Government of Lesotho

United Nations Development Programme

Renewable Energy-Based Rural Electrification in Lesotho

Brief Description

The project aims at reducing Lesotho's energy related CO_2 emissions by promoting renewable and low Green House Gases (GHG) technologies as a substitute for fossil fuels utilized in rural areas of the country. The activities proposed in the project are designed to remove barriers that hamper the wide-scale implementation of renewable energy technologies. The objective of the Government of Lesotho (GoL) as stated in the Poverty Reduction Strategy is to increase the electrification targets from the current 8% to at least 35% by 2020, countrywide. Since the geography of Lesotho does not allow extensive extension of the national electricity grid, renewable energy sources are excellent alternatives to reaching this target. The project will assist in the development of a renewable energy market (mostly PV systems) in the remote rural areas of the country and facilitate the use of renewable energy for productive uses.

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SIGNATURE PAGE

Country: Lesotho

UNDAF Outcome(s)/Indicator(s):	Support to energy activities to reduce poverty and achieve sustainable development objectives at the local and national using renewable energy sources
Implementing partner:	Ministry of Natural Resources, Department of Energy
Other Partners:	UNDP

Programme Period: **2006-2010**
Programme Component: **MYFF Service Line 3.3. Access to Sustainable Energy Services**
Project Title: **Renewable Energy -based Rural electrification in Lesotho**
Project ID: _____
Project Duration: **5 Years**
Management Arrangement: **NEX**

Project Budget - GEF	**2,500,000**
General Management Support Fee:	
Total budget:	**4,728,500**
Co – Financing Total	**2,228,500**
• Government (Renewable)	**183,000**
• Rural Electrification Fund	**2,500,000**
• Access Pilot Project PV	**816,500**
• Other:	
o World Bank	**546,000**
o Private Sector	**10,000**
o Rural Water Supply	**73,000**
• In kind contributions, Gov	**100,000**

MOSITO NICHOLAS KHETHISA

Agreed by (Government): _____

Dr. Moeketsi Majoro
Principal Secretary, Ministry of Finance and Development Planning

Agreed by (Implementing partner/Executing entity): _____

Mr. Bataung Leleka
Principal Secretary, Ministry of natural Resources

Agreed by (UNDP): _____ 20th October 2006

Ms. Hodan A. Haji-Mohamud
UNDP Resident Representative

Acronyms

AfDB	African Development Bank
ATES	Access to Electricity Study
DANCED	Danish co-operation for Environment and Development
DOE	Department of Energy
EAP	Energy Action Plan
EAPP	Electricity Access Pilot Projects
EMP	Electricity Master plan
EPF	Energy Policy Framework
FAO	Food and Agricultural Organisation
FINESSE	Financing Energy Services for Small Scale Energy Users
GEF	Global Environment Facility
GHG	Green House Gas
GOL	Government of Lesotho
IMTF	Interim Management Task Force
[illegible]	kilo Watt
[illegible]Wh	kilo Watt hour
LEC	Lesotho Electricity Corporation
LEMP	Lesotho Energy Master plan
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LMS	Lesotho Meteorological Services
MHP	Muela Hydropower Plant
MNR	Ministry of Natural Resources
NEMP	National Electricity Master plan
NGOs	Non-Governmental Organisations
NREB	National Rural Electrification Board
NREF	National Rural Electrification Fund
NREP	National Rural Electrification Programme
PRSP	Poverty Reduction Strategy Paper
PS	Principal Secretary
PSC	Project Steering Committee
PSPC	Power Sector Policy Committee
[illegible]	Photovoltaics
[illegible]T	Renewable energy technology
REU	Rural Electrification Unit
REWG	Rural Electrification Working Group
RR	UNDP Country Resident Representative
SADC	Southern African Development Community
t	metric tonne (1000 kilograms)
UNDP	United Nations Development Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WB	World Bank

SECTION I: Elaboration of the Narrative

Part I. Situation Analysis

The population of Lesotho is about 2.2 million persons, of which about 85% live in rural areas. The rural areas are characterised by rough terrains with villages sparsely scattered on mountain sides and accessibility to some is only by foot or horseback. With an average of 6 persons per households, this leads to approximately 275,000 households residing in rural areas. At present only about 11% of households in Lesotho have access to electricity, with most of these being located in urban areas. It is estimated that only 1% (about 2400HH) of rural households has access to reliable electricity. The Government of Lesotho (GoL) objective is to increase the electrification targets from this current 11 to at least 35% by 2020, countrywide.

The Vision 2020 and the Poverty Reduction Strategy Paper (PRSP) have identified community priority needs as employment creation, infrastructure development and food security and rural development. Availability of reliable and affordable energy supply is a prerequisite for the needs to be satisfied.

The topography of Lesotho, with its mountainous terrain and peaks of up to 3000 metres, does not lend itself to extensive extension of the national electricity grid. However, Lesotho has excellent renewable energy resource base ranging from mini hydropower potential, small-scale wind potential to abundant solar radiation and harnessing of these energy sources would make it possible for the GoL to meet the basic energy needs of the rural population and the 2020 electrification target.

Renewable Energy Technologies (RETs), particularly PV systems have a formal history of about thirty years in Lesotho. Despite several initiatives in the development and promotion of RETs, they are still not widely used in the country due to a number of barriers. Efforts to address the barriers have been implemented with limited success in the country and positive progress has been recorded in addressing the issue of lack of awareness of RETs, poor workmanship in the installation and lack of qualified personnel for maintenance. Progress includes the design and implementation of dissemination strategies, the preparation of the code of practice for solar home systems, and having RETs introduced in the teaching programme of secondary schools. Despite progress, the barriers still apply and the issues of institutional set up and high initial investment costs for RETs continue to be the greatest barriers in the promotion and utilisation of these technologies and consequently they are of high priority.

e Lesotho Electricity Corporation (LEC) was established in 1969 through the Electricity Act of 1969 which provided for the generation, transmission, distribution and supply of electricity in the country. The Department of Energy was formed in 1985 within the Ministry of Natural Resources charged with the responsibility for policy formulation, energy planning and sector coordination

The 1996 the Electricity Master Plan and the Power Sector Policy Statement heralded important developments in the electricity sub-sector including institutional reforms of the sector, private sector participation and the establishment of a regulatory authority. Privatization of LEC, to streamline and improve financial viability of the company within a given area of jurisdiction or service territory began in 2001. Rural electrification outside the service territory is the responsibility of the Government. This is being implemented by the Rural Electrification Unit (REU) that has been established within the DOE in 2004. Electricity Access Pilot Projects funded by the World Bank (WB) are being implemented to test various technologies, institutional set-up and financial mechanisms for sustainable rural electrification programmes in Lesotho. The regulatory function of the electricity sub-sector including renewable based forms of electricity generation is performed by the Lesotho Electricity Authority established in 2004. In

addition to this, a Rural Electrification Working Group, a stakeholder – based advisory body on rural electrification matters was formed.

In 2002 the Energy Policy Framework, which provides general energy policy direction and guides decisions and activities of the DOE, was formulated.

Lesotho has excellent renewable energy resource base, ranging from extensive mini hydropower potential, small-scale wind potential to abundant solar radiation. The exploration of these energy sources using renewable energy technologies would make it possible to meet the basic energy needs of the rural population. Providing clean energy for basic services will give a tremendous improvement in the quality of life of the rural population. Clean energy resources will mainly replace paraffin currently used for lighting purposes and dry cell batteries for entertainment purposes. Local benefits are a reduction in the exposure of smoke and soot from paraffin and reduced expenditure on dry cell batteries. Local businesses will benefit through the reduced need for diesel generators and the associated cost and noise reduction.

:ring the PDF B phase the project identified the main barriers for the large-scale utilization of renewable energy technologies in Lesotho. These barriers are:

Institutional barriers

- Lack of an effective infrastructure for delivering renewable energy-based energy services on a sustainable basis
- Fragmented institutional responsibilities and lack of integrated planning and implementation by various stakeholders including Government, the research institutions, the academic institutions, the NGOs, community based organizations (CBOs) and the private sector with regard to the applications of renewable energy technologies. The involvement of community participation in the promotion of renewable energy technologies is essential.

Economic, financial and market barriers

- Limited private sector capacity to supply, distribute, install and maintain renewable energy systems. The situation is severe with maintenance since all the suppliers and installers are in the capital Maseru and not in rural areas where maintenance is required. In addition, ordinary retail shops do not sell PV components. Consequently, the consumers need to travel long distances to get the required maintenance services or even to replace a light. In some cases, the consumers prefer not to pursue the maintenance but rather stop using the PV technology. This is one of the greatest barriers in the utilization of PV electricity.
- Limited business skills, while there are some people with energy expertise the appropriate business skills to start energy enterprises are lacking
- Lack of or limited in-country experience with relevant renewable energy systems.
- Lack of suitable financing arrangements for renewable energy companies and end users, and the need for training of in-country financial institutions to lend for renewable energy enterprises and projects. This is one of the greatest barriers to the development of the market of PV industry in the country.

Technical barriers

- Poor workmanship in the installation, operation and maintenance of renewable energy technologies, including PV systems.

Information, education and training barriers

- Lack of access to necessary information
- Lack of public awareness of the technologies
- Lack of trained manpower at all levels and in particular insufficient qualified personnel for maintenance for renewable energy systems including PV.

The proposed project activities would not take place in the absence of UNDP and GEF support, making the project activities largely incremental. The project is not requesting a subsidy per W of renewable energy technology capacity installed. Therefore, the incremental costs associated with this project are considered to be the costs of the activities designed to remove the barriers to renewable energy-based electrification and stimulate the market in the three target districts and eventually in the whole country.

A Financing Mechanism Options Study commissioned in the latter part of 2005 as part of this project and in preparation for its implementation confirmed that the rural market for solar in Lesotho is already well primed. It established that rural households buy thousands of specialised lead acid batteries each year for household electrification, primarily to power televisions cassette players, radios and satellite systems. Consequently it is believed that 50,000 rural households own and use lead acid batteries and that these batteries are serviced by an extensive rural network of battery chargers.

The study also indicates that a large percentage of Lesotho's rural population have the disposable income to afford the above systems. Secondly, it shows that the rural people know how to operate and maintain battery based and generator systems and lastly it shows the existence of a network of supply, erations and maintenance systems even in the remotest parts of the country.

Part II: Strategy

Project Goal, Objective, Outcomes and Outputs/activities

The project aims at reducing Lesotho's energy-related CO_2 emissions by introducing renewable energy technologies as a substitute for fossil fuel (paraffin and diesel) in rural areas remote from the national electricity grid and improving people's livelihoods by improving their access to and affordability of modern energy services. In addition, the project will decrease the growing number of rural poor, adults and children alike, who contract respiratory and eye problems due to prolonged exposure to paraffin smoke and soot (poor indoor air quality). The activities proposed in the project are designed to remove barriers to the wide-scale utilization of renewable energy technologies (PV, wind and mini hydro) to meet the basic electricity needs of households, small businesses and of community users like health clinics and schools, initially in the three pilot districts, but eventually in the whole country.

