluation Study of the Rural Electrification Program in Bangladesh, by Prof. Abul Barkat, et al, of the Human Development Research Centre (HDRC) of Bangladesh (October 2002) are available from NRECA International Ltd. This study was conducted with the support of the Rural Electrification Board, the semi-autonomous government agency responsible for implementing the RE Program in Bangladesh.

Pradip Jayawardene, Solar Industries Association, Sri Lanka
pradipj@sltnet.lk

In 2001 we initiated a private-public partnership with the Uva provincial government where funds from the Uva province government were used to buy down the capital cost of SHS (approx US$100). The main advantage of the scheme was to bring in the government as a partner in providing solar as a rural electrification method. This direct government participation was far more effective than a policy statement from the government. Secondary benefits were the discount (for a limited time) and the promotion of the scheme by the government. The scheme also had the advantage of two credit providers and four solar companies who were in intense competition with each other. The scheme resulted in over 6000 SHS being sold in the Uva province in 2001. The World Bank and the government of Sri Lanka has recognized the success of the scheme and has now provided funding to expand the scheme to two other provinces.

Indrajit Dey, Society for Rural Industrialization, India
idey@vitalmail.com

We have good experience in operating a 15kV biomass gasifier based power generation system providing lighting to 57 households, energizing 3 (of 5hp each) pumping sets and running 1 leaf cup machine on time sharing basis. The system is in operation for the last two years without interruption. The main lesson is that demand side management problems should be tackled carefully. In remote villages people are not in a position to pay for the power if the bill is more than Rs 30 (60 cents) per month. Demand

side management should be planned around value addition to raw materials produced or collected by the villagers that can be sold in the local market. The demand will generate slowly but once it picks up it goes very fast. This model can be replicated.

Vaidyanathan Ramasubramanian, Sahyadri Energy Systems Pvt. Ltd., India
tell_rams@yahoo.co.in

Equipment which has been provided free of cost will never stand the test of time. Even in cases where the end-users pay in kind, once a problem arises in the equipment they don't own responsibility to get it repaired. In addition to the payment in kind, if the end-users are made to contribute monetarily - even if it is a small fraction, this attitude will see a big change.

Where the decision-making is fully with local rural governmental bodies - like gram panchayats in India - RETs had good success. Gram Panchayats can decide on their choice of power source and make funds available to their villages. Some micro hydro schemes have been installed under this facility in Kerala.

CBOs (Community Based Organizations) have a major role in promoting RETs in new areas. CBOs can take a greater risk as they have easier access to funds to try out new RETs in their areas. Once the awareness is built up, marketing RETs becomes easy.

Veena Joshi, Swiss Development Cooperation, India
veena.joshi@sdc.net

Many hard lessons come to mind:

- While working on cooking energy interventions we ended up saying we need to first consider energy services that are needed by the communities themselves. These often were related to energy services for water for drinking or irrigation.
- When attempts were made to provide lighting through market development route based on SPV technology, the successes were far and few and required tenuous and innovative financial mechanisms.
- Attempts to promote energy efficient biomass based technologies for cardamom drying and silk reeling led us to factors that governed the markets on which projects had hardly any influence. These points are made not to undermine the successes so far but to encourage ourselves to look at the issue afresh. I believe we are at a juncture where our perspective at looking at energy services calls for a fresh look from the

perspective of those majority people without access. A few starting points to build such a perspective could be:

- Strengths and initiatives of the communities whom we have not reached so far.
- Local knowledge base of the families.
- Their institutional base.
- Their perspective of their relationship with modern energy sources.

I wonder if we can design such a dialogue on a trial basis to see if it will lead to a few pilot projects whose principles may be replicable on a sustainable basis.

Indrani Hetttiarachchy, SEEDS, Sri Lanka
solar678@sltnet.lk

Innovative financing mechanism for renewable energy is operated in Sri Lanka by SEEDS and it has brought remarkable changes in the local Solar PV market and accessibility for rural remote households. SEEDS's work is based on the basic rule of the service at the doorstep of the client. When working with the underserved and unsaved communities this is essential since they are not familiar with procedures. In this system, SEEDS works in close collaboration with the Solar PV supplier company. The following guidelines are followed:

- Products are offered to match the needs / cash flow of the client
- Service is provided without any additional charges. Consumers are expected to provide minimum equity contribution. The loan repayment is over a period of 1 to 4 years. Additional provision is made to purchase additional components when necessary.
- Client education and creating awareness by way of demonstrations is an important element.
- A Risk Assurance Fund (instead of insurance) is in place to cover possible risks like repair costs due to unforeseen damages / natural disasters, borrower's death, permanent disability, disruption of loan installments in case of crop failure or loss of income, etc.
- Strict quality standards are enforced. Independent complaint handling system to assist clients with grievances is a special feature of the system.

SEEDS financed over 16,000 families in Sri Lanka on the Solar PV program. The socio-economic impact of the service is very high. The program has helped people to access better light and substitute kerosene bottle lamp which is accident prone and harmful to health. Children's education has improved as they have more study time in the night.

Udaia Kumar, SHARE MicroFin Ltd. India
sml@sharemicrofin.com

SHARE started the Solar Project with a view to promote solar energy in the rural areas of Andhra Pradesh using its existing member base of over 100,000 clients. SHARE being a micro finance institution that helps rural poor women undertake income generation activities, decided to promote this product.

The clientele of SHARE are rural poor women who fall below the poverty line. Thereby, SHARE started with the solar lantern to begin with, which is the simplest product in solar equipment. SHARE pilot tested the product and got mixed results.

- There was no market awareness.
- Our clients were reluctant to make such a large investment in a product that did not support their income generating activity in a big way.
- Another factor that limited the promotion of Solar was the extensive coverage of grid in Andhra Pradesh.
- The interested clientele did not get the needed technical support due to absence of technical centers.
- They were not confident about the performance of the product and were reluctant to make an investment.
- Price was an issue.

SHARE is still in its initial period with solar financing for lanterns and is yet to find solutions for innovative financing and to counter the above problems. Its experience stands limited as far as good practices are concerned. Winrock International India, an NGO promoting renewable energy sources provided technical and initial financial assistance to conduct feasibility studies and to conduct surveys on the existing energy sources used in rural areas. It also helped organize exposure visits for the staff of SHARE to SEEDS in Sri Lanka. Winrock International India helped SHARE organize workshops to help create awareness among the members. Technical assistance was provided in the form of identifying the supplier, testing the equipment and organizing training camps for the staff. With this initial help, SHARE has made plans to expand the solar business substantially in the coming years.

Pavankumar Siddhi, Sungrace Energy Solutions, India
sungrace@satyam.net.in

Sungrace is a commercial organization involved in the solar photovoltaic field for the last five years. We have experience of selling more than 25,000 solar lanterns and other PV products to various rural customers in India with the help of NGOs and rural

cooperatives as financial intermediaries. Majority of the solar lanterns sold through these organizations were under the PV market development program of IREDA (Indian Renewable Energy Development Agency) and WB with a soft loan of 2.5% interest per annum, ten year repayment of loan and 85% of the product cost being funded. Sungrace has implemented various innovative marketing, micro credit and after sales service mechanisms to make the solar lanterns affordable to the poor and needy users of the society.

As the Soft loan program came to an end by December 2001 there was no money available with the rural cooperatives and financial intermediaries to finance the solar lanterns on soft terms. The customers who are looking at the softer loan terms were unwilling to pay higher interest rates for the product. The market, which is expected to be nearly 20,000 lanterns for the year 2002-2003 suddenly disappeared and the potential buyers were looking at the government program to be announced for the year where the lanterns can be purchased under capital subsidy. During the same time the government of India announced the withdrawal of capital subsidy to the solar lanterns. The market which was nearly 50,000 lanterns per year has also disappeared and all the solar lantern producers like sungrace were in big trouble due to the withdrawal of both capital and interest subsidy.

Sungrace realized that there a great opportunity emerged due to withdrawal of subsidy on solar lanterns and decided to work towards commercial selling without any kind of subsidy support. The following requirements were considered:

- Specifications of the solar lantern stipulated for the subsidy scheme were on a higher side considering the availability of sunlight. In many parts of India the module size could be reduced to nearly 80% without reducing the light availability for the user.
- The product perceived value could be increased and higher price collected from the users if the same is offered with value addition like LED based night lamp to eliminate the usage of Kerosene for lighting.
- Marketing costs could be reduced by using the NGO and rural cooperative networks who were already operating in the rural areas and aware of solar lanterns.(many NGOs and rural cooperatives are now acting as intermediaries for Sungrace as there is no government. involvement in the process and proper after sales service and spares are provided to them).
- Overheads could be reduced by careful planning of raw materials and manpower.
- The cost of the lantern could be reduced considerably with bulk purchase/ import of the components like PV cells and batteries.
- Profit margins by Sungrace should be kept low to match the nearest possible subsidy lantern price, and gradually work towards increase in volumes for increase in profits.

Sungrace has taken the initiative and launched the solar lantern (The 7W CFL works for 2 hours every night and the LED based bright night lamp works for the rest of the night) in the market through selected NGOs and rural cooperatives across the country keeping the operating margins very low.

- ?? NGOs were offered the product with good quality battery, electronics and an additional night lamp, which eliminates the usage of kerosene for lighting. (The Lantern which works all the night was a very good selling point).
- ?? They were provided with the product training and with minimum required spares to service the lanterns locally.
- ?? They were offered small lots of lanterns to start with to avoid high initial investments by the NGO's.
- ?? The price was close to that of subsidized lantern and NGOs also operated with lower service charges.
- ?? Equipment was supplied to the selected NGOs at 30- 45 days of credit.

The response from market was encouraging. With the support of nearly 15 NGOs and 7 rural cooperatives, Sungrace was able to market more than 3000 lanterns within six months of launching the product. The key for the success of this project was the involvement of NGOs and rural cooperatives, which have invested their money and offered credit to the rural users (short term).

Volumes can be achieved if these organizations can be offered the soft loan facility directly, to operate in their areas. The expected volume for the current financial year is more than 10,000 lanterns which we are confident of achieving.

After selling 3000 lanterns in a period of six months without any subsidy support and expecting to sell more than 10,000 lanterns in the current year, we feel that real volumes can be achieved only with some external support (like soft loan or capital subsidy), which can be gradually withdrawn to stabilize the market. Sudden withdrawal of any subsidy/support will adversely affect the development of the market.

Traditional Energy Development & Environmental Organization, Tanzania
tatedo@raha.com

Solar PV Development Experience of TaTEDO

Introduction

For the past 5 years TaTEDO has carried out a renewable energy and networking program. The main objective has been to build TaTEDO and her country partner's capacity to facilitate access to better energy services for the population in the targeted rural areas of Tanzania. To achieve this goal, it was decided to work through networking with partner organizations to provide relevant information and technical assistance in

renewable energy technologies to the target groups. The activities in the program included training, awareness raising, research, consultancy, market development, demonstration plants and information networking. Among the renewable energy technologies, solar PV was emphasized, but solar drying, resource assessment and capacity development for wind and micro hydro for electricity generation were also covered.

Training

In implementing the program, TaTEDO has incorporated materials on basic entrepreneurship and business skills in their technical solar PV training courses. This is a result of recommendations from evaluation of the previous courses by former trainees. Business and entrepreneurship skills to course participants are meant to assist them in pushing commercialization of the technology.

The organization also continued to collaborate with trainees of the past courses to conduct training in their localities. The trainings aimed at increasing trainees experience with solar electric systems and enhance wide dissemination of the technology in the areas within the project sphere. So far TaTEDO has conducted eight trainings, two in each of the three regions (Kilimanjaro, Mwanza and Dar es Salaam) and two follow-up courses one in each Kilimanjaro and Mwanza regions, respectively. 58 people were trained in these regions. In addition to that, TaTEDO was in February 2003 hired by Umeme Jua Ltd Company to train 78 people in basic technical solar PV technology course in Dar es Salaam and Mbeya regions. The trainees are expected to carry out solar PV system installation, repairs and maintenance work in their localities.

Awareness Raising

Awareness raising efforts on the use of renewable energy technologies have been carried out in the project regions by organizing workshops, preparations and airing of radio and TV programs, newspaper articles and participating in exhibitions and trade fairs. Maintenance and repair of installed demonstration solar electric systems, mainly in health centers and dispensaries have been carried out. Other activities included preparations and distribution of information materials and packages on solar electric systems such as brochures, operations manuals and leaflets.

TaTEDO organized a National solar PV Stakeholders workshop in May 2000 in Dar es Salaam from which participants agreed to form Tanzania Solar Energy Association (TASEA) in order to increase efforts to promote solar technologies and also strengthen the lobbying and advocacy ability of the stakeholders.

TaTEDO also organized a national solar drying technology stakeholders' workshop in Dar es Salaam with financial support from ITDG to deliberate on possible strategies to effectively disseminate the technology in the country. Solar drying has shown potential as both an income generating activity and a source for nutritional value in both off-season for vegetables and fruits and in areas not growing such products. This could have a substantial impact in poverty eradication efforts.

In our efforts to promote wind technology, a micro wind turbine (600W), which was installed at the Sustainable Renewable Energy Centre of Tanzania (SRECTA), is operating as a demonstration unit. In the meantime monitoring performance of the unit for its appropriateness to Tanzanian conditions is in progress. TaTEDO has also continued to participate in a national pilot wind speed measurement project commissioned by the Ministry of Energy and Minerals - Tanzania in collaboration with DANIDA, in which it is a project partner.

Market Development and Studies

Experience from neighboring countries among others has shown that some donor supported renewable energy projects have not been successful and instead commercial market development has been realized as a potential approach for sustainable technology adoption and dissemination. In efforts to develop commercial markets in Tanzania, four entrepreneurs have been assisted to develop solar PV business in Mwanza, Dar-es-Salaam and Kilimanjaro regions. TaTEDO is a resource center providing technical knowledge and contacts for renewable energy financing programs and equipment manufacturers and suppliers.

TaTEDO has undertaken market studies on potential commercial markets for different solar PV systems for Umeme Jua Ltd Company in Arusha, Kilimanjaro, Mwanza, Dar es Salaam, Mbeya and Morogoro regions. This market study was carried out in collaboration with Energy Alternatives Africa, an energy consulting organization in Nairobi, Kenya. Results from these studies are inputs to the market strategy for Umeme Jua. Another study was "Removing Barriers to the Transformation of the Rural Solar PV Market in Tanzania' which was financially supported by UNDP/GEF and commissioned by the Ministry of Energy and Minerals. The study identified the barriers limiting adoption of solar PV in Tanzania.

Lessons Learnt

- Results from recently conducted market studies indicate high demand for electricity in different parts of rural areas in Tanzania. More than 40% of households are potential customers for solar electric systems based on income levels and acceptance. In most cases however, affordability is relatively low for individuals to procure solar electric systems and pay upfront, as such, a financing mechanism would be needed to improve affordability.
- Training solar PV electricians alone is not enough. Follow up initiatives to assist the qualified electricians to establish themselves in their new career is important. Apart from providing them with simple toolkits, they need some assistance to establish working premises and simple demo units in order to gain confidence of the potential customers.
- Students from universities visiting TaTEDO to carry out solar studies have been very useful for TaTEDO's activities in the field and collected useful information.

- The general level of awareness on solar PV technology has increased among Tanzanians. However; there has been some misunderstanding due to partial knowledge and experience with the technology resulting from unprofessional and unskilled practitioners in the field. Several newspapers have reported wrongly on the technology and thus created a bad image of the technology by making people believe that solar PV systems simply do not work. Still, some of the potential customers do not appreciate a service that can be offered by a solar electric system unless it can provide energy for cooking, boiling water and ironing clothes just like grid electricity. In the coming programs, an emphasis will be put to educate media personnel and the public in general on applications of solar PV systems.
- Supply of solar electric equipment has substantially increased following operations of new companies such as Umeme Jua Ltd and Ensol (T) Ltd. However, prices of solar PV equipment are high due to taxes and other duties. There are possibilities to bring about changes in taxation policies through efforts of lobbying pressure groups such as TASEA. All in all, delivery channels for the technology products are still limited to towns only. Much still needs to be done to promote the market to rural areas.
- Still there are unprofessional practices in conducting solar PV businesses; some systems are sold undersized, of poor quality equipment, poorly installed and maintained by untrained technicians. This has led to failure of some of the installed systems. Similar to this, some of the solar electric systems belonging to some organizations in Tanzania such as the Tanzania Railways Corporation and the Ministry of Health are not working because "experts" who installed them are no longer available to service and maintain the systems, since they were brought in from outside. User training is important after every PV installation.
- A credit scheme or energy fund to both entrepreneurs and end users is vital in order to win a big potential PV market existing in the country. Based on studies, only less than 10% can afford to pay upfront cost for solar PV systems in Tanzania.
- Less effort has been made by solar PV companies to enter the rural markets where most potential customers are, and less is expected. Most of the solar PV companies are based in big towns and cities, far away from the rural communities. TaTEDO in collaboration with other stakeholders still has a role to promote the market and link the rural customers with solar PV companies in towns and provide relevant market information to both parties.

3

Project Profiles

Asia

Micro finance for Energy Services and Income-Generating Opportunities for the Poor: Project ENSIGN

K V Ramani, Rural Energy Specialist, Kuala Lumpur

1. Overview

3.2 Project ENSIGN (Energy Services and Income-Generating Opportunities for the Poor) was undertaken by the Asian and Pacific Development Centre (APDC) with UNDP funding. The development objective of ENSIGN was to minimize the energy constraint on poverty eradication efforts in an efficient, cost-effective and environmentally sustainable manner. This was to be accomplished by explicitly addressing the energy-poverty nexus with attention to those issues concerning energy that pose barriers to improving the economic conditions of the poor.

3.3 The immediate objectives of the project were:

a) to review prevailing policies and institutions for energy development, poverty alleviation/ eradication and development financing with the view to identifying opportunities for convergence among them at the level of the poor;
b) to develop, finance and implement a set of pilot projects combining energy services and income-generation activities for the poor in household or community micro enterprises;
c) to seek country ownership of such projects through the direct involvement of national financing institutions and project implementation agencies in the project design, evaluation and delivery process; and
d) to enhance the replication potential of the pilot projects by documenting the experiences with formulating and implementing them, and undertaking supporting in-country capacity-building activities

3.4 ENSIGN was underpinned by the following hypotheses:

- The relatively high costs of efficient modern energy services can be met by the poor on a sustained basis only when their purchasing power matches the costs of energy services offered;
- The poor can access efficient energy services through innovative credit facilities devised specifically to match their borrowing and repayment capacity. Such facilities must have:
  - a grassroots outreach in order to manage small-volume loans in a convenient and simple manner, and
  - be able to assemble several small retail loans into larger packages that can attract the interest of national and international development financing institutions
- Energy services can be made affordable to the poor by linking them to income-generation activities made possible by enhanced energy availability. Such an approach will ensure a close complementarity between energy development and poverty eradication, as well as improve the poor's acceptance of energy projects.
- In order to prepare the recipient base for such integrated financing, it is necessary to develop projects promoting energy-intensive micro enterprises. By explicitly recognizing the interdependence between energy and income, such micro enterprise projects will have a higher success rate and replication potential as opposed to conventional stand-alone energy projects.

3.5 ENSIGN was carried out in eight countries of the Asian region — India, Indonesia, Mongolia, Myanmar, Nepal, Philippines, Sri Lanka and Vietnam. Project ENSIGN was implemented during 1996-98, and focused on the following main activities:

a) A review of the micro financing programs of the SEWA Bank in India to establish the feasibility of a new energy-linked micro enterprise loan portfolio;
b) An analysis of renewable energy project implementation experiences in Philippines leading to the development of a methodology for formulating integrated energy and income-generation projects;
c) Establishment of a regional revolving fund to co-finance, in collaboration with national financing institutions in the participating countries, a series of energy-linked micro enterprises for the poor by way of pilot projects;
d) Scoping studies in all countries assessing existing national policies and institutions for energy, poverty alleviation/eradication and micro financing in order to identify opportunities and strategies for future replication of the project concept; and
e) Documentation of the outcomes of the preceding activities in the form of manuals, guidelines and reports to assist future capacity-building efforts

2. Financing

3.6 The ENSIGN pilot projects were co-financed by an APDC-established Regional Revolving Fund and national financing institutions in seven of the participating countries. The national financing institutions were the SEWA Bank (India), the Foundation of Technology for Development (Indonesia), the Poverty Alleviation Programme Office (Mongolia), the Yoma Bank (Myanmar), the Lalitpur Financing Co., Pvt. Ltd. and the Agricultural Development Bank (Nepal), the Technology and Livelihood Resource Center (Philippines), and the Regional Rural Development Bank (Sri Lanka). Pilot projects could not be undertaken in Vietnam due to the lack of agreement between APDC and the Vietnam Bank for the Poor on co-financing arrangements.

