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Scaling-up Renewable Energy

Report on Productive Uses of Renewable Energy

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1. EXECUTIVE SUMMARY

A new programme to focus on renewable energy in low income countries, provisionally called the Scaling-up Renewable Energy Programme (SREP), is being proposed under the Strategic Climate Fund (SCF) within the Climate Investment Fund. A number of renewable energy support projects and programmes under various agencies, including the World Bank, are being implemented throughout the world; the majority of which are targeted towards basic energy services.

Experience from around the world suggests that the promotion of productive uses of energy has a positive impact on the benefits of renewable energy projects. This brief study examines seven renewable energy projects and programmes from around the world and assesses them on their implementation approach, budget and outcomes, with the aim of developing recommended approaches to implementing such programmes under the future SREP. Renewable energy programmes in India, China, Nepal, Argentina, Chile and Honduras are examined.

A programmatic approach to implementing the renewable energy programme, with productive uses at the centre, is examined with a view to assessing the key components of such an approach. The programmatic approach has been found to be beneficial in maximising the impact and change brought about by a support programme, as evidenced by case examples. Various delivery models that are being used are also examined in the context of the SREP and their usefulness commented upon. Advantages and disadvantages of pursuing a programmatic approach for promoting productive uses of energy are also analysed, including an assessment of linkages that a future SREP programme may have with existing programmes and agencies. It has been recognised that the involvement of the private sector, though difficult initially, should be encouraged based on successful experience in several renewable energy support programmes.

It is concluded that a future SREP should have a focus on the productive use of energy as well as follow a programmatic approach, which is being implemented by agencies such as GEF. It is also recommended that SREP works with existing renewable energy programmes and agencies to maximise the effectiveness of future SREP initiatives.

Finally, this study has been carried out within a short space of time and with examples and evidence from a relatively small number of projects and programmes. Even though it is believed that the findings represent the reality, further work is recommended to confirm and validate the findings and identify the best mechanisms to implement SREP initiatives targeted at productive uses in LICs.

2. BACKGROUND

A new programme is being developed within the Strategic Climate Fund (SCF - part of the Climate Investment Funds) that will focus on renewable energy in low income countries. It is provisionally called the Scaling-up Renewable Energy Programme (SREP). There are hundreds of renewable energy promotion programmes around the world, often supported from grant aid and with heavy reliance on institutional support from the local governments and/or the agencies that provide the grant. For example, at the time of writing this report, there were 252 active projects supported by the World Bank in the Renewable Energy Sector. A large number of these, and other programmes supported by other agencies, focus on basic energy services such as lighting, media services (TV & Radio) and cooking, and have not specifically targeted value-added economic activities such as agricultural processing, irrigation, water pumping, manufacturing and communications. According to FAO, although priority might be placed on electricity for productive activities such as food production, agro-industries and small scale rural industries, the reality is that household and community needs for lighting, space and water heating, and small appliance power have received rather more attention[1].

Information on renewable energy programmes specifically targeted to address productive uses is very limited. This fact is also reiterated by GEF and University of Toronto's joint study of 2003[2].

The following sections of this document outline a desk-based review carried out by IT Power of existing international renewable energy programmes and projects supported by multi and bilateral organisations, in middle and low income countries (MIC and LIC).
Although the conclusions and review presented in this report are believed to represent the reality, it should be noted that this study was undertaken and completed within a week and hence further work would be required to confirm and validate the views presented in this document.

3. SELECTED RENEWABLE ENERGY PROGRAMMES

One of the objectives of this document is to summarise the range of renewable energy projects that have been undertaken in developing countries in recent years. A range of renewable energy projects and programmes were chosen to represent as diverse economic, technical and social characteristics as possible. Programmes from Lower and Upper MICs are chosen as evidence of success (or failure) that can be applied to LICs under the SREP. Examples of renewable energy programmes by country are shown below. Their outcomes are indicated, as well as their budget (where available) and the organisations involved in their implementation. Details of each programme are provided in the Appendices.

3.1 Solar Water Pumping in Punjab (India)

The Solar Water Pumping Systems in Agricultural Sector (SWPSAS) programme, which started in 1999, is being funded by the Indian Government through the Ministry of New and Renewable Energy Sources (MNRE), the Government of Punjab and the Indian Renewable Development Agency (IREDA). The programme has been designed to use a Solar PV pumping system to curtail widespread use of diesel powered pumps which are traditionally used for irrigation by the farming community in Punjab. The programme was delivered

[1] FAO (2000). *The Energy and Agriculture Nexus.* Environment and Natural Resources Working Paper No. 4. Rome: FAO.
[2] Etcheverry, J (2003). Renewable Energy for Productive Uses: Strategies to Enhance Environmental Protection and the Quality of Rural Life. University of Toronto.

through the state renewable energy agency – the Punjab Energy Development Agency (PEDA).

The programme is running in two phases; the first phase running from 1999 with a five year budget of US$127m for 2002-2007. A fifty percent subsidy towards the cost of PV Pumps was funded by the programme, while IREDA provided soft loans to provide the farmers with the pumping system under a lease-finance scheme. The government contributed by providing tax benefits, among other initiatives.

The programme has been one of the most successful schemes in the country. Some 1,700 pumps were installed in the period between 2001 and 2003.

The scheme has been so successful that similar schemes have now been approved for other states in India. The total number of PV systems by September 2008 was 7,148.

3.2 RVREP (India)

The Remote Village Renewable Energy Programme (RVREP) was launched in 2002 with a five year budget of US$150m for 2002-2007, with MNRE (Govt of India), State Nodal Agencies, local village units, NGOs and private sector as participants in the programme.

Both productive uses (e.g. cottage industries, weaving, water pumping) and non-productive uses (e.g. solar home systems for lighting) of energy were considered in the programme. It is currently in its second phase of implementation. However, productive use is not a stated objective of the programme; the main objective is to provide basic energy needs through off-grid systems in 8,281 villages and 794 hamlets to which grid extension was either considered not feasible or not cost effective.

A feature of this programme is the active role played by government departments. The fund available for this programme provides a subsidy of up to 90% of the cost of the renewable energy devices. The selection of which villages to electrify is made by the State Nodal Agencies of the MNRE through a well-documented process. Long-term sustainability is considered whereby annual maintenance contracts with the suppliers are part of the deal. The MNRE sponsors a number of training and awareness programmes in different states.

Due to continuous support from the government for this programme, today India has more than 200 PV system integrator and 280 commercial solar shops across the country to supply and service solar PV systems. RVREP provides basic energy services to one million villagers in India and creates thousands of jobs in the PV industry across the country.

3.3 Barrier Removal for Renewable Energies (Chile)

This programme acts within the framework of the PER: Proyecto de Electrificacion Rural in Chile. The execution of the project is the responsibility of the Comisión Nacional de Energía (CNE). The programme is supported by GEF and the Chilean Government through the CNE. The programme's main objective is barrier removal for the successful use of renewable energy in the Chilean PER programme. The total budget for the programme is about US$31 million, with GEF contributing about US$6 million while the rest was contributed by the Government (about US$16 million), private sector and end users. The programme was scheduled to last for five years from 2001, but the new revised date for completion is 2009.

Productive uses were not taken into account when the project was designed; however, some technical assistance was provided towards productive use of energy, apparently due to the realisation of their importance.
A decentralised management model has been used for the implementation of this programme. A 'bottom up' approach is used where rural communities propose rural

electrification projects which are then reviewed and prioritised for funding by the regional governments. Several barriers to successful implementation of renewable energy were identified, and several training and information manuals, standards and solar radiation databases were prepared as part of the programme.

3.4 Linking Income-Generating Activities and Micro Enterprises with Energy Services (Honduras)

The Linking Income-Generating Activities and Micro Enterprises with Energy Services in Honduras was launched in 2007 with a year budget of US$130K, with the World Bank Rural Electrification programme in Honduras, the Government of Honduras and GVEP as participants in the programme.

This project consisted of a programme to showcase best practice in the implementation of renewable energy projects for productive applications in Honduras. The initiative was designed to complement and support the activities planned under the Rural Infrastructure Project, sponsored by the World Bank.

The project also included the creation of income generating applications that enhanced the quality of life of those families involved, while providing additional income streams to pay for the electricity services provided. Furthermore, the project developed tools to enhance projected capacity building activities in the form of manuals and training programs. This took place in close coordination with the communities and stakeholders that are expected to benefit from the two MHP projects.

A monitoring and evaluation plan was designed and applied to build a stronger case supporting not only the delivery of energy services to remote rural communities, but also to provide knowledge and capacity for productive applications.

Another task was to increase the knowledge of end users, rural developers and micro-financing institutions on the relationship between energy services, rural development and micro-financing, linking income generation and micro enterprises with off-grid energy services in Honduras.

The project, even though not officially termed programmatic, had several characteristics of a programmatic approach and concentrated on productive uses of energy.

3.5 PERMER (Argentina)

PERMER, Renewable Energy in Rural Market Project formally started in 2000, but the actual implementation only started in 2002 - the delay was due to the Argentine economic crisis. The programme was supported monetarily by a GEF grant and a loan from the World Bank, with a total budget of US$226 million. The programme was implemented to cover a range of interventions – from technical to capacity building in policy matters. The programme objectives were consistent with GEF goals. In PERMER, a concession approach has been chosen for rural electrification, mainly because of the country's ample experience with concessions for the provision of infrastructure services (e.g. telecommunications, water). The concessionaire obtained the monopoly of a given province, in return for the obligation to connect the service when requested by the customers, and to maintain its continuity over the duration of the concession.