The project activities and outputs are designed to achieve six outcomes:

1. **delivery of renewable energy-based technology packages:** To implement different delivery models for renewable energy-based rural electrification targeting different end-user groups and making use of different technology packages
2. **awareness raising**: To increase awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas
3. **private and public sector strengthening and training:** To strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas
4. **policy support and policy framework:** To assist the development of policy and institutional arrangements needed for the widespread adoption of renewable energy sources for off-grid electricity services
5. **financial mechanisms:** To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers
6. **learning and replication:** To disseminate experience and lessons learned in order to promote replication throughout the country of rural electrification based on renewable energy technologies

The project activities focus on establishing codes and standards; launching awareness campaigns for decision makers, the general public and end-users; piloting PV systems at community water-pumping facilities and business-centres; demonstrating the viability of wind/PV mini-grids: showing the viability of expanding the use of mini hydro in Lesotho; assisting renewable energy technology companies in business planning and training of technicians; testing end-user and supply-chain financing mechanisms such as dealer credit and partial risk guarantee schemes and providing grants to innovative business ideas for productive uses.

The most crucial and innovative component of the project is the financing mechanisms which uses performance based incentives on the one hand and a credit guarantee scheme on the other. For more details please refer to the final report on Financing Mechanisms for Solar PV in Lesotho, which was prepared with the PDF B top up funds following the recommendations at Work Programme entry. The report is available upon request from martin.krause@undp.org.

Performance Grant Scheme: A performance-based grant scheme will be operated using World Bank funds to incentivise suppliers /installers to sell systems in the three districts of Mokhotlong, Thaba Tseka d Qacha's Nek. The level of the grant will be different depending upon the size of the system, with the grant being higher per Watt peak (Wp) on smaller systems (20-40 Wp) than on larger systems (>80-100 Wp). Some USD 500,000 will be made available through the World Bank supported facility. Payments will be made to pre qualified dealers /suppliers /installers based upon post installment verification by independent auditors who will be competitively selected by the project.

Box 1: The Performance Grant Scheme

A **Performance Grant Scheme** will be put in place, administered through a special account at the Central Bank of Lesotho, for providing performance-based grants for those suppliers (dealers, installers, etc.) who actually sell, install and provide consumers with one year warranties for their systems in the three target districts. These suppliers will be pre-qualified using transparent, international (and Lesotho) technical standards. The equipment they install will fit international and Lesotho standards, that are not so stringent as to drive prices beyond the reach of the target customers.

As stated, this performance-based scheme is intended to incentivise suppliers to move their operations into rural areas by reducing the risk, through the performance-based grant/subsidy, to doing business and extending sales and installation into deep rural areas. This will reduce the risk and transaction costs on dealers/suppliers in the sector. US$500,000 will be available through the World Bank's rural electrification support.

It is also envisaged that this will be primarily a 'pump-priming' activity, which will demonstrate to suppliers/dealers/installers the commercial value of selling and installing PV systems in rural areas. To qualify for grant all systems will have to be covered by at least a one-year warranty. This will be part of both the ..rification and monitoring programmes.

One hundred percent of all systems installed will be visited by an independent auditing and verification firm, competitively selected by bid. This will involve the actual physical verification of the installation, operation and warranty of the systems in the target rural areas. Once those systems are verified, a ***certificate of verified installation*** will be issued to the supplier who can then present that to the agent acting on behalf of the Central Bank of Lesotho for payment of the relevant subsidy. Suppliers could, just as easily, use these certificates as security with any entity financing their consumer or supplier credit – a number of finance institutions already view these future certificates as a 'cash guarantee'.

The grant will be an absolute number/value (in Maloti) for the system, as opposed to some percentage of the total value of the system. Were it set as a subsidy on the cost of the whole system, it would set in place a perverse incentive of encouraging dealers to sell and/or value systems of higher value. Rather, it will be geared towards two basic principles.

First, all institutional systems (for schools, clinics, etc.) will get 100% subsidy. This is to ensure that in the social services area, all people, no matter how poor, will benefit from the Project through increased access to modern electricity. The number of institutions will be limited – about 50 systems distributed in the three target districts. The DoE will work with the Ministry of Local Government to establish qualifying criteria for selection of, say, 15-20 institutional systems in each district. The Ministry of Local Government would then work with local authorities to

identify those institutions to be electrified by solar PV. Pre-qualified firms will be notified of the target institutions and will bid to electrify them, with the dealers/suppliers with the best systems at lowest prices awarded the contract for installation and the 100% subsidy.
Second, home and small business systems are eligible for a range of grants depending upon the system size. Smaller systems will receive a higher subsidy relative to the total cost of the system than a larger, more expensive system. This assures some form of more equitable access to relatively poorer consumers.
As seen in many other countries, if the grants are not relatively similar, then a higher per unit or per watt peak subsidy could result in the perverse economic effect of wealthier consumers buying a number of smaller systems (each with a relatively higher grant than larger systems). This can be overcome in a number of ways, but most efficiently by making the subsidy differential relatively close for all system sizes.

Credit Guarantee Scheme: The project will put in place a credit guarantee scheme that will cover up to 75% of the credit provided by qualified and competitively selected financiers /supplier credit companies to consumers and suppliers selling in the there districts. This will fundamentally increase consumer access to solar PV systems by significantly reducing the down payments for the systems and by enabling suppliers to offer credit terms for payments in installments over periods ranging from six to twelve months. It will cover the risks to finance /supplier credit entities and markedly accelerate sales of solar systems in the three districts.

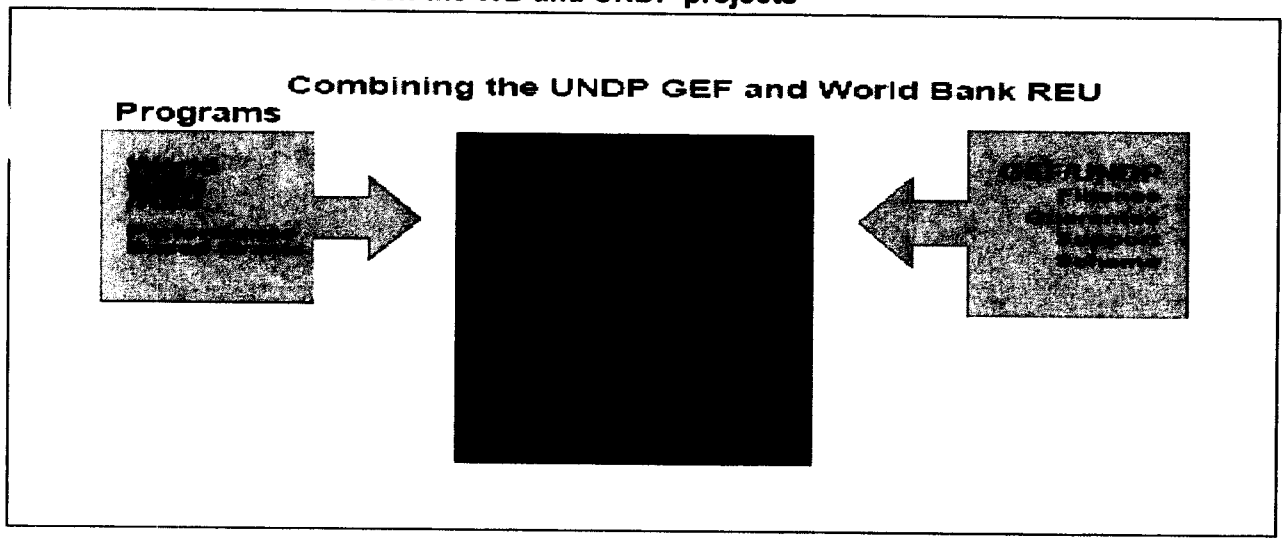
Box 2: The Credit Guarantee Scheme

A **Credit Guarantee Scheme (CGS)** will be put in place in a special account at the Central Bank of Lesotho by the GEF to address the first barrier/constraint.
The Credit Guarantee Scheme will set pre-qualification criteria that are open and transparent, and that will require participants in the CGS (those seeking credit guarantees) to undertake a high level of due diligence on suppliers and consumers they intend to provide credit to.
It will require them to set out, in a standardized template business proposal format, their strategies for financing suppliers and/or consumers, where they target those suppliers and/or consumers, with what kind of systems, and on what kind of terms (specifically up front payment requirements, and repayment/installment terms).
This will help develop a robust wholesaling and retailing system in solar PV systems, on the one hand, and drop the costs to consumers fairly dramatic. This will increase access to rural electricity from solar PV systems, on the one hand, and will set a working commercial model and example for other rural electrification (e.g., mini-hydroelectric grids, grid extensions and connections, etc.), on the other.
The mechanics of the CGS are straightforward. The UNDP-GEF project will set up a credit guarantee account in a special account at the Central Bank of Lesotho. Companies seeking to insure risk of non-payment will apply through proposals to the Project to obtain credit guarantees for their consumer and/or supplier credit.
They, namely those who apply for the CGS support, will be expected to set out a commercial marketing and siness plan for establishing a 'line of credit' specifically for consumer/supplier finance. This line of credit must be ninimum of M100,000 (approx. USD 14,285) and a maximum of M1 million (approx USD 142,850). The CGS will guarantee up to 75% of this line of credit. It will provide those companies or financial institutions with limited recourse (75%) guarantees on their lines of credit.
Their proposals will set out their target areas, their target customer types, their target geographic areas, their means for undertaking due diligence on consumers/suppliers for eligibility for credit, their procedures for insuring or covering risk (additional to the CGS), and their means of recourse (short of the CGS) in cases of default or non-payment (e.g., repossession of solar PV systems). They will set out their procedures for qualifying credit to suppliers/ consumers.
Once approved by the Project, the line of credit will be established. It will be reduced by the number and value of sales of solar PV systems, so that, say, from an initial M100,000 covered, it will decline to zero after all systems targeted are sold. Only in the case of default, and exercising their standard recourse for default (e.g., repossession) would the borrower apply to the CGS for payment on credit guarantee.
The level of 75% guarantee by the CGS ensures that both they and the consumer will bear some, but not all the risk. One hundred percent coverage has been shown in programmes throughout the world to lead many participating firms to use the guarantee rather than take their own first actions to ensure repayment. A lower than 75% guarantee will limit the attractiveness of the scheme to very few banks/ dealers.

This limited recourse coverage is standard throughout the world. Applications for credit guarantee payments on default/non-payment will be made relatively easy, but not so easy that the means for taking action against consumer non-payment set out in their proposals are not used first before recourse to the CGS is made.

Currently, there are WB supported rural electrification pilot projects whose main objective is to test various institutional delivery mechanisms for energy service delivery in rural areas. The WB is also providing seed money for testing of these institutional models in the form of capital subsidies to consumers. On the other hand, the GEF support will concentrate on the removal of barriers and the project activities will include Market-conditioning activities such as training and capacity building, promotion, technical assistance in RET, feasibility studies, setting and enforcing quality standards, monitoring, and establishment of sustainable delivery infrastructure.