3.7 Contributions from the Regional Revolving Fund amounted overall to 36% of the total loans for all pilot projects, while national financing institutions covered 50% of the required loan funds. Borrowers' equity, accounting for the remaining 14% of loan funds, ranged between 10-33%. Loans involving very poor borrowers had no equity component, while a few loans involving high cost equipment generated as much as 50% equity contribution.

3.8 Rate of interest charged on the ENSIGN co-financing component from APDC was one-third of the normal lending rate of the concerned national financing institution, with both the principal and the accrued interest subject to reinvestment in new loans with the concurrence of APDC. The interest rate to the end-user/borrower was somewhat below prevailing market interest rates for commercial loans in the countries, varying between 15% in Indonesia to 20.5% in Myanmar. A concessional rate of 6% was applied in the case of Mongolia since the pilot project there was directed at a predominantly blind and disabled group of people.

3.9 Repayment periods for loans ranged between 2 to 6 years, with longer repayment schedules and grace periods of between 6 to 12 months generally associated with projects with a renewable energy component. Loan volumes averaged about US$ 350 per household. Barring a few instances of delay, loan repayments were being made according to schedule in all countries as of the last review.

3.10 In all, 34 pilot projects covering 275 households, involving both household and community enterprises, were implemented through the above loans. Micro enterprises financed under the projects extended over a wide variety of activities, such as garment making, embroidery, felt and leather goods manufacturing, copper welding, utensils manufacturing, bakery, cold storage, rubber stamp making, beauty salon, grain grinding, threshing, fish drying and powdering, soybean processing, rice husk charcoal briquette manufacturing, battery-charging, manufacturing of rice husk cook stoves, spice drying, *beedi* wrapping and cinnamon peeling, and rice processing. Urban projects were based mostly on grid electricity, while rural projects employed renewable energy sources (solar photovoltaic, solar thermal, rice husk) as well as coal briquette and diesel.

3. Impact

Economic impacts

3.11 The central objective of Project ENSIGN was to increase the incomes of the poor. This was achieved with a considerable degree of success. Phase 1 of the project, under which the majority of loans were given, resulted in a monthly income growth of 66% on average in the poor households covered. As shown in the table below, the rise in incomes ranged between 55.5% and 306%, with the exception of the community project implemented in Nepal.

Country	**No. of Households**	**No. of Beneficiaries**	**% Increase in Income**
India	28	139	55.5
Indonesia	33	132	89.0
Mongolia	32	120	137.5
Myanmar	25	25	61.0
Nepal	5	150	9.0
Philippines	30	210	233.0
Sri Lanka	66	330	306.0
Total/Average	*219*	*1,106*	*123.0*

Gender impacts

3.12 A key discovery of Project ENSIGN was that the majority of borrowers under the pilot loans comprised women. This was true of all household level enterprises and most community enterprises. The gender dimension was not in-built into the project objectives or scope initially since the main thrust was on putting energy to use for poverty eradication. In retrospect, the dominant role of women among the borrower group in all countries was to be expected since micro financing experiences in Asia-Pacific countries offer widespread evidence that women constitute the bulk of borrowers for small loans in households.

3.13 Consistent with mainstream micro financing experiences in the region, women borrowers under ENSIGN pilot projects proved enterprising, innovative and, crucially, creditworthy. While this does not imply male borrowers could not have possessed such attributes, it nevertheless lends a powerful argument in support of targeting women in ENSIGN-type initiatives. Apart from their economic impact, the pilot projects generated

a range of positive social impacts, which played a vital role in mitigating the hardships faced by women in both rural and urban settings. The most common social benefit accruing to women was a reduction in human labor for both household activities and existing enterprises operated without electro-mechanical equipment. This enhanced the time available to them for childcare, recreational activities and social interaction. A significant impact was to raise women's self-confidence as a result of new or improved abilities to support the household income and greater control over self-generated finances.

Environment impacts

3.14 Although an attempt was made under the project to promote renewable energy options that carry distinct environmental benefits, the majority of pilot loans were in urban areas and, as such, the main energy intervention was electricity supplied by the grid. In all such cases, the main substitution was of human labor with no perceivable environmental gains. However, where fuelwood and fossil fuels (coal, kerosene) were replaced, distinct environmental benefits occurred in the form of reduced pollution.

4. Scale-up

Lessons from Pilot Project Implementation

3.15 The ENSIGN pilot projects were implemented in each country by the national financing institutions with technical support from the respective national study teams. Technical support activities undertaken by the latter included interviews/discussions with potential borrowers, technology evaluation, market potential assessment, preparation of loan proposals consistent with the requirements of financing institutions, supervision of equipment procurement, installation and commissioning, user orientation/training, and post-project monitoring and evaluation. The study teams also assisted the financing institutions in establishing essential linkages with national energy agencies and other relevant national institutions. While the overall impacts of the pilot projects proved unquestionably beneficial to the poor, experiences gained from the implementation process led to the following learning points:

3.16 In instances where the financing institutions do not have a client outreach to individual households, intending borrowers incur additional transaction costs, such as guarantee fees to intermediaries. Although such additional costs were largely avoided in the pilot projects due to the bridging role played by national study teams, these costs need to be acknowledged and internalized in future replication exercises.

3.17 The majority of borrowers in the pilot projects consisted of women. However, the actual operation of micro enterprises often involved male members of households, indicating the common benefits accruing to entire households in terms of employment creation. Experiences with women borrowers of the SEWA Bank in India suggest that their creditworthiness and repayment record are usually better than those of men.

3.18 Borrowers under the pilot projects were usually not the bottom poor in the countries. This is attributed to the fact that energy becomes a relevant input to income-

generation only when a certain economic capacity beyond sheer subsistence is reached. At the same time, pilot projects in Indonesia and Philippines featured borrowers in the role of equity contributors as well as the very poor in the form of labor contributors under the same micro enterprises. Thus, even within poor communities, the projects were able to generate a certain extent of positive trickle-down economic effect.

3.19 Access to own resources and a higher literacy level could have played a role in the success of the projects. However, this might not be a pre-condition to project success since several of the loans were provided with zero equity contributions from the borrowers. Also, while most household level borrowers did not maintain systematic accounts or records, they indicated a close awareness of relevant facts and figures concerning the status of their business. In the balance, given the potential growth prospects of the micro enterprises financed, it would be advisable to strengthen the borrowers' capabilities in terms of business skills and management know-how.

3.20 Given that future replication efforts might not have the benefit of national study teams, there is a need for business facilitators in each country to assume the role of intermediaries between the financing institutions and potential borrowers, both in the urban and in the rural contexts. NGOs involved in community development and other aspects of poverty eradication should be trained for such a role.

3.21 The pilot projects were conceived of and implemented within a limited gestation period of six to nine months. Time constraints encountered by the national financing institutions and study teams resulted in a concentration of the projects upon the urban poor and conventional energy options. However, rural projects implemented with a renewable energy component indicate the potential of these energy options in the context of the poor, especially in village level community enterprises.

3.22 Since renewable energy technologies are often subsidized by the government, as in the case of India, it is necessary to further explore their economic feasibility in relation to poor borrowers if such subsidies were to be removed or reduced.

3.23 From the viewpoint of financing institutions, the pilot projects demonstrated the incremental income growth potential of energy-intensive loans for micro enterprises. In the process, they induced institutions like the SEWA Bank to better understand the relevance of technology and to explore technology-intensive loans for the very poor.

Recommended Follow-up Strategies

3.24 The experiences of Project ENSIGN, in particular its pilot projects, were reviewed at an end-of-project workshop. The ensuing recommendations were as follows:

Formulation and Delivery of Energy-Intensive Micro enterprise Projects

- The primary focus should be on the market for and marketability of income-generating activities (IGA) for the poor.
- Both centralized and decentralized energy services should act as inputs to IGA.

- ?? Poverty eradication can be pursued under ENSIGN-type projects through:
- ?? Energy-consuming activities alone (focusing on efficient end-use appliances and devices).
- ?? Energy-consuming and energy-generating activities (mix of efficient end-use appliances and devices, and centralized/decentralized energy supply technologies).
- ?? energy-generating activities alone (centralized/decentralized energy supply technologies).

In order to interest the poor to take advantage of ENSIGN-type loans, it is necessary to:

- ?? view income-generation as the prime catalyst.
- ?? create, through government-led poverty alleviation/eradication programs, awareness among the poor and among various institutions of project opportunities.
- ?? involve NGOs and mediators in project identification, formulation and implementation.
- ?? formulate and disseminate information packages relevant to different agencies and institutions.

3.25 An ENSIGN "business facilitator" should typically be able to:

- ?? formulate an IGA business plan.
- ?? prepare a proposal for acceptance by a financing institution.
- ?? gain users' acceptability through knowledge of their needs and commitment to them.

3.26 Extensive training programs would be needed at all levels from policy to grassroots implementation, covering in particular energy development, promotion of renewable energy technologies and energy efficiency, poverty eradication, micro enterprise development, micro financing and upstream financing.

3.27 An information support system is needed to facilitate national ENSIGN programs, which should be linked to government-led poverty eradication efforts. Information packages made available under the system should make use of existing information from diverse sources.

3.28 No new institutional structures are envisaged to develop and disseminate information packages. The primary recipients of information packages would be NGOs, self-help organizations, poor communities and private sector associations.

Financing Mechanisms and Fund Mobilization

3.29 National financial policies should:

- ?? ensure closer integration between the allocation of financial resources for energy and poverty eradication programs.
- ?? define energy services appropriate for the poor and thus eligible for financing.
- ?? enhance awareness of financing needs and funding sources among the poor.
- ?? facilitate the co-ordination of financing for integrated energy-cum-income projects by sectoral development agencies.
- ?? classify and declare the eligibility of ENSIGN schemes under the government's priority programs for financing.
- ?? extend preferential interest rates for ENSIGN loans to the poor.
- ?? approve flexible lending terms commensurate with the borrowing and repayment capacity of the poor, for example, waiver of collateral, low debt-equity ratio.
- ?? set an upper limit of not more than US$1,000 per household micro enterprise loan (with loans for community enterprises matching the number of beneficiary households).
- ?? designate appropriate institutions and institutional co-ordination mechanisms to ensure the smooth flow of funds from capital mobilization to loan disbursement.
- ?? Internal sources of funds for ENSIGN loans may be derived from:
- ?? governmental budgetary resources for poverty eradication, rural development, renewable energy promotion and other areas of developmental priority.
- ?? market borrowings through tax-free bonds.
- ?? a national ENSIGN fund created through a surcharge on conventional energy.
- ?? External funds for ENSIGN loans may be sourced from:
- ?? international financing institutions under international development assistance terms.
- ?? bilateral financing institutions.
- ?? capacity-building funds from donors to promote the ENSIGN concept.

Capacity-Building

- ?? Institutional linkages between financing institutions, governmental institutions, energy agencies and NGOs should be strengthened on the basis of the beginning made under the project.
- ?? In strengthening institutional linkages, a country-specific approach should be adopted with emphasis on collaboration among existing institutions.

- ?? Informal ENSIGN groups formed under the present project should be institutionalized in each country.
- ?? An apex consortium should be set up to advise national ENSIGN groups.
- ?? The national ENSIGN groups should initiate policy dialogues with NGOs and perform other support tasks to sustain the momentum of replication efforts.
- ?? Micro financing institutions should be provided capacity-building training on:
- ?? technical features of energy supply and end-use technologies, equipment and appliances.
- ?? economic evaluation of the technologies for the purpose of loan appraisal
- ?? market feasibility assessment to ensure the viability of IGA businesses.
- ?? micro financing institutions, in turn, should provide training to poor borrowers, NGOs and business facilitators as a part of their loan portfolio development.

Bangladesh

Electricity Services to Rural Markets Serviced by a PV Micro Utility

S Kumar, Asian Institute of Technology, Bangkok

1. Overview

a) Reason for the project

3.30 About 81% of the total population of Bangladesh live in rural areas, and only around 20.4% of the population (25% in urban areas and 10% in rural areas) has access to electricity. Farmers in rural areas sell their products to the retailers from cities in the rural markets. However, many of these markets are without electricity and are not able to attract as many retailers, forcing farmers to sell their products at comparatively lower prices.

3.31 Kerosene lamps called "Kupi" and "Hurican" are the major appliances used to meet the lighting needs of these market shops. Some shops use more expensive mantle lamps called "Hazzak" to obtain brighter light. Diesel generators also supply electricity in some rural markets, but with very poor quality and voltage fluctuations that shorten the life of the appliances connected to them. The possibility of grid electricity reaching these markets is very low as the power demand is low and extension of the grid network involves huge investment due their remote location.

b) Location and local setting

3.32 The project is located in Manikganj Bazaar in the Dinajpur district, some 400 km north of the capital, Dhaka. A big bazaar is set up twice a week where farmers from many villages bring their products to sell to retailers. The bazaar is more than 5 km away from the nearest grid transmission line. Grid extension, which is estimated to cost about Taka 30,000/km (US$[3]500), is not economically feasible.

3.33 Most of the shops need only a light or two for an operating period of maximum 5 hours. A few of them also want to operate small cassette players. They were also willing to pay a daily tariff not exceeding Taka 4-5 (~¢8) per light (this approximation was obtained from the diesel generator service available in the market). The market has a "Bazaar Management Committee (BMC)" that is responsible for all activities related to the development and welfare of the market. The BMC is chaired by a local leader and has participation by selected shop owners.

c) Participants involved in project development

3.34 Center for Mass Education in Science (CMES), an NGO based in Dhaka implemented this project under the Renewable Energy Technologies in Asia: A Regional Research and Dissemination Program (**www.retsasia.ait.ac.th**), financed by the Swedish

[3] 1USD = Tk. 59.17 (April 2002)

International Development Cooperation Agency (SIDA) and coordinated by the Asian Institute of Technology (AIT).

d) End users

3.35 The users of this project are the shop owners of the market, who are able to extend their operating hours into the evening because of the high-quality bright light. Specifically, the end-users include owners of grocery shops, restaurants, barbershops, pharmacies, village doctor's chamber, tea stalls, etc. The following were provided:

- 18 shops, each with one 7 watt lamp.
- 3 shops, each with two 7 watt lamps; and
- 1 Black/White TV in the communal room of the Bazaar Management Committee.

3.36 The villagers coming to the market also benefited from this project as they were able to enjoy longer shopping hours and more convenient shopping.

e)Fuel/resources and technology used

3.37 Photovoltaic (PV) technology was used to generate and supply electricity to the shops. Seven solar modules of 50 W_p each divided into two groups, were installed in two suitable locations of the bazaar. The batteries and controllers of each group were placed in two rooms close to the solar arrays. Table 1 provides the specifications of the micro-utility system installed at Manikganj bazaar.

f) Cost and availability of fuel/resources/technology used

3.38 The total cost of micro utility systems including equipment, transportation, installation and training was Taka 175,701 (US$ 2970).

Resources

3.39 Bangladesh is blessed with significant solar radiation almost throughout the whole year. Daily average solar radiation varies between 4 to 6.5 kWh/m^2. The maximum amount of radiation is available during March-April and the minimum is during December-January.

Technology

3.40 The PV system was designed based on the following considerations:

- Latitude: 25.7^0 N
- Days of autonomy: 3 days
- Operating hours: 5 hours
- Design temperature: 25^0C
- Design tilt angle: 25^0
- Derating factor, DF = 0.9 for moderate and non-critical environment

Table 1: List of components installed in Manikganj Bazaar for Micro Utility

Component	Model	Manufacturer	Tech. Specification	Nos.
PV module	SR-50	Siemens (Germany): Imported	Watt: 50 Wp Total: 350Wp	7
Battery	6BC 160T/3	Rahimafrooz (Bangladesh): Locally purchased	Type: Lead-acid Capacity: 100Ah@10Hr Nominal Voltage: 12V	7
Charge controller	Type -A (CMES)	CMES (Bangladesh): Locally developed	Rating: 10A Over charge protection: 14.5V Over discharge protection: 11.5V	7
Ballast		CMES (Bangladesh): Locally developed	Watt: 7W Frequency: 50 kHz	24
Fluorescent Lamp	FL-7	Toshiba (Japan): Locally purchased	Watt: 7W Current Consumption: 0.6A Voltage Range: 11.2 -14.4V Illumination: 700 Lumens	24

Details of the other design values are given in Table 2.

Table 2: Details of design values of Micro Utility system

Parameters	Description	Values
Loads	24 fluorescent lights of 7W each	168 watt
	1 B/W TV of 25W	25 watt
	Total energy demand per day	965 Wh
	Total Ah demand per day	80.42 Ah
Battery design	Bus voltage	12 volt
	Maximum depth of discharge (DOD)	70%
	Required battery capacity	460 Ah
Module design	Battery round trip efficiency	85%
	Required array output	1,287 Wh
	Number of modules of 50Wp	7

g) Completion time

3.41 The project was conceived over a considerable period of time including a general survey for the selection of the bazaar. However, the whole process of implementation of the micro utility, including meetings with the Bazaar Management Committee, selection of loads (number of shops and quantity of lights in each shop), system design, transportation and installation was completed in less than two months.

3.42 An analysis of the technical and financial viability of the installed micro-utility by using RETScreen[4] software was done. Based on the site and system (capacity, battery and load), the cost of PV module represents 58% of the total cost whereas the balance of system costs, transportation and installation form the remaining 42%. The project life is estimated to be 25 years, while the batteries and the lamps are expected to be replaced

[4] Developed by Ministry of Natural Resources, Canada, used to evaluate the energy production, life cycle costs and greenhouse gas emissions reduction for renewable energy based electricity generation.

every 5 and 3 years respectively. The fund for installation has been assumed to be a soft loan with 2.5% interest.

Table 3: Summarized results obtained from RET Screen

Technical Issues	**PV module capacity**	**Installed: 350 Wp**	
	Annual energy demand and supply	**Demand**	**349 kWh**
		Supply	**332 kWh**
Financial Issues	Total project cost	Taka 175,701	
Annual revenue*	@ Taka 5 per lamp per day	Taka 46,965	
Annual payment	Loan repayment (for 5 years)	Taka 37,819	
	Operation & maintenance	Taka 11,100	
Summary	Simple payback period	4.9 years	
	Net present value	Taka 219,241	

Revenue from TV has not been considered

3.43 Based on radiation data and load demand, the annual electricity demand estimated by the software appears to be slightly less, and this deficit is expected during the months of June and July. The simple payback period for such a utility is estimated to be about 4.9 years. The cost options available in RETScreen, those related to logistic, engineering, training and unforeseen were not considered in the analysis. However, assuming costs for these increases the total project cost by about 10% and the simple payback period to about 5.4 years.

2. Financing

3.44 The project was completely financed by the Swedish International Development Agency (SIDA) through the Asian Institute of Technology (AIT).

3.45 The users pay a daily tariff of Taka 5 (~¢8) per light, which is collected by a technician appointed from the locality. In addition, a refundable deposit of Taka 200 (~US$3.4) was also paid for each connection. CMES reserves the right to forfeit this money in case of any damage made to its assets. The tariff collected is used to pay technician salary and meet the expenses of repair and replacement of the components and the rest is deposited in a bank account maintained by the technician and CMES.

3. Impact

Qualitative impacts

3.46 A monitoring and evaluation carried out to record the impacts of PV micro utility system showed that the shopkeepers appreciate the micro-utility and the users are satisfied in terms of amount of light and quality of service. It is felt that the market was livelier than before and had created an environment for the people to stay longer in the market resulting in increase in business. PV-powered television has been regarded as an added attraction, which has evolved as a recreation facility for the villagers.