Hundreds of Solar Home Systems (SHS) have been installed as part of the PERMER programme in various provinces within jurisdiction of the programme. Additionally, various community establishments such as schools have also been electrified using SHS.
The initial PERMER programme did not consider productive uses of energy. However, due to an apparent realisation of their importance, productive use of energy is one of the main

components in the new phase of PERMER that was recently approved by the World Bank and the Government of Argentina.

3.6 RRE (China)

The programme "Promotion of Rural Renewable Energy (RRE) in Western China" was set up with Dutch Government assistance in 2003 with a view to improving the rural farmers' quality of life and support poverty alleviation and income generation. A grant of €5.3 million was provided by the Dutch government, with matching funds of just over €0.5 million from the Chinese Government. As one of the objectives was income generation, there was a significant focus on productive uses of energy. The programme consisted of demonstration projects on technologies such as micro hydro, biomass/biogas and solar power. The programme was of programmatic nature as it also included technology transfer and capacity building, as opposed to mere installation of projects. Energy efficiency projects were also part of the programme. Non-productive uses of electricity were promoted too.

The lesson from this programme was that focus should be given on productive use of renewable energy as rural farmers were reluctant to invest in energy technologies that did not mean a cost saving or income generation or both.

Another conclusion was that investigation on local conditions should be carried out to identify suitable RRE technologies that meet the local conditions and farmers' needs, while awareness building was regarded important for project dissemination and replication.

3.7 Rural Energy Development Programme (Nepal)

The Rural Energy Development Programme (REDP) was initiated in 1996 by the Government of Nepal and the UNDP. The primary objective of the programme is to enhance rural livelihoods through the promotion of rural energy technologies, most commonly micro-hydro schemes. The programme is now in its third phase and has expanded from initial pilot projects in 5 districts in phase 1 to the current phase 3 which covers 75 districts. The programme works through community mobilisation, with decisions made by community organisations and collaborations of community groups called functional groups. Six basic principles are incorporated into the community mobilisation, these are: organisation development, capital formation, skill enhancement, technology promotion, environmental management and vulnerable community empowerment. A holistic development approach is taken, encouraging cross thematic links between education, health, women's empowerment and family incomes. This approach is adopted as it is perceived that access to energy by itself is not enough to facilitate economic and social development as other factors such as access to water, to markets, to health services etc., are also of importance. The programme is implemented through the Alternative Energy Promotion Centre of the Ministry of Environment, Science and Technology.

The programme has resulted in productive and non–productive uses of energy. Numerous cottage industries have been set up, with the additional income from these industries raising earnings and livelihoods of the households. Mills which have been established following the REDP programme have reduced the manual labour required for agricultural processing in many households. Numerous micro hydro systems have been established and moreover, people's skills, technical ability, business knowledge and group organisation have been developed through training, technology promotion and community groups involvement.

4. PROGRAMMATIC APPROACH FOR PRODUCTIVE USES

4.1 Introduction

Programmatic approaches for sustainable development support initiatives have been used over the past years, including in some renewable energy support programmes in Middle and Low Income Countries (MIC and LIC). The "Paris Declaration on Aid Effectiveness" provided support to this idea by encouraging organisations to integrate efforts in development activities in "outcome based" methodologies with a set of measurable indicators and related targets. Additionally, programmatic approach can be defined as a range of connected activities that are delivered through a local partner such as a state renewable energy agency or utility, using private sector wherever possible.

A number of organisations and programmes, such as UNIDO and GEF, have made efforts to define programmatic approach in their operation. This section discusses various aspects of a programmatic approach in the context of SREP and tries to set out definitions, pointers and guidelines for the forthcoming SREP initiative. The information provided in this section and others has been derived using the current short desk-based research, as well as using existing IT Power experience, and as such not every recommendation and conclusions presented here will thus be preceded by direct evidence presented within this document.

There are multitudes of support programmes around the world that focus on renewable energy and rural electrification – both grid extension and off-grid. A large number of these programmes target a specific area of intervention, such as technology dissemination or capacity building, with a limited budget and with, for example, no stated goal of influencing policy decisions that can potentially provide an enabling environment for such interventions. Such projects with a limited scope may bring some benefits but, in the absence of an institutional framework and enabling policy support, such benefits are not long lasting and the effectiveness of the support provided is limited.

However, renewable energy support programmes with wider objectives and holistic approach not only concentrate on providing limited technical project-based support, but also focus on interaction with regional and national delivery agency and policy making bodies to help create enabling environments for increased change and impact. For example, the Solar Water Pumping programme in India, as mentioned in Section 3.1, assisted the farmers with provision of loans and tax incentives for suppliers of the pumping systems under an accelerated depreciation arrangement. The programme has been very successful and is now being replicated in several states of India.

Another successful example of programme execution and enhanced impact is the Rural Energy Development Programme (REDP) in Nepal, as mentioned in Section 3.7. The original programme started in 1996, and has now been extended a number of times with financial support from various agencies including the World Bank. The approach taken by REDP is multi faceted, as every level of organisation is involved in delivering its objectives of promoting renewable energy to enhance rural livelihoods. REDP works in a joint collaboration with the government agencies for policies and coordination, the local bodies for planning, management and resource mobilization, the private sector for technical services, NGOs for community mobilization and the local community for operation and management as owners.

A recent review of the programme shows that the programme has had clear positive impacts on livelihoods and quality of life and is considered a "best practice model" given that it is working in an integrated manner, including skills development, enterprise development, information services and institution and capacity building[3],

4.2 Productive Use of Energy

There is a recognition that introduction of renewable energy technologies alone is not sufficient to achieve MDGs because the provision of energy as such is not included in the MDGs. However, several of the MDGs have direct and indirect links to energy services for their fulfilment.

Implementation of renewable electricity generation projects have often resulted in being a burden on the community if these projects were purely aimed at providing basic uses of electricity such as lighting, heating and cooking. Electricity becomes an additional commodity, along with food and other essential services, that needs to be paid for by the income generated from other sources. Given that in a rural setting in an LIC or MIC the sources of income are scarce, the demand for electricity can be low giving rise to low utilization factors and subsequently poor return on investment from energy projects, undermining the sustainability of the energy supply. The utilization factor of a renewable energy project or mini grid can be substantially increased using demand side management with introduction of “productive uses” as additional use of electricity apart from lighting and cooking.

The term ‘Productive Use’ is broadly defined here as a range of income generating and productive activities such as small industries, agricultural and food processing, telecommunications, health services, educational facilities and heating and cooling applications. The report does not consider extension of productive working hours due to basic energy services such as lighting to be productive uses, even though many programmes in the past have used this definition and encouraged it. The following table shows a list of possible productive uses and some of the relevant renewable energy technologies that can power them; however the list is not exhaustive. If a renewable technology is not listed in the table, it does not necessarily mean that there are no other technologies that can potentially supply electricity to these productive uses.

Productive Uses	**Renewable Energy Technology**
Coffee Shop (Kettle etc)	Hydro, Biomass, Mini grid
Saw Mill (saw, planers)	Hydro, Mini Grid, PV
Mechanical Workshop (Grinder, Saw, welding)	Hydro, Mini Grid
Agro-processing (Grinding, Milling, Hulling)	Hydro, Mini Grid, PV
Oil Expelling	Hydro, Mini Grid
Refrigeration (ice making, chilling milk, fruit & vegetables and meat)	Hydro, Biomass, Mini Grid
Bakery	Hydro, Biomass, Mini Grid
Water pumping (drinking, irrigation)	Hydro, PV, Mini Grid, Wind
Battery Charging	Hydro, PV, Mini Grid, Wind

Providing electricity access to rural areas, with a view to implementing productive uses, can provide market access to agricultural produces by way of providing long term storage solutions such as drying and chilling. According to Fuentes & Alvarez[4], the potential of

[3] Winrock International Nepal (2006): Assessment of REDP Impact on MDGs.
[4] Fuentes, M. and Álvarez M (2005). Analysis of Rural Electrification in Latin America: Sustainability and local job creation, XV European PV conference, Barcelona, Spain.

renewable energy to contribute to an increase in income-generating activities in rural areas is currently under-recognised by national policy-makers and planners.

Productive use has to be given consideration at an early stage of planning of an electrification programme, because a particular renewable energy system needs to be sized according to residential as well as industrial requirements. To do this, surveys of local produce and local markets for processed and value-added products need to be carried out. Additionally, training should be provided on business and technical aspects to the prospective owners and users of the productive uses systems. According to Kartha & Leach (2001)[5], if a rural energy activity is meant to reduce poverty, end-use activities must be thought of early in project design to determine how best to provide energy services so as to optimise the poverty reduction impact.

4.3 Key Characteristics and Components of SREP

Based on the experience of programmatic renewable energy initiatives presented in this document and elsewhere, any successful renewable energy programme is expected to have certain key characteristics and components.

End User Participation & Ownership

There are numerous examples where attempts to implement off-grid, decentralised electricity schemes have failed and an important factor in the failure of these schemes has been the lack of participation of end users in the planning and implementation of projects[6]. Financial commitment, in terms of matching funds from the beneficiary at local and national level, may be considered to consolidate the sense of ownership and provide an incentive to support the programme.

Monitoring & Evaluation (M&E)

A proper M&E system will enable evaluation of whether all the activities of the proposed programme are being carried out competently and efficiently. A monitoring system will help to see whether the expectations of people will be met by defining indicators of success, as experience shows that the beneficiary communities' perceived expectations can be different depending on social or gender status, for example.

For Programmatic initiatives, with the help of an appropriate institutional M&E framework, it will be easier to track the effectiveness of the various activities and institutions and change plans midway if there are any major hurdles.