Box 3: Collaboration between the WB and UNDP projects



Project Indicators, Risks and Assumptions

Key indicators of the project are the number of PV systems sold in the target districts over the lifetime of the project, the number of wind (hybrid) mini-grids installed and the additional installed hydropower capacity, combined with the reduction in the consumption of paraffin in households using renewable energy based systems and the amount of diesel consumption avoided. The project M&E system will make provisions to verify baseline data and track these indicators at regular intervals.

Important project assumptions relate to the market price of paraffin, the willingness of the private sector and end-users to engage with the project activities, willingness at the political level to create an enabling environment (including the implementation of the proposed National Rural Electrification Fund) and the execution as planned of the Electricity Access Pilot Project (EAPP). These assumptions will be closely monitored and the project intervention strategy adapted accordingly.

Country Ownership: Country Eligibility and Country Drivenness

The project has been developed in close consultation with various key stakeholders, which include private sector, non-governmental organizations and Government departments, and is supported at the highest political level. The Government attaches high priority to providing basic energy services to the

country's off-grid rural communities as expressed in the proposed National Rural Electrification Fund. As one of the key strategic objectives for the energy sector in Lesotho reducing the fossil fuel dependency for isolated grids and remote locations and the increased use of renewable energy as a substitute have been identified. Other objectives include promoting private sector participation in the energy sector and studying the potential role of renewable energy, particularly in rural electrification initiatives.

The Government of Lesotho has initiated several initiatives in the field of rural electrification; particularly the establishment of a rural electrification unit within the Department of Energy, the Rural Electrification Working Group and the planned World Bank funded Electricity Access Pilot Projects. The proposed GEF supported programme will interlink with these initiatives and complement them.

Sustainability

The Government of Lesotho considers rural electrification essential to support income-generating activities thus contributing to poverty alleviation. In this respect, the establishment of the National Rural Electrification Fund (NREF) is a positive step. According to the NREF regulations, NREF will provide early stage funding and enterprise development services to entrepreneurs, helping build successful business that supply clean energy technologies and services to rural and peri-urban areas in the country. The proposed project is viewed as a support initiative to, and an integral part of the on going sustainable national efforts to effectively promote rural electrification.

The performance grant and credit guarantee schemes which have been put in place during the PDF B top-up phase establish long term financing structures which will last beyond the life time of the project. Funding to sustain these schemes will be made available through the WB supported NREF.

This project will 'kick-start' a major solar PV rural electrification programme with both credit guarantees and after-sales (verified) PV sales and installations. This will help substantially increase the market for solar PV systems in rural Lesotho by reducing risk to suppliers and financiers. Sustainability will be accomplished using an approach where credit guarantees and grants will be phased out, thereby leading to a sustainable programme that has markedly increased access to rural electrification to well over 20% of the rural population.

Therefore it is important that the suggested financial instruments are not seen to be dictating to companies **how** to sell and finance their sales. Rather, the instruments are intended to help draw down, reduce, the risks associated with a new market, on the one hand (which the performance-based grant addresses), and with reducing the up front costs to the consumer, which is internationally acknowledged as a primary barrier to successful solar PV commercialization. The credit guarantee addresses the risk associated with finance institutions, be they banks or sales companies, providing consumers with term-finance.

Within the framework established by the project, participating finance agencies and companies must be encouraged to design their own schemes. This is so that they are comfortable with the way they are financing PV and that the plans are appropriate to their own particular objectives, sales areas, target clients and expansion programmes. This is a fundamental element of the sustainability of the programme.

The exit strategies are envisaged as follows: Once the USD 500k that are available for the Performance Grant scheme from the WB supported EAPP programme are disbursed, the Grant scheme (including the quality assurance component thereof) has come to an end. In 2006 the market for solar PV systems in rural Lesotho is at the Pioneer-stage which is characterized by low awareness, few shops and low sales

volume. With an injection of USD 500k (through the PGS) the market will mature and evolve over a "Emerging Market" into a "Mature Market", which is characterized by wide use of 12VDC appliances, functioning wholesale and retail supplier chains and large sales volumes.[1] In a mature market prices for PV systems have dropped significantly compared to the Pioneer market stage, hence grants and subsidies are no longer needed. For the Credit Guarantee Scheme the same principle applies. If funds that were set aside from the project budget for the CGS remain in the bank account of the Central Bank of Lesotho by the end of the project's life time the GoL together with UNDP and GEF will decide on the further usage of these funds.

Replicability

An entire component (#6) of the project has been designed to replicate models, approaches and lessons both within Lesotho and the SADC region. It is envisaged to design a roll-out programme for renewable energy-based systems based on the experiences in the Mokhotlong, Thaba-Tseka and Qacha's Nek districts. After a successful demonstration during the project period of a private sector-led model for the livery of basic electricity services to rural communities, it is expected that companies will expand their business to other districts in the country, thus replicating delivery and financing modalities.

Part III: Management Arrangements

The GEF/UNDP project will be executed using a mix of National Execution (NEX) and Direct Execution by (DEX). NEX creates a platform for Government to ensure that UNDP supported projects are executed in support of the attainment of national development priorities. In particular, NEX enhances integration, thus increased prospects for sustainability, of UNDP supported projects into the overall activities of the executing agency. The Department of Energy (DOE) of the Ministry of Natural Resources will serve as overall Executing Agency for the project. DOE is responsible for overall national energy policy, coordination and monitoring of energy programmes and projects. DOE is fully responsible for the planning and implementation of rural electrification in Lesotho. Specific project execution and implementation services will be provided by UNDP. A detailed Project Implementation and Project Execution Plan will be prepared detailing and costing each related activities. The Plan will form the basis of a Memorandum of Understating (MOU)/ Letter of Agreement between UNDP and the Government for collaboration in the joint implementation of the project.

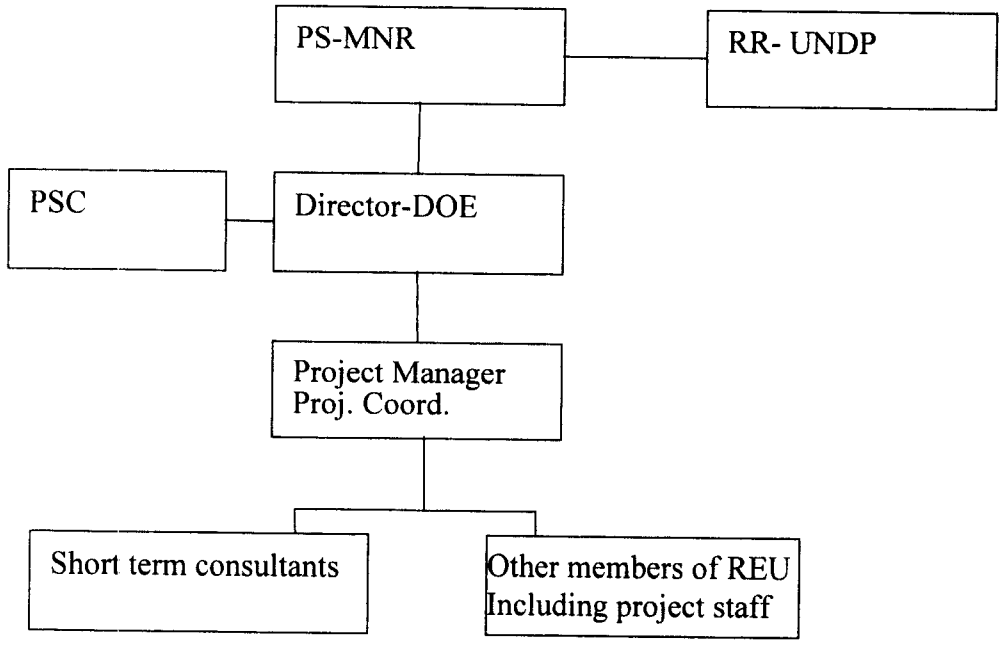
The project is viewed as a support initiative to the national efforts to effectively promote rural electrification and as such its overall management, planning and implementation will be part of the activities of the Rural Electrification Unit (REU) whose Head reports directly to the Director of Energy. A Project Coordinator who will be a national of Lesotho will be recruited and be responsible for the day-to-day implementation of all components of the project. He will in turn be assisted by a team consisting of a Project Administrator who will be responsible for the administrative and financial aspects of the project; a Communications and Training specialist who will be responsible for the training and awareness creating part of the project. Project support staff namely a secretary and driver will also be recruited. International and national consultants will be recruited from time to time to carry out specialised components of the project. The Technical staff, and other DOE and REU staff will be responsible for technical input to the project. A Steering Committee will be established to ensure successful implementation of the project.

[1] This follows the PV market stage descriptions as presented in the UNDP-GEF publication "Solar Photovoltaics in Africa – Experiences with Financing and Delivery Models" 2004, Pages 34-35.

Specifically to ensure that the project is executed under the financial rules and regulations of UNDP and that it is follows the service delivery platforms existing at Country Office, a UNV Project Support Specialist, based at UNDP, will be recruited and will be responsible for ensuring timely delivery of the project outputs and will assist the Environment Unit to liaise with the Ministry, the Department and other key stakeholders.

In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including among others, project hardware and vehicles purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgment to GEF. The UNDP logo should be more prominent -- and separated from the GEF logo if possible, as UN visibility is important for security purposes.

Fig 1: Proposed implementation Structure



PS-MNR – Principal Secretary of the Ministry of Natural Resources
RR- UNDP - Resident Representative of UNDP
PSC – Project Steering Committee

Part IV: Monitoring and Evaluation

UNDP Monitoring

The project will be monitored and evaluated according to standard UNDP rules for nationally executed projects. For each of the six components, a monitoring plan will be prepared during project inception

phase. As part of the project inception, the project planning matrix will be revised; specifically the detailed indicators will be revisited and adapted, including measures to track the major external project risks. These indicators will draw upon all sources of information, including those of other donors active in the energy field in Lesotho. Appropriate and specific performance benchmarks will be established prior to project implementation to effectively monitor project progress and to make crucial management decisions. An annual reporting cycle will be established for this project that will provide progress reports to be shared by all participants in the project.

Following UNDP's change to results based management; the country office has developed a new format for work plans. The format emphasises achievements (benchmarks and milestones) as well as cost per output/result. This format will allow for a critical assessment of program performance as it shows, at a glance, what activities are to take place, when, the cost for each activity, the responsible agent for implementation, progress at the end of every quarter, and to facilitate the preparation of the work plans for the subsequent quarters.

In addition to normal Government monitoring, UNDP will have the monitoring and reporting obligation for the program. In this connection, additional monitoring and evaluation missions will be undertaken by UNDP when this is judged to be required, as for example when there is a need for an intermediate assessment of progress or impact before a decision is taken as to the continuation of any given activity. This will be done in collaboration with the executing agency as well as with the implementing partners.

Annual reviews

Annual review meetings involving key stakeholders will be held to review the status of implementation of the programme. The purpose of the review meetings is to assess the progress made and to take decisions on recommendations to improve the design and implementation of the programme in order to achieve the expected outputs. The annual review is to be based on the Annual Programme Report.