Sustainability impacts

The following features will make this micro utility model sustainable:

- ?? Reliable power supply: The system supplies power to the users for 5 hours every evening. Since, there are no moving parts in the PV system, it functions well and increases the users reliability.
- ?? Easy payment: Unlike purchasing the whole PV system, which needs high initial investment, the users pay a daily tariff for using the service only. They also do not need to buy any hardware. These make payment for the users easy.
- ?? Local employment: As the system is taken care of by a trained technician from the area the users feel very confident on the system as well as the reliability of service. It has also generated employment in the locality.
- ?? Decentralized and removable: No infrastructure like transmission line is required for installation of PV systems. This makes it installable anywhere easily and reduces the cost for installation. The whole system can also be removed and/or transferred to some other place/location, in case the location gets access to local grid.
- ?? Environment friendly: PV system does not emit any smoke or pollute the environment. This makes the systems environment friendly.
- ?? Renewable source: As the traditional fuel is depleting fast, it is necessary to generate electricity using non-conventional/renewable energy sources.

4. Scale up

Challenges faced and steps taken to overcome

3.47 The problems faced and the respective solutions during the implementation of micro utility model can be summarized as follows:

- ?? Awareness: Since PV technology is fairly new in the country and rural people have little knowledge about the technology, it was very difficult to convince the people to use PV system for electrification. Conducting meetings with the potential users and local people and explaining the use and benefit of PV micro utility system addressed this concern.
- ?? Energy need: Assessment of energy need of the consumers was a major factor to design the system accordingly. Surveying the energy needs of the shop owners did this.
- ?? Tariff structure: Before installation of micro utility system, a diesel generator was supplying electricity to the shops at Taka 5 (US¢ 8) per day per light. So, it was felt that a higher tariff would not make the users interested to use PV system. The discussion with the shop owners revealed that the tariff for the micro utility should also be same as the payment for diesel generator.
- ?? Users education: The system size was kept as small as possible to reduce the investment. Therefore, there were chances that system would suffer

from shortage of energy during the rainy season. Therefore, the users were informed about this possibility. Discussions with the Bazaar Management Committee were very crucial in implementing this activity.

- Least maintenance cost: Analysis showed that if CMES had to take care of the system, the cost for operation and maintenance will be very high and there will be risk of recovering the initial cost. Therefore, a local technician was trained on operation and maintenance to take care of the system. Since he could execute this job in addition to his other works, he was provided a small payment. Moreover, he was trained to do minor troubleshooting so that CMES needed not to spend money for sending staffs frequently. This kept the maintenance low. In addition, as the users knew the technician and they could contact him anytime needed, the trust for this system was increased.
- Selection of site: This is a very important aspect to be considered that the site be away but not too far from the grid network. Moreover, users who know the benefits of electricity will be more interested in such systems.
- Availability of grid: If it is perceived that a grid would arrive at the selected location, the system could be transferred to another suitable location.

So far, eight such utilities have been installed by CMES. Grameen Shakthi has developed similar programs as well, indicating that the scale-up is taking place.

Bangladesh

Empowering Women through Micro-Enterprise Development by Using Renewable Energy Sources

Dipal Barua, Grameen Shakti, Dhaka

1. Overview

3.48 This is a project specially designed and run by Grameen Shakti, a member of the Grameen family of organizations in Bangladesh. This project envisaged empowering women through micro-enterprise development by using renewable energy sources over a period of three years during 2002-05.

a. Reason for/Cause of the Project

- Poverty in Bangladesh is largely a rural phenomenon. Landlessness, low income and unemployment characterize rural Bangladesh.
- Environment is also an emerging concern for the rural poor. Indiscriminate deforestation, overuse of biomass and drying up of water bodies have become major problems for the poor.
- Growth of population and industrial development has significantly increased the demand for energy.
- Vast majority of women are disempowered and have no role in development process.

The goal of this project is *to assist in empowerment of women in rural Bangladesh through creating access to renewable energy technologies*. The major objectives of the project are:

- to reduce women's burden of fuel shortage.
- to provide ownership and control over assets.
- building the capacity of the rural poor women for economic leadership.
- to increase relative income by reducing time taken to accomplish specific IGAs, and
- to reduce diseases related to exposure of indoor pollution in rural poor households.

b. Location and local Setting

3.49 The project is located in Khulna and Satkhira districts, both of which are in the south-west corner of Bangladesh. One manager and three skilled personnel, all women, have been assigned to execute project activities.

c. Project activities

- ?? Installing 175 units of Solar Home Systems (SHS).
- ?? Training women on income-generating activities.
- ?? Assisting the rural poor women to develop enterprises.
- ?? Training 50 technicians in PV technology to repair and maintain PV systems in rural areas with a view to popularizing PV and increasing employment.
- ?? Training the customers on usage of PV systems.
- ?? Selling 5 village mobile phone systems.
- ?? Designing 50 solar dryers suitable for household applications to dry up fish, fruits, spices, and other commonly produced household items in the rural areas.
- ?? Designing and installing 30 solar cookers in households and workshops.
- ?? Training the target women and the workshop owners/technicians in fabrication of solar dryers.

d. Cost and availability of fuel/resources/technology used

1. Solar Home System: US$ 435
2. Village Mobile Phone: US$ 638
3. Solar Dryer Fabrication: US$ 62
4. Solar Cooker Fabrications: US$ 56

2. Financing

Solar Home System, Solar Dryer and Solar Cooker

- ?? The customer has to pay 15% of the total price as down payment.
- ?? The remaining 85% of the loan amount including 10% service charges are to be repaid by 36 account payee cheques in advance.

Village Mobile Phone System

Grameen Shakti will offer the following credit mode for those women who want to buy the proposed village mobile phone systems on credit, that is:

a) The customer has to pay 10% of the total price as down payment.
b) The remaining 90% of the cost are to be repaid within 36 months with 12% service charge.

3. Impact

3.50 The following impacts are expected from the proposed project:

- ?? The project, through providing for increased harnessing/generation and usage of renewable energy, will influence the policies of the government.

?? By allowing increased time for income generating activities, the project would encourage economic self-dependence and the self-confidence of the poor and distressed women.

?? Children would have additional time to do their studies. Overall atmosphere in the family would improve.

?? Usage of the otherwise neglected renewable energy for various domestic and economic activities would help conservation of the fast-depleting natural sources of energy allowing a greater scope to maintain the ecological balance.

?? Health status of the target women and the children would improve through reduction of indoor air pollution.

4. Scale-up

Major Challenges		*Selected Measures*
3.51 Capacity Building	??	Training in technology assessment, project planning, technical aspects, and maintenance.
	??	Major information dissemination, promotion activities, publicity campaign, demonstration, closely targeted to particular types of decision makers and potential consumers.
	??	Transmission of latest information, through workshops, seminars, publications, training sessions.
Infrastructure Development	??	Information dissemination activities.
	??	Initiatives to reach technology to grassroots level.
	??	Knowledge and experience sharing.
	??	Specific targets to set up local infrastructure including encouraging local entrepreneurs to set up maintenance and component shops.
Encouraging innovation	??	Development of prototypes or concepts such as mobile charger, Micro utility system, mobile phone shop through R & D programs for income generating activities.
Back-up services	??	Development of efficient service and maintenance teams to ensure high end user satisfaction.
Soft Financing	??	Establish innovative financing mechanisms that take into account the abilities and constraints of poor/rural users.
Motivation for implementers	??	Incentives and awards based on results.

Bangladesh

IDCOL Renewable Energy Program

Fouzul Kabir Khan, Infrastructure Development Company Limited, Dhaka

1. Overview

a) Reason for/Cause of Project

3.52 Infrastructure Development Company Limited (IDCOL) implements a part of the World Bank's Rural Electrification and Renewable Energy Development (REREDP) project, which is intended to help Bangladesh accelerate its electricity access rate by promoting mainly solar home system (SHS) and a few wind, mini-hydro, and biomass renewable energy projects in rural areas where conventional grid electricity is absent and/or is unlikely to reach in near future.

b) Location and local setting

3.53 The project is being implemented in rural areas in Bangladesh.

c) Participants involved in project development

3.54 The project is being implemented by NGOs/MFIs (hereinafter, Participating Organizations or POs). Five POs -- Grameen Shakti, BRAC Foundation, Srizony, TMSS, and Coast Trust are currently enlisted in the program. IDCOL is likely to recruit a few more POs in the near future. Roles of other stakeholders, other than IDCOL, in the program are discussed below:

3.55 Households (a) contribute equity up front, (b) own and operate the system as instructed, and (c) regularly pay debt service in monthly instalments to MFIs.

3.56 Technical Standards Committee (a) establish and update equipment and service standards, (b) design a quality assurance program, (c) determine technical standards for equipment to be financed, (d) review the product credentials submitted by dealers, and approve the eligible equipment, and (e) evaluate the feedback from dealers and POs to develop the industry standards for the PV hardware equipment.

3.57 POs (a) identify households in partnership, (b) sell (at a reduced price after adjusting for grant) SHS to customers and install the SHS; (c) require households to put minimum 10% of the system cost as down payment; (d) approve credit based on application and deposit on equity margin; (e) prepare SHS installation program in partnership with SHS dealers; and (f) claim GEF grant and refinance up to 80% of such loans made to household; and (g) furnish periodic reports to IDCOL.

3.58 Publicity and Training Committee reviews and approves (a) all scripts and other materials for publicity designed for expansion of SHS; and (b) training modules designed for (Lender) POs and households.

3.59 Along with maintaining relationship with households and manufacturers, POs need to submit disbursement applications in prescribed format (included in the participation agreement) to claim grants and refinancing from IDCOL. Regular payment of interest and repayment for the refinancing facility is also a prime task of the PO for the smooth operation of the program.

2. Financing

3.60 Broadly, IDCOL contemplates financing of 2.44 MWp, or an estimated 50,000 SHSs over a period of five-and-half years [October 2002-June 2008]. It would also include a few wind, mini-hydro and biomass pilot projects. The total project cost is about US$25 million. The various sources of project funding include (a) US$11.44 million by International Development Association (IDA); (b) US$6.67 million by Global Environment Facility (GEF); (c) US$3.59 million by participatory organizations; and (d) US$3.2 million by households.

3.61 In a pilot program already implemented, IDCOL through the five POs has provided grants and refinanced loans extended to households by POs for purchase of 250 SHSs. Since the start of the second phase in January 2003, over 2500 SHSs have been installed under the program all over the country in just four months.

3.62 Under the program, IDCOL will:

i) Provide two grants for purchase of SHS: the buy-down grant to lower initial investment cost of SHS, and the institutional development grant for institutional development of POs. Both the components of GEF grant will decline as market expands and becomes commercially viable. Specifically, the grant will decline in the following pattern:

Item	**Grant Available - US$ per SHS/household**		
	Total	**Buy-down grant**	**Institutional Development Grant**
First 20,000 systems	90	70	20
Next 20,000 systems	70	55	15
Next 10,000 systems	50	40	10

ii) Refinance 80% of the loans made to the households for purchase of SHS by the NGOs/MFIs selected as POs with a cap of USUS$ 230 per system.

iii) Provide technical assistance, loans and GEF grants to POs for development of sub-projects (pilots on wind, hydro, and bio-mass power systems). Technical assistance will be for overcoming barriers to renewable energy market development, project development and administration, capacity building, project monitoring and evaluation. This would include support for activities, such as (a) households and POs training; (b) publicity campaign; (c) quality assurance programs; (d) developing the commercial capabilities of

SHS dealers; and (e) other activities to be defined during project implementation.

Terms and conditions of IDCOL Refinancing Facility to POs	
Tenure	10 years
Grace	2 years
Interest rate (declining balance)	6% per annum
Repayment frequency	Semi-annual

Bangladesh

An overview of Renewable Energy Project

B P Mondal, BRAC Foundation, Dhaka

1. Introduction to BRAC

3.63 BRAC (Bangladesh Rural Advance Committee) was established as a relief organization in 1972 after the liberation war. It has involved into the country's largest development organization with the principal objective of "alleviation of poverty and empowerment of the poor." Its wide range of programs cover education, health care, agriculture, poultry, research, crafts, computer, banking, printing and publication, dairy and food products, and Micro credit. BRAC entered the renewable energy field in 1997 to add environmental protection to its portfolio. A separate BRAC Foundation is involved in implementing the RE program.

2. BRAC Foundation's SHS Project

3.64 The solar home system project of the BRAC Foundation has the following objectives:

- ?? to change the living and social standard of the rural people.
- ?? to change the economy of the society by pursuing modern approach through TV, Radio, etc.
- ?? to meet the demand of electricity in rural and remote areas.
- ?? to increase the working hours, and
- ?? to implement a marketing campaign to develop awareness about PV technology.

3. Organizational structure

3.65 At the Head Office level, Program Coordinator supervises the project, reporting to the Deputy Executive Director. A Project Engineer (Solar) is responsible for technical issues. At the field level there are seven Regional Sector Specialists responsible for execution of the program. At the district level (52 districts), a diploma engineer provides technical support. Every thana/Area office has one program organizer who is directly involved with marketing and installation of the SHS.

4. Application of PV systems

3.66 The customers of BRAC Foundation are using PV systems mainly for lighting and for recreational purpose. Some of the end-uses are:

- ?? Charging mobile phone.
- ?? Lighting in tailoring shops, grocery shops, restaurants, poultry farms, weekly markets, etc.,
- ?? Operating computers, and

?? Micro utility (selling power to the neighboring shop).

5. Marketing Strategy

?? Demonstration (Schools, Colleges, Weekly markets, Union Parisad offices, etc.).
?? Distribution of printing materials for publicity (Poster, Leaflet, Brochure, Banner, etc.).
?? Personal contact campaigns.
?? Formal and Informal group discussions.

6. Financing

3.67 BRAC offers the following credit terms for the purchase of SHS.

System-1: Customer has to pay 20-25% of the system price as down payment. The remaining 75-80% is to be repaid within 12 months with 15% service charge.

System-2: Customer has to pay 20-25% of the system price as down payment. The remaining 75-80% is to be repaid within 24 months with 15% service charge.

System-3: In the case of cash sale, 4% discount is offered.

For every system, there is a US$70 grant from IDCOL under a World Bank project. In addition IDCOL provides 80% of the loan amount as refinance and 20% is from BRAC Foundation.

7. Services provide by BRAC

?? Installation of system.
?? Credit support (if necessary).
?? Free service to the customer for 3 years.
?? Customer's training for awareness development.
?? Ensure spare parts of the system.

8. Progress in Sales

3.68 Presently, BRAC is operating in 300 thanas of 52 districts, covering most of Bangladesh. Priority is given to off-grid areas. Up to April 2003, BRAC has sold and installed the following systems

?? 1635 solar home systems of 72.50 kw capacity.
?? 2 PV-utility interactive systems and 6 PV-wind turbine hybrid systems in the coastal area.
?? Distributed 200 solar cookers.
?? Constructed 1536 biogas plants.
?? Installed 120,000 improved cooking stoves.

9. Impacts

Children's education has improved due to better quality of light. Women are happy as they can do the sewing at night. Operating computers by solar in rural areas increases the knowledge about the technology. There are strong health benefits through avoidance of kerosene lamps and diesel power packs.

10. Challenges

The major challenges of SHS are:

- ?? Recovery of the loan installment in due time.
- ?? Educating customers on proper operation and maintenance.
- ?? Ensuring timely service.
- ?? Ensuring availability of spare parts locally.
- ?? Ensuring the quality of the product performance.
- ?? Reaching the low-income groups.
- ?? Limited local infrastructure (for making Battery, Charger Controller, Inverter, etc.)

11. Major lessons

- ?? PV systems have been used mainly for improvement of the quality of life. About 10% of the systems are used in income generation activities.
- ?? Cost of PV systems compared the purchasing power of rural people is very high. Suitable financing is the key to expansion of the program.
- ?? Publicity should be increased to popularize the PV systems.
- ?? Service and spares parts should be made available in time.
- ?? Training and orientation is essential of the customer to handle the system properly.
- ?? There is a demand of using fan in addition to lights.
- ?? Customers show interest on PV system initially, but the prospect of grid power availability (usually promised by politicians) in the near future brings down their interest.

Bhutan

Micro Hydro Project for Off-grid Rural Electrification

Bharat Tamang, Thimphu

1. Overview

3.69 In 1996, the Dutch Ministry of Housing, Spatial Planning and Environment (VROM) and the Ministry of Finance, Royal Government of Bhutan agreed to jointly fund and Activities Implemented Jointly (AIJ) pilot project – a 200 kW Micro Hydro Plant for off-grid rural electrification.

3.70 For the VROM, the aim was to study the possibility of the green house gas emissions abatement through measures abroad, under the presumption that the same mitigation effect could be achieved at a lower cost. For the Royal Government of Bhutan, it was capacity building in sustainable development of renewable resources through joint efforts to provide clean energy access in one of the remotest areas of Bhutan.

3.71 The project had a hardware component and a software component[5]. The software component dealt with the actual AIJ monitoring of the Project while the hardware component dealt with actual construction of the generating plant and equipment including building of rural electrification infrastructure for distribution of electricity.

3.72 VROM provided funds to cover 50% of the cost to build the 200 kW generating plant and to conduct the AIJ monitoring and impact assessment study, while the Royal Government of Bhutan funded 50% of the generation cost as well as the rural electrification. The study on the software component was carried out carried out by ETC-Netherlands in close consultation with National Environment Commission and the Department of Power (now Department of Energy) of the Royal Government of Bhutan. The hardware component of the Project constituted survey, investigation, planning, designed and construction of the 38 meters head, 0.888 cum/s flow, 200 kW firm power micro hydro plant across Rongchu to supply electricity to 130 households in Kellungchu valley in Gangjur block of Lhuentse district in North-East Bhutan. The hardware component was fully planned, designed and implemented by the Bhutanese engineers, technicians and contractor without any technical assistance from outside. Only the generating plant and equipment (turbine-generating sets) were imported from M/s Kubota, Japan, since Bhutan had no manufacturing capacity. Pump as turbine (PAT) is used with electronic dummy load controller as governor. Since the Project was in a remote area, inaccessible by road, it took longer to implement than expected due to time

[5] The software study component of the Project was presented at the AIJ conference held in New Delhi 8-10 January 1997, organized by Development Alternatives, New Delhi.

taken for obtaining environment clearance for building the 6.4 km long road as well as its construction itself as additional work was necessary.

3.73 The project was successfully commissioned and dedicated to the nation in December 2001. The project offered multiple benefits. The water channel was designed to provide drinking water to 8 households in the vicinity, irrigate 25 acres of land adjacent to the power house and generate 200 kW firm power. The road constructed to transport the equipment, became an additional benefit. The scheme is semi-automatically controlled and the power house is un-manned. A semi-skilled caretaker and his helper are the only people involved in normal care, routine maintenance and shutdown/re-start operations.

The generating power plant was completed at a cost of US$523,000 excluding the cost of 6.4 km long road (US$70,600) which benefited not only hydroelectric construction and RE infrastructures development, but also provided road access to the farmers living in the remote area. Electrification of 130 Households during the 1st phase of the Plan was completed at a cost of US$256,000. Second phase of electrification is going on to extend the supply 20 km upstream in the North. The scheme has a built-in provision for grid integration/synchronization for efficient capacity utilization in future and injection of surplus power in the grid.

2. Financing and Cost Recovery

3.74 The project has a generation capacity of 1.67 GWh per annum at 95% plant capacity factor. The micro hydro development cost therefore worked out to be US$ 2615 per kW and 31.42 cents per kWh. If we price the electricity generation considering a 20 years economic life at 10% discount rate and 1.5% annual operations and maintenance cost, the generation cost per unit of energy works out to 4.16 cents per Unit. However, if the plant load factor of the rural electric scheme is only about 25%, in which case, the economic cost of the generation would work out to be 16 cents per Unit in the beginning.