ESMAP's demand oriented approach[7] and IT Power/REEEP's M&E Toolkit[8] provide guidance on Monitoring and Evaluation of Renewable Energy Programmes and are recommended as guidelines for SREP.

[5] Kartha & Leach (2001). Using Modern Bioenergy to Reduce Rural Poverty. SEI

[6] Ward, S (2000). A Guide to Producing Manual and Facilitating Participation in the Planning of Off-grid Electrification Projects: ITC's Experience in Developing Guidelines and Participatory Manuals for Off-grid Communities in Sri Lanka and Zimbabwe. IT Consultants (as quoted by Etcheverry)

[7] UNDP & ESMAP (2003). Monitoring and Evaluation in Rural Electrification Projects: A Demand Driven Approach.

[8] Rai, K (2005). Monitoring & Evaluation of the Impact of Renewable Energy Programmes: A toolkit for Applying Participatory Approaches. IT Power & REEEP.

Government Support

It is essential to get the government support right at the outset of the programme implementation so that, if necessary, government policies can be streamlined to accommodate objectives of the SREP.

Stakeholder Partnerships

Experience from past development programmes shows that active involvement of stakeholders in a programme ensures long-term efficient execution and long-term sustainability of the programme. Using local partners in the country or region of programme implementation brings in local experience and knowledge, which is vital for a successful implementation and enhanced impact of the programme.

Complementary to existing development programmes and initiatives

Countless failed initiatives show the futility of a rural electrification programme decoupled from ongoing development programmes. Any renewable energy programme should align with national sustainable development strategies and national energy policy, among others. Providing an electricity supply will only make a significant contribution to sustainable rural development when other necessary conditions are present[9]. Security of land tenure, availability of agricultural inputs, access to health and education services, reliable water supplies, and adequate dwellings are among the more obvious of these conditions.

Risk identification and mitigation measures

In line with any external intervention in the sustainable development sector, there will be risks associated with planning and implementing a programmatic initiative such as the one that is likely to be supported by SREP. However, as shown in the review of the programmes in Section 3, there exists little coverage of failure of a part of a programme or the complete programme, and the majority of reviews concentrate on the success of a programme. This is an important area of further research, outputs of which can inform future renewable energy programmes.

Capacity Building

Capacity building at various levels should be an inherent part of any development programme. This could include training skilled manpower to install, operate and maintain the hardware of renewable energy systems or it could include assisting the government departments in defining and setting up renewable energy policies and sustainable development goals. Additionally, technology transfer for local manufacture of renewable energy technologies will help lower the cost of the technologies, and hence technology transfer could form part of the capacity building component of a programme. Capacity building forms a significant part of the exit strategy of a programme.

Sustainability/Exit Strategy

A renewable energy support programme cannot continue to provide support indefinitely, and will need to cease operation when the objectives set out for the life time of the programmes are achieved. However, for the programme to continue providing the benefits to the end users beyond the programme life time, an exit strategy for sustainability has to be put in place in the overall plan of the programme and implemented at the end.

[9] Fuentes, M. and Álvarez M (2000). *Analysis of Rural Electrification in Latin America: Sustainability and local job creation*, XV European PV conference, Barcelona, Spain.

4.4 Private Sector Participation

Private sector participation has been essential to enable delivery in the majority of successful renewable energy support programmes. However, in order to ensure their participation, significant financial incentives have been needed, generally in the form of national or international development funds. To consolidate and sustain their involvement, a system or model that stands on its own without development funding is needed. Private involvement in the rural electrification in LICs has traditionally been limited due to the past focus on lighting-only projects, which simply generate too low a level of income to attract private funding on its own.

The Chilean project 'Barrier Removal for Rural Electrification with Renewable Energies', presented as an example in this document, contained a 24% private finance component which was secured against a contingency fund established by the GEF and the Chilean Government. Most of the installations were PV, with the majority of the projects identified in a bottom-up approach, and all projects provided a positive social return yet a negative private return. In return for financial support, the company receiving the subsidy is responsible for the execution, maintenance, operation and management of the project for a specified number of years.

Another model to incentivise private participation is through an output-based approach in the formation of concession areas. In Senegal, IT Power has assisted the Senegalese Rural Electrification Agency (ASER) in a World Bank-supported project designed to promote national and international private sector participation in a newly instituted rural electrification concessions system. Each concession is the subject of a Local Electrification Plan which defines the appropriate techniques and RE technologies, the type of investment, the market and the productive uses as well as the collective and social equipment needed in order to maximise the effects of rural electrification on poverty reduction.

For each of the concessions a private company has a potential customer base of 5,000 – 10,000 clients. ASER will choose providers who can provide the maximum number of clients for the smallest subsidy with an overall minimum operator investment of 20%.

The PERMER project in Argentina (Section 3.5 and Appendix) also utilised a concession approach building on successful experience in water and telecommunications projects in the country. However, the remainder of the cost not covered by the householders was supplied by government and not private investment. It has initially resulted in hundreds of successful SHS installations with householders paying 50% of the capital cost.

The Senegalese concession project allowed, through the Local Electrification Plan, a level of local direction for the concession. As such, and where local conditions allow, more productive modes of renewable generation could be considered. This will clearly have a knock-on effect on the overall financial status of the concession and potentially make it more attractive to private operators.

It is important to be aware of the many loan-based approaches which operate successfully in MICs for the distribution of RETs. A prime example would be the operations of Energetica, a Bolivian NGO, which implemented the first phase of a Dutch-sponsored SHS project selling 500 SHS systems of 20 Wp and 50 Wp through private entrepreneurs. Sixteen percent of the clients bought their systems with cash; the remaining 84 % received a loan through a local credit organisation that designed a special credit scheme for this project. After two years of operation, 44 % of the debtors had no arrears; the other 56 % rescheduled their loan to fit with the agricultural reality. See Section 4.8 for further relevant examples.

Another option worthy of further exploration is the formation of public/private ESCOs (Energy Service Companies) [see Section 4.8.2]. Research work undertaken by a consortium, including IT Power, to improve the amount of ESCOs present in the deployment of renewable technologies on the islands of Fiji[10] highlights that the formation of a public/private partnership can be still attractive to a private operator in situations where a 'pure-private' ESCO would be unattractive, and in many situations the added partnership ensures that the available financing packages are more attractive.

In order to streamline the investment of private funding, programmes such as SREP can help by presenting the local circumstance in as clear way as possible. Such methods include clear guidance on market status, assistance to the host country with technical support and 'pump-priming' with prefeasibility studies or pilot projects. Strategic use of a wider technical study or even demonstration projects can go a long way in giving private investors evidence to base their decisions on. If studies and pilots are designed to have a wider application than a specific niche then their effect will be more widespread.

While it is recognised that private sector participation is important to make renewable energy services commercially viable and to ensure the sustainability of the programme, it is important to recognise that encouraging and involving private sector in rural areas of LICs is not always straightforward. Even though these areas typically are un-electrified, it does not necessarily mean that there is a commercial market to attract the private sector. This situation is exacerbated by the fact that lighting-only renewable energy projects are likely to generate a lower level of income, making the scheme less attractive to a private sector investor. If productive use is planned at the outset, the scheme will become much more attractive financially and hence private sector intervention is feasible. In this context, there is global consensus that international cooperation, strong national commitments and public funding are initially needed to build basic energy service delivery structures[11]. However, this should not prevent a future SREP programme from encouraging private sector participation by providing incentives to participate. Exact roles of the private sector will depend on the type of intervention the particular SREP initiative is going to adopt.

4.5 Advantages and Disadvantages of a Programmatic Approach

The following sections discuss advantages and disadvantages of a programmatic approach to implementing renewable energy programme for productive uses, but most of the points will be valid for any renewable energy programme or any development programme. These have been compiled from various sources, including IT Power's own experience around the world and from specific examples presented in this report.

Advantages

- Following a programmatic approach increases the chances of the project's objectives being met due to collaborative measures between the partners.
- Policy gaps are easily identified. For example, the Community Micro Hydropower Project in Tungu-Kabiri in Kenya sparked a major policy debate in Parliament, leading to the passage of a bill to encourage small, decentralised power systems.
- Successful approaches can be replicated across numerous programmes
- Volume of 'non-project' work (overhead) is reduced as multiple projects run with the same administration and planning teams

[10] FIJI PROMOTING SUSTAINABILITY OF RET'S AND RESCOS – ADEME, IT Power, transenérgie

[11] UNIDO Initiative on Rural Energy for Productive Use, 2002

- Local delivery partners know the local context well and are able to implement projects more successfully
- Potential for 'rolling fund' - using profits/pay back from one scheme to fund capital costs of the next scheme
- Programmes will be larger than individual projects, therefore will receive more publicity/recognition and greater potential for replication. Beneficiaries of one project can play a larger role in future projects - knowledge transfer

Disadvantages

- Programmatic approach means reliance on there being suitably qualified/experience local partners, which may not be always available
- Increasing the number of different organisations involved also increases the potential for delays and incomplete work
- An approach which works in one country and context may not be applicable in a different country/context - 'one size' does not fit all
- Private sector and all organisations involved need to know RE technologies well (this can also be an advantage - widening the knowledge of renewables)
- Government participation may sometimes be bureaucratic in meeting project timelines, especially in developing countries, and may create avenues for corruption.
- There is a risk of being rigid if adaptability and flexibility is not built in
- Political uncertainty – many LICs have unstable governments and policy may change at short notice

4.6 Linkages with Other Agencies and Programmes

As mentioned elsewhere in this document, a renewable energy support programme should use existing networks and other development programmes to maximise the effectiveness of the programme. This is even more significant in a programmatic approach, as one of the objectives is an "outcome-based" initiative which focuses on effectiveness or efficiency.