UNDP Evaluation

Two independent external evaluations will be carried out. One mid-term evaluation after 2½ to 3 years of project implementation and one evaluation will be carried out towards the end of the programme after 5 years of implementation. The mid-term evaluation will assist the executing and implementing agencies in receiving detailed feedback on the project operations that can be used to steer and/or re-direct the project activities in case necessary. The final evaluation will assist programme stakeholders to draw lessons learned for use in improving the quality of future development interventions with similar activities. The evaluation should be done in collaboration with other development partners. An amount of US $ 50,000 from GEF has been specifically earmarked for these two external evaluations.

GEF specific monitoring and evaluation

The impact of the proposed project activities in terms of reductions in the emissions of green house gasses (expressed in CO_2 equivalents) is of immediate interest to the GEF, as these reductions are their main mandate. The GEF would like to achieve the reductions in GHG emissions through the removal or lowering of barriers towards the large-scale implementation of renewable energy technologies. Associated aspects as market development for renewable energy technologies, improve quality of live of the rural population and increase opportunities for businesses are considered important as they contribute towards the sustainability of the project and thus the (continued) reduction in GHG emissions. In order to properly and practically monitor these impacts it will be necessary that baselines be established prior to introducing and disseminating PV and other renewable energy technologies. During

the PDF B phase a literature scan and an analysis of existing datasets and documentation has been carried out. The data collected during this phase have been used to develop the project baseline. At the start of the project the data used for the baseline need to be verified through an appropriate activity.

Based on the information gathered during the PDF B phase, augmented by any other information source, it will be necessary to identify a number of measurable indicators that can be used for monitoring of the impacts. The impact monitoring should be done on an annual basis by the project implementation team and the data collected and analysed should serve as a management tool for the team to steer and/or redirect the project's implementation. It is proposed that the indicators as displayed in the Table below will be used. These and other indicators are presented in detail in the logframe of the project.

Box 4: Indicators to be used

Impact to be monitored	Indicator to be used	Means of verification
CO_2 emission reduction	litres of paraffin used operational PV systems	end-user survey dealer survey
Increased PV market activity	number of PV businesses active	market survey dealer survey
Increased income generating	number of businesses	end-user survey
increased number of mini-grids managed in sustainable way	number of mini-grids	energy regulator

Please note that the baseline methodologies and monitoring and evaluation plans as they are being used as part of the Clean Development Mechanism (CDM) project development circle could be used to further fine-tune the impact monitoring scheme. An amount of US $ 50,000 from GEF has been specially earmarked for these GEF specific monitoring and evaluation activities.

Part V: Legal Context

This programme document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of Lesotho and United Nations Development Programme. The host country-executing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the Government co-operating agency described in that Agreement. As support to the executing agency, the UNDP country office will provide support services for some of the activities of the project as identified and agreed upon by all parties, especially in the following areas:

- Identification and recruitment of the required personnel/experts to undertake specific activities under the project;
- Identification and facilitation of training services
- Procurement of goods and services

The country office will be provided a fee directly from UNDP/GEF headquarters in New York for the provision of all the identified and agreed upon services. This fee will be in addition to the proposed GEF project budget and will be negotiated separately between UNDP/GEF headquarters and UNDP Lesotho.

The following types of revisions may be made to this Programme Document with the signature of UNDP Resident Representative only, provided he/she is assured that the other signatories of the programme document have no objection to the proposed changes:

- Revisions in, or in addition to, any of the annexes of this project document

- Revision which do not involve significant changes in the immediate outcomes, outputs or activities of the programme, but are caused by the re-arrangement of inputs already agreed upon or by cost increases due to inflation; and
- Mandatory annual revisions, which re-phase the delivery of agreed programme inputs, or reflect increased expenditure or other costs due to inflation or take into account agency expenditure flexibility.

SECTION II: STRATEGIC RESULTS FRAMEWORK AND GEF INCREMENT

PART I: Incremental Cost Analysis

Project activity	Baseline	Alternative	Increment
Component 1: Delivery of renewable energy-based technology packages: To implement different delivery models for renewable energy-based rural electrification targeting different end-user groups and making use of different technology packages	Cash sales of PV systems through the private sector as is currently the case will continue at the current very low level Very limited applications of PV for productive uses The community in Sani Top will continue to rely on fossil fuels for their energy services Three villages will be provided with pumped water The mini-grid at Semonkong will be expanded from the current 42 customers to 250 customers by installing additional diesel generation capacity The mini-grid at Seforong will be implemented without a hydro component	5000 customers will be targeted for purchase of a PV system through cash sales or a credit scheme Establishment of small-scale productive uses through the provision of "solar-containers" A hybrid wind/PV mini-grid will be established at Sani Top Wind energy potential for rural areas assessed Three villages will be provided with PV pumped water The mini-grid at Semonkong is expanded from the current 42 customers to 250 customers by installing additional hydro capacity and additional diesel capacity The hydro-potential at Seforong is identified and a hybrid mini-grid is implemented	Increased application of renewable energy-based rural electrification Increased application of renewable energy for productive uses. Potential of small-scale wind applications in the rural areas is known Water pumping in the rural areas is increasingly done using PV The Semonkong mini-grid will be expanded using both the hydro resource and additional diesel capacity The Seforong mini-grid is implemented using hydropower.
	Cost: US $ 816,500 (EAPP PV) US $ 234,000 (EAPP Semonkong) US $ 73,000 (RWS) total US $ 1,123,500	Cost: US $ 816,500 (EAPP) US $ 234,000 (EAPP Semonkong) US $ 600,000 (GEF) US $ 73,000 (RWS) US $ 2,500,000 (NREF) total US $ 4,223,500	Incremental cost: US $ 600,000 (GEF) US $ 2,500,000 (NREF) total US $ 3,100,000

Project activity	Baseline	Alternative	Increment
Component 2: Awareness raising: to increase awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas	Consumers are not fully aware of the potential of utilizing renewable energy-based technologies as an alternative for paraffin, candles and dry cell batteries to obtain safe, efficient and reliable lighting / electricity services in the rural areas Decision makers are not fully sensitized with regard to the role that PV and hybrid mini-grids can play in rural electrification	Formulate a programme utilizing multi-media, organize general awareness campaigns and demonstrations of PV and hybrid mini-grid applications	Renewable energy dissemination programme
	Cost: US $ 0	Cost: US $ 300,000 (GEF) US $ 50,000 (GOL in kind) total US $ 350,000	Incremental cost: US $ 300.000 (GEF) US $ 50,000 (GOL in kind total US $ 350,000
Component 3. To strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas	Local companies have limited capacity for quality interventions regarding PV systems and renewables linked mini-grids A limited number of companies will be able to expand their operations, but the market growth will be minimal	Develop an appropriate curriculum to increase the capacity of the local companies to deliver quality products Assist the private sector in developing business skills, prepare business plans and access loans to expand the market	Local companies are able to deliver higher quality products and services Private sector companies have better business skills and thus able to expand their operations
	Cost: US $ 0	Cost: US $ 400,000 (GEF)	Incremental cost: US $ 400.000 (GEF)

Project activity	Bas e	Alternative	Increment
Component 4: Policy support and policy framework: To assist in the development of policy and institutional arrangements needed for the widespread adoption of renewable energy sources for off-grid electricity services	Renewable energy-based rural electrification will not be an integrated activity in the National Rural Electrification Fund No standards for PV and mini-grids are in place and enforced	Assistance to the integration of renewable energy-based rural electrification in the activities of the NREF Standards for PV and mini-grids are in place	Far more attention to the specific role renewable energy-based rural electrification in Lesotho High standards for the implemented projects on renewable energy-based rural electrification projects implemented
	Cost: US $ 183,000 (GOL in kind) US $ 546,000 (WB) total US $ 729,000	Cost: US $ 183,000 (GOL in kind) US $ 546,000 (WB)) US $ 200,000 (GEF) total US $ 929,000	Incremental cost: US $ 200,000 (GEF)
Component 5. Financial mechanisms: To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers	Despite some interest and previous initiatives, very little actual lending for investments in the PV market occurs. As the market slowly expands, the lack of financing to PV customers and industry will become a major bottleneck to its expansion Long-term financial support schemes for renewable energy-based rural electrification are not attended to in the rural electrification schemes	To test, apply and evaluate financing options that have been developed (i.e. performance grant and credit guarantee schemes) for disseminating renewable energy-based rural energy services	Valuable experience on setting up appropriate financing schemes for rural energy service provision in Lesotho is obtained Longer term financing in the form of performance grant and credit guarantee schemes for renewable energy-based rural electrification have been integrated into the operations of the National Rural Electrification Fund
	Cost: US $ 10,000 (private sector in kind)	Cost: US $ 10,000 (private sector in kind) US $ 400,000 (GEF) US $ 25,000 (GOL in kind) total US $ 435,000	Incremental cost: US $ 400,000 (GEF) US $ 25,000 (GOL in kind) total US $ 425,000

Project activity	Baseline	Alternative	Increment
Component 6. Learning and replication: To disseminate experience and lessons learned to promote replication of rural electrification based on renewable energy technologies throughout the country	No structured learning and dissemination of activities in the baseline Limited ability to learn from projects both within and outside the country	Closely follow the implementation of component 1 and initiate a national programme to replicate the use of PV and hybrid mini-grids to generate and supply electricity to off-grid rural customers Evaluate the impact of the project interventions Closely follow the implementation of similar projects in other SADC countries and learn from their experiences	Recommendations for the inclusion of renewable energy based rural electrification in the operational activities of the NREF Improved understanding of the impact of rural electrification on the quality of life of the communities in rural areas Lessons learned documented and a dissemination programme for such is in place
	Cost: US $ 10,000 (UNDP PDF B) US $ 17,000 (GOL PDF B)	Cost: US $ 10,000 (UNDP PDF B) US $ 17,000 (GOL PDF B) US $ 500,000 (GEF) total US $ 527,000	Incremental cost: US $ 500,000 (GEF)
Component: Monitoring and evaluation	No monitoring of the impact on CO_2 emissions reductions and the impact on the quality of life of the rural population of Lesotho will occur	To design a baseline, indicators and means of verification of the impacts on CO_2 emissions reduction, the PV market development, income generating activities and hybrid mini-grids	Impacts of the proposed interventions have been measured, analysed and serve as a management tool for the project management team
	Cost: US $ 0	Cost: US $ 100,000 (GEF) US $ 25,000 (GOL in kind) total US $ 125,000	Incremental cost: US $ 100,000 (GEF) US $ 25,000 (GOL in kind) total US $ 125,000
TOTAL costs	Cost: US $ 1,050,500 (EAPP) US $ 73,000 (RWS) US $ 200,000 (GOL) US $ 10,000 (UNDP) US $ 10,000 (priv.sec.) total US $ 1,343,500	Cost: US $ 1,050,500 (EAPP) US $ 73,000 (RWS) US $ 2,500,000 (GEF) US $ 2,500,000 (NREF) US $ 300,000 (GOL) US $ 10,000 (UNDP) US $ 10,000 (priv.sec.) total US $ 6,443,500	Incremental cost: US $ 2,500,000 (GEF) US $ 2,500,000 (NREF) US $ 100,000 (GOL) total US $ 5,100,000