Presently the rural consumers pay only about 1.5 cents per Unit, which is far less than the economic cost of generation, transmission and distribution estimated at 8.67 cents per Unit (LRMC). This low rate is being charged since that matched the people's ability to pay for energy services (e.g. equivalent to the amount they generally spend on kerosene for lighting).

3. Project Impacts

3.75 The Project has supplied hydroelectricity to substitute kerosene and fire wood use to meet the lighting energy requirement and to some extent cooking (e.g. rice cookers becoming popular). Since hydroelectricity is a clean and renewable form of energy; it contributed to the reduction of GHG emissions. The education standards of the village children have improved due to increased study time in the evenings. Money and time are also saved as rural folk do not have to travel hours to procure kerosene from the nearest market/outlet. Health has also improved as the children and women are less exposed to kerosene fumes and smoky kitchens during cooking.

4. Scale-up

3.76 If "scaling up" is to be understood as increasing the size of the project to derive more benefits at least cost input; then this project definitely underwent such an exercise. Earlier, the size of the micro hydro facility was planned only for 100 kW capacity to cater to the demand of 130 rural households though there was adequate water in the river for generating 200 kW, mainly due to budgetary constraint. So, the scaling exercise was undertaken to derive maximum benefits at minimum cost inputs. The investment cost per unit kW and kWh improved as the size/capacity was doubled, keeping in view the future demand as well as the water potential/availability.

3.77 Past experience has taught us that the rural micro hydroelectric load exceeds the generation capacity in 8-10 years and plant starts getting overloaded and the quality of supply is affected. To avoid this problem, a demand study was conducted and the inter-connection/grid synchronization provision has also been made so that in 8-10 years, when the grid reaches, the power plant can be synchronized with the grid.

Bhutan

Incorporating needs and Roles of Women in Energy and Water Management in Rural South Asia – Capacity Building in Rural Areas of the Himalaya

Manju Giri, Royal Society for Protection of Nature, Thimphu

1. Overview

a) Objectives

3.78 The main objective of the this project, funded by UNDP and SIDA, is to draw appropriate development interventions with which the project proponent can help reduce women's burden and improve their economic productivity through conservation programs. Specific objectives are:

- To analyze and identify the current status on energy and water needs and constraints for women through collection of primary information, compilation of available data and statistics and information with respect to the selected areas; and
- To primarily focus on women's need and to identify environment-friendly water and energy related technological options that not only cater to their needs and be suitable for the selected sites but most importantly enhance environmental sustainability.

b) Location and local setting

3.79 The Royal Society for Protection of Nature (RSPN) has identified the sites to promote and empower women's participation in the sustainable management of appropriate energy and water related technologies.

Project Site- I (Wangduephodrang)

3.80 The selected sites under Wangduephodrang district are Phobji, Gangte and Bjena. The first two share cool temperate and warm summer but cold and chilly winter climatic conditions. The sandy-clay loam soil found in these two geogs (blocks) is in general fertile for cultivating potatoes, vegetables, mustard and buckwheat. The settlements are widely scattered with both rugged and gentle slopes. Bjena, is located in the central part of Wangduephodrang and is considered important from the conservation point of view because of its abundant forest resources and high potential for agro-livestock activities. It is a largely a rice-based farming community with high holdings of wetland and large areas of pasture and abundant forests. Potato cultivation and livestock rearing are also popular in Bjena.

Project site – II (Ha)

3.81 The group of Yomto, Gyensa, Talung and Jamtey villages under Bji geog in Ha district is identified as another potential project site. Bji is the largest geog in the district. Yomto, Gyensa and Talung are located by the riverbank except for Jamtey village. The geog's main crops include wheat, barley and potato. Apples and vegetables are also grown in the lower part of the geog. With high alpine forest cover, the geog has the highest number of yaks in the district (6,084 out of the total 9114). People of this community are subsistence farmers engaged in agricultural farming and livestock rearing. Besides growing potato, maize, wheat, barley and buckwheat, there are other income generating activities.

Project site – III (Punakha)

3.82 Lingmutechhu Watershed Area under Punakha district is designated as another project site. The area is at about 1200-3000 meters above sea level. The whole catchment's area is roughly about 34 sq.km. and has rich biodiversity. About 75% of the area is covered with forest and it has 343 acres of wetland and 136 acres of dryland. Lingmutechhu watershed area remains important for the geog's 188 households and to the lowland settlements in Punakha and Wangdue because of its high altitude, rich forest resources, soil fertility and the good gradient for irrigation and water.

3.83 The Conservation and Development Unit of RSPN is responsible for the development of this project. We have been studying the needs of these areas to bring about development through the project.

c)Participants involved in project development

3.84 The International Centre for Integrated Mountain Development (ICIMOD) is implementing the project in the hills and mountain areas of Bhutan, India and Nepal. In order to implement the project, ICIMOD has identified the following institutions in three countries, namely:

- ?? Royal Society for Protection of Nature (RSPN), Thimphu in Bhutan.
- ?? Tata Energy Research Institute (TERI), New Delhi in India, and
- ?? Centre for Rural Technology (CRT), Kathmandu in Nepal.

d) End-users

3.85 The main focus of this project is on women. It aims to explore community development interventions that would empower and promote integration of women in decision-making, implementation and management of household energy and water initiation that better reflect their role and needs. Since we are trying to implement our project activities in all the three project sites, a total of 13 villages are going to be benefited.

e) Fuel resource and technology use and costs

3.86 We are on the preliminary stage of our project, and haven't used any kind of resource or technology so far. However we do plan to implement various activities through this project for drudgery reduction. The two identified sites under our project are not electrified; people mostly use fuelwood in their day-to-day life. Hence we plan to provide them with solar equipment and kerosene heaters at a subsidized rate.

f) Completion Time

The implementation of the activities will be done by June 2003 and the completion time period is January 2004.

2. Impact

3.87 The expected output of the project is the integration of women in decision-making, reduction of working hours so they have more time for recreational activities. The National Women's Association of Bhutan has initiated a non-formal education among the older illiterate group of people in the villages. If women of our project sites will be able to reduce their working hours through our activities, they could devote some of their time in the NWA classes. With the provision of LPG stoves, smokeless stoves and kerosene heaters, we expect that the fuelwood collection from forests will be reduced and there will be less environmental degradation. The usage of stoves will also bring about reduction in the drudgery of cooking over traditional open stoves for many women, which will generally reduce health risks. Besides their daily indoor activity, women are also responsible in the farm work like plantation, weeding, harvesting etc. If they could take out some spare time from their daily schedule, they will be able to concentrate more in the field activities resulting in higher yield of their agricultural products.

Brazil

PRODEEM Project

BP Solar-Rural Solutions Team, UK

1. Overview

Reason for/cause of project

3.88 The Brazilian Ministry of Mines of Energy is implementing a program aiming at providing access to energy to schools and other community buildings in rural areas. The prevalent idea is to enable the community to use the schools for evening classes and as a focal point for the community to get together and promote association and citizenship.

3.89 The program (PRODEEM) was initiated in 1996 and originally consisting of the Ministry buying equipment and delivering to the state governments, who would be responsible for the installation of the equipments. There were several problems with respect to inappropriate installation and systems maintenance. Later on the Ministry re-evaluated the program and decided to buy turnkey systems with 3 years maintenance and guarantee. In December 2001 the Ministry was awarded a US$10.4 million contract to install solar systems on 1852 schools in 11 States in Brazil. In November 2002 all systems have been successfully installed.

Location and local setting

3.90 The PRODEEM systems were installed in schools scattered in rural communities in 11 Brazilian states (Parana, Minas Gerais, Bahia, Alagoas, Sergipe, Pernambuco, Piaui, Ceara, Paraiba, Rio Grande do Norte and Espirito Santo) covering an area of 2.3 million square km, ten times the size of France .

Participants involved in project development

3.91 BP Solar was hired on a turnkey basis and have mobilized several manufacturers, local and international, to supply the other components of the systems: Batteries, wiring, civil construction (bought locally), inverters, charge controllers, etc.

3.92 BP Solar hired and trained 14 local companies to proceed with the installation and training, mobilizing 100 crews of 4 members each. There was a string involvement of the teachers and community leaders to explain the benefits of the solar systems and how to operate them correctly.

3.93 The project also involved the regional PRODEEM leaders, to assess the quality and completion of the installation but also to update information about the schools and local leadership.

End-use

3.94 In total, 1852 school packaged systems of 720 Wp capacity were installed, individual, totaling 1.33 MW, one of the largest projects in the world of this kind. A total of 11,112 panels of 120 Watts each were installed on this project

Each system was designed to supply 1820 KhW/Day, on a typical school comprising Class room with 6 light bulbs, TV, antenna, video, Teachers Room, with 2 light bulbs, Kitchen with 2 light bulbs and one refrigerator and a WC with 2 light bulbs.

End-users

At least 60,000 schoolchildren and 7400 teachers were benefited by the project; an extended community of 700,000 people can now access the schools for meetings and productive activities.

Completion time

3.95 MME and BP Solar signed the contract on December 30th 2001. The first months of 2002 were dedicated to order the equipment, hire and train the local contractors, rent local warehouses and obtain import and other licenses. The equipments were tested by CEPEL the Eletrobras technology centre, before installation.

3.96 Installation had begun in June 2002. By late November all schools have been successfully covered. In December BP Solar was able to get documentation from the States certifying that the systems have been duly installed.

2. Financing

3.97 The Brazilian Government funded the Project. Since the schools belong to the municipal governments there is no payment contribution from the end-users. The contract with BP Solar has a provision for maintenance over the next 3 years.

3. Impacts

3.98 The project enabled distance-learning programs using a combination of video and TV, and brought connectivity with the rest of Brazil (now people can have information). Adults can now attend evening classes, after a long day working on the field. The schools are forming a nucleus for community activities.

3.99 BP Solar is also using PRODEEM as a learning curve for small CDM projects. The Project is avoiding emissions of 1722 tonnes of CO_2 on a standardized baseline for all schools. BP Solar also produced a video CD on the project co-sponsored by the World Business Council for Sustainable Development.

4. Scale-up

3.100 PRODEEM as a whole is one the largest solar powered community systems programs in the world. To date PRODEEM has helped install more than 8000 school and irrigation systems and intends to extend the Program to productive uses, in order to generate income opportunities for rural communities, enabled by renewable energy. Adequate maintenance on the long run is still a challenge and MME is intending to hire

local companies to revitalize the equipments that were not bought on a turnkey basis and provide maintenance services.

India

Socio-economic Development in Tribal Villages of Andhra Pradesh

V N V K Sastry, Environment Protection Research & Training Institute, Hyderabad

1. Overview

a. Reason for/cause of project

3.101 There are 3437 small habitations located in the reserve forest areas of the state of Andhra Pradesh, which are inhabited mostly by hunting and gathering communities classified as Primitive Tribal Groups by Government of India for paying special attention to their development. These villages will never be connected by grid due to logistical and financial feasibility reasons. Primitive agriculture, gathering of forest produce, high levels of malnutrition and infant mortality rates characterize these tribals. Most of these areas are declared as wildlife sanctuaries and eco development projects. Taking up energy plantations in reserve forests or using exploiting them for fuelwood is prohibited. Hence Solar energy is the best alternative.

b. Location and local setting

3.102 Fourteen villages located in deep forest areas of Nallamala forests in Mehboobnagar District have been selected and project report prepared. One village was taken initially for demonstration purposes.

c. Participants involved in project development

3.103 The main project participants include the various tribes in the villages, NGOs working in the area, anthropologists who did research in this area, EPTRI and renewable energy Specialists.

d. End-use

Village electrification, education, health and economic activity.

e. End-users

About 200 families living in these villages will be benefited

f. Fuel/resource and technology used

Solar Energy.

g. Cost and availability of fuel/resource/technology used

Cost varies from village to village.

h. Completion time

One year.

2. Financing

Government of India is initially providing one million rupees (US$20,000).

3. Impact

3.104 The project is expected to provide lighting to students for education, power for refrigerators to store anti-snake bite venom, and electricity for lifting water for horticulture.

India

Putsil Village Micro Hydro Project

V Ram Subramanian, Sahyadri Energy Systems, Bangalore

1. Overview

3.105 Putsil is a small tribal village in Koraput district of Orissa. About 80 Kond tribals live here. The village is 8 km away from the nearest motorable road. Grid is also at the same distance from the village. Their main occupation is agriculture and they grow rice for their own consumption. They also collect minor forest produce and sell them in weekly market in a nearby village. Some of the villagers had visited towns and seen the electric lights. Local utility was not in a position to extend the grid to this village. Kerosene was the main fuel used for lighting.

3.106 Knowing the plight of these people, WIDA, an NGO working in the region started exploring various alternatives and found that there was enough water to generate power to supply lighting to the whole village. The villagers formed a committee to work out the details. Work started in late 1998 and the 13 kW power plant was commissioned on 15August 1999. The total cost of the project was Rs. 1.6 million (US$32,000). The main costs were that of a 450m long penstock and 1.5 km underground transmission line.

3.107 Lighting and milling/grinding came out to be the two main demands of the people which they expected to meet from the proposed micro hydro scheme. The loads arising from these applications can be summarized as follows:

a) Domestic demand		
??	3 X 20 W lamps per household	60W
??	Provision for radio/cassette player	10W
??	Total demand by all 80 households	5600W
b) Street lighting:		
??	15 lamps X 40W	600W
c) Milling grinding machinery		3750W
??	Total nighttime power demand	6200W
??	Total daytime power demand	3750W

Based on the experience of similar projects elsewhere, a load growth can be expected following electrification as people start acquiring various electrical appliances. As the chances of extending the national grid supply to Putsil are very remote, the project should plan for increased electricity demand due to population growth. Taking these two factors into account, the demand is expected to be about 10kW to 12 kW within the next 7 to 8 years.

2. Financing

3.108 WIDA, the NGO raised the required capital cost from international funding agencies. The villagers provided labor – amounting to Rs.300 000 (US$6000) – in kind. Each family contributed one person to help the construction.

3.109 The micro hydro committee decided to collect a monthly tariff of Rs.20 from each family. The collection started from Jan 1999 -- even before the project started. This continues to this date. In addition to this, the operators' paddy fields are taken care of by the committee members.

3. Impacts

3.110 In addition to the usual positive impacts like extended lighting hours for children to study and for women to work in the kitchen, a new flour mill has been installed where a rice huller, an oil expeller and a flour mill operate during the day hours. The village now has a dish antenna and a community TV, which connects them to the outside world. WIDA has also installed a computer in the community centre of the village where children are encouraged to learn computer. A database of village statistics is also maintained.

3.111 The villagers have also realized the value of water management and hence they have started taking up reforestation in the catchment areas. The NGO continues to provide technical support for all these activities.

Though individual TVs are not encouraged, nowadays quite a few of the families have bought color TVs. This has resulted in resentment amongst non-TV owners; tariff system had to be reworked. Because of the NGO's active role, the project is still functioning. The question is whether this would survive if the NGO withdraws from the village.

4. Scale-up

3.112 Rural electrification through micro hydro is one of the most attractive community RE options. We have limited experience on this model. But we do have clear understanding of the challenges ahead in this direction.

1) Technical: Load management is still largely dependent on the community integrity. Available load limiting technologies can be easily bypassed by the end users. This can be controlled only with the full cooperation of the local population.
2) Financial: In most cases, people are ready to contribute their labor but when it comes to equipment financing, external sources are still preferred. Under the new Village Electrification program of the Indian government, local governmental bodies like *panchayats* can directly finance such projects. Banks and other financial institutions are hesitant when dealing with community loan schemes because of bad precedence of non-repayment. Most of these projects will qualify under small scale CDM projects, which will give high premium CERs, the sale of which in turn can offset some costs.

3) Institutional/Policy: Tax exemptions on the equipment will reduce the overall costs as such projects reduce the demand on the overloaded national grid and the corresponding losses.

India

Age-old watermills to modern energy services

Binu Parthan, IT Power India, Pondicherry

1. Overview

3.113 Since 1996, IT Power has been actively involved in the promotion and dissemination of improved water mills in the Indian Himalayas. The initial phase of technology development activities was supported by UNDP/GEF with the later initiatives funded by USAID/RECOMM[6] and EAP[7]. The current work on up-scaling of the efforts is being supported by DFID.

a) Reason for/cause of project

3.114 Watermills dotting the Himalayan region have begun to fall into disuse as a result of diffusion of diesel power plants. Many mill owners are now unable to sustain their livelihood on traditional milling alone and descend to the plains in search of better employment opportunities. It was identified under the UNDP/GEF project that the abundant hydro resource could be utilized more effectively with appropriate modernised equipment, which resulted in IT Power being brought in as international consultants.

b) Location and Local setting

3.115 IT Power efforts since 1996 have centred around Chamoli district in the state of Uttaranchal[8]. Each village usually have several watermills serving the village community for grain milling. The watermills are indigenously built and maintained by watermillers using local materials.

c) Participants involved in project development

IT Power – An international renewable energy consultancy having the South Asia operations in India, have been the technology, institutional and financing partners.

HESCO - Himalayan Environmental Studies and Conservation Organisation, an NGO was the local partner, who supported IT Power on the technical and institutional side. Watermill Association of Chamoli District was established under the project by HESCO, which since 2000 has taken over the technical and institutional aspects of the program but continues to work under guidance from HESCO.

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[6] Through Winrock International

[7] Engineers against Poverty, a foundation established by the UK institutions of mechanical, civil and electrical engineering societies.

[8] A relatively new state in India which was earlier part of Uttar Pradesh.

Gita Pumps – Manufacturer of pumps and hydraulic machinery located in Saharanpur, the manufacturing partner for watermill upgrades.

d) End use

Grain milling typically for wheat where the grinding rates have increased by up to 60% using the "New Gharat" compared to the old watermill.

Rice Hulling was introduced as a new end-use of watermills[9] and the villagers report better quality at lower prices compared to Diesel mills.

End-uses such as spice grinding, juice extraction, wool carding and welding are technically possible but not currently financially viable.

e) End users

3.116 Village communities use the upgraded watermill for domestic agro-processing needs. It should be noted that almost all the watermillers in the Himalayan states belong to the poorest section of the hill societies with the per capita income of 60 cents/day, below the benchmark of absolute poverty. 45 watermills have so far been upgraded by the Watermillers Association.

f) Fuel/resource and technology use and costs

3.117 The resource is water which is abundantly available in the Himalayas. There exists a local system for utilization of hydro resource for watermilling purposes and the watermillers pay a small cess (about 20 cents)[10] to the government for utilization of the resource. There are two technology pathways possible for the upgrades, which are:

i) New Gharat[11] upgrades which replace the runner, the drive train and in some cases replaces the open chute with a penstock. Costs range from 150-300 US$ depending upon the range of modification;

ii) Open Cross-flow upgrades are carried out on high head and high discharge sites and replace the vertical waterwheel with an open cross-flow runner with power available on a horizontal shaft for multiple applications. Costs range from 1500-2500 US$ depending upon the civil construction costs and end-use equipment.

g) Completion time

3.118 The current phase of the project involving the establishment of commercial sustainability of the watermill upgrades will be completed by mid 2004. Typically the time required for a New Gharat upgrade is about 2 months and for the "Open-Cross-Flow upgrade around 6-7 months.

[9] In India and there have been attempts in the past in Nepal

[10] 20 US cents annually

[11] Gharat in Hindi means watermill

2. Financing

3.119 The finance so far for the technical assistance activities such as technology development, feasibility surveys, management, raining, publications and handbooks have come in the form of donor grants. IT Power also its subsidized professional charges as contribution.

3.120 The cost of the watermill upgrades hardware has been financed by conditional grants and user contributions. The watermillers and the community also contributed manual labour and materials for the civil works and installation services. These contributions were converted into a revolving fund managed by the Watermillers Association with repayments going back to the fund.

3. Impact

3.121 Impacts on the community include improved revenue for watermillers. The impact on the villages has been in terms saving of time and money for milling and de-husking with better quality. Improved watermills led to the closure of several diesel plants[12]. The impact on the rice hulling facilities on women has been limited as they continue to manually de-husk the paddy at home.