As shown in the examples of renewable energy programmes in Section 3, linkages with organisations with similar objectives are a common factor in a renewable energy support project or programme and the proposed SREP should be no exception. Several organisations are involved in renewable energy promotion in the world and SREP should explore opportunities of working together with them.

One of the agencies with which SREP could work is UNIDO, which has a long standing experience of working in renewable energy programmes in cooperation with agencies like the World Bank. UNIDO encourages and implements energy programmes and projects which have specific emphasis on productive uses of energy[12]. Future SREP programmes could benefit from UNIDO's experience in renewable energy and productive use programme implementation if the programmes are implemented with UNIDO as a partner.

There are other potential partner programmes and partnerships such as Global Village Energy Partnership (GVEP) and the Global Energy Facility (GEF). GVEP is currently undertaking major programmes in Africa and other regions that could be beneficial to the SREP. The €4 million Developing Energy Enterprises Project (DEEP) aims to build the

[12] UNIDO Initiative on Rural Energy for Productive Use, 2002

capacity of over 1,800 small and micro energy enterprises in rural and peri-urban regions of Kenya, Tanzania and Uganda over the next 4-5 years.

The DEEP programme is expected to increase the effectiveness of established service providers while also helping to scale up small village businesses. Experts in energy technologies, business development and financing will provide the necessary training, mentoring and access to finance to help make ideas a reality. This initiative builds and consolidates the capacity of the SMEs to deliver renewable energy projects, providing the opportunity for a future SREP initiative to build on the GVEP DEEP work and maximise benefits of the monetary and other support that the SREP initiative will bring in. This will enable thousands of households to have access to modern energy products and services supplied by these supported energy enterprises, with the help from SREP initiative. A complementary US$30 million Regional Energy Access Fund is also being proposed to be administered through the World Bank and hence it is important to consider this while designing the SREP.

The GEF helps countries remove barriers to developing markets for renewable energies wherever cost-effective. Additionally, the GEF support helps create enabling policy frameworks, build the capacity for understanding and using the technologies, and establish financial mechanisms to make renewable energy more affordable. The SREP should aim to deliver its programmes in conjunction with GEF initiatives as the two programmes are complementary to each other. Additionally, GEF emphasises on programmatic approach and productive use in their grant funded programmes.

SREP should also strive to work in a complementary basis with other SCF programmes, such as Pilot Program for Climate Resilience (PPCR) and initiatives such as the “Energy For The Poor Initiative” (EFPI). However, it is imperative that the objectives and programmatic approach of SREP are preserved.

It should be noted that the analysis presented in this section is based on IT Power’s current understanding of SREP modalities. As the SREP is still evolving, a review of potential partners and complementary programmes should be carried out to match the updated working model of SREP.

4.7 Target Intervention

As mentioned elsewhere in this document, one of the most effective ways to increase the efficiency of a programme (ratio of cost to benefit) is to work in tandem with other development initiatives in a complementary basis. The technical areas of interventions for the future SREP should focus broadly on are:

1. Complementary activities
2. Areas of relative poverty where private sector participation will not be sustainable due to under developed market an low demand

Specific Projects under a future SREP initiative could include:
* Energy Efficiency
* Biomass/biodiesel based Multifunctional Platforms
* Productive Use
* Technology Transfer/Capacity Building
* Enterprise Development (e.g. complementary to GVEP programmes)

These are provided as some examples to guide the SREP. However, the exact nature of intervention will depend on the need of the country and sector at the time of the programme implementation and will have to be ascertained by carrying out a needs assessment study specific to the target country.

Since the funds available to SREP are limited, the size of the fund and the countries/regions of intervention will have to be identified and will be limited as well. As already identified in NL-UK-Swiss Shared Principles, a set of objective and transparent criteria will have to be developed and applied to select the priority countries. This activity is not trivial, given the political sensitivity associated with it. Mere development of the criteria will not be sufficient – the criteria will need to be objective and quantifiable. For example, criteria such as 'willingness' is something hard to measure and hence will need to be translated into measureable indicators of 'willingness'.

Similarly, the determination of the size of the fund is not something that can be pre-empted. There is an interlink between the country chosen and the amount of funding allocated to the particular country, which means it may be necessary to chose the country and the amount at the same time using a combined set of criteria. This aspect is something that is not possible to cover in this document due to limited time allocation.

4.8 Fund Distribution Models

Several fund delivery models have been developed and are being implemented in renewable energy programmes around the world. There should be a strong emphasis on supporting the establishment or replication of proven business models for rolling out low carbon energy services, with high levels of community involvement and ownership. With the correct model for the local circumstances, low carbon technology can maximise its considerable potential to meeting the energy needs of rural and remote communities in developing countries. However, the high capital cost of these systems means that new and innovative implementation models are needed in order to encourage widespread use of the technology.

In the following paragraphs, different examples of Solar Home Systems delivery model have been presented and classified into 'Dealer Sales' model with direct exchange of product and fee, and 'Fee-for-Service' model that offers a 'Service' to the end-user. The typical characteristics of the models are described, including the mechanisms, advantages, disadvantages, and associated risks[13]. It should be noted that the examples provided below refer to PV Solar Home Systems (SHS) delivery models, however, similar models can be developed by adapting these to suit local conditions for rolling out productive uses of energy and other renewable energy technologies.

4.8.1 Cash Sales

A PV system is sold directly or via a dealer to the end-user where the end-user immediately becomes the owner of the system. Clearly in this case, the market will be limited to those who can afford the systems outright and tends to produce markets of low cost, cash and carry systems with limited after sales service. The advantages of low set up and support costs can get a local market going quickly, however other factors tend to leave a market with limited penetration (<10%) and compromised with poor equipment.

This model has worked well in some areas of Tibet where credit models were too complex and often resulted in failure to pay.

[13] See IEA PVPS paper, Summary of Models for the Implementation of Solar Home Systems in Developing Countries for further examples

4.8.2 Credit Sales

The end-user acquires the PV system on credit. Credit sales are divided into three categories.

4.8.3 Dealer Credit

The PV supplier/dealer sells the PV system to the end-user, who enters into a credit arrangement with the PV dealer. Depending on the arrangements, the end-user immediately becomes the owner of the system, or becomes the owner when all payments are made.

This is a good workaround to reduce the initial investment, but due to the frequent need of the dealer to secure additional funding it can result in high down payments (~50%) and high interest rates (~20%). They are popular if the credit can be repaid in a short period (~6months). This system still excludes the poorest of households but due to limited government involvement and the familiarity of credit systems in MICs, it can be a workable solution.

This system has no way to safeguard extreme changes in the currency markets and can, for example in Indonesia during the Asian financial crisis, result in bankruptcy. This has worked in Gambia for small private companies who generally have good relationships with the end-user; this has avoided the creation of bad debt but limits the available market to those known by the dealer.

Dealer credit has been tried in the past but the experience is generally not positive. This model is only successful if the market is attractive and sufficient number of competing companies exists.[14]

4.8.3.1 End-user Credit

In this model, the PV supplier/dealer sells the PV system to the end-user, who obtains consumer credit from a third party credit institution. Usually the end-user becomes the owner of the system immediately, but this can be delayed until all payments are made. The PV system can be used as collateral against the loan.

This is similar to Dealer Credit but the loan is taken directly by the end-user which can result in more favourable down payments (20-40%) and lower interest rates (10-15%). End-users need to be eligible for credit, but where credit systems already exist (for example for agricultural purposes) and a suitable case can be made, it can streamline the overall process.

As already mentioned, this kind of scheme has been successful in Bolivia with significant (84%) numbers of participants favouring a local credit organisation over cash purchase. The credit can be provided by financing institutions such as IREDA, as shown in Solar Pumping example from India.

In Namibia, the Peri-Urban and Rural Solar Electrification Revolving Fund provides information brochures and loan application forms to potential solar home system customers who have been identified by technicians. Eligibility conditions include a minimum regular income and a positive record with previous loans. After approval of credit from the fund, the end-users make a down-payment of 10% of the purchase price. The remaining 90% is given

[14] Reiche et al (2000). WorldPower 2000. Expanding Electricity Access to Remote Areas: Off-Grid Rural Electrification in Developing Countries.

as a credit, with 5% annual interest rate to be paid back over 5 years. Initially the down payment was 20%, but this was found to be too high for most customers. The credit recovery rate of the fund has been high with arrears of only 6% of the amount paid out.

4.8.3.2 Lease or Hire Purchase

The PV supplier/dealer or a financial intermediary leases the PV system to the end-user. At the end of the lease period, ownership may or may not be transferred to the end-user, depending on the arrangements. During the lease period, the lessor remains owner of the system and is responsible for its maintenance and repair.
Although different in legal standing, lease and hire purchase are essentially the same in implementation.

The major advantage of this system is that the payment cycle can be best optimised to fit the client, thus rendering the project a lower initial capital and wider appeal. The schemes are generally also run by one body which controls both technical and financial operations. This can be a mixed blessing; on the one hand it simplifies transactions, but on the other it necessitates a larger managing agent which could restrict overall repeatability. As these contracts tend to run for medium term periods (3 years) it is in the interest of the managing agent to purchase better products and ensure that a regular servicing is undertaken.

4.8.4 Fee-for-Service

This model is generally used by ESCOs – energy service companies. The equipment is owned by the ESCOs and they charge a fee to the end user for renting the equipment for power generation. The repair and maintenance responsibility lies with the ESCOs. If the market is not attractive and there is no critical mass of the consumers in a given region, competitive arrangements between ESCOs may not work. In such situations, such as the case in PERMER in Argentina, ESCOs are given “concessions” to operate in a region without fear of competition.