Global environmental benefits	An ...mated 1650 tonnes of CO_2 emissions avoided over 10 years in Lesotho due to anticipated baseline activities	PV programme: ...er 10 years in the three target districts 25,000 tonnes of CO_2 emissions avoided Due to the implementation of microhydro mini-grids, CO_2 emissions reduction of 30,000 tonnes	Nation-wide approximately 55,000 tonnes of CO_2 will be reduced over a 10 years time horizon (for PV) and 20 years (for microhydro)
Domestic benefits	PV market continues to grow very slowly. The hydro resources of the country are not fully exploited Most rural households will continue being exposed to smoke and soot due to the use paraffin for lighting,	The market for PV will grow at a much faster rate The hydro potential of the country will be better utilized Significant reduction of the exposure to paraffin smoke and soot in the project areas and in the country as a whole	In the target areas a reduction of the consumption of 3.75 million litres of paraffin achieved Additionally approximately 280000 litres of paraffin are saved nation-wide Approximate savings of 8.8 million litres of diesel due to replacement by hydro capacity Significant reduction in the exposure to indoor air pollution from paraffin

Part II: Logical Framework Analysis

Strategy	Indicators	Means of verification	Critical assumption
Global objective: To reduce Lesotho's energy related CO_2 emissions by substituting fossil fuel (paraffin and diesel) with renewable energy sources (PV, wind and hydro) for household and productive uses through the provision of basic energy services to rural homes and community users	Consumption of paraffin reduced by 80 % in the households using renewable energy based systems for lighting	Energy use survey	
	Incidence of paraffin related respiratory and eye diseases reduced by 10 % over 5 years within those households targeted by the project	Medical survey	
	Small scale renewable energy-based business activities increased by 50 % compared to the baseline	Dealer survey	
	Consumption of diesel for generating electricity reduced by 80% in the households and businesses targeted by the wind/PV and hydro/diesel mini-grid pilots	Energy use survey	
Development objective: To improve people's livelihoods by promoting the utilisation of renewable energy to provide basic electricity services to the rural areas in Lesotho starting in the Mokhotlong, Thaba-Tseka and Qacha's Nek district, thus reducing the country's dependency on fossil fuels	**The number of customers reached by renewable energy-based electricity services in the Mokhotlong, Thaba Tseka ans Qacha's Nek districts reaches 5735 in year 5 of the project, as compared to 735 in the baseline;**	Dealer survey EAPP files Project files	Paraffin prices will not significantly drop EAPP will be implemented as planned
	The hydro component of the Semonkong hydro/diesel mini-grid is expanded to increase its customer base	Site visit	The feasibility study that will be carried out under the project concludes the expansion of the hydro capacity at Semonkong is feasible

Strategy	Indicators	Means of verification	Critical assumption
Outcome 1: To implement different delivery models for renewable energy-based rural electrification targeting different end-user groups and making use of different technology packages	The number of households with PV systems in the project area will increase by 1000 annually	Project implementation and progress report	End-users are able and willing to adopt new technologies
	A hybrid mini-grid using PV and wind is established at Sani Top		
	The Semonkong mini-grid is equipped with additional hydro generation equipment		
Output 1.1 1000 customers purchased PV-systems through a credit scheme or through cash sales in Mokhotlong, Thaba Tseka and Qacha's Nek districts annually	1000 PV systems sold in Mokhotlong district Thaba Tseka and Qacha's Nek districts annually	Data from PV dealers	Private sector is willing to engage in offering credit schemes to rural customers
Output 1.2 At least three business centres are established in each district using PV as their energy source	Nine business centres established using PV	Project files	Rural households are interested to use the services of the business centres
Output 1.3 Limited grant financing is provided to a small number of schemes proposed by the private sector to test various productive uses of renewable energy	At least 15 grants provided to companies by the end of the project	Project files	Private sector is willing to participate in the development of productive use applications of PV
	At least 3 products for productive use applications is commercialized by the end of the project	Dealer survey	
Output 1.4 An isolated hybrid mini-grid using wind and PV is installed at Sani Top serving at least 25 customers and two businesses	25 domestic customers and two businesses connected to a hybrid mini-grid at Sani Top	Project files	End-users are able and willing to adopt new technologies

Strategy	Indicators	Means of verification	Critical assumption
Output 1.5 The wind energy potential for small-scale power generation, in particularly hybrid mini-grids at selected sites that are favourable for hybrid mini-grids using wind is assessed	Capacity built in the Department of Energy and LMS to interpret wind data for assessing the wind energy potential	Report on capacity building activities done Collected data and site evaluation	Funds for wind measurement equipment will be provided for in the annual budget of LMS
Output 1.6 Three villages in each district have been provided with PV water pumping systems	Nine systems installed and in operation in line with the PV Code of Practice	Project files	
Output 1.7 Feasibility study on the potential to increase the hydro component of the Semonkong hydro/diesel mini-grid	Report on the feasibility of increasing the installed hydro capacity	Project files	
Output 1.8 The capacity of the hydro station at Semonkong is increased	The installed capacity at the Semonkong hydro station is increased following the recommendation of the feasibility study	Project files	The feasibility study that is carried out under output 2.1 concludes the expansion of the hydro capacity at Semonkong is technically feasible and economical viable
Output 1.9 The use of hydropower generation is included in the Seforong mini-grid	The mini-grid at Seforong has a hydropower component	Project files	
Strategy	**Indicators**	**Means of verification**	**Critical assumption**
Outcome 2: To increase awareness among the general public, decision makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas	Annual increase in the number of people using renewable energy technologies as compared with the baseline scenario	Energy consumption report	
Output 2.1 Information and awareness packages have been developed and made available to the general public	Information and awareness packages in the form of brochures, leaflets, demonstrations, road shows, TV/radio announcements	Copies of these packages are readily available	Willingness of market parties, national, district and local government to act as an outlet for the distribution of the packages

Output 2.2 Awareness programme for decision makers is developed and implemented	At least 25 key decision makers (Ministers, MPs, District Administration, PSs, Counsellors) have visited the target area and have been exposed to the activities of the project	Reports prepared on these visits	Willingness of high-level decision makers to undertake multi-day trips to remote rural areas.
Output 2.3 A rural customer awareness programme is formulated and implemented	At least 1000 persons attending information meetings in the rural areas per annum.	Reports on information meetings	Rural customers are interested to participate in information meetings
Strategy	**Indicators**	**Means of verification**	**Critical assumption**
Outcome 3: To strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas	Number of businesses dealing with renewable energy systems increased by 50% by the end of the project	Dealer survey	Market actors are willing to co-operate and businesses are eager to expand and/or include renewable energy technologies in their business
	Level of end-user satisfaction with installation and after sales increased by 50% by the end of the project	End-user survey	
Output 3.1 Business development services in the renewable energy sector will be strengthened	At least 70% of all renewable energy dealers/companies active in Lesotho participated in at least one capacity building activity offered by the project	Project files (attendance register capacity building activities)	Willingness of private sector to invest time in training
Output 3.2 Technical knowledge of renewable energy technologies is strengthened	Several technical training courses offered to vendors, dealers, technicians, etc. which are completed by 75% of the participants	Project files	
Output 3.3 The association of PV suppliers in Lesotho is operational (Lesotho Solar Energy Society, LESES)	75% of all PV businesses are member of the association	Membership register of LESES	Private sector is willing to co-operate in the PV association

Strategy	Indicators	Means of verification	Critical assumption
Outcome 4: To assist the development of policy and institutional arrangements needed for the widespread adoption of renewable energy sources for off-grid electricity services			Willingness of NREF to incorporate renewable energy based electricity into their operations
Output 4.1 A policy and implementation framework for renewable energy based rural electrification is defined and in place	By the end of the project renewable energy features prominently in the National Rural Electrification Master Plan as an option for meeting energy needs in rural areas	National Rural Electrification Master Plan	
Output 4.2 Standards for renewable energy technologies and mini-grids are updated and enforced	80% of suppliers of PV committed to the PV code of practice	List of companies that agreed to adhere to the code of practice	Private sector willing to improve quality of services by adhering to PV code of practice
	Workmanship complaints from end users reduced by 30%	Complaints registry	End users report complaints
	Standards publicly available	Standards and Codes of Practice, booklets and handouts	Industry is willing to co-operate to develop these standards
Strategy	Indicators	Means of verification	Critical assumption
Outcome 5: To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers	All major PV dealers operating within the project area offer at least one financing option for rural customers	Contracts between dealers and consumers Audit reports Data from dealers and financial institutions compiled in project documentation	Willingness of financial sector to get involved in financing renewable / PV energy systems
Output 5.1 The performance based grant scheme is implemented and used by suppliers/ installers	At least 2/3 of the available funds have been disbursed under this scheme to deliver PV systems to rural customers	Data from REU and WB	
Output 5.2 The credit guarantee scheme is operational and used by financial institutions/ supplier credit entities	Credit terms offered by suppliers to costumers have improved significantly (extension of installment periods, interest rates)	Data from REU and filed/ customer survey	

Strategy	Indicators	Means of verification	Critical assumption
Outcome 6: To disseminate experiences and lessons learned in order to promote replication throughout the country of rural electrification based on renewable energy technologies			
Output 6.1 A programme for replication of the activities implemented under immediate objective 1 is prepared	Increase in the number of end users using renewable energy sources in other districts.	Sales figures	Successful implementation of the activities of component 1 Willingness of rural customers in other districts to use PV
	After year 4 of the project, the planned mini-grid at Seforong will be implemented using hydropower	Resource assessment completed Hydropower included in the tendering documents	
Output 6.2 Evaluation of the impact of renewable energy technologies on rural livelihoods	Baseline survey and annual data updates provided throughout the project-life	Evaluation report	Willingness / ability of rural customers to provide necessary socio-economic information to assess impact
Output 6.3 Support has been provided to disseminate the learning and replication experiences in the project area	Experiences from this project will be shared with all actors involved in rural electrification in Lesotho	Project files	Actors involved in rural electrification in Lesotho are willing to learn from the project experiences
	The experiences from this project will be shared with at least four countries in the SADC region before the end of the project	Project files	Willingness of actors in other countries to actively share information on their renewable energy based rural electrification activities.