4. Scale-up

3.122 There are believed to be about 200,000 waterwheels in Indian Himalayas alone and many thousands more in Afghanistan, Pakistan, Nepal, Bhutan, Myanmar etc. The current activities to scale-up are focussed on a detailed social impact assessment to develop the scale-up guidelines, a market survey to identify more end-uses and ways to improve economics, identifying an institutional framework and players and finally discussions with local and national banks to develop credit facilities to finance the scale-up.

[12] In one of the upgrades 5 diesel mills within a 2.5 km radius has closed down.

India

Rural Electrification and EmPower Partnership Projects

Hari Sharan, DESI Power, Bangalore

1. Overview

3.123 The Indian government has decided to "electrify" 18,000 remotely located villages on the basis of decentralized power supply systems based on renewable energy resources and technologies. It is a great decision, which, if properly implemented, can contribute substantially to reduce poverty in these villages and promote their sustainable development.

3.124 In actual practice, most of the electrified villages do not have reliable, adequate or good quality power. No commercial investments in micro enterprises can therefore be made by either individuals or companies without installing diesel generators which have a very high generating cost, create adverse environmental and climate change impacts, cause high foreign exchange outflows, and reduce the country's energy security.

3.125 As the experience of DESI Power's Empower partnership program shows, grid supply to remote areas is not competitive with modern renewable energy plants.

Table 4. Cost of Power Supply to a Village

	Generation		T&D losses		End-use power	
	MW	Cost Rs	MW	Cost Rs	MW	Cost Rs/MW
Centralised Grid Supply	1	35 MM	0.3	5 MM	0.7	57 MM
Decentralised biomass power plant (gasification)	1	35 MM	0.1	5 MM	0.9	44 MM

Table 5. Savings - Decentralized vs. Centralized

	Power	Saving	Avoided Cost	Saving in Cost	Amount
Generation/End Use	0.2 MW	22%	13 million Rs/MW	29.5%	
CO2 Emissions					5500 t/y per MW

Biomass may be the prime source of renewable energy in a large number of the 18,000 villages.

2. Financing

3.126 The total investment needed for EmPower Partnership projects, based on biomass, with a power plant, energy services, and micro industries, would be about Rs 7 million (US$140,000) per village. Assuming that 10,000 villages will be covered through this route over 10 years, with a modest 50 kW of installed capacity per village, the required total outlay will be Rs 70 billion or US$1.4 billion (an annual outlay of Rs7 billion). This will result in the total saving of Rs 6.5 billion over ten years on the power supply side.

3.127 Since the projects are profitable, at least 25% of this capital can be raised from the private sector on various forms. These are recognized as premium CDM projects and about 15% can be raised by selling CO_2 credits. The government subsidy for rural electrification may bring about 25% and the remaining amount can be raised as a loan from banks such as IREDA, SIDBI, NABARD, etc. or from commercial banks. If the government provides a suitable framework, direct ethical foreign investments are also highly likely in these projects, especially if they are bundled as public-private partnership schemes.

3. Impact

3.128 The program will create over 250,000 direct, year-round jobs in addition to increasing farm production. It will also reduce pollution, improve women's health and reduce migration to the city slums.

4. Scale-Up

3.129 Electrification alone will neither make the electrical supply profitable nor promote the economic and social development of remote villages in India. Self-sustained growth can only take place if the rural electrification program is linked to village micro enterprises for local value addition and employment generation. The power generation based on local renewable energy resources can provide reliable and affordable electricity supply to make the micro enterprises profitable and thus bankable and attractive for private entrepreneurs.

3.130 To take its initiative to the next stage, DESI Power has prepared a project proposal to cover 100 villages. The proposal is based on the successful field experience of EmPower Partnership projects of DESI Power which can become a viable "Corporate Rural Electrification and Employment Generation Model" for large-scale replication. The cost of power production from the small-scale biomass gasification systems is lower than any other technology in India today. Even so, they will only become widely used if the power station package is disseminated simultaneously with the micro-enterprise package by professional and experienced partnerships under a policy framework for the self-reliant progress of the rural people.

3.131 A hundred successful EmPower Partnership projects as proposed will provide the basis for establishing the policy framework and financing mechanisms. The mitigation of CO_2 emissions will be an additional gain to the global community.

3.132 The successful implementation of the EmPower Partnership Program in 100 villages within a period of two or three years will create the momentum to promote a large-scale replication of the program. A systematic documentation and training program based on the experience, combined with the flow of experienced people, will help the transfer of know-how to new project groups. Several 100 village programs implemented by different companies, coalitions, and consortia will augment the experience and broaden the network for the transfer of competence regarding the planning and implementation of such decentralized projects in a decentralized manner.

India

Energy Clinics for Housewives

K M Dharesan, Energy Management Center, Tiruvanantapuram

3.133 Energy Clinic is a unique and powerful awareness programme of the Energy Management Centre (EMC) in Kerala state on energy conservation activities in domestic sector. Energy Clinic is the first of its kind in India at state level. Energy Clinics focus on creating wide awareness about energy conservation practices in the domestic sector focussed in the grassroots level especially in rural areas. By mere awareness, it is possible to save 10-15 % of total energy. Energy Clinics provide valuable information to the rural population on energy conservation, energy efficient equipment, and right methods of energy usage to reduce wastage.

3.134 A notable factor in the cultural background of Indian homes is that women are the managers of energy, water and sanitation. Hence this program is demonstrated and implemented through women volunteers who are the change agents. Energy Clinics have the following objectives:

- To create a wide awareness among the rural population about energy conservation.
- To inculcate a new culture by introducing energy conservation equipment and gadget.
- To contribute towards women empowerment by energy conservation activities.
- To reduce the drudgery of rural women.
- To help them generate income through energy conservation activities
- To conserve energy used in the domestic sector and improve family budget.
- To reduce pollution by conserving energy and protect the environment.
- To contribute to the activities going on against deforestation.

3.135 Volunteers, mostly women, are selected from various organizations from all the 14 districts. The selected volunteers are given one day extensive training for the successful conduct of the Energy Clinic. Each volunteer has to conduct 10 clinics in 5 *panchayats.* All the *panchayats* concerned are given information with regard to the cooperation for conducting clinics. The selected volunteers were supplied with identity cards, list of target *panchayats*, procedures for conducting clinics with last date for completing it, energy kits, pamphlets, etc. The Energy Kit contains the following energy efficient equipment:

- Compact Flourescent Light.
- Electronic Ballast .
- Pressure Cooker.

- ?? Nutan (improved kerosene stove).
- ?? Thapabharani(Thermal Cooker).

3.136 Energy Clinics have been found to be very effective in Kerala. Till date, nearly 150 volunteers were trained in the 14 districts of Kerala state. These volunteers conducted more than 800 clinics throughout the state ensuring the participation of over 40,000 rural women.

Latin America & The Caribbean

Rural Energy and Social Issues Project

Byron Chiliquinga, OLADE, Quito

1. Overview

3.137 Rural Energy and Social Issues (RE&SI) is part of a larger Program in Sustainable Energy that is being developed jointly by the Latin American Energy Organization (OLADE) and the University of Calgary in Canada. The umbrella program will focus on enhancing policy making of the 26 OLADE member countries in the areas of rural energy, climate change and energy competition, incorporating considerations on gender perspective, and the direct participation of indigenous peoples. The program will assist decision-makers in the LAC region in defining more effective energy strategies and policies, aimed at meeting sustainable developmental goals.

3.138 The RE&SI project will work to create an enabling environment for the development of accessible, sustainable rural energy systems through the formation of supportive policy guidelines, improved access to appropriate technology, and training of relevant stakeholders from the local to the national level. As part of the initiative, 12 rural energy pilot projects will be launched and designed to help meet local developmental needs through the provision of sustainable energy systems. The lessons learned through these projects will be used to inform the policy guidelines and provide a model for the replication of similar systems throughout the region. All policy guidelines, training and pilot projects will be cognizant of the social issues and priorities outlined by gender considerations and participation of relevant actors.

a) Reason for/cause of project

3.139 Although the provision of energy resources alone does not ensure development, the availability and accessibility of energy services for productive and residential uses are critical factors in achieving poverty reduction and sustainable development. Rural populations often lack adequate energy resources to meet their development needs, relying on traditional energy sources or weak energy service systems. In addition, women and indigenous peoples have had a marginal participation in decision-making of their own development. The aim of this initiative is therefore to contribute to the mitigation of poverty in LAC countries by helping to meet the developmental needs of rural populations through the development of sustainable energy systems.

b) Location and local setting

3.140 12 pilot projects will be implemented in selected communities of the following countries: Guatemala, Haiti, Bolivia, and Paraguay to include all sub-regions represented in OLADE. In addition, community selection will include the widest array possible of situations that may be considered as representing the rural world in LAC. While poverty

and lack of reliable and modern energy services will be common features, selected communities will vary in aspects as population composition (indigenous, non indigenous) geographical setting (coastal, highlands, forest), availability of energy sources (solar/hydro/wind/small scale gas/none). Among the reasons for preferring diversity is the fact that the "ultimate product" of this program would be the policy guidelines for the whole LAC region.

c) Participants involved in project development

3.141 The main participants involved in the project activities will be all users of the pilot projects, and relevant stakeholders at community and national level, including officers related with rural development.

d)End-use

3.142 The philosophy of the project is that energy provision is not an end in itself. Development, according to each community perception and considering gender promotion needs and cultural particularities (especially in indigenous communities) will be favored by the projects. In accordance with the energy assessment the 12 pilot projects will determine the kind of energy system and the appropriate end-use for each community.

e) End-users

3.143 As end-use will depend on each community, we may expect to include, in the 12 planned pilot projects, female and male producers, households, basic infrastructure premises (health, education, communication, etc) as the potential end-users of the services. The size of each community will be at least 30 families.

f) Fuel/resource and technology used

3.144 This will be defined according to the end-use. Energy technologies to be applied in each case will depend on each community's priorities and on gender equity promotion needs, as well as cultural particularities. However, for demonstration purposes we don't want to have all projects using the same resource/technology. Community selection criteria are relevant to give a chance to several possible resources/technologies. Ultimately though, the chosen ones will depend on suitability to needs/preferences/cultural context/sustainability considerations.

g) Cost and availability of fuel/resource/technology used

3.145 Cost and availability will vary and depend on each case. We are not expecting, though, that any project exceeds 10 kW of installed capacity.

h) Completion time

3.146 The duration of the whole program is 5 years. We are just beginning the project (June 2003) and it will be different for each community. In 2003 we planned to start the program in two countries.

2. Financing

Whereas CIDA funds (Canadian International Development Agency) will cover the main part of the costs, a contribution is expected from the government and the communities. One of the main key issues of the program will be the design and implementation of appropriate community management schemes to deal with financial issues, operation, maintenance and general follow-up of the services. We are expecting that form and characteristics of said schemes vary to suit communities' particularities.

3. Impacts

3.147 We will analyze the pilot projects' impact in each one of the communities that will be involved in the program in order to derive appropriate policy guidelines for all the 26 OLADE member countries. Additionally, we are expecting to gain field experience in development from an end-user perspective, gender and culture sensibility, expertise, knowledge, a network, as the main impacts of the project.

4. Scale-up

3.148 Scaling up possibilities is at the core of the policy guidelines that the pilot projects will inform. We are expecting that the pilot projects will provide us with a better understanding to identify a wide range of challenges to and opportunities and conditions for scaling up.

Mali

Solar Rural Electrification to Combat Rural Exodus

Ibrahim Togola, Mali-Folkecenter, Bamako

1. Overview

a) Reason for/cause of the project

3.149 The project was conceived by the Mali-Folkecenter and the Danish Folkecenter to meet the demands of a target group that directly expressed their need for support for water supply, health and education to combat rural exodus during participative needs analysis meetings. In fact the needs expressed match remarkably well with the government priorities.

b) Location and local setting:
The project is based in 23 villages in Southern Mali.

c) Participants involved in project development:

The project is implemented by Mali-Folkecenter in Koumantou municipality, Sikasso region, southern Mali. The project is estimated to reach about 30,000 people.

d) End-use

3.150 Project beneficiaries in three villages will receive a variety of community solar installations (lighting in school, lighting and refrigeration in clinics, lighting in public squares, and water pumping). The twenty other villages will receive school lighting installations.

f) Completion time:

It was originally conceived as a 3-year project, but will over-run to about three and a half years.

2. Financing

3.151 The project was funded by DANIDA (Danish International Development Agency) NGO Window. The target groups provided a cash contribution to project costs to encourage a feeling of ownership and appropriation of equipment so vital to long term sustainability. Also they contribute funds annually to pay for operation and maintenance of all the installations. In villages with water pumping installations, the pumped water will be sold to generate the necessary income for operation and maintenance. In villages with only school lighting installation, monthly or annual contributions are collected, according to the preference of the village.

3.152 In each village where installations are made, a Maintenance Committee is formed, and trained by Mali-Folkecenter to operate and maintain the equipment. This is vital to

long term sustainability of the hardware. A Solar Training Centre has been established in the project area to allow in depth training in solar energy. This will be an important resource in the future, when demand for rural solar technicians rises due to the new World Bank HEURA (Household Energy & Universal Rural Access) project.

3. Impacts

3.153 Impacts so far have been very positive, including much improved conditions for healthcare organization by the beneficiaries of adult literacy training in the evenings, etc. With the water pumping component (part of the project highly valued by the beneficiaries) to be installed in the next months, the perspectives are encouraging, and a convenient and hygienic water supply will significantly reduce health problems, which are becoming more serious.

Mali

Multi-functional Platform Technology for Rural Energy Services

Ibrahim Togola, Mali-Folkecenter, Bamako

1. Overview

3.154 This project was aimed at jatropha oil multi-function platforms, which have been installed in the southern and western regions of Mali, as projects by GTZ (German Technical Co-operation), FENR (Women and New and Renewable Energies). These installations were experiencing mainly organizational difficulties including financial management, which meant there weren't sufficient funds to repair/ replace equipment. This was severely limiting their development potential. The technology could in principle be disseminated throughout Mali, but no mechanical presses were available in the country. Existing presses had been imported from Nepal, but clearly this is not a sustainable option, especially for spare parts. Therefore a local alternative was needed.

3.155 Jatropha is an oil bearing plant, indigenous to Mali. It is grown around crop fields to keep out animals, act as a windbreak, and to reduce soil erosion. It is very easy to grow, as a cutting taken from a plant and simply pushed into the ground will take root. The oil pressed from its seed is non-edible. Jatropha oil can be used as an alternative to diesel (due similar chemical properties) for the stationary Lister type Indian engines in rural areas, often in the form of multi-functional platforms. These are already widespread in West Africa and are used to provide mechanical shaft power in many villages throughout the sub-region. The press allows these engines to make the transition to CO_2 neutral vegetable oil, a renewable energy source and biofuel. Jatropha oil as fuel has many environmental (anti-desertification and deforestation) and indirect economic benefits (such as production of soap from oil or press cake, or sale of press cake as fertilizer).

South-South Technology Transfer

3.156 This was a 12 month project, funded by the UNEP Collaborating Centre on Energy and Environment, and implemented in close cooperation with the Ministry of Energy, CNESOLER - the National Centre for Renewable Energy and, AMC, one of Mali's most important metal workshops. If the jatropha multi-function platform with all its benefits was to move beyond the project phase into commercial viability, this problem of indigenous presses had to be addressed. Hence South-South technology transfer was effected to produce the press locally in Mali. The previous GTZ project had purchased the production rights and given them to the Ministry of Energy. However, the project had ended before construction was possible. But this project was able to work with the Ministry of Energy and AMC to produce the press in Mali. The Malian press now costs about half that of the original, thus a barrier to widespread adoption of jatropha oil

technology has been removed. Promotion of the press and the technology is an ongoing activity for Mali-Folkecenter.

North-South Technology Transfer

3.157 In order to really illustrate the possible benefits of jatropha oil technology, Mali-Folkecenter implemented North-South technology transfer of engine conversion technology, supported by the Danish Folkecenter.

3.158 A Toyota pick-up is used for implementation of renewable energy-fuelled development projects in rural Mali. This pickup was converted to run on plant oil. In a simple procedure taking only 1-2 days of work, its standard 2.8 litre diesel engine was converted to run on jatropha oil by an engineer from the German company Elsbett at a workshop in Bamako, Mali. This conversion was really to highlight the benefits of jatropha oil technology and to show that in the future, farmers could harvest not only food and crops for trading, but also energy crops like jatropha. They will harvest the sun and wind using RE technology to provide for their energy needs. PV systems can provide high quality lighting, wind power can pump water or generate electricity, and jatropha oil can be used to provide heavy duty mechanical power necessary for agricultural processing, tractors, and transportation. The local production means local employment, and local generation of income. The potential benefit of jatropha technology to Mali, a country dependent on imported fossil fuels, is huge.

3.159 Mali-Folkecenter continues to promote the environmental (anti-desertification & deforestation), energetic (as a biofuel for rural areas for agricultural processing) and economic (micro-enterprise based on direct and indirect outputs) benefits of the jatropha plant through this project funded by the Siemenpuu Foundation. Information-Education-Sensitization campaigns are carried out, as well as a resource survey which will lead to drawing up of a jatropha map for three regions of Mali. This will allow informed decision making and planning based on the resource and should facilitate scale up of activities in the future. People are trained in soap making techniques, and two jatropha platforms will be installed.

3.160 Under the AREED (African Rural Energy Enterprise Development) project, Mali-Folkecenter assisted an entrepreneur in securing financing for a commercial jatropha multi-functional platform. This is perhaps the first step to a wide scale adoption of the technology, which is by nature suitable for decentralized operation by individual operators. The results of this first installation could then be replicated to thousands of other installations throughout Mali and the sub-region.

2. Scale-up

Solar energy is providing high quality electricity for lighting, refrigeration and water pumping, while jatropha oil can provide heavy duty shaft power which can be a base for rural industries, everything from grinding flour to welding and metal workshops. With decentralised renewable technologies, it will be necessary to choose the technology appropriate to the given situation. Hybrid systems will become more and more important

for bringing about cost reductions and increased efficiency and reliability. Mali-Folkecenter is currently looking for opportunities to develop this more integrated approach. Focus on productive uses will be important.

3.161 For any scale up of renewable energy activities, it will be necessary to work closely with the local government and elected officials at the municipality level. Mali is currently undergoing a process of decentralization, essentially a devolving of decision making away from central government and towards the newly created municipalities. The municipality is responsible for tax collection, and 90% of taxes collected stay in the commune. The elected staff of the municipality is responsible for using those funds for the development of their commune. There are also central funds available that can be mobilized by the commune. However the experience of these local decision makers is understandably limited, especially in the energy sector. Therefore there is a need for building up the capacity to allow informed decision making, and the inclusion of energy projects in the Municipal Development Plans which are drawn up to define development priorities in the commune.

Nepal

Home Employment and Lighting Package (HELP)

Adam Friedensohn, Himalayan Light Foundation, Kathmandu

1. Overview

a) Reason for/cause of project

3.162 Objectives: To offer a sustainable method of Solar Home Systems (SHS) deployment by intrinsically combining alternative energy systems with income generating opportunities to rural communities by the introduction of HELP program module which avails outside commercial revenue streams into SHS deployment financing mechanisms.

3.163 The main focus of the Home Employment and Lighting Package (HELP) program is to develop remote villages using an intrinsically combined package of small solar photovoltaic (PV) lighting systems (SHS) and income generation resulting from the presence of such systems. The HELP program enables villagers with a method of receiving home electrification with no cash or collateral other than the systems themselves and "social collateral" thereby availing SHS to the poorest of the poor with income generation to the poorest of the poor. By adding the additional revenue streams from income generation activities a more sustainable financial mechanism is developed and a deeper penetration to the bottom of the financial chain can be established.

3.164 Villagers are familiarized with the HELP program and assisted to make a community based organization known as a Solar Development Committee (SDC). Villagers then enter into agreement with the SDC to obtain SHS and produce handicrafts on a monthly basis to repay the systems. SHS are carried to the nearest road head where they are picked up by villagers and installed by the local village technician. Villagers enter training programs (provided) in order to learn how to make products for the international market. Products are paid back to the SDC monthly. Resulting funds in the SDC allow additional families to enter the HELP program. After SHS are compensated for, villagers receive cash for every product they produce.