An energy service company (ESCO) owns the system, and provides an energy service to the end-user, who pays a periodic fee (e.g. monthly) to the ESCO. The end-user is not responsible for the maintenance of the system and never becomes the owner.

It is essential for suitable financing to be in place as to sell energy at a reasonable price requires a project period of between 5-10 years before the initial capital is paid back. Generally this results in a more professional service with better grade technology and regular servicing with limited end-user risk. However with this level of professionalism can come high fees and long contracts which become prohibitive to low income households. As the end-user is not the owner of the system this can present issues regarding care and even theft of systems.

When developing a new market for solar home systems (SHS) or other technologies, it is vital that an informed choice on the implementation model is made. An inappropriate approach to the deployment of solar home systems will result in a failure to develop a sustainable market for PV. It is important to recognise that local conditions will demand tailored solutions and approaches, or combinations of the models described. To understand the country and its energy market, the following questions should be answered:

- What is the status of the energy sector in the country, and what are the policies relating to non-electrified areas and to electrification and development?

- Who are the end-users? What are their electricity (and energy service) needs and expectations? What is their economic activity and source of income (farming, livestock, services, craft)?
- What are the competing/conventional practices to cover domestic energy needs, and what is the household expenditure for it?
- How can the end-users be reached? Who are the stakeholders?
- What is the potential for productive use of electricity?
- Which is the most suitable model or combination of implementation models to use?

Through answering these questions, the most suitable implementation model can be identified or designed. It cannot be stressed enough that flexibility and pragmatism are crucial in developing a successful implementation strategy. The models presented are generalised and must be adapted or combined to suit the local circumstances. Changes in approach may also be required as the scale of the project expands and the target area is widened. Therefore continual monitoring and evaluation is necessary.

Even though various financing models are described here, care should be exercised when identifying the most suitable implementation model, or a mixture of components from various models. This is because a model suitable for a community or a country or a technology may not be suitable for another. It is therefore important to understand the country and its energy market, the end-users' willingness-to-pay for electricity and the current energy spending patterns.

5. CONCLUSIONS AND FURTHER WORK

5.1 Conclusions

- There are hundreds of programmes around the world focussing on renewable energy with a primary focus on electrification, but not many have an explicit objective of income generation through productive uses.
- Programmes with productive use components are shown to be successful in creating income generating activities.
- Inclusion of productive use of energy is key to enhancing the income of the end user community and the long-term success and sustainability of any renewable energy support programmes.
- Several examples of a programmatic approach to the implementation of renewable energy programmes show that the impact of the support from such programmes is higher when an integrated approach to renewable energy development is adopted, in terms of wider interaction with public and private sector and intervention of the government in creating the enabling environment for investment in renewable energy.
- Linkages with existing programmes and partners are key to the successful implementation of SREP and other programmes.
- It is generally accepted that international cooperation and strong national commitment is necessary to build basic energy service delivery structure, and that private sector participation needs initial support in the form of subsidies and information. However, it is encouraging to note that there are several examples where the private sector has been involved in the delivery of renewable energy related products and services.

5.2 Further Work

- Since the programmatic approach is relatively new, little information is available as to potential drawbacks of the approach, specifically related to productive uses. Further research and experience from implemented programmes will be necessary to understand potential risks that could have adverse impacts on the programme, so that mitigation measures informed by experience can be put in place from the outset of a programme.
- There are few examples of delivery models for productive use of energy. This is one area where further research would be required.
- As mentioned elsewhere in the document, country prioritisation and funding amount selection is interlinked and hence a combined set of selection criteria may need to be developed. This is the matter of further activity that should be pursued.
- Since SREP is evolving, review of potential partners and complementary programmes at a later date would be important. Need assessment for target intervention sector within renewable energy should also be carried out.

6. APPENDICES

Project Name and Location	Solar Water Pumping Systems in Agricultural Sector
Source for further information	www.mnes.nic.in www.ireda.in http://punjabgovt.nic.in/government/PEDA.HTM
Funding body	MNRE, PEDA, community, IREDA, private financial institutions
Organisations Involved	Punjab Energy Development Agency, Individual farmers (Village community), Indian Renewable Energy Development Agency (IREDA), Ministry of New and Renewable Energy (MNRE)
Budget	USD127million (2002-2007) & USD364 million (2007-2012) with other programmes.
Timeframe	1999 – ongoing
Productive/Non-productive energy use	Solar PV pumping system for irrigation.
Project Aims	The scheme was designed to promote the use of solar photovoltaic pumping systems as an alternative to diesel powered systems in order to reduce diesel consumption, which in turn will reduce environmental pollution and the difficulty for farmers who must travel long distances to purchase the required diesel fuel.
Approach (programmatic or other?)	Under the Solar Photovoltaic Water Pumping Programme of the MNES, the Punjab Energy Development Agency (PEDA) installed 500 solar pumps in Punjab for agricultural purposes. When the subsidy scheme for solar photovoltaic pumping was first introduced in India, only 900 Watts (1 horsepower) systems at roughly INR 200,000 were approved with a 50 percent subsidy towards the cost of a complete system. There were few takers of this scheme in Punjab because the 1 horsepower system was not sufficient to meet the irrigation requirements of the farmers and the expected contribution from the farmer (INR 100,000) was also very high. Realising that farmers needed a minimum 2 horsepower (1800 Watts) capacity pump which would cost them INR 350,000 through the Punjab Energy Development Agency (PEDA), along with a better financing scheme, the Punjab State Government took the following initiatives: 1. Approved the 1800 Watt (2 horsepower) capacity solar photovoltaic pumping system through the MNRE for distribution under the scheme 2. Helped manufacturers enter into agreements with financial institutions to obtain soft loans from IREDA and offer pumps to the farmers under a lease-financing scheme. (In this scheme, the financial institution takes advantage of 100 percent accelerated depreciation incentives for the first year available under existing Income tax rules and passes on this incentive to the user by offering him a one-time lump-sum payment instead of the regular rental.) 3. Offered to pay half of the one-time lump-sum charges to the financial institution on behalf of the farmer, thereby reducing his payment even further. The above steps brought the farmer's share down from INR 175,000 to INR 35,000. The 1800-Watt system is capable of delivering about 140,000 litres of water per day from a depth of about 6 to 7 metres. This quantity of water is considered adequate for irrigating about 5 to 8 acres of the land needed for most the crops. PEDA initially identified the villages suitable for installation of the solar pumps. In order to identify the beneficiaries, newspaper advertisements were published. Interested participants were asked to apply, supplying proof of ownership for at least five acres of land in their name, information about the water table as well as a deposit of INR 10,000 with PEDA. After screening the applications, the IREDA

	selected five recognized suppliers who were asked to visit the applicants for a detailed survey of the sites before final approval. Each supplier was allocated several sites in clusters for installation of the pumps, and was then required to open at least one service centre in Punjab in order to provide the farmers with a five-year maintenance contract. The solar pumps were made available under a lease- finance arrangement, where the supplier secured a soft loan (at low interest rates and long repayment periods) from IREDA, then leased the system to the farmer. The company qualified for income tax benefits under the accelerated depreciation allowed by the Government of India on renewable energy systems. These benefits were then passed on to the farmer in the form of an option to pay reduced lease rentals as a one time upfront lump-sum amount. PEDA also provides a further subsidy on this lump-sum amount. As a result of this arrangement, the farmer pays only INR 35,000 towards the pumping system; the remaining amounts of lease charges are paid by PEDA
Outcomes	The scheme has been one of the most successful in the renewable energy sector of the country. The scheme became operational in Punjab in 1999. However, installations of pumps started in year 2001. Under this scheme, 1700 pumps have been installed in the state of Punjab alone between 2001 and 2003. Till September 2008, the total number of SPV pumps installed in the whole country is 7148.
Success	It is now estimated that each farmer with a PV system is able to save INR 40,000 to 60,000 in diesel expenses per year. Apart from this saving, employment has also been generated in the state because each manufacturer has had to develop service facilities at the district level as part of the arrangement. Field reports indicate that farmers are happy with the solar pumps. The successful implementation of this project in Punjab has encouraged other states like Haryana, Uttar Pradesh, Gujarat, Bihar and Andhra Pradesh to propose implementation of similar projects in their own areas.
Recommendations for replication/scale up	Similar schemes have now been approved for other states such as Haryana, Andhra Pradesh, Uttar Pradesh, Gujarat etc. Location-specific factors such as the availability of ground water are also essential elements for the successful implementation of these schemes elsewhere.

Source: The Energy & Research Institute, TERI, India. 2003.

Project Name and location	**Remote Village Renewable Energy Programme (RVREP)**
Source for further information	MNRE website www.mnes.nic.in
Funding body	MNRE, Government of India, State nodal Agencies
Organisations Involved	Ministry of New and Renewable Energy (MNRE), State nodal Agencies, District Advisory Committee, Village Panchayats, NGOs and private companies.
Budget	USD150million (2002-2007) & USD364 million(2007-2012)
Timeframe	2002-2007 & 2002-2012
Productive/Non-productive energy use	Both productive and non productive: Renewable energy system like solar home systems, micro hydro and biomass gasifier for lighting, cottage industries, weaving, water pumping, community lighting, entertainment etc
Project Aims	Providing basic energy need through off grid renewable energy systems in remote villages (8281 villages and 794 hamlets) of India where grid connectivity either not feasible or cost effective. To fulfill the goal of providing access to electricity to all households by the year 2009, quality and reliable power supply at reasonable rates, and minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.