SECTION III: Total Budget and Workplan

Award ID: **00043714**
Award Title: **PIMS 1858 CC FSP: Renewable Energy-Based Rural Electrification in Lesotho**
Project ID: **0005114**
Project Title: **PIMS 1858 CC FSP: Renewable Energy-Based Rural Electrification in Lesotho**
Impl. Partner / Executing Agency: **NEX: Ministry of Natural Resources, Department of Energy (DOE) and**

GEF Outcome/ATLAS Activity	Responsible Party / Impl. Agent	Funds	ERP/ATLAS Budget Description		Amount 2006	Amount 2007	Amount 2008	Amount 2009	Amount 2010	Total
Outcome 1 - Different delivery models for renewable energy-based rural electrification implemented	DOE	GEF	71200	International Consultants	20,000	10,000			10,000	40,000
			71300	Local Consultants	18,000	18,000	18,000	18,000	18,000	90,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			72500	Supplies	10,000	5,000	5,000	5,000	5,000	30,000
			71600	Travel	10,000	5,000	5,000	5,000	5,000	30,000
			74500	Miscellaneous Expenses	5,000	5,000	5,000	5,000	5,000	25,000
			72200	Equipment and Furniture	25,000	10,000	10,000	10,000		55,000
			72100	Contractual Services	40,000	40,000	40,000	40,000	40,000	200,000
			Sub total		**148,000**	**113,000**	**103,000**	**103,000**	**103,000**	**570,000**
Outcome 2 - Increased awareness on the potential role of renewable energy in meeting basic energy needs in rural areas	DOE	GEF	71200	International Consultants	25,000	15,000	10,000			50,000
			71300	Local Consultants	18,000	18,000	18,000	10,000	18,000	82,000
			72100	Contractual Services	40,000	40,000	40,000			120,000
			74500	Miscellaneous Expenses	5,000	5,000				10,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			Sub total		**108,000**	**98,000**	**88,000**	**30,000**	**38,000**	**362,000**
Outcome 3 - Public and private sector working in the renewable energy sector strengthened to provide better quality of service to the rural areas	DOE	GEF	71200	International Consultants	20,000	10,000			10,000	40,000
			71300	Local Consultants	18,000	18,000	18,000	18,000	18,000	90,000
			72100	Training & Education	75,000					75,000
			72100	Contractual Services	40,000	40,000	40,000	40,000	40,000	200,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			Sub total		**173,000**	**88,000**	**78,000**	**78,000**	**88,000**	**505,000**

Outcome 4. - Policy and institutional arrangements needed for the widespread adoption of renewable energy Developed	DOE	GEF	71200	International Consultants	20,000	10,000				30,000
			71300	Local Consultants	18,000	18,000	18,000	18,000	18000	90,000
			72100	Contractual Services	40,000	40,000	40,000			120,000
			74500	Miscellaneous Expenses	10,000	10,000				20,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			Sub total		**108,000**	**98,000**	**78,000**	**38,000**	**38,000**	**360,000**
Outcome 5 - To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers	DOE	GEF	71200	International Consultants	20,000		5,000	5,000	10,000	40,000
			71300	Local Consultants	18,000	18,000	18,000	18,000	18,000	90,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			72500	Supplies	10,000	15,000				25,000
			Sub total		**68,000**	**53,000**	**43,000**	**43,000**	**48,000**	**255,000**
Outcome 6 - Experience and lessons learned disseminated to promote replication of rural electrification based on renewable energy technologies throughout the country	DOE	GEF	71200	International Consultants	13,000	10,000		5,000		28,000
			71300	Local Consultants	18,000	18,000	18,000	18,000	18,000	90,000
			72100	Contractual Services	40,000	40,000		40,000	40,000	160,000
			74500	Miscellaneous Expenses	10,000					10,000
			71500	UN Volunteers	20,000	20,000	20,000	20,000	20,000	100,000
			Sub total		**101,000**	**88,000**	**38,000**	**83,000**	**78,000**	**388,000**
Monitoring and Evaluation	DOE	GEF	74500	Miscellaneous Expenses	15,000	10,000	10,000	10,000	15,000	60,000
			Sub total		**15,000**	**10,000**	**10,000**	**10,000**	**15,000**	**60,000**
	TOTAL				**721,000**	**548,000**	**438,000**	**385,000**	**408,000**	**2,500,000**

SECTION IV: ADDITIONAL INFORMATION

Terms of References for key project staff and main sub-contracts

A) PROJECT MANAGER:

The Project Manager will be the Head of the Rural Electrification Unit of the Department of Energy, Ministry of Natural Resources. Under the overall supervision of the Director of the Department of Energy he/she will be specifically and directly responsible for the coordinated implementation of the project, covering the technical and financial aspects thereof. He/she will report to the National Steering Committee on progress in the implementation of the project. Specifically he/she will be responsible for:

- Supervision of the Project Coordinator and other project staff through the Coordinator to ensure timely implementation of the project and delivery of expected outputs in accordance with the Project Document, the Work plan and budget
- Supervise the Coordinator in the Preparation of terms of reference for studies and other activities under the project in consultation with the Steering Committee and UNDP
- Participation in the selection of consultants to be contracted for specific tasks

B) PROJECT COORDINATOR

The Lesotho Renewable Energy Based Rural Electrification Project (LREBRE) will be coordinated by an independent, local selected Project Coordinator based out of the Rural Electrification Unit. The PC will have overall responsibility for the execution of all project activities as described herein and in the project document. The PC will have direct responsibility for the GEF Guarantee Fund Management and for liaison with participating companies.

Assignment Objective

The PC will manage the LREBRE program as described in the GEF project document, the finance document and is elaborated below.

The primary objective of LREBRE is to put in place a commercial infrastructure for PV delivery all over Lesotho. The PC and LREBRE team will manage the 6 project activities (as described in the original project document), namely:

- ***Delivery of renewable energy-based technology packages:*** *To implement different delivery models for renewable energy –based rural electrifification targeting different end-user groups and making use of different technology packages*

- ***Awareness raising***: *to increase awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas*

- ***Private and public sector strengthening and training***: *to strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas*

- ***Policy support and policy framework:*** *to assist the development of policy and institutional arragments needed for the widespread adoption of renewable energy sources of off-grid electricity services.*

- ***Financial mechanisms***: *to assist with the implementation of LREBRE financing mechanisms for the larger scale dissemination of renewable energy sources for off-grid electricity services.*

- ***Learning and replication***: *to disseminate experience and lessons learned in order to promote replication throughout the country of rural electrification based on renewable energy technologies*

The PC has broad responsibilities in project management, CGS management, quality control and verification, and management of private sector sport as explained in the sections below;

Program Management

The PC will be responsible to the Head of REU the PC will oversee all aspects of LREBRE.

The PC will be responsible for participating in the recruitment of any necessary LREBRE staff. Final decisions on hiring will be made by the Head of the REU. As such, the PC will have responsibility for preparation of all staff ToRs and contracts. In addition the PC will facilitate any contracts and consulting activities that the project requires.

The PC will promote the LREBRE program and solicit involvement of qualifying companies. Through appropriate mechanisms, and through direct contact as necessary the PC will keep participating companies, Government agencies, NGOs , and other stakeholders appraised of LREBRE status.

The PC shall be responsible for ensuring that all activities are carried out in the timeframes and budgets outlined in the project brief. Should changes in budgets or timeframes be necessary, the PC will make such changes in consultation with the DoE and REU.

The PC will insure that the project activities are carefully staged and integrated so that the benefits of the various activities complement one another and build upon the work of each other.

Guarantee Fund and the REU Performance Grant Scheme

As an initial activity, the PC will participate in the selection of finance agencies that participate in the CGS according to the terms laid out in this report. The PC will be the primary interface with short-listed financial institutions and shall work with them to implement their proposals and to incorporate their activities into the overall work of the project.

The PC shall participate in the implementation and execution of the REU/WB-supported performance grant portion of the project. The PC will manage the pre-qualification process by which companies apply and are qualified to participate in LREBRE. This shall be done in accordance with the project brief.

As part of this process, the PC will develop a methodology, in conjunction with consultants if necessary, and as laid out in Section 4, by which (a) companies submit equipment for approval, (b) LREBRE processes the applications and (c) components are accepted, rejected or sent for further testing.

Verification and Monitoring

The PC shall be responsible for the final development and execution of a methodology that ensure systems installed under the project meet minimum quality and standards. The PC shall work with the outsourced Independent Auditing Group and the project team to ensure the verification and inspection tools of the project are in place and working through the duration of the project.

The PC shall conduct the tendering process for the Quality Monitoring and Verification Management portion of LREBRE (see Activity ToR , Annex 6.2).

The PC shall ensure that the selected monitoring and verification agent conducts its work in an efficient manner.

The PC will establish and maintain standard reporting procedures for participating companies in verification and quality assurance.

The PC will provide input into development of system inspection procedures.

In the event of company non-compliance with established procedures, the PC will have the authority to suspend non-compliant companies form LREBRE and from receiving GEF or other project benefits.

The PC shall advise GEF and the LREBRE accountants to make payments to participating companies when said companies and agents are awarded grants and subsidies.

Estimated level of effort and schedule
The initial job duration will be 1 year with a negotiable extension after the second year for the following two years.

Direction and Work Station
The PC will report to the Head of REU. His workstation will be within the Rural Energy Unit.

Reporting/Deliverables
The PC will be responsible for providing reports to the Department of Energy and the Steering Committee on the execution of LREBRE according to the timetable and the agree-upon milestones. The PC will also be responsible for reporting on all project expenditures as per the LREBRE budget.

Qualifications:

- The PC will have a degree in engineering, economics, and natural resources management or related field.
- He/she will have knowledge of business aspects of PV, with more than 5 years experience working with business and technology in developing countries.
- He/she will also have strong management skills and an ability to maintain confidentiality and confidence of participating companies and finance institutions with which s/he will be will be the primary interface.
- He/She should be a good negotiator
- Demonstrated ability to work with limited supervision, independently adjusting priorities and achieving results with agreed upon objectives, and ability to work collegially in a multicultural team environment in an openly communicative way is also a requirement of the post.

B) UNDP Project Support Specialist (UN Volunteer)

Expected Duration of UNV Appointment: 12 Months (renewable)

Functions:
Under the direction supervision of the Country Office Unit GEF Manager, the Project Monitoring and Evaluation Specialist will lead, supervise and coordinate the delivery support activities of the project

The principal responsibilities of the Monitoring and Evaluation Specialist are:

- Provide technical support for project delivery in the country office, including procurement, project implementation and project monitoring.
- Lead the development and implementation of a comprehensive monitoring and evaluation plan for the project in the country office.
- Assist in monitoring and ensuring that in implementing the project the Country Office compliance of all procurement processes with UNDP regulations, rules, and standard practices; promote and monitor the transparency of the procurement and contractual processes, and the use of international best practices.
- Assist the CO with contract management matters and consult with the Legal
- Ensure consistent reporting to Country Office Managers and Officials as required;
- Share lessons learned with other UNDP Country Offices managing Global Environmental Facility grants.

Qualifications:

The UNV Project Monitoring and Evaluation Specialist will have:

- A University degree in the social sciences, with an emphasis on quantitative and qualitative data analysis.
- Experience in the design, implementation, and monitoring of environmental projects, particularly in the fields relevant to this position.
- Experience in developing countries and in dealing with a range of stakeholders, as well as international organizations, development agencies, scientific and technical bodies, developing country counterparts, and NGOs would be advantage
- Basic awareness of global environmental issues, including biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants.
- Demonstrated ability to work with limited supervision, independently adjusting priorities and achieving results with agreed upon objectives, and ability to work collegially in a multicultural team environment in an openly communicative way.
- Previous background in institutional environment of development cooperation (NGO's, UN system, multilateral cooperation, etc.) with preference given to candidates with experience in UNDP field operations.
- Knowledge of the political and economic situation in the African continent is highly desirable.
- Previous experience with ERP (People soft) systems would be a bonus.