3.165 "Social Collateral" means disbursing credit/loan to an individual or family with a group or community as guarantor and supervisor and also not taking any land collateral.The villagers pay for their SHS via the sale of handicrafts they are trained to produce which are sold using a variety of market access tools and then go on to earn cash income by their sale once SHS are paid for in full.

3.166 By proving this unique and appropriate development mechanism in the Bongadovan village, the basis for expansion and replication has been set. The program prepared the Foundation for other village development works including establishment of

the community based organization (CBO) known as the Solar Development Committee or SDC, the objectives of which are.

- ?? Provide solar electric system without any collateral to the rural poorest communities who do not have access to rural credit systems. Develop and use social collateral instead.
- ?? Provide useful skill developing trainings to produce handcraft goods at local level.
- ?? Use of leisure hours in productive income generating activities.
- ?? Increase purchasing power of local communities by producing good quality marketable handicrafts, which are sold for cash.
- ?? Connect Himalayan Light Foundation (HLF) HELP families with global communication and international markets by introducing their unique products and stories over the Internet for sympathetic buyers access.
- ?? Encourage women's participation in alleviating poverty by pulling them out of drudgery and involving them in more productive activities.
- ?? Encourage the communities to organize in self-HELP groups SDC and Saving and Credit Groups (C/S) and HELP them to utilize their money, materials and time in more productive manners.
- ?? Encourage and educate HELP families to share the workload of women and encourage them to participate in development activities.
- ?? HELP villages to save on candles, kerosene and small batteries further improving their cash positions and decreasing various forms of pollution, and
- ?? Enable families to easily replace the use of fatwood harvest for lighting.

b. Location

3.167 West Nepal, Bongadovan VDC, Baglung District: Woolen handicraft production;Lekhani VDC: "Paper and power"; Baglung District: Nepali handmade papers and product; Kavre district "Paint and Power" The Tri-Ratna Thangka Painting School.

c. Participants involved in project development

- ?? Himalayan Light Foundation (HLF).
- ?? Solar Development Committee SDC) both of Bongadovan and Lekhani VDC of Baglung district.
- ?? Buddha Darsan Club, (A local club of Kavre district).
- ?? His Majesty's Government Nepal, Alternative Energy Promotion Center of (HMG/N, AEPC).
- ?? Global Environment Facility/Small Grants Program (GEF/SGP).
- ?? Over 200 families in the areas mentioned above.

d. End-use

- ?? Knitting crocheted woolen bags under solar lights during leisure hours.
- ?? Thangka Painting.
- ?? Handmade paper and products.

e. End-users

- ?? Lekhani community with over 90 households (495 persons) and Kavre families total of 198 families overall.
- ?? Bongadovan community with 105 households average of 5.5 persons per family (577.5 persons).

f. Fuel/resource and technology used

Solar Photovoltaic Home Lighting Systems

g. Cost and availability of fuel/resource/technology used

3.168 Total system costs US$355 for PV Solar Home System. Subsidy from the government is US$157 per system. So the beneficiary had to pay US$198. The SHS were purchased from the local manufacturer.

h. Completion time

Dec 1999- June 2001 (18 months) for the first village (still self-sustaining)

2. Financing

3.169 Funding was from UNDP/GEF Small Grants Programme. The users pay back for the SHS by the crochet bag. They pay one bag per month for 24 months. Bag sales return revenues into The Revolving Electrification and Income Enterprise Fund (RELIEF).

3. Impacts

3.170 1047 families reside in the project areas (Bongadovan). Each household in Bongadovan used 3 liters of Kerosene oil to light a lamp/month. Each liter of kerosene produces 2.6 kg of CO_2.There are currently 105 families under HELP program who have received SHSs. Therefore, the total use of kerosene by 105 families is 315 liters/month. The HELP program has thereby curbed the use of approximately 315 liters of kerosene since its commencement a year and a half ago.

3.171 Therefore, 315 x 2.6 x 12 months = 98 tones CO_2 formation has been mitigated in 1 year. HLF has plans to install 1000 SHSs in various districts of Nepal in the next few years. Extrapolating the saving, one can see that nearly 930 tonnes of CO_2 can be saved annually.Further extrapolations can be made when assessing the current remote electrification needs of the average developing country, which claim figures near to 85% non-electrified regions.

3.172 The above calculation is based on the replacement of kerosene use for lighting as was the case in Bongadovan but does not reflect the program's potential mitigation in such areas where diesel generation is used for remote area electrification and does not consider the additional carbon emission savings created by the reduction of Dilayo (fat wood) and hardwood consumption saved in this program by lighting and ICS establishment and use. Fat wood is used exclusively for lighting in this region as it has a high resinous content. The rate of harvest is one tree per family per year. Over 100 families participating in the HLF program would save 100 trees per year.

3.173 Anecdotal benefits include a dramatic drop in villagers attending the local health post for respiratory and eye problems previously caused by a smoky environment. Although only an initial preliminary impact study made by HLF field staff, the coordinators have been in constant contact with villagers in the field and had numerous interviews along with continuous eyewitness accounts. The collective evidence clearly indicates that study hours for children have increased significantly in homes that used SHS.

Some accounts have come to HLF attention via letters drafted by villagers were comments have been made about the ease the new SHS facility has presented to them for a variety if uses including study. Some families indicate that study hours have increased as eye fatigue is less due to the greater strength of the SHS light compared to Diyalo or Tuki (small kerosene wick lamps).

4. Scale-up

3.174 HLF has applied to GEF for a medium scale project (MSP) to expand and replicate the project to include a wider range of village products that will be sold on the web internationally. A critical mass of product variety is needed for a functional sales port while proving the needed return rates for a final approach to SDG or IFC for a more commercial development phase. GEF MSP processes have been filled with local and international politics making the process far too long for the project timing.

Nepal

Project on Women in Energy and Water Management

Ganesh Ram Shresta, Center for Rural Technology, Kathmandu

1. Overview

a) Reason for project

3.175 Women and their opinions have long been overlooked in the process of development. In the use of energy and water technologies too, their role has been either minimized or totally neglected in the policy formulation as well as project design despite the fact that women are the primary users of energy and water at the household level. It is, therefore, essential that they be involved in the project cycle at all stages. For this to be possible, women who are to act as major stakeholders and/or project implementers need to acquire the appropriate skills and knowledge base. This is what the regional project called "Women in Energy and Water Management" implemented in Nepal by the Centre for Rural technology, Nepal (CRT/N) with support from the International Center for Integrated Mountain Development (ICIMOD) and United Nations Environment Program (UNEP) hopes to accomplish. This is a two-year project beginning in April 2002.

b) Location and Local Setting

3.176 The project is being implemented as a pilot in two micro watersheds, Angakhola and Thankhuwa, in the hilly districts Palpa and Dhankuta, respectively.

c) Participants involved in Project Development

3.177 CRT/N, with the support of ICIMOD and UNEP, is executing the project with the cooperation of other partner organizations. Partners at the district level include Nepal Red Cross Society, Palpa, and Society of Local Volunteers Effort (SOLVE) in Palpa and Dhankuta districts, respectively. A number of other NGOs and GOs are also working at the community level at the respective project sites. The participation of the local people, especially the women, has been central to the project right from the very beginning. This was the basic premise for the needs identification and issues assessment that were carried out. A Steering Committee at the central level, mainly for the purpose of monitoring and supervising project activities, was also formed. The committee consists of representatives of related key institutions, including NGOs, INGOs, and other governmental organizations.

d) End-use

- Improved self-sufficiency of rural women in energy and water needs especially at the households and community level.
- Enhanced integration of women in the decision making process in the management and use of environment-friendly water and energy schemes.

- ?? Enhanced capabilities of rural women through awareness and training programs in use and management of water and energy resources.
- ?? Reduction of health related hazards due to improved water, sanitation and energy related technological options.
- ?? Availability of case studies, baseline data, training manual and guidelines, documentation of practices (what did work and didn't), project implementation process, and reports on meetings and monitoring visits, etc.
- ?? Process and procedures for project replication.

e) End-users

3.178 Though the project is specifically targeted at assisting local women, the ultimate users/ beneficiaries are the whole community living within the micro-watershed areas who are now able to more efficiently utilize their energy and water resources.

f) Completion time

The duration of the project is 2 years, from April 2002 to March 2004.

2.Financing

3.179 The project is being financed by ICIMOD with the support of UNEP. Different training courses, exposure visits and other such capacity building activities for the local women are funded with partial local contributions. These activities are linked with food production, processing and market development and provision of seed money for revolving funds (wherever micro-finance facilities/services are not available). Institutional support to develop and/or strengthen women's groups and organizations to have better access to energy, water and other productive resources is also provided. End-users can also utilize the revolving funds to borrow for the procuring water and energy related technologies.

3. Impact

3.180 Although the project is just halfway in its implementation, some important lessons have already begun to emerge, including:

a) A series of dialogues, meetings, and trust and confidence building and awareness creation measures with the project communities, especially with the local women have been found essential for successful project start-up. It took considerable time at the beginning of project, but local women leaders and motivators played a key role in speeding up this process.

b) As most of the community members are economically-deprived, income-generating options such as vegetable productions with simple drip irrigation system in Palpa project site encouraged local women to initiate water management activities.

c) Women in the project sites have complained about having to form separate groups and committees to obtain service. They feel burdened about having to attend meetings, while also attending to their work at home. It is better to utilize existing groups for the

service function. This approach was adopted in Dhankuta project site and proved effective.

d) Small technology demonstration and orientation on technologies at the project site helped the technology transfer process gain momentum. The role of local schools, educational institutions and students was instrumental and proved to be very effective.

e) Local women and partner organizations have now realized that the 2 years project duration is inadequate to successfully complete the project cycle and document the process for possible replication to other areas. The project duration should be about 5 years and implementation approach should be "process oriented" rather than "project oriented."

4. Scale-up

3.181 The project can be scaled up and replicated in various other districts of Nepal if it succeeds in bringing out expected and visible impacts during its pilot phase. Possible extension of the current project period or scope and potential for scale up will be determined by the end of April 2004, the expected project completion period. However, the project experiences and outcome received so far have been very encouraging and indicate tremendous potential for scale-up.

Nepal

Technical Support to Improved Cooking Stoves Development

Ganesh Ram Shresta, Center for Rural Technology, Kathmandu

1. Overview

a) Reason for Project

3.182 The Improved Cooking Stove (ICS) Promotion Project was initiated in Nepal since the early 1980s with a view to save fuelwood and arrest forest degradation. After a number of years of implementation, in the late 1980s, the project could not generate the desired acceptance and impacts and was discontinued. The implementation approach was more on a limited time bound "project approach". The need for a new innovative approach to ICS dissemination, among potential stakeholders, was realized in early 1990s and a number of small initiatives took place with a changed approach, i.e. focusing on user's education especially to women, and flexible stove designs. These initiatives not only renewed the interest, increased users' acceptance and enhanced demand, but also contributed to the realization at the policy level of the need for a new program with user friendly approaches.

3.183 Accordingly, a new ICS Program was formulated with the participation of CRT/N and other stakeholders in early 1999 incorporating past experiences and lessons learned, and with a more demand oriented, qualitative "software" oriented approach, with particular focus on local capacity enhancement. Moreover, an ICS Network managed by CRT/N with linkages to the Asia Regional Cook Stove Program (ARECOP) was established.

3.184 The Energy Sector Assistance Program (ESAP) of DANIDA and the Alternative Energy Promotion Center (AEPC) of the Government supported the ICS Program, incorporating changes in the approaches as mentioned above, along with "no direct subsidy" policy. CRT/N became the implementation agency while AEPC assumed the role of providing policy guidelines and monitoring support at the national level.

b) Location

3.185 The program is currently being implemented in 11 rural mid-hill districts, of which CRT/N is directly responsible for implementation in 9 districts through its technical support units and partnership with district organizations.

c) Participants involved in Project Development

3.186 Locally-trained, self-employed promoters are the ones who install ICS and get paid for the services rendered to the ICS users. Most of these promoters are women from local communities. These trained promoters also train the households on how to operate

and maintain the stoves. In addition, there are also local Partners GOs/NGOs/CBOs who are trained to promote ICS in the community. CRT/N's main role is to provide technical services and capacity building to the partners the District ICS Promotion Centers. AEPC and ESAP provide overall policy and monitoring support and funding support for promotional campaigns and skills training and coordination, and the Department of Women Development through their district women offices provides support in social mobilization alongside the local partner CBOs.

d) End Use

3.187 The program intends to have better performing stoves in terms of fuel saving and low indoor smoke emissions resulting in the improvement in family health. Apart from the basic use of cooking, stoves are also used for space heating in high hills. Recently kitchen management and household sanitation has been integrated into the ICS promotion resulting in better kitchen environment.

e) End Users

3.188 The end users are primarily women who traditionally perform the cooking for the entire family. So far about 40,000 families have benefited from the program in general.

f) Fuel Resource and Technology Used

A range of biomass fuels like fuelwood, agro-residue and dung cakes are used in the stoves.

g) Fuel Resource /Technology

3.189 The fuel sources are the public forests, community forests, private plantations, and agricultural lands. Technologies used are improved and user-friendly version of the "mud and brick stove" with one to three-potholes mostly with low-height chimney, installed in the kitchen by the trained promoters. More adaptive and participatory research and development activities would be required particularly on technology upgrading for hill, mountain and plain (Terai) regions.

h) Cost and Availability of Fuel/resource/technology used

3.190 Stoves are built from the locally available materials like clay, rice-husk, few pieces of iron bars and a small piece of tin sheet for chimney outlet cover, etc. The cost to end-users is about US$1-2 per stove installed, of which the main cost is remuneration for the local installer. The major indirect cost is for the training of the promoters (women installers) and some technical monitoring to ensure quality of the installations.

g) Completion Time

The duration of the current phase is from May 1999 to May 2004.

2. Impact

3.191 Following the new approach, the ICS program has succeeded in creating mass awareness, building local capacity among promoters and users and in partnership with local organizations, disseminated about 40,200 ICS during the last 3 years as against the

target of 40,000 by May 2004. An assessment carried out in 2001 indicated that more than 90% of the ICS installed were regularly used and maintained and that the program has succeeded in achieving a broader coverage of ICS across the mid-hill region thereby improving living conditions, saving fuelwood (30-40%), saving time normally spent for wood collection and cooking, and on the whole, creating positive impacts on rural communities and women.

3.192 More than 850 local people have been trained as ICS Promoters and about 20% of these promoters are certified as senior promoters, who can work as trainers to train other promoters. The program has helped to generate extra income for these self-employed promoters (of which more than 50% are women) with ICS installation. Another remarkable impact seen by the local women is on the children who now have more time to spend studying, thereby raising overall literacy (especially among girls) and improvements in the family health and kitchen environment.

3. Scale-up

3.193 In view of the positive impacts on the rural livelihoods, His Majesty's Government of Nepal (HMG/N) has acknowledged the importance of this program and is supporting the extension of this program to the high hills, mountain and the plain areas with a target of 250,000 ICS in the 10th Plan (2003-2007). To achieve these objectives, a large-scale ICS program scale up is essential, for which a sound basis at the national and program level along with strong technical and institutional capacity exists. A significant number of trained ICS promoters, technical cadres of CRT/N and collaborating local partners, and established institutional linkages at the national, district and program level and experiences on ICS promotion with "no subsidy" are in place to embark upon a scale up of National ICS Development Initiative.

3.194 Some technical, financial and policy/institutional problems are foreseeable while implementing the scaled-up initiative. To minimize and overcome these problems, the following measures are suggested:

Technical

3.195 A range of suitable stove models should be improved and modified to cater to the socio-economic needs of diverse geographical regions. Some adoptive and participatory research will be needed, both in social and technical/design aspects. Existing best performing promoters should be used as resource persons for training the new promoters in the same districts to meet the need during scale-up. Some improvements on the existing Training Manuals, Information, Education and Communication (IEC) materials will be needed for adaptation in the mountain and plain areas.

Financial

3.196 Various users groups related to forestry, women, micro credit, energy and water management, etc supported by District Development Committees (DDCs) and Village Development Committees (VDCs) and other GOs, INGOs should be mobilized for cost

sharing and capacity enhancement for ICS promotion and dissemination. Cost effective approaches should be explored to reduce the cost of implementation and at the same time commercialization of ICS would be adopted.

Policy/ Institutional

3.197 The role of AEPC would be very important particularly for policy incentives, ICS integration with sector programs, arrangement for funding support, donor coordination, and to regularize the ICS policy among the stakeholders in accordance with fulfilling the government target. At the program level, further institutional support to strengthen the promoters' groups/associations as technical service centers will be required for user education and ICS installation services.

4. Conclusions

3.198 Based on the experiences from the ongoing ICS program the following conclusions can be drawn:

1) Short term time-bound "project approach" of implementation has not been effective.
2) A number of innovative ideas and approaches have been tested and proven and the current AEPC/ESAP supported ICS Program has succeeded in establishing a strong technical foundation and institutional base.
3) It has been tested and proven that ICS activities can be promoted without "direct subsidy" provided there is a strong information and awareness campaign along with appropriate and efficient technology as well as the activities are tied up with income generation and social development for sustainability.
4) Further funding support and technical back up support and services are essential for sustained development of such ICS program initiative with widespread national coverage.

Nepal

Promotion and Dissemination of Improved Water Mills in Hill Districts

Ganesh Ram Shresta, Center for Rural Technology, Kathmandu

1. Overview

a. Reason for/cause of project

3.199 Traditional water mills (TWM) have been the part of rural villagers' life in hills and mountains of Nepal and used for grinding their food grains for many centuries. It is estimated that more than 25,000 such mills exist in Nepal. Presently, these low efficient traditional mills have not been able to cope with the processing needs. The improved water mill (IWM) was developed by private metal workshops in cooperation with GTZ in the second half of 1980s, using reliable modern technology, to enhance the performance of TWMs. These improved ones have the potential of significantly improving the lives of the rural inhabitants by increasing the quantity of processed agricultural products as well as diversifying the types of services available to them. Some 1000 IWMs have been improved through the technical services provided by the Centre for Rural Technology, Nepal (CRT/N), private workshops and financing agencies/ banks. These IWMs are currently in operation, offering grinding, hulling, oil extracting and even electrification services. The improved water mill has proven to be a user and environment friendly source that holds promise to improve the quality of life of the millers and the rural population.

b. Location and local setting

3.200 Potential hills and mountain areas, where traditional water mills are already in operation with the help of water intake from streams and rivers, are ideal.

c. Participants involved in project development

3.201 The main participants of the project are the millers themselves. The Centre for Rural Technology (CRT/N) has been providing required technical support services with the cooperation and support from various development agencies like GTZ/Nepal and ICIMOD. GTZ/Nepal provided technical assistance in the dissemination of improved water mills while ICIMOD supported the strengthening of the organizational capabilities of water mill owners by forming millers' groups and associations during 2000-01.

d. End-use

3.202 Apart from grain (maize, millet and wheat) grinding, which is the only end-use possible with the traditional water mills, the IWM provides other services such as paddy milling, oil expelling, saw milling, electricity generation, etc. thereby providing the rural communities, especially the women, the benefits from efficient milling services, saving time and drudgery and income from marketing services.

e. End-users

3.203 About 25-50 and in some cases, more local households are served from each IWM of 1- 2 kW.

f. Fuel/resource and technology used

3.204 Water from streams and rivers is harnessed for generation of energy/power. An improved kit made of metal runner and shaft is used to generate the energy with the fall of water on it. The energy generated in the shaft is transmitted to grinder, huller, expeller or generator with the help of belt and pulley. Trained mill operators operate the systems.

g. Cost and availability of fuel/resource/technology used

3.205 Waterfalls are freely and abundantly available in the hilly terrains of the country. However, there is investment requirement in developing the required civil structure along with coupling the mechanical components as well as the machines for undertaking various end-uses.