Approach (programmatic or other?)	The main technologies used for the electrification of remote villages using New and Renewable Energy Sources are -Small hydro power plants, Biomass gasification systems in conjunction with 100% producer gas engines or with dual-fuel engines using non-edible vegetable oils, Solar photovoltaic power plants and SPV Home lighting Systems. In many situations, particularly in very small and very remote villages, no other renewable energy option except SPV home lighting systems may prove to be feasible. The Rural Electrification Policy has now laid down that in "villages/habitations where grid connectivity would not be feasible or not cost effective, off-grid solutions based on stand-alone systems may be taken up for supply of electricity. Where these also are not feasible and if only alternative is to use isolated lighting technologies like solar photovoltaic, these may be adopted. However, such remote villages may not be designated as electrified". A majority of remote census villages taken up for electrification under the programme are provided with SPV home lighting systems (about 95%). While, before 2004-05, support was being provided for SPV home lighting systems of upto 4 lights each, after 2005 it has been restricted to systems of 2 lights each. BPL households are provided single light systems with 100% subsidy. The solar home lighting systems for two lights are designed to provide around 0.1 kWh of energy per day and cost USD250-300 per system per household. Some villages have also been electrified with distributed SPV power plants, biomass gasification systems and small hydro systems. The small hydro option has been used successfully for electrification of remote villages mainly in the states of Uttarakhand, Arunachal Pradesh and Himachal Pradesh. MNRE provides a subsidy of up to 90% of the costs of various renewable energy devices/systems subject to pre-specified maximum amounts. In addition, many other promotional supports and also a substantial amount of service charges are provided to the state implementing agencies Selection of villages: The proposed villages are selected by state nodal agencies of MNRE. Ministry refers the lists of remote villages identified by state governments, which they propose to take up for electrification through New and Renewable Energy Sources to REC for confirmation on this aspect. Subsequently, after identification of remoteness of villages by REC, states are advised to submit proposals for support to the Ministry as per the provisions of the scheme. Approvals of the state government for submitting the proposals are also required in the prescribed format before sanction. Explicit willingness of villagers that the systems being proposed are acceptable to them is also desirable. Submission of Proposals: Ideally once the village is confirmed for electrification with New and Renewable Energy Sources by REC, a survey should be carried out to determine the availability of local resources and energy requirements on the basis of which a system configuration can be planned. The State Agencies then submit project proposals in prescribed format to the Ministry in terms of the provisions of the Remote Village Electrification Scheme. The proposals are then examined by the Ministry to ascertain that the various requirements and terms and conditions of the scheme have been fulfilled, after which the projects are sanctioned and fund released to the concerned nodal agencies as per guidelines of administrative approval. Implementation: Concerned state nodal agencies implement the projects following their own procedure and guidelines of MNRE and state government.

	MNRE generally release 50% advance payment and balance 50% is released after placing purchase order for supply materials. Operation & Maintenance and capacity building: The O&M of installed systems is the responsibility of the state governments. Further, the CFA sanctioned by the Ministry includes the cost of a 5 year Annual Maintenance Contract with the suppliers. Training of local youth in O&M, formation of village committees and collection of a minimum user charge (INR20 to INR50 per month) are some of the other strategies being proposed by the Ministry. MNRE sponsors a number of training and awareness programmes in different states for training and awareness of different stakeholders such as the concerned officials, the beneficiaries, the elected representatives and NGOs.
Outcomes	3330 (out of 5259 sanctioned) un-electrified census villages and 830 un-electrified hamlets of electrified villages have so far been provided with basic electricity facilities. System installation work is currently going on in 1670 remote villages and 630 remote hamlets. Out of the villages taken up for electrification through renewable energy, 296 are being/have been covered through distributed generation technologies of biomass gasification and small hydro. Balance 6431 is being/have been covered through solar photovoltaic technologies. The project helps to bring a boom in India RE industry, PV in particular. Due continuous support from the government for this programme today India has more than 200 PV system integrator and 280 commercial solar shops across the country to supply and service for solar PV systems.
Success	This programme is considered successful as far rural energy demand and basic energy need in rural area is concerned. Out of 9075 villages and hamlets identified by Rural Electrification Corporation in 24 states, MNRE has sanctioned 6727 villages and hamlets for electrification with the help of RE systems and 4162 villages and hamlets have been already been electrified since 2001. RVREP provides basic energy and light to a million villagers in India. A PV system provides light, operates TV and radios, charge mobile phones and increase productivity of rural artisans. It creates thousands of jobs in PV industry across the country through manufacturing, installation and maintenance of PV systems. The subsidy scheme also creates awareness and confidence among people on PV systems and helps to create a commercial market for PV.
Recommendations for replication/scale up	The RVREP was started by MNRE and few state nodal agencies in 1992-93 in very small scale and as demonstration area projects. Since then the success and experience on this project help MNRE to decide to scale up this project in a big way. The outlay for the 10th 5 years plan period (2002-2007) was 150 million USD and based on the success achieved during 10th plan MNRE has fixed a target of 9000 villages and earmarked 364 million USD for the 11th Plan period (2007-2012) under Remote Village Renewable Energy Programme. The project has tremendous scope of replication.

Project Name and location	**Barrier Removal for Rural Electrification with Renewable Energies-Chile**
Source for further information	http://www.cne.cl/per
Funding body	The required resources for the execution of the project are "in kind" and "cash." In-kind contributions are provided mainly by the Chilean Government through the CNE. Cash contributions are provided by: Chilean Government; Private enterprise; Users (beneficiaries of the projects); and,

	GEF. A Financial Mechanism was developed. The main objective of this Financial Mechanism was to establish a guarantee or contingency Fund to ease access by the NCRE investors to private credit. It included clear methodologies and procedures to aid investors in the application process, format and content of application forms, operating procedures, and selection processes of the cooperating banking institutions.
Organisations Involved	This project acts within the framework of the PER: Proyecto de Electrificacion Rural in Chile. The execution of the project were the responsibility of the Comisión Nacional de Energía (CNE), which being the executing agency, named, from within its staff, a National Project Director, responsible for the execution. The project also contracted Main Technical Consultant, who was be responsible for the administration, under supervision of the National Director. There were also be a Project Coordination Committee supporting the execution and guaranteeing that the project activities meet the project's objectives, and the National Climate Change Strategy. The CNE was responsible for the design, direction and monitoring of the project's components, approval of each of its activities and specific terms of reference, contracting of all professional, personal and equipment services, reporting and payment orders. A Project Coordination Committee was established to support project implementation, monitor project activities, and ensure that such activities fulfill the project's objectives as well as those of the National Strategy for Climate Change. The Committee was chaired by the Executive Secretary of the CNE and included the following members: the National Director; representatives of the CONAMA, UNDP and SUBDERE.
Budget	GEF: Project: 5,984,900 PDF B: 82,400 Subtotal GEF: 6,067,300 Co-financing: Government of Chile: 16,489,000 (cash) 755,000 (in kind) Private: 7,628,000 Users: 1,458,000 (cash) Subtotal Co-financing: 26,330,000 Total: 31,642,300 (cash) 755,000 (in kind)
Timeframe	5 years, starting from October 2001 The project is due to finalise during the first semester of 2009.
Productive/Non-productive energy use	Productive uses have not been taken into account when the project was designed. However, there was some technical assistance orientated towards productive uses of energy during the last year. For instance, pilot project for irrigation activities.
Project Aims	The overall objective of the proposed project was to assist the Government of Chile to reduce GHG emissions by avoiding the use of fossil fuels to satisfy the energy needs of the rural population. The project: (i) promoted the removal of the barriers that prevent the successful use of renewable energies in the Chilean rural electrification program (PER), generating within the existing institutional framework the conditions for the development of a NCRE market in Chile, and (ii) promoted public and private investments towards the development of rural electrification with non-conventional energies. By means of co-funding and a Financing Mechanism, approximately 10,370 households out of a total household market of 74,000 were supplied with electricity. Thus, this project generated, within rural

	electrification, the market conditions that allows for the reduction of emissions produced by diesel-fueled electricity systems. The desired effect was to establish the market conditions for the NCRE to develop in rural and urban areas. This project identified the barriers to the use of NCRE in rural electrification. These barriers were: (a) lack of rural electrification projects with NCRE; (b) lack of regulations for renewable energy equipment; (c) lack of certification procedures for renewable energy systems and their installation; (d) lack of general knowledge with respect to NCRE; (e) lack of formal training programs; (f) existence of high cost investments in projects with NCRE; (g) perception of associated risks with renewable energy technologies; (h) lack of technical expertise, equipment, and analysis to make wind resource measurements; and (i) lack of NCRE commercial projects having economies of scale.
Approach (programmatic or other?)	* Decentralized management model: the central government only provides funds and technical assistance and coordinates the program. * Methodology for project selection: only those projects with a positive social return but a negative private return are considered for subsidies. * Bottom-up approach: the rural communities present proposals for electrification projects to the municipalities, and the regional government reviews and prioritizes those proposals. * Project execution: the company receiving the subsidy is responsible for the execution, maintenance, operation and management of the project for a specified number of years.
Outcomes	Up to March 2008 the achievement were: Project Portfolio The following project portfolio has been developed. This project helped with the pre-feasibility and feasibility studies (through technical assistance) and in some cases to implement projects. Most of the projects were PV, some of them hybrid PV-diesel or wind-diesel. Region I Atacama: 6 projects to electrify 234 households Region II Antofagasta: 7 projects to electrify 311 households Region III Atacama: 3 projects to electrify 741 households Region IV Coquimbo: 5 projects to electrify 4726 households. It included the installation of 3064 SHS. Users have been trained as well. Region V Valparaiso: 1 project to electrify 38 households Region VII Maule: 3 projects to electrify 407 households. It included the installation of 407 SHS Region VIII Bio-Bio: 7 projects to electrify 311 households. It included the installation of 752 SHS Region X Los Lagos: 19 projects to electrify 270 households. Region XI Aysen: 4 projects to electrify 1547 households. It included the installation of 950 SHS Region XII Magallanes: 2 projects to electrify 62 households Printed material Prepared the following printed material: “Chile Sun Radiation database”(published), “Construction Manual for Domestic Biogas Plants”(published), Operation and Maintenance Manual for Domestic Biogas Plants”(published), General Biogas Manual for Domestic Biogas Plants”(published), “Compendium, Chilean Standards for Photovoltaic Systems”, “Compendium , Chilean Standards for Wind Generation Systems”, “Compendium , Chilean Standards for Small Hydro Power Generation Systems”, “Compendium , Chilean Standards for Hybrid Generation Systems” Productive uses: Raised a project portfolio of productive project using NCRE in the IV Region.