C) PROJECT ADMINISTRATOR

Expected Duration of Project Administrator Appointment: 12 Months (renewable)
Duty Station Maseru- Department of Energy Ministry of Natural Resources

Functions:
Under the direct supervision of the Project Coordinator and the indirect supervision of the Chief of the REU/Project Manger the Project Administrator will assist the coordinator in the administrative and financial aspects of the project to ensure timely delivery of the expected outputs in accordance with the Project Document, the Work plan and the Budget. He/she will work closely with project staff, and staff of DOE

The principal responsibilities of the administrator are:

- Provide financial and administrative support for project delivery and ensures the effective functioning of financial and administrative systems and operations including recruitment and procurement
- Assist the project coordinator in the development and implementation of a comprehensive financial monitoring plan for the project
- Assist in monitoring the use of project funds and ensuring compliance with UNDP/ Government procedures regulations, rules, and standard practices; whichever is applied in accordance with NEX procedures.
- Assist in the compilation of up to date financial records of the project
- Promote and monitor the transparency of the procurement and contractual processes, and the use of international best practices.
- Assist with the management of staff and compilation and safe keeping of project personnel records
- Assist the CO with contract management matters and legal issues of the project
- Assist with preparation for project audits and other reviews and evaluations
- Assist in the provision of administrative and financial guidance to project staff.
- Establishes effective relationships with internal and external clients.

Qualifications:

The Project Administrator will have:

- A University degree with qualifications in Accounting, BCom or business administration or Licensed Accountant
- A minimum of 3 years relevant experience.
- Experience in the financial monitoring of projects
- Basic awareness of global environmental issues, including climate change, and land degradation.
- Demonstrated ability to work with limited supervision, independently adjusting priorities and achieving results with agreed upon objectives, and ability to work collegially in a team environment in an openly communicative way.
- Proficiency with current office software applications
- Previous experience with ERP (People soft) systems would be a bonus.

D) Training and Communications Specialist - TORs to be developed

UNDP Response to Council Comments

WORK PROGRAM: COMMENTS FROM COUNCIL MEMBERS
(Reference to GEF/C.23/5 – April 20, 2004)

Lesotho: Renewable Energy-based Rural Electrification (UNDP)

Comments from France:

The project aims at developing the use of renewable energy (solar, wind, mini-hydro) in remote areas of Lesotho (Mokholong and Semonkong). About 1 600 customers are targeted within the project but the number could increase to 3000 if other regions are covered. The use of paraffin and diesel will be substituted. The money of the project will be spent in (i) awareness, (ii) training, (iii) financial mechanism, (iv) equipment and co-ordination.

* The overall objective is valuable but the way how to achieve it is unclear and its cost per customer is very high. Project document should answer to the following questions addressing the sustainability:
Will the users pay something? Who will exploit the mini-grids? Who will invest?

UNDP response:
A performance grant and a credit guarantee scheme has been designed with the additional PDF B funds and is described on page 8 of the ProDoc and in much more detail in the report "Financing Mechanisms Options for Solar PV in Lesotho", available upon request. According to the designed schemes, the users will ultimately pay for the PV systems but they will benefit from attractive financing schemes that have been put in place.
It is expected that private investors invest in the mini-grids supported by the National Rural Electrification Fund (NREF). The NREF will provide early stage funding and enterprise development services to entrepreneurs, helping build successful business that supply clean energy technologies and services to rural and peri-urban areas in the country.

Comments from USA:

Summary: This project would help develop rural off-grid electricity (PV, mini-hydro and the wind) replacing paraffin use in poverty-stricken areas of the country, and thereby also improving health. It is expected to reduce 20,000 tons of CO2 in the target area and another 16,000 tons in other areas as the project is replicated.

The project document states that lessons learned from previous projects have been incorporated into the design. For example, Lesotho's mountainous geography makes it less likely that the grid will be extended to the project area, which has undermined other off-grid rural renewable energy projects. However, it is not entirely clear how this project will be sustained or replicated. Nor does it appear to be cost effective, at $69 per ton of CO2 emissions averted.

US Position: Support, but request that prior to CEO Endorsement, the Secretariat review this project specifically for the issue of sustainability, replicability and cost effectiveness and ensure adequate measures are in place.

UNDP Response

The Government of Lesotho considers rural electrification essential to support income generating activities thus contributing to poverty alleviation. In this respect, the establishment of the National Rural Electrification Fund (NREF) is a positive step. According to the NREF regulations, NREF will provide early stage funding and enterprise development services to entrepreneurs, helping build successful business that supply clean energy technologies and services to rural and peri-urban areas in the country. The proposed project is viewed as a support initiative to, and an integral part of the on going sustainable national efforts to effectively promote rural electrification.

The performance grant and credit guarantee schemes which have been put in place during the PDF B top-up phase establish long term financing structures which will last beyond the life time of the project. Funding to sustain these schemes will be made available through the NREF.

An entire component (#6) of the project has been designed to replicate models, approaches and lessons both within Lesotho and the SADC region. It is envisaged to design a roll-out programme for renewable energy-based systems based on the experiences in the Mokhotlong district for the districts of Thaba-Tseka and Qacha's Nek. After a successful demonstration during the project period of a private sector-led model for the delivery of basic electricity services to rural communities, it is expected that companies will expand their business to other regions in the country, thus replicating delivery and financing modalities.

Improved cost effectiveness will be achieved by surpassing the rather modest targets for PV system sales (5000 in the three target districts). With the financing schemes in place it is likely that PV system sales will increase way beyond the originally established targets.

<u>*Comments from Canada:*</u>

While Canada is in favour of a private sector approach, the nature of the project points to need for raising public awareness on the issue of climate change and renewable energy options as well as financing. Locally-based NGOs are well placed to provide this type of support, and there are active NGOs in both the areas where the project plans to work. We would therefore propose that the PPP be enhanced to the level of PPCSP - Public, Private, Civil Society Partnership in order to make a well-rounded project that will be able to address the special needs of rural communities.

Recommendation: Assuming the above-mentioned questions and concerns are adequately addressed, the proposed project should be endorsed.

UNDP Response

The awareness raising component of the project is very targeted towards "increasing awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas". More general public awareness raising campaigns on climate change and renewable energy are not part of the intervention strategy of this project. However, we welcome the suggestion to expand partnership options towards the civil society and local NGOs.

PROJECT BRIEF

1. IDENTIFIERS:

PROJECT NUMBER	1858 (PIMS)
PROJECT NAME	Renewable Energy-Based Rural Electrification in Lesotho
DURATION	Five years
IMPLEMENTING AGENCY	United Nations Development Programme
EXECUTING AGENCY	Government of Lesotho / Ministry of Natural Resources
REQUESTING COUNTRY	Lesotho
ELIGIBILITY	Lesotho ratified the UNFCCC on 7th February 1995
GEF FOCAL AREA	Climate Change
GEF PROGRAMMING FRAMEWORK	OP #6: Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

2. Summary:

The project aims at reducing Lesotho's energy related CO_2 emissions by promoting renewable and low GHG technologies as a substitute for fossil fuels utilised in rural areas of the country. The activities proposed in the project are designed to remove barriers that hamper the wide-scale implementation of renewable energy technologies. The project will assist in the development of a renewable energy market in the remote rural areas of the country and facilitate the use of renewable energy for productive uses.

3. Costs and Financing		US Dollar
GEF	Project:	2,500,000
	PDF B:	220,000
	Subtotal GEF	**2,720,000**
Co-financing (Parallel)	PDF B Government (in kind)	17,000
	PDF B UNDP	10,000
	Government (in kind)	100,000
	Government (budget renewables)	183,000
	National Rural Electrification Fund	2,500,000
	Electrification access pilot project (PV)	816,500
	Department of Rural Water Supply	73,000
	WB (support Rural Electrification Unit)	546,000
	Private sector	10,000
	Co-financing total	**$4,255,500**
Total Project Financing		**$6,975,500**

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List of acronyms and abbreviations

AfDB	African Development Bank
ATES	Access to Electricity Study
DANCED	Danish co-operation for Environment and Development
DOE	Department of Energy
EAP	Energy Action Plan
EAPP	Electricity Access Pilot Projects
EMP	Electricity Master plan
EPF	Energy Policy Framework
FAO	Food and Agricultural Organisation
FINESSE	Financing Energy Services for Small Scale Energy Users
GEF	Global Environment Facility
GHG	Green House Gas
GOL	Government of Lesotho
IMTF	Interim Management Task Force
kW	kilo Watt
kWh	kilo Watt hour
LEC	Lesotho Electricity Corporation
LEMP	Lesotho Energy Master plan
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LMS	Lesotho Meteorological Services
MHP	Muela Hydropower Plant
MNR	Ministry of Natural Resources
NEMP	National Electricity Master plan
NGOs	Non-Governmental Organisations
NREB	National Rural Electrification Board
NREF	National Rural Electrification Fund
NREP	National Rural Electrification Programme
PRSP	Poverty Reduction Strategy Paper
PS	Principal Secretary
PSC	Project Steering Committee
PSPC	Power Sector Policy Committee
PV	Photovoltaics
RET	Renewable energy technology
REU	Rural Electrification Unit
REWG	Rural Electrification Working Group
RR	UNDP Country Resident Representative
SADC	Southern African Development Community
t	metric tonne (1000 kilograms)
UNDP	United Nations Development Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WB	World Bank

Exchange rate 1 US $ = 7 M (end 2003)

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Background and context

Overview of rural electrification in Lesotho

1. The electricity supply in Lesotho began in 1969 with the establishment of the Lesotho Electricity Corporation (LEC) in terms of the Electricity Act of 1969. LEC was mandated by the Act for the generation, transmission, distribution and supply of electricity in the entire country. The national grid was established in the lowlands, linking major centres to the Eskom network in South Africa, and gradually expanded to reach other centres. Four mini-hydro plants, some of them with diesel back up, were developed at Mantsonyane (2MW), Semonkong (180kW), Tlokoeng (670kW) and Tsoelike (400kW).

2. The Department of Energy (DOE) was formed in 1985 in the Ministry of Natural Resources with the responsibility of policy formulation, energy planning and sector coordination. A number of Government ministries participate in energy sector issues, but primary responsibility for the sector lies with the DOE.

3. In 1986 the Lesotho Highlands Development Authority (LHDA) was established as implementing agency for the Lesotho Highlands Water Project (LHWP). As such, the LHDA was mandated to develop hydropower schemes as part of the LHWP, and constructed the 72MW 'Muela Hydropower Plant (MHP) which was commissioned in late 1998. LHDA also operates a 500kW mini-hydro plant at Katse dam to supply the local power requirements. The 1993 *Policy on the LHDA/LEC Interface* defines the precise responsibilities and roles of the two utilities.

4. In the early 1990s the GOL proposed an electrification target of 5% to be achieved by the year 2000 and commissioned the Electricity Master Plan (EMP) for the period 1994-2003. The EMP was released in 1996 and approved as the working document for the power sector in April 1997. The EMP envisaged increasing domestic connections in urban and rural areas from about 10,000 in April 1994 to 20,000 by the end of 2000 (5%), and to 40,000 by 2010 (13%).

5. The Power Sector Policy Committee (PSPC) was established in 1997 to formulate and implement policy for the electricity sector, and to coordinate power sector activities between LEC and LHDA. The *Power Sector Policy Statement,* which was formulated in 1998 and amended in October 2000, builds on the recommendations of the EMP, focusing on institutional reform of the sector, private sector participation in electricity service provision, the costing structure of electricity, and the establishment of a regulatory authority.