3.206 Cost of undertaking the civil structure (water intake, canal, fore-bay, etc.) is site specific and varies. The cost of improving the TWM ranges from US$150 for grinding application only to US$2000 for diversified applications, possibly including electricity generation up to 2 kW. However, the transportation cost to carry the components in remote areas is quite high. Cost for adding machines for various end-uses varies according to the type added. Cost of operator and repair/maintenance are the only operational costs.

h. Completion time

3.207 GTZ/Nepal supported water mill improvement project till 2000 while the support of ICIMOD continued till 2001.

2. Financing

3.208 In some cases, the mill owners themselves provide financing for the improvement work. The majority of traditional water mill owners are usually poor and do not have cash at hand, so there were initially expectations that local lending institutions would provide some financing. However, lending institutions/ banks were not too enthusiastic to finance small loans.

3. Impact

3.209 Through the water mill improvement activities, the socio-economic conditions of not only the millers but also of the users have improved substantially. The mill improvement works have provided an opportunity to millers to increase their income through efficient and diversified services. The improved water mills have also helped the rural community members, especially women whose primary tasks include food grinding through traditional means, to reduce their drudgery as well as to save their time. Time saved is used for other productive purposes including income generation activities. A few electrification projects have brought additional convenience and comfort and improvement in the living conditions of the local communities through the use of

lighting, radio and television. It has also provided positive contribution towards education, health and gender equality. In many instances, IWMs, through diversified end use applications, have also been used as "Village Energy Service Centers" meeting rural energy needs and linking agricultural processing with rural markets, creating opportunities for blacksmiths and other village enterprises.

4. Scale-up

3.210 Technical improvements and institutional innovations that emerged during the past decade in course of TWM improvement have led to the formulation of 5-year scale up project initiative with support from His Majesty's Government of Nepal and the Netherlands Government. HMG/N has highlighted the installation of IWM in its 10th Five Year Plan (2003–07). Accordingly, a IWM scale up project aiming to improve 4000 traditional water mills has been formulated where AEPC would provide policy support to implement the project on "Promotion and Dissemination of Improved Water Mill in Potential Hill Districts of Nepal" with funding from the Netherlands Government. This project started in January 2003 with CRT/N playing a key role as one of the main implementing organizations.

3.211 Technical, financial and institutional supports are required for implementing this project. To achieve this, partnership and collaboration between village communities/ water millers, private and public sector support agencies and financing agencies will be established and strengthened. To overcome the implementation challenges, the following measures are envisaged to be undertaken within the framework of the project:

Technical

- The metal kit runners will be standardized to provide quality products to the millers and the manufacturers will be encouraged to produce only standard products.
- Various possible end-uses will be demonstrated to improve awareness about the end-uses among the potential millers.
- Capabilities of potential service providers such as Technical Service Centers, Micro-Finance Institutions (MFIs) and Private Workshops will be developed/ strengthened through training, R&D support and exchange visit activities.
- On-site training on the proper operation and maintenance of the mill will be carried out among millers.

Financial

- Efforts will be made to organize Water Millers' Association and mobilize local funds through such Associations.
- Efforts will be made to mobilize MFIs for providing soft loans to establish improved mills. The current project will provide matching fund to finance MFIs for the purpose.

?? The project has the provision to provide partial subsidy for procuring the kit runner (around US$50 per unit) to the millers.

Institutional

?? Local Service Providers (LSPs) will be developed to offer required services locally to the millers for water mill improvement and in the preparation of water mill inventory

?? CRT/N will play the role of facilitator to identify potential LSPs and develop their capabilities so that they are competent to provide required services to the millers and local community, especially women, who are the primary food processors.

?? Gender issues will be included in the project strategy to reduce gender disparity, both from reduction of workload to women, health perspective as well as women's participation in the Miller's Association and mill management.

?? Millers will be trained and assisted to organize themselves to form Water Millers Associations incorporating the outcome/process developed through the ICIMOD-supported project for strengthening their service receiving and delivery capacity.

?? A Central Coordination Committee (CCC) will be formed at the central level while District Coordination Committees (DCC) will be formed at district level to provide advisory services to the project.

?? AEPC of His Majesty’s Government of Nepal will provide the policy and coordination support to implement the project while the Netherlands Government will provide the required funding support for the project.

Nepal
Small-scale Wind Energy

Govind Nepal, ITDG, Kathmandu

1. Overview

a) Reason for the Project

3.212 Many windy hills of Nepal have potential for generating wind energy. Currently available wind energy generation technology can compete with other RETs if compared fully in terms of the availability of the source round the year, investment and operation costs, and simplicity in operation and maintenance. Despite these potentialities and competitiveness, no locally manufactured small-scale wind plants were in installed until Intermediate Technology Development Group (ITDG) transferred this technology to Nepal from Sri Lanka in 2001.

b) Location and Local Setting

3.213 As of May 2003, there are five demonstration plants located at different geographical locations from Eastern to the Western parts of Nepal. As these wind turbines are for demonstration purpose, they have been installed in different local settings – one on a college premises with an expectation that thousands of students studying over there will have an opportunity to see the operating system and pass the message to their own villages. The other in a government office so that officials become familiar with the technology and help mobilize government support. The third installation is in a location, which can be used by both the villagers and a school jointly. The other two installations are in a village community, which have been jointly shared by two to three households.

c) Participants Involved in the Project Development

3.214 Basically, there are four parties involved in the project development and implementation. ITDG Nepal organized a 2 day National Workshop jointly with Ministry of Science and technology and ICIMOD to discuss the potential for developing wind energy in Nepal. This workshop gave mandate to ITDG Nepal to pilot test the small-scale wind energy system in Nepal. Finally, the plant was installed with grant money from an individual donor from United Kingdom, manufacturing support from a local manufacturer from Eastern Nepal, and technical and managerial support from ITDG Nepal and ITDG Sri Lanka. After the installation, the users have been managing their own plants.

d) End Use

3.215 This small-scale wind turbine is a 200-watt system and hence does not cater to equipment that requires more power. Basically the power from wind plant has been used to run black and white TV, radio and cassette players. This has been used in the school for lighting to run literacy classes. In the college, it has been used for street lighting.

e) End Users

3.216 End users are mainly the household members, but not all the members get the benefit proportionately. Women and children have benefited more because women have to work in the late night and before dawn, and children have to study and do their homework. Children also mostly enjoy TV and cassette players.

f) Resource and Technology Used

3.217 Resources are the winds available freely in the hills of Nepal. They are unused and generate no external diseconomies. The technology is simple to understand and handle, is manufactured locally and maintained locally. The beauty of the technology is that any technical personnel manufacturing equipment for any type of decentralized energy system can do it with one week of training.

g) Cost and availability of Resource Technology

3.218 The resource is cost-free and the technology at demonstration phase cost around US$1,000 on average inclusive of costs for manufacturing, transportation to the site and the installation. It is rationally expected that the cost will fall with manufacturing of larger scale systems.

h) Completion Time

3.219 The time for installation is two days for two persons and the transportation time depends on the distance of installation site from the manufacturer site.

2. Financing

3.220 As this is a demonstration project, all the investment costs were born by the project. However, in the future, the investment cost will have to be shared by the users of the plant in terms of equity capital or loan. It is expected that for some years government will come with subsidy policy, as they are doing now for other renewable technologies.

3. Impact

3.221 In Nepal it has yet to show its impact. However, the experience of Sri Lanka shows that it has significant impact on changing the indoor environment of the household (clean and better lighting, use of recreational instruments, etc.), increased knowledge and information about the national and international affairs and events. In Nepal, after one year of installation, records of the variety and intensity of the uses of the plant will be collected and disseminated.

4. Scale-up

3.222 There is a plan for scaling up of the small-scale wind system. For this, some research on appropriate size of the plant from technical as well as managerial point of view will be needed after completing the pilot phase of one year. For the scaling up, an institutional environment for sharing the investment cost with the users of the wind system, availability of repair and maintenance services in the vicinity of the plant location, wind mapping of the potential sites, and linking the consumers with micro credits will be needed. To create favorable techno-institutional environment, policy

lobbying and persuasive approach will be needed. One of the mechanisms in practice in Nepal is the formation of a Forum in which all stakeholders of small-scale wind energy (NGOs, Governments, Manufacturers, technical experts etc.) will be voluntarily members.

Nepal

Rural Energy Development Programme

Kiran Mansingh, REDP, Kathmandu

1. Overview

3.223 The Rural Energy Development Programme (REDP) is a joint initiative of HMG/N and UNDP. Initiated in August 1996, REDP has been recognized as a best practice program nationally and internationally. The main objective of the program is to improve the living conditions of the rural poor by increasing their access to rural energy technologies, especially the micro hydro and management of environment and natural resources through institutionalization of the rural energy at local level, and supporting the policy feedback to the government on the development of decentralized rural energy systems.

a) Reason for the Program

3.224 In Nepal, access to electricity by the people is just 18% and just 6% in the rural areas. The scattered settings in rugged geographical terrain have become the main impediments in accelerating the reach of rural people to electricity, which demand high cost of investment and O&M. In this backdrop, in order to help support the government's endeavor to achieve sustainable development and alleviate rural poverty, REDP was launched for the promotion of decentralized rural energy systems, especially the micro hydro schemes following the holistic approach based on community mobilization processes.

b) Location and Local Setting:

3.225 Currently REDP is being implemented in 15 hilly districts of the country viz. Baitadi, Dadeldhura, Bajura, Achham, Dailekh, Pyuthan, Myagdi, Baglung, Parvat, Tanahun, Kavre, Sindhupalchowk, Dolakha, Okhaldhunga and Tehrathum. In these districts the program activities are implemented in some 100 remote Village Development Committees (VDCs) that are not likely to be connected to the national grid at least in the next five years.

c) Participants Involved in the Program Development

3.226 The important participants include the local elected bodies (DDCs and (VDCs), private sector, local NGOs, financial institutions, INGOs and the government. The communities, both men and women were also consulted, though on a limited scale.

d) End-use

3.227 The implementation of the program has led to the emergence of various end-uses. The most useful and effective end-uses that are based on the electricity generated by the micro-hydro plants include clean and better lighting, agro-processing mills, rural

enterprises such as rural bakery, thangka painting, incense stick making, rural soap making, poultry farming, computer institute, recreation centers and the like. The added facility of irrigation and drinking water in some cases is the other end-use developed in the community. Improved health and sanitation, and well managed greenery of the surroundings are the others facets of the end-uses. However, the most critical ones are the development of strong social capital amongst the communities, and institutionalization of the decentralized rural energy systems and management of natural resources at the local level.

e) End-users

3.228 The end-users are primarily the community members, both male and female. So far, 2737 Community Organizations (COs) have been formed (1366 male COs and 1371 female COs) in the program VDCs encompassing about 150,000 rural people of about 30,000 households. Besides, people of the adjoining settlements are also benefiting from the established end-uses, enterprises such as agro-processing mills, computer institute, photo studios, recreation centers, etc.

f) Resource and Technology Used

3.229 The principal technologies include the micro-hydro (from river), toilet-attached biogas plant (biomass), solar PV home system (solar) and improved cook stove (biomass). Besides, numerous other technologies that are linked to these technologies such as agro-processing mills, photo studio and poultry farming have also been established. Most importantly, the soft technologies applied are the skills and knowledge especially through training in upgrading the latent skills and capability of the community people.

Cost and Availability of Technology Used

3.230 All the technologies promoted by the REDP are developed/manufactured in the country, although some components are also imported from outside. They are lower in cost and compatible to local skills and resources. The government has a policy of providing subsidy to the consumers for widespread dissemination and increased reach to the technology.

Completion Time

3.231 It takes around one year to complete a micro hydro scheme i.e. starting from community mobilization, planning, resources mobilization, construction and installation. The actual installation time is about 5 to 6 months. The other RETs could be installed in a very short span of time.

2. Financing

3.232 People mobilize funds for the installation of micro hydro plants from various sources in the form of subsidy (government), grant (donors), investment (elected bodies), loan (bank) and equity contribution. In addition, people are responsible for labor and locally available materials. All the funds are put into a basket – the Community Energy

Fund (CEF) and spent as needed. During the operation phase, the tariffs collected from the consumers are deposited into the CEF. The money is used for paying the salaries of the operator, manager and other administrative expenses. In addition, the money is also used for the repair and maintenance, future expansion, dividend and other purposes that are agreed by the community people based upon the participatory and transparent decision making process.

3. Impact

3.233 The impact at the local is impressive, especially in the income generation, drudgery reduction, education, health, agriculture and ICT fronts. With the increase in access to decentralized electricity, community people have become successful in establishing various productive end-uses and enterprises that have led to increase of household income and comfort in livelihood. The children are availed of better light which has resulted in improvement in study conditions. The introduction of improved cookstoves and biogas digesters resulted in the reduction of respiratory and eye diseases. Furthermore, reduced deforestation rate has been noticed. As the slurry from the biogas plant contains high nutrient value, its impacts are seen in increased agricultural yield also. REDP has been successful in supporting the introduction of ICT even in remote rural settings, because of the electricity from micro hydro schemes. Improved irrigation facilities have increased the crop yields.

4. Scale-up

3.234 REDP has been successful in scaling up on three fronts, viz. policy, institutions and expansion. The good practices and lessons are internalized in the policy of the Government. The local level institutions are adopted by the elected bodies (DDC and VDC). The National Planning Commission is working under a UNDP Thematic Trust Fund for strengthening the National Policy Framework on Rural Energy. A joint project of HMG/N, UNDP and World Bank is being implemented for the expansion of the REDP approach and activities in 10 additional districts.

5. REDP Progress

Micro Hydro Schemes including Peltric Sets	109 (1468.7 kW)
Biogas plants with toilet attached	2, 705
Solar Home Systems	1,474
Improved Cooking Stove	7,043
Nursery Establishment	96
Community Managed Forests	180
Plantation	2,702,622

Toilet Construction	9,961
Environment Classes	322
Training on Technical Subjects	1,170
Environment Management Training	2,077
Enterprise Development Training	4,498
Others	12,600

	Male	Female	Total
Community Organization (No)	1,366	1,371	2,737
Community Members (No)	28,086	27,225	55,311
Cumulative Investments (Rs.)	21,070,370	19,036,890	40,107,260

Pakistan

Development of Micro Hydro Plants in Northern Aareas

Isthiaq A Qazi, Pakistan Council for Renewable Energy Technologies, Islamabad

1. Overview

a) Reason for/cause of project

3.235 The project envisages installation of Micro Hydro Power (MHP) plants in the remote hilly population pockets, which are beyond the reach of the national grid, and are not techno- economically feasible to be connected with it. MHP technology has proven to be an economical and environment friendly source of energy which holds promise to improve the quality of life of the otherwise neglected rural masses.

b. Location and local setting

Remote hilly areas, where perennial natural water falls and streams are available.

c. Participants involved in project development

3.236 The remarkable feature of Pakistan's MHP program is the participation of the members of the local community who are involved in the project right from the initiation to the final implementation. The communities also undertake the subsequent operation and maintenance of MHP plants. While the turbine and generator are provided by the government through the Pakistan Council of Renewable Energy Technologies (PCRET), the cost of the civil works, penstock pipe and distribution lines, etc. is borne by the local community, who also provide the land and the labor.

d. End-use

3.237 The electric power generated is used for domestic lighting in the night while in the day-time, in some cases, the mechanical power is employed for running small-scale industrial units like sawmill, flour mill, oil expeller, wood and metal lathe machines, etc.

e. End-users

3.238 50-200 rural households are supplied electricity from each MHP plant of 10-50 KW capacity.

f. Fuel/resource and technology used

3.239 Natural perennial water streams and falls are harnessed for generation of electricity. An impulse turbine known as cross flow turbine, which is a free stream radial wheel, has been found more suited to the local conditions. A generator of 220/230V, 1500 rpm, with self-excitation system is coupled with the turbine through pulley-belt system.

g. Cost and availability of fuel/resource/technology used

3.240 Natural perennial waterfalls are available abundantly in the hilly terrains of the country.

h. Completion time

3.241 The present phase of the project for the installation of 50 units is likely to be completed in the summer of 2003.

2. Financing

3.242 PCRET provides Technical Assistance, Turbine, Generator, allied components, panel board and cable. Beneficiaries have to meet all other expenditure to be incurred on civil work, penstock pipe and the distribution system. Besides, they also meet the expenditure required for procurement, erection and operation of small-scale industrial units from their own pocket.

3. Impact

3.243 Through these projects, socio-economic conditions of the rural population have improved considerably. This has not only brought convenience and comfort to their homes but through the use of radios and television etc. has affected a number of other benefits in education, health and gender equality.

4. Scale-up

3.244 It is found that energy needs of the inhabitants of the target areas are gradually increasing and, based on the number of requests received at our office every week, the scale up of the project is definitely required.

3.245 A project proposal for installation of 100 MHP plants is under process. The electricity generated from these plants would be utilized for establishment of micro industrial zones in the remote villages.

3.246 Technical, financial & social problems are likely be encountered, while implementing this project. To overcome these challenges the following measures are proposed:

Technical

- Hydraulic load controller would be coupled with the turbine to control the power fluctuations in the system.
- Local people would be helped in selection and acquisition technology equipment etc. for establishment of need oriented industrial units.
- On-site training would be imparted to the local people in operation and maintenance of MHP plants as well as the allied industrial units.

Financial

- ?? Efforts would be made to mobilize micro credit institutions for providing soft loans (at a nominal markup) to the beneficiaries for establishing small scale industries.
- ?? Tax exemption would be given on the products of these micro industrial zones.

Social problems

- ?? Efforts would be made to formulate community-based organization in each village to resolve the social problems like water rights, land and other emerging social problems.

Marketing

- ?? Efforts would be made for establishing a market network for sales of the products of these micro industrial zones.

Philippines

Municipal Solar Infrastructure Project (MSIP)

BP Solar-Rural Solutions Team, UK

1. Overview

a) Reason for/cause of project

3.247 In the Philippines, BP Solar is engaged in a number of Rural Infrastructure Projects. Of particular note is the Municipal Solar Infrastructure Project (MSIP), undertaken in conjunction with the Philippine and Australian Governments. MSIP is a significant project due to its large scale and the emphasis placed on delivering a sustainable development program. MSIP uses solar energy as "the enabling technology" to allow the Philippine Government to target specific survival needs of remote and poor un-electrified communities, and upgrade basic community facilities. As a result of the MSIP project, BP Solar has developed a lot of experience in this form of comprehensive project delivery. Rural Infrastructure Projects are now at the core of BP Solar's business strategy and the company is “cloning” MSIP in other regions.

b) Location

3.248 MSIP was conceived, designed and implemented with the aim of improving the quality of life for people living in some of the most remote and poorest areas of Mindanao and the Visayas Provinces of the Philippines.

c) Participants involved in project development

3.249 BP Solar was involved in the project from the start, in helping to determine the systems and services necessary to satisfy community needs. The company worked with the governments of Australia and the Philippines to identify the target communities and to design and implement the programs from beginning to end.

d) End-use

3.250 In total 1,145 packaged solar systems were installed in 435 Barangays. On completion of the MSIP the community facilities upgraded and provided with a packaged solar system were as follows:

4	District Hospitals.
11	Rural Health Centers.
104	Barangay Health Centers.
260	Barangay Potable Water Supply Systems.
6	Municipal Halls.
201	Barangay Halls.
266	Schools.

289 Communal area lighting for markets and fishermen's wharves.

e) End-users

3.251 It is estimated that at least half a million people living in remote locations in the Philippines have directly benefited from the MSIP project.

f) Fuel/resource and technology used

3.252 Solar energy was used as the enabling technology to upgrade community facilities. In total 1,145 packaged solar systems were installed. These packages included applications to improve public health, education, productive uses, etc.

g) Cost and availability of fuel/resource/technology used

The total project value was US$27 million.

h) Completion time

3.253 MSIP commenced in November 1997 and was completed in May 2001. BP got involved as a natural progression from the rural off-grid work already undertaken and because of direct interaction with the Australian Development Aid program, AusAid.

2. Financing

3.254 The project, one of the largest solar contracts in the world, cost US$27 million; funding was provided by way of a grant of 33% from the Australian Government plus an OECD "soft" loan from the Australian Government for the remaining 67%.