	Design and implementation of 4 Solar irrigation demonstration projects.
Project implementation	Activity 1 Generation of a portfolio of rural electrification projects with NCRE Activity 2 Development of Technical Norms for Electrical Systems with NCRE Activity 3 Development of Certification Procedures for Electrical Systems with NCRE Activity 4 Implementation of a Dissemination and promotion Campaign of NCRE Activity 5 Training Program Development Activity 6 Design and Execution of a Large-Scale Photovoltaic Demonstrative Project Activity 7 Development of a Financial Mechanism of Risk Mitigation Investment in Projects with NCRE Activity 8 Definition of the CO2 Emissions Reduction Project by means of Hybridizing the Existent Projects Activity 9 Creation of Training Capacity to Evaluate Wind Resource in Chile

Project Name and location	**Linking Income-Generating Activities and Micro Enterprises with Energy Services in Honduras**
Source for further information	http://www.gvepinternational.org/project/30/
Funding body	The Government of Honduras and the GVEP through the Global Action Programmes Fund (GAPFund)
Organisations Involved	The Government of Honduras, the Project of Rural Infrastructure (PIR) funded by the World bank
Budget	GAPfund: **70,250 USD** Government of Honduras: **61,450 USD** Total cost of proposed project: **131,700 USD**
Timeframe	1 year. The Project formally ended in 2008
Productive/Non-productive energy use	The initiative was designed to complement and support the activities planned under the Rural Infrastructure Project, sponsored by the World Bank. In particular it was designed to strengthen Component 1 (Support to the participatory local planning for integrated infrastructure service delivery) of the Rural Infrastructure Project. As planned, this component of the World Bank loan to the Government of Honduras will be used for the construction of at least two Micro Hydro Power Stations. Both MHP plants, with an installed capacity of 63kW and 86 kW respectively, are at the construction stage. Once on-line, a total of 300 homes from six rural communities will directly benefit.
Project Aims	This project consisted of a programme to showcase Best Practice in the implementation of renewable energy projects in Honduras. The project showcased two cases of “Best Practice” in the delivery and appropriate use of renewable energy technologies for productive applications in rural areas. The project included also the creation of income generating applications that enhanced the quality of life of those families involved, while providing additional income stream to pay for the electricity services provided. Furthermore, the project developed tools that will enhance projected capacity building activities in the form of manuals and training programs. This took place in close coordination with the communities and stakeholders that are expected to benefit from the two MHP projects. A monitoring and evaluation plan was designed and applied to build a stronger case supporting not only the delivery of energy services to remote rural communities, but also to

	provide knowledge and capacity for productive applications. The objectives are built upon the main problem areas that the project will address. They are as follows: ▪ Objective 1: To increase awareness among Rural Developers on the links between energy services and rural development, by linking income generation and micro enterprises with off-grid energy services for rural households in Honduras. ▪ Objective 2: To facilitate the access of rural micro enterprises to financing, which is specifically targeted at sustainable energy technologies and services. ▪ Objective 3: To build capacity of local stakeholders to develop an appropriate, poverty focussed monitoring and evaluation framework of energy projects.
Approach (programmatic or other?)	▪ This project seeks to create these mechanisms and tools by means of the following tasks: ▪ Task 1: Establish sustainable mechanisms for the development of Rural Micro-enterprises ▪ Task 2. Implement two Best Practice demonstration projects that will serve as a basis for future similar projects in Honduras ▪ Task 3. Increase the knowledge of end users, rural developers and micro-financing institutions on the relationship between energy services, rural development and micro-financing, linking income generation and micro enterprises with off-grid energy services in Honduras. ▪ Task 4: Facilitate access by rural micro enterprises to finance, which is specifically directed to sustainable energy services. ▪ Task 5: Train local stakeholders for the monitoring and evaluation of energy projects focused on the elimination of poverty.
Outcomes	▪ The products developed in each of these activities are described below. ▪ Results related to Task 1 ▪ Sustainable mechanisms for the development of rural micro-enterprises ▪ During this task a methodology was developed to implement income generating activities and models of micro financing for productive uses based on the MHP energy from Las Champas and La Atravesada. ▪ The methodology developed is based on four main elements. The first methodological element consists of establishing a principle of active and permanent participation of the population starting from the identification of the productive enterprises. Participation must be established from the beginning of the work process. As part of the activities to implement this methodology, a questionnaire was developed to validate the socioeconomic indicators of the communities ▪ The second methodological element consists of explaining what the process of identification of the potential productive enterprises consists of without leading to the generation of expectations or commitments on the part of the institutional promoter. ▪ The third methodological element is the process of prioritization of the productive uses. For this prioritization process a combined system of dimensions and attributes has been utilized, which have been applied to the different productive uses identified. The basic dimensions established for the classification and prioritization of the productive uses, in order of importance, are the following:

	▪ Social Dimension. ▪ Economic Dimension ▪ Ecological Dimension ▪ Technological Dimension ▪ Finally, the fourth methodological element consists of a Market analysis with the productive Uses that they expect to foster with the aim of carrying out a pre-viability study of such uses. ▪ Results related to Task 2 ▪ Two Best Practice demonstration projects ▪ Two Best Practice demonstration projects were designed for income generating applications using renewable energies. ▪ The enterprise designed for the Las Champas community and its surroundings in the Municipality of Irione was elaborated with the purpose of satisfying a selected market of meat consumers. This enterprise will be legally constituted under the declaration Individual Merchant; it has been named "Meat and foods trader Las Champas" ("Comercializadora de Carnes y alimentos Las Champas" COMERCA). ▪ The benefit of "La Atravesada" Coffee House consists of the "coffee beneficiary" (in an organic manner), which includes the purchase of the bean, its pulp removal and drying by means of mechanisms that allow to account for a sale that can be called organic classification, packaging and sale. ▪ Results related to Task 3 ▪ Guidelines and orientation for energy uses in productive micro-enterprises ▪ A tool has been created to evaluate the connection between rural energy services and income generating activities. This includes information that helps final users, project developers and micro financing institutions in the identification of productive uses. The tool makes recommendations for the choice of the necessary appropriate equipment and provides estimates on the investment and recurrent costs as well as operation and maintenance requirements. ▪ The use of electric equipment transforms the processes of production thus making them faster, saving time and labour, and allows high levels of incomes. The guidelines show how to obtain these benefits for the productive activities most commonly found in the areas visited: ▪ Coffee beneficiary to obtain mainly pulp free and dry bean (Pergamino coffee). ▪ Production of meat cuts. ▪ Production of grain flours. ▪ Conservation of raw milk. ▪ Carpentry workshop for the production of wooden tables, chairs, doors and windows. ▪ Metal- mechanic workshop. ▪ Of different kinds of dough for bread, crackers, etc. ▪ Rural lodging for ecological tourism. ▪ Training Manuals for the receivers of the micro credit (Micro enterprises) ▪ Results related to Task 4: ▪ Two concrete results are considered in order to satisfy this objective. ▪ A micro-credit model to promote and improve the access to micro-financing for productive activities by means of the use of energy in Honduras and an Inventory of Financial services for rural micro-entrepreneurs in Honduras. ▪ Results related to Task 5: Train local stakeholders in the

	monitoring and evaluation of energy projects focused on the elimination of poverty ▪ A monitoring and evaluation plan for energy projects.
Project implementation	The whole project was implemented simultaneously with the MHP installation process. The assessments of markets and productive enterprises took place in the first six months of the project. These activities did not need energy supply. All training activities and micro finance related activities took place from month 6 to 12. The monitoring activities took take place simultaneously.