3.255 Funds are collected from end-users to cover the costs of operation and maintenance. The income levels did not allow for a contribution towards the capital costs.

3. Impact

3.256 This rural development project provided health, education and governance benefits to more than 500,000 poor Filipinos in 11 Provinces, 53 Municipalities and 435 Barangays in the Mindanao and Visayas regions.

Results of the MSIP project at a glance

- Over life of project (20years) 13.7 million kWh of energy saved, approximately 13,000 tons of CO_2 avoided.
- Over life of project (20years) 13.7 million kWh of energy produced by 1,145 installations, 500kWp installed capacity.
- 260 water storage tanks constructed (10-40 m^3) 6m above ground with more than 200km of distribution with over 1,000 tap stands.
- Many innovative solutions found. Not only technical but more importantly community development, administrative, logistics, training and maintenance as the project was wide spread covering many

ethnic minorities and language groups in very remote locations, sometimes 2 days walk from "end of road or river."

- ?? More than 2,000 persons informed directly as trainers and equipment operators plus more than 260,000 villagers involved in Social Preparation.
- ?? 1,200 new jobs created.
- ?? More than 4,000 publications disseminated .
- ?? The positive health spin offs effected nearly one million Filipinos living in the targeted Barangays, Municipalities and Provinces.
- ?? Improved School Attendance in Targeted Barangays.

4. Scale-up

3.257 This project was one of the largest in the world, targeting more than 400 villages and affecting at least half a million people. The project is currently being replicated elsewhere in the world. In the Philippines, a follow up project (SPOTS) is being implemented with focus on creating income generating opportunities for Agriculture Reform Communities. The key challenge in replicating and scaling up these projects is to mobilize funding from donors.

Philippines

Solar Power Technology Support Project (SPOTS)

BP Solar-Rural Solutions Team, UK

1. Overview

a) Reason for/cause of project

3.258 Building on the success of the MSIP project, completed May 2001, BP Solar, together with the Philippine Governmental department responsible for Agrarian Reform (DAR), has taken this concept forward and developed the Solar Power Technology Support Project (SPOTS). The aim of this project is to improve the standard of living and enhance agrarian productivity by supplying solar packages for Social Development for Health and Education; Security and Communal Lighting; Income generation (water supply for irrigation, etc.).

3.259 SPOTS addresses rural poverty in up to 79 Agrarian Reform Communities (ARC) in the region of Mindanao by applying specific solar packages targeted at improving social welfare, increasing agricultural productivity and empowering local ARC and Farmer's Organizations. BP Solar Project will be responsible for project management, financial management, social preparation, definition of local needs, supply of equipment packages, and installation and commissioning.

b) Location

3.260 SPOTS was conceived, designed and implemented with the aim of improving the quality of life for people living in some of the most remote and poorest areas of Mindanao Provinces of the Philippines, particularly in Agricultural Reform Communities.

c) Participants involved in project development

3.261 BP Solar is working with the governments of Spain and the Philippines (DAR) to identify the target communities and to design and implement the programs from beginning to end.

d) end-use

3.262 The project is targeted at 79 Agricultural Reform Communities

e) fuel/resource and technology used

3.263 Solar energy would be used as the enabling technology to upgrade community facilities, and in particular to create income-generating opportunities (productive use packages).

f) cost and availability of fuel/resource/technology used

3.264 The total project value is US$ 25 million for Phase 1.

g) completion time

3.265 The project (SPOTS 1) will be implemented during 2003-05.

2. Financing

3.266 BP Solar have won the tendering process and the contract was signed in April 2001. This project (Phase I & Phase II) will be the world's largest solar project implemented to date and matches the strategic aims of the company in becoming a recognized world leader capable of successfully implementing large rural infrastructure projects in the developing parts of the world.

3.267 The total project is valued at about US$50 million and will be financed under the Financial Protocol signed between the Spanish and the Philippine governments. The second phase is dependent upon the satisfactory completion of phase 1.

3. Impact

3.268 It is anticipated that more than 150 local people will be employed directly through BP during the duration of this project, with the expectation that many more local people and NGOs will be employed indirectly. There will be substantial training of local technicians within the ARCs on maintenance requirements of the equipment.

3.269 The project will bring environmental benefits by displacing the use of kerosene. The project is expected to significantly improve the standard of living and enhance agrarian productivity by supplying solar packages for Social Development for Health and Education; Security and Communal Lighting; Income generation (water supply for irrigation, etc.).

Sri Lanka

Village Energy Financing Program

Indrani Hettiarchchi, SEEDS, Colombo

1. Overview

a) Reason for/cause of project

3.270 Better known by its acronym SEEDS, Sarvodaya Economic Enterprise Development Services (Guarantee) Limited is a unique development organization created in 1987 to focus on village level economic infrastructure within overall SARVODAYA philosophy. SEEDS is a Micro Finance Institution (MFI) working on Credit Plus approach. The mission of SEEDS is eradication of poverty by promoting economic enterprises for a sustainable livelihood. The definition of poverty in this context is not having basic needs. Following are the identified basic needs:

- Adequate supply of food.
- Adequate supply clean water.
- Basic health care.
- Minimum clothing requirements.
- Modest house.
- Energy requirements.
- Basic communication.
- Total education.
- Spiritual and cultural needs.
- Clean and beautiful environment.

3.271 The village energy financing program was commenced as a progressive step to reduce energy poverty in rural village households.

b) Location and local setting

- Country's Population is 18.7 m (Rural 80%, Plantation 5.3%, Urban 14.7%) .
- Main grid power availability is 55%.
- Two Million households or 45% of population is without grid power.
- Sources of energy used in the villages are kerosene, firewood, candles, and batteries.

2. Financing

Financing program has two components: Solar Home Systems (SHS) and Village Hydro (VH)

Solar Home Systems Financing

Stage 1 – Introductory Phase

3.272 Popularizing the technology and building awareness by fixing 100 systems in temples and community centers.

Stage 11 – Pilot Phase

- ?? Survey to asses the market.
- ?? Operation from two Districts.
- ?? Total service concept - Sales & Marketing / Technical and after sales service,
- ?? Credit 400 systems fixed - low productivity and poor profitability.

Stage 111 - Commercialization phase

- ?? Specialization on financial intermediations.
- ?? Partnership with solar PV companies.
- ?? Expanded the service to 20 Districts.
- ?? Financed 18,000 clients. Invested US$7.28m.

Funding

- ?? Introductory phase - Grant funds from USA through an NGO to Sarvodaya.
- ?? Pilot Phase and first year of commercialization - Borrowings from Development Banks and other financial Institutions
- ?? Borrowings as a PCI of the Energy Services Delivery Project (ESD).
- ?? Latter stage - PCI status in the ESD & RERED.

Progress in Funding

Volume

Year 1999 average loans considered per month - 10

3.273 Year 2000 average loans considered was - 50

At present average loans considered is - 800
(2001 / 2002 / 2003)

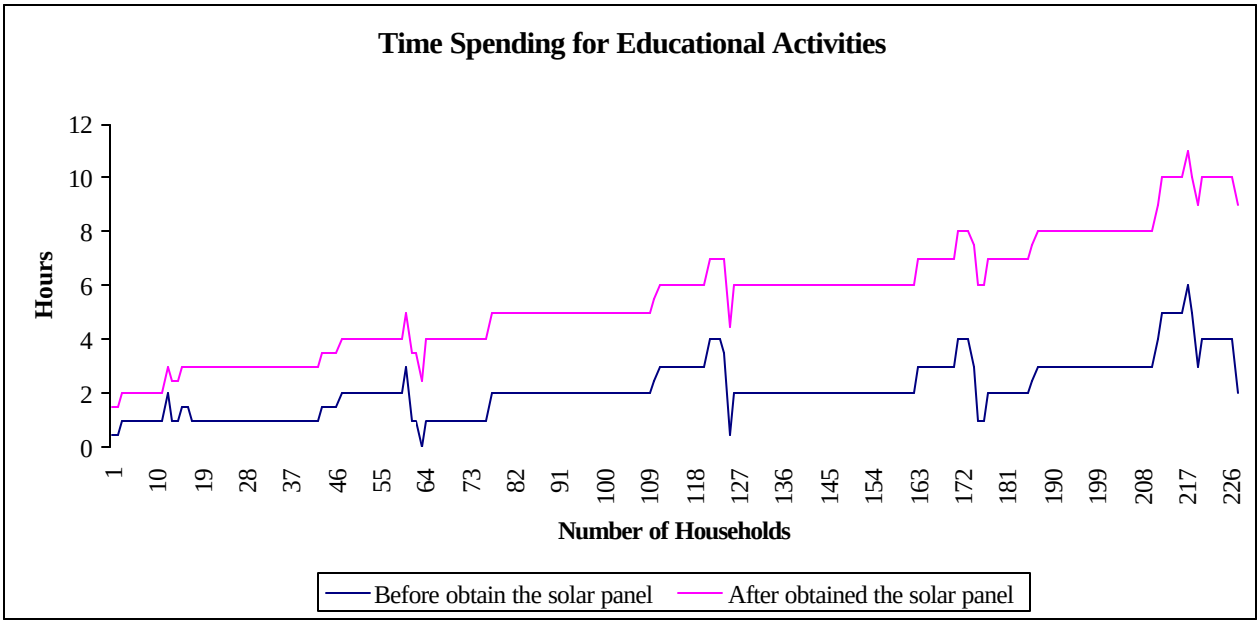
Value	**Rs. m.**	**US $ m.**
For 3 years up to 2001 March	110.65	1.14
By 2002 March	229.573	2.37
By 2003 March	358.791	3.70

End user profile	Earning < US$50 p.m.	56.3%
	< US$100 p.m.	31.2%

< US$150 p.m.	3.0%
Higher income (US $ 400 – 500) -	9.5%

3. Impact

- ?? Knowledge improvement.
- ?? Improved standard of life.
- ?? Children's education.
- ?? Common study centers, common reading centers.



(From a sample survey)

Economic activities commenced

- ?? Computer centers, TV. Parlors.
- ?? Trade activities / Production activities .
- ?? Retail boutiques / Battery charging.
- ?? Barber saloons/ Cycle repair shops.
- ?? Sewing facilities/ Product sorting and packing.
- ?? Small rice mills / water pumping.

Improved quality of life

- ?? Safe mode of lighting / Prevention of accidents.
- ?? Clean bright light free of smoke.
- ?? Environmental friendly service.

Negative factors

- Low customer satisfaction on the product.
- Technology limitations of SHS.
- Inability of the product to fulfill the clients total requirements.
- No solar powered equipments.

4. Scaling up

Good environment

- Funding sources.
- Demand.
- Supply (Goods and Credit).

Internal issues

Heavy demand for credit	Delay in credit processing, delay in recovery
Man power	Knowledge Training Attitude changes Improvement of public relations IT Skills
Technology	Conversion of the manual system to IT based operation Capital for investment in IT Acceptable IT Solutions

External issues

Natural Disasters	Drought / Floods
Income fluctuations	Volatile market
Geographical barriers	Distance to travel by the field officer to meet the clients

Strategies to overcome the issues

- Fully trained credit staff.
- Automation of the operation.
- Combined operation with solar PV Companies.
- Reorganization of the systems.
- New modes of collection.
  - Through SSS/ Agents.
  - Solar PV companies.

- Group system.
- Post office net work.

?? More customer orientation.
?? Risk assurance facility.
?? Additional credit for upgrading, components, batteries.
?? Rebate for early payments.
?? Restructuring for genuine payment difficulties.
?? Different systems for disposal of used panels.

Village Hydro Financing

3.274 The village forms into a society to obtain the facility, and works on contributory basis. Village contribution is usually in labor. SEEDS financed 7 projects with a total of Rs. 1,960,983 (US$20,216).

Sri Lanka

National Solar Industry Status

Pradip Jayawerdene, Solar Industries Association, Colombo

1. Overview

a) Reason for/cause of project

3.275 A survey done in Sri Lanka during 1986 showed that 81% of the households (2.5m) had no access to grid electricity. The survey also showed that despite the best efforts of the government in extending grid lines, 2 million homes would still remain unconnected on account of rapid growth of rural housing and the exponential cost of grid extension. The survey further indicated that 470,000 of these homes could afford to pay for a solar home system. A business was set up in 1987 to service these potential customers using SHS.

b) Location and local setting

3.276 The company Power & Sun Ltd.(later Solar Power & Light Co. Ltd) would service customers island-wide with focus on areas with low electrification and high income.(e.g. irrigated paddy farmers or small tea estate holders). The business met with only limited success in the first decade of operation since there was no consumer credit available for the customers. Most systems were sold on cash basis or with short dealer credit. The business however overcame significant obstacles of customer education and created an agent scheme which later paved the way for rapid growth and profitability. The company developed a comprehensive customer awareness program to inform potential customers of this new technology. This included demonstrations in villages and a complementary radio program. The village demonstration program was done on an ongoing basis and was conducted continuously for many years.

3.277 A sales and technical agents scheme was also developed by the company as a way to reach rural customers. This was a direct sales method where customers were visited door to door. This scheme was originally set up to help sell and service products from dealer shops which were located in towns. At a later stage the company set up its own stock centers (Solar centers) and sold products directly through agents. This method of sales is now practiced by all local solar companies.

3.278 In 1987 the Sri Lanka government launched the Energy Services Delivery project, funded by the World Bank consortium, which provided resources for the financing of solar customers. These funds however remained largely unutilized until a consumer credit scheme was launched by SEEDS (Sarvodaya Economic Enterprise Development Service) as a result of an innovative MOU signed between Solar Power &Light Co and SEEDS.

3.279 In 1999 the company collaborated with the Shell group and became Shell Renewables Lanka. Shell retained the management as well as the concept of sales & technical agents and the village demonstration scheme. The main purpose of the collaboration was to access capital required to develop the market. Shell invested US$2.5 million over a 3 year period (1999 - 2001).

c) Participants involved in project development

3.280 The participants of the project were three local entrepreneurs, Pradip Jayewardene, Lalith Gunarantne and Viren Perera. Two local development banks, DFCC Bank and the National Development bank also provided equity and loan funding.

d) End-use

3.281 The end use of the product was lighting, TV and Radio. A few customers also used the system for powering mobile phones.

e) End-users

3.282 End users of the product are mostly farming families living away from the grid. The number of end users who purchased the product was approximately 500 per year from 1988 to 1999. In 2000 the company achieved sales of 1,800 systems as result of the new investment (largely to finance stock) and in 2001 the company sold 4,500 systems.

f) Fuel/resource and technology use

3.283 The business focused mainly on the sale of solar home systems.

2. Financing

3.284 Initially the business was funded by private equity as well as equity and loan funds from development banks. This investment was insufficient and a US$2.5 million investment from Shell was required to make the business scale up to a profitable level.

3.285 Customers paid for the system by accessing loans from SEEDS, a micro financing organization working in rural areas. The company developed a comprehensive agreement with SEEDS where SEEDS provided consumer finance and the company was responsible for sales and service of the product. By maximizing the relative strengths of both organizations' sales increased exponentially.

3.286 SEEDS was able to access the ESD project, which allowed them to re-finance 80% of loans given to solar customers. A GEF grant of US$100 per system was also important in keeping prices to the end user at reasonable level.

3. Impact

3.287 It is estimated that more than 30,000 homes in rural Sri Lanka use solar home systems. This is now growing at the rate of around 1000 each month with 6 active solar companies and 80 retail outlets dealing exclusively in SHS. Many users report that SHS transformed their lives with ease of doing housework, cooking at night and early morning, TV for information and entertainment. One of the greatest benefits reported is

the ability for children to study and the elimination of the fire hazard associated with kerosene lamps, especially in houses with young children.

4. Scale-up

3.288 As the company was set up from the outset as an ongoing business, scale up of the business required only additional capital. The business model can be scaled up and is expected to sell and install 10,000 systems in 2003 (using the same model which sold 1,800 systems in 2000). One of the innovative schemes pioneered by the company was to obtain an additional grant (US$100 per system) from a provincial government, which reduced the capital cost of the equipment. This grant has a significant impact as it gave tremendous credibility to the use of SHS in a world where a grid connection was the preferred way to access electricity. In other words the government grant (shown as a discount in the price of the system) showed government participation in the supply of solar home systems. The scheme has now been extended to two more provinces with impressive results.

Vietnam

Integrated Agriculture and Community Development Project (IACDP)

BP Solar-Rural Solutions Team, UK

1. Overview

a) Reason for/cause of project

3.289 As part of BP's on-going social investment program in Vietnam, a jointly funded pilot project has been undertaken as a collaborative effort between BP Solar, BP Oil and BP Exploration. In partnership with the Ministry of Agriculture and Rural Development (MARD), the above BP Group Companies will supply a standalone central power supply system to a remote non-electrified commune centre nominated by MARD as the enabling and least cost technology to:

- ?? Upgrade existing basic survival facilities.
- ?? Increase income generating opportunitites.
- ?? Improve governance, and
- ?? Train the project partners.

3.290 The long term objective of the project is to improve the quality of life, health, education and help reduce poverty in an integrated, sustainable and environmental friendly way. This is an important step forward for BP in delivering an integrated social investment strategy in Vietnam. The company sees solar technology playing a pivotal role in improving the quality of lives for many thousands of Vietnamese people living in remote areas where it is the only viable energy source.

b) Location

3.291 The Sy Hai Commune, Ha Quang District, Cao Bang Province has been selected for this pilot program. Cao Bang is ranked number two in order of poverty in the list of provinces having the poorest communes of the country. The province has several districts along the border with China. Cao Bang Township is about 310km from Hanoi. Sy Hai is over 1000m above sea level and is often referred to as "the Sixth Area" which was actually one of 6 areas within the northern mountainous region previously under French rule. Of a population of approximately 1280, around 10% are H'Mong and the rest are Nung ethnic minorities.

c) Participants involved in project development

3.292 BP Solar is working with BP Vietnam, the government of Vietnam (Ministry of Agriculture and Rural Development - MARD) and UNDP to implement this project.

3.293

d) End-use

3.294 The project is targeted at a remote community Sy Hai with 1280 people.

The project targets the following: Communal Center including Communal Hall, Clinic, School and Teachers' House. The project provides one centralized system (72 x BP585 12V-85Wp Solar Modules meeting a load of about 10 kWh/day and 2000 Ah batteries), 1 standalone vaccine refrigerator system, and three street light systems.

e) Fuel/resource and technology used

3.295 Solar energy was used as the enabling and least cost technology to upgrade community facilities, and in particular to create income-generating opportunities (productive use packages).

f) Completion time

3.296 The project is currently being implemented.

2. Financing

3.297 BP Vietnam provided financing for this project.

3. Impact

3.298 This project envisions the following benefits:

- Upgrading existing basic survival facilities, such as health clinics (vaccine fridge, sterilizer, lights), schools (lights, TV and Video), potable water supply (storage and distribution) for living and irrigation, battery charging and communications.
- Increased income-generating opportunities (providing usable amounts of electric energy for grain grinders and water pumps and some load equipment such as battery chargers).
- Improved governance and commune project management (upgrade commune's facilities with lights and TV, Video and develop commune management and monitoring skills).
- Trained project partners on the latest solar technologies, design methodologies and solar/micro hydro hybrid systems as well as users in installation, operation and maintenance of the systems.

4. Scale-up

3.299 BP Solar is currently mobilizing funding for a large project in Vietnam, building on this pilot project. The key challenge in replicating and scaling up these projects is to mobilize funding from donors.

Annex 1. Project Profile Form

1. Overview: Please provide a brief overview of your project, including a description of the:

   a) reason for/cause of project.
   b) location and local setting.
   c) participants involved in project development.
   d) end-use.
   e) end-users (including number).
   f) fuel/resource and technology used.
   g) cost and availability of fuel/resource/technology used.
   h) completion time.

2. Financing: How did you finance the project? How do end-users pay for the services?

3. Impact: What have been the various positive/negative impacts (e.g. education, health, agriculture, ICT, environment) of the project for the practitioners and the end-users?

4. Scale-up: Have you tried to scale up this project, and if so what challenges (e.g. technical, financial, policy/institutional) did/do you face? What are you doing to overcome these challenges?