Project Name and location	**PERMER, RENEWABLE ENERGY IN RURAL MARKET PROJECT, Argentina**
Source for further information	http://www.mecon.gov.ar
Funding body	GEF and a loan from the World Bank to the Government of Argentina
Organisations Involved	The recipient of the proposed GEF grant and World Bank loan were the Government of Argentina. The Bank Loan and the GEF grant were transferred to the Provincial Governments (PG) on a grant basis together with funds from the Electricity Investment Development (FEDEI) and Tariff Compensation (FCT) funds. Institutional and implementation arrangements for the project were based on a Project Implementation Plan prepared by the Secretary of Energy (SE), which was discussed during project preparation and were agreed upon during project appraisal.
Budget	TOTAL PROJECT COST: US$225.7 million GEF FINANCING: US$13.5 million GOVERNMENT COUNTERPART FINANCING: US$57.9 million COFINANCING: IBRD US$60.0 million Concessionaires US$81.9 million Customers US$12.3 million
Timeframe	5 years The Project formally started in 2000, but due to the Argentina crisis, effectively it started in 2002.
Productive/Non-productive energy use	A concessionaire provides SHS services in the levels of 50W, 100W, 150W and up to 400W. Dispersed lowest income households (Type-I income level): The system to be provided is 50W. Dispersed low income households (Type-II and Type-III income level): 50W to 100W systems provided. Public service centres: The basis electricity needs are provided, with PV. There was a pilot project within PERMER to test the cost-effectiveness of employing small wind turbines (about 300-600 watts each, rated at 12 m/sec windspeeds) rather than PV in windy areas. There were identified two communities of about 100 households each in dispersed areas with good wind regimes for the experiment. There was also a feasibility study for the use of biomass in rural communities.
Project Aims	The project objectives were to: (a) Provide rural areas with reliable electric supply in a sustainable manner, using renewable energy technologies, where feasible; (b) Support the consolidation of the power sector reform strategy of the Government of Argentina (GOA); (c) Support the GOA strategy to expand private sector participating in the provision of electricity in rural areas; (d) Strengthen the regulatory function of provincial governments (PGs) in the power sector; and (e) Improve the standard of living of rural population. Global GEF objectives are to: (i) promote environmentally sound energy resource

	development in Argentina and reduce the energy sector's dependence on fossil fuels; (ii) remove market barriers to application, implementation, and dissemination of renewable energy sources; and (iii) reduce global warming through lessening GHG emissions that would be produced by thermal generation using hydrocarbons.
Approach (programmatic or other?)	In PERMER, a concession approach has been chosen for rural electrification, mainly because of the country's ample experience with concessions for the provision of infrastructure services (e.g. telecommunications, water). The concessionaire obtained the monopoly of a given province in turn for the obligation to connect the service when requested by the customers, and to maintain its continuity over the duration of the concession. The concession Contracts were tailored to the condition prevailing in each particular province and awarded through a competitive bidding process that minimises subsidies. Concessions are eligible to re-bid for their business every 15 years up to a total of 45 years, competitively against other eligible firms. Tariffs are renegotiated every 2 years. The financial rate of return obtained by the concessionaires was close to 14%. Average willingness to pay in the PERMER target provinces for basic lighting and communication varies between $10 and $20 per month. A household with a typical 50 Wp SHS might pays around $8-10 per month and receives perhaps 3 kWh monthly, enough for lighting and television for a few hours each day. The household pays 10% of the initial installation cost of $800 and 40% of the system lifecycle cost ($1,400 including maintenance and battery costs) over the 15-year life of the system - with the remaining 50% of the lifecycle cost covered by government subsidies. The provinces that are part of PERMER up to 2008 are Jujuy, Salta, Tucumán, Santiago del Estero, Chaco, Buenos Aires, Catamarca, Misiones, Córdoba, Mendoza, Neuquén, Río Negro, Chubut y San Juan.
Outcomes	Up to 2007, the following installations have been implemented: • **Jujuy:** 1900 SHS plus two Hybrid (PV diesel) minigrids (CASPALÁ, JAMA y VALLE COLORADO) • **Salta:** 178 rural schools y 137 community centres • **Tucumán:** 39 rural schools and 500 SHS • **Santiago del Estero**: 702 rural schools. • **Catamarca:** 38 rural schools pus two minigrids. • **Chaco:** 61 rural schools plus 500 SHS. • **Neuquén:** 51 rural schools • **Río Negro:** 30 rural schools.
Project implementation	The participating provinces coordinate the project activities at the provincial level. The PG awards the concession contract through international competitive bidding (ICB). Concession contracts already awarded in which the concessionaires must serve the dispersed rural market in addition to the concentrated market, were eligible for the World Bank/GEF support if and only if: (i) the Bank had no objection to tariffs schedules revised and adapted to serve dispersed rural consumers; and (ii) procurement of equipment to more dispersed rural consumers was done through ICB. The PG were assisted by the Project Coordination Unit (PCU) that works within the Secretary of Energy and consultants financed by the World Bank and the GEF in: (a) implementing the procurement by PRA or the concessionaire's bidding process, and b) monitoring and supervising the execution of the project by the concessionaire. The training and promotion programs were carried out by the PCU

	and the PGs. The physical components of the project are implemented by the private sector through concession contracts granted by the PG of the participating provinces.
Recommendations for replication/scale up	The initial PERMER programme did not consider productive uses of energy. However, due to an apparent realisation of their importance, productive use of energy is one of the main components in the new phase of PERMER that was recently approved by the World Bank and the Government of Argentina.

Project Name and location	**Rural Energy Development Programme (REDP)** Nepal
Source for further information	REDP website: http://www.redp.org.np/phase3/
Funding body	
Organisations Involved	Government of Nepal and UNDP. The Alternative Energy Promotion Centre of Ministry of Environment, Science and Technology (MoEST) is the implementing agency
Budget	
Timeframe	Pilot projects commenced 1996, expanded to 10 districts 1998 and to 15 districts in 2000. Phase 3 commenced September 2007.
Productive/Non-productive energy use	Productive: small scale cottage industries like water mills, grain mills, battery charging, video shows and computer centres Non Productive: lighting and cooking
Project Aims	The main project objective is to enhance rural livelihoods through the promotion of rural energy technologies.
Approach (programmatic or other?)	Decentralized and participatory decision making through community organisations, which collaborate to form functional groups Community mobilisation includes 6 basic principles: organisation development, capital formation, skill enhancement, technology promotion, environmental management and vulnerable community empowerment. Holistic development approach which encourages links between different themes, REDPs energy projects have a positive benefit on family incomes, education, health, women's empowerment and the environment. REDP programme complements the World Bank's Nepal Country Strategy Paper (CSP) which seeks to increase domestic power supply and encourage private sector investment in the power sector.
Outcomes	Additional income from small scale cottage industries has raised earnings and livelihoods of rural households In 1996 over 40% of rural households processed grain using traditional manual methods. By 2005 only 20% of rural households processed grain using traditional methods. 67% of the mills were installed following REDP project The ways that the REDP projects have impacted on family income can be seen in Figure 1.
Success	REDP has been acknowledged as a "best practice" at both national and international levels, claiming various international awards including the "Energy Globe Award" 2000 Programme has been running for over 10 years and is now in its third phase which aims to replicate the success of phase 1 and 2 in additional districts Numerous micro hydro systems established also increase in skills, technical ability, business knowledge and group organisation through training, technology promotion and community groups involvement.

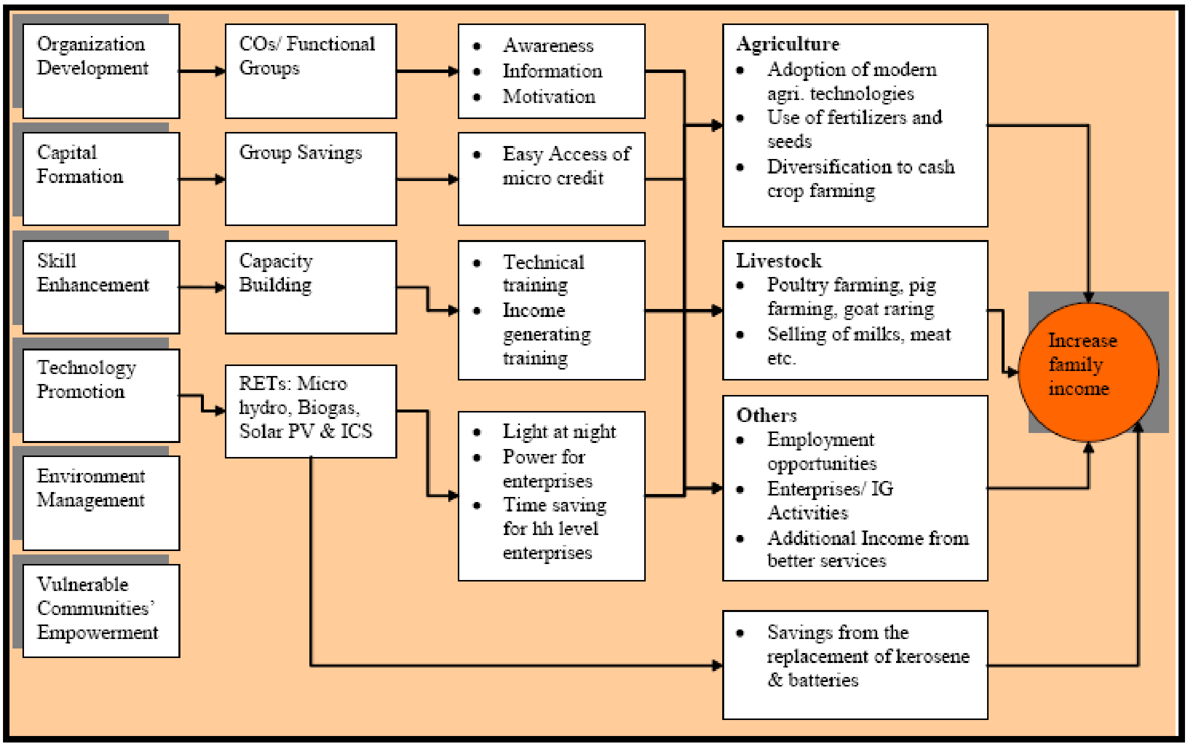

Figure 1 Pathway Interlink between REDP's Initiatives and Poverty Reduction,

Source: Winrock International Nepal (2006): Assessment of REDP Impact on MDGs.