6. The privatization process for LEC began in 2001 with the appointment of an Interim Management Task Force (IMTF) to streamline operations and improve financial viability of the company. The IMTF produced a *Service Territory Study* (STS) report that proposes the service territory of a privatized LEC, and an *Access to Electricity Study* (ATES) report that identified existing and potential customers within and outside the future service territory of LEC. Rural electrification outside the service territory is the responsibility of the GOL. The ATES report identified a

number of pilot projects to test four rural electrification approaches outside the service territory.

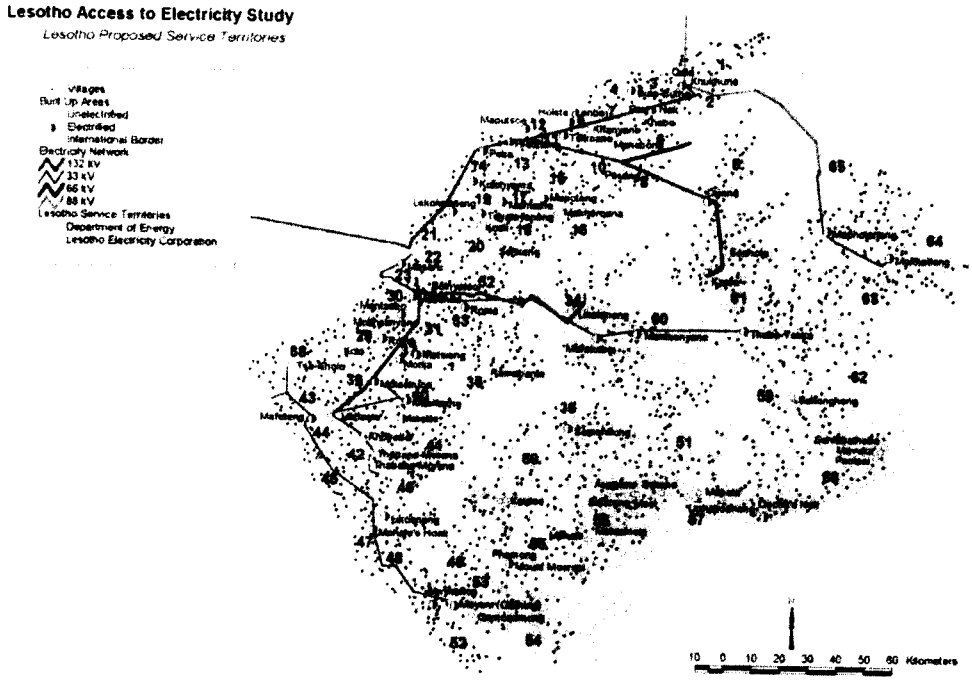

Figure 1 Proposed LEC service territory

7. A Sales Advisory Group (SAG) was appointed in late 2001 to develop a privatization strategy and make recommendations to the GOL on selling LEC through international competitive bidding. Following concerns that the outright privatization of LEC may compromise the GOL's economic and social objectives, it has been agreed with the World Bank (WB) that a public concession scheme will be implemented instead.

8. Lesotho's *Energy Policy Framework* (EPF) was released in June 2002, providing general energy policy direction, and to guide decisions and activities of the DOE and its interactions with other Government departments. The EPF builds on and complements national development planning activities. An *Energy Action Plan* (EAP) is being prepared (latest draft: June 2003) to provide specific energy sector targets in terms of the EPF.

9. In mid 2003, the DOE established a stakeholder-based Rural Electrification Working Group (REWG), to prepare for the implementation of rural electrification pilot projects and the formulation of NREP. Guided by facilitators, CORE International, the REWG prepared a report entitled "*Overall Action Plan for Rural Electrification in Lesotho – Phase I: Preparation and Implementation of RE Pilot Projects*". This report includes a list of major immediate and mid-term milestones and actions for rural electrification in Lesotho, as well as best practices from other parts of the world.

Government strategy / policy

10. Policy for the electricity industry envisages considerable institutional changes, both in relation to regulatory and policy bodies, as well as industry structure. With regard to the future of utilities it has been decided that:

    - LEC should be commercialised and privatised through a public concession scheme. The privatisation of LEC includes reducing its service territory to those areas considered financially viable.
    - New entrants into the industry will be encouraged. GOL has raised the options of retail competition (more a long-term objective), independent operators of isolated networks, and independent operators of grid extensions in rural areas. The LEC distribution assets outside its service territory will either be transferred to the relevant local government entities or outsourced under contract to appropriate operators.

11. The restructuring of the power sector will enable LEC to concentrate on improving its operations in a more restricted service area, and allow independent operators to service rural communities.

12. With regard to public institutions, GOL has proposed the establishment of three new institutions:

    - The Lesotho Electricity Authority to take responsibility for regulation of the sector, including licences, price controls and standards. The Lesotho Electricity Authority Act of 2002 provides for the establishment of an electricity regulator and the process of appointing LEA Board members and recruiting its chief executive has been initiated.
    - The National Rural Electrification Fund (NREF) to channel capital subsidy resources into rural electrification. Initially, this fund will be resourced through connection fees collected by LEC from government financed electrification projects, but will require other sources of funding in the medium term. The GOL in favour of an output-based approach to subsidies.
    - The Rural Electrification Unit (REU) to facilitate, co-ordinate, and manage the rural electrification projects in the country. As part of Access Pilot Projects, the World Bank is supporting the establishment of this unit through provision of funds to cater for the REU Head and two Engineers. The Access Pilot projects, which will be funded through the World Bank, have been divided into two phases and each phase consists of the following projects:

Phase 1a			
District	**Pilot area**	**Technology**	**Budget (US$)**
Butha-Buthe	Qholaqhoe	Grid Extension	295 714
Maseru	Semonkong	Mini-grid rehabilitation	234 107
Mokhotlong	Linakaneng	Solar Home System	816 500
Quthing	Dilli-Dilli/Sixondo	Grid cross border	118 286
Qacha's Nek	Ha Sekake	Diesel mini-grid	141 286
TOTAL BUDGET			**1 605 893**
Phase 1b			
Thaba-Tseka	Linakeng	Solar Home System	345 000
Thaba-Tseka	Sehonghong	Diesel mini-grid	252 343
Quthing	Mphaki	Diesel mini-grid	252 343
Qacha's Nek	Sehlabathebe	Grid cross border	335 143
TOTAL BUDGET			**1 184 829**

Table 1 Electricity Access Pilot Projects

Prior / ongoing assistance

13. In 1984 the Government of Germany provided technical assistance to the Government of Lesotho. There were two primary reasons for assistance; firstly to establish the Department of Energy within the Ministry of Water, Energy and Mining (now Ministry of Natural Resources) and secondly to prepare a national energy policy which resulted in the development of a comprehensive, in terms of data base, Lesotho Energy Masterplan (LEMP). The Masterplan contains a national energy policy and strategies to translate policy into practical realisation. One of the strategies was the promotion of new and renewable sources of energy. This strategy led to further technical assistance by the Government of Germany in the area of renewable energy in early 1990's. The Energy Master plan was finalised in 1988, the main feature of the plan was self reliance and less dependence, especially on South Africa, on energy supply.

14. In the early 1990's there were positive developments, which included the introduction of democracy in South Africa, and the Southern African Development Co-ordination Conference (SADCC) changed to Southern African Development Community (SADC) with the new focus being on regional economic integration. In light of these developments a decision was made to review the LEMP and this led to the technical assistance by the Government of Denmark, whose implementation began in 1999 and ended in 2002. The five main outputs of the assistance were:

- **National Energy Policy Framework:** National Energy Policy Framework and the associated action plan to translate the strategies into practical implementation were prepared.
- **Implementation of energy planning strategies:** This part was essentially meant to implement small projects to test the practical implications of the proposed policies as outlined in the policy framework. Due to the time constraint, this task was only conceptualised and never realised implementation.
- **Framework for Power Sector monitoring and Governance:** This component was essentially meant to provide backstopping activities and constant advice to the Director of the Department of Energy in relation to electricity projects monitoring and power sector governance.
- **Strengthening of LEC for efficient production, distribution and use of electricity:** This part was meant to assist the Lesotho Electricity Corporation (LEC) to improve efficiency and effectiveness in its operations. However, the assistance of Denmark did not reach conclusions since there was an introduction of World Bank (WB) assistance in restructuring the power sector. This led to the engagement of an Interim Management Task Force to manage LEC so that it is turned into a commercially viable institution.
- **Wind energy survey:** It is under this component, where wind energy assessment for electricity generation was done. Wind measurements, at heights of more than 10 metres, were initiated in three locations in the country. Assessment for wind energy potential was done for the three locations. The conclusions were that there is potential for wind electricity generation particularly for large scale applications for connection to the national electricity grid, particularly with one site " Letseng La Terai"

15. Specific to the power sector, GOL has over many years obtained assistance from international donor community for electrification schemes of various types. The Swedish and Norwegian Governments have among others supported the construction of main infrastructures such as transmission lines and substations since many years. Lately, the World Bank (WB) and African Development Bank (AfDB) are assisting the GOL in the process of restructuring the Lesotho Electricity Corporation (LEC) including finance of some rural electrification projects. Other important donor assistance were received from Caisse Francaise de Development, the German Government and others. More recently (2003), the United States Agency for International Development (USAID) has financed a study on "Rural Electrification Planning in Lesotho" that resulted in the establishment of the Rural Electrification Working Group (REWG) and the preparation of an action plan for implementation of rural electrification pilot projects.

16. Formal initiatives to promote and utilise renewable sources of energy including photovoltaic (PV) systems started in the late 70's with assistance from United States Agency for International Development (USAID), United Nations Educational Cultural and Scientific Organisation (UNESCO), the Food and Agricultural Organisation (FAO), the Governments of China and Germany. The initiatives here focussed on dissemination. During the assistance with the Government of Germany, in 1992, a study was commissioned to find out the constraints limiting the widespread adoption of renewable energy technologies

including energy efficiency in buildings. A number of constraints were identified and included: high investment costs for renewable energy systems, poor workmanship in the installations and lack of awareness.

17. The study further confirmed that PV lighting, energy efficiency in buildings and solar water heating are needed technologies by the public. This led to the continuation of the German assistance where the removal of the identified barriers in the promotion of PV lighting and energy efficiency in buildings was considered. This led to the preparation and the development of a video on PV and energy efficiency in buildings, demonstration PV units for lighting and TV in shops and inclusion of renewable energy technologies in the curriculum of secondary schools and technical and vocational schools.

18. Under the Southern African Development Community (SADC), a regional project was launched in some member states including Lesotho, The Project "Financing Services for Small Scale Energy Users (FINESSE)" which was aimed at identifying potential renewable energy technologies and preparing business plans for financing. The technologies identified for Lesotho were three and included: PV lighting in homes, energy efficiency in buildings and solar water heating. The greatest problem in the proposed business plans was the proposed delivery mode, especially institutional aspects, was not attractive.

19. Lessons and experiences include:
    - For the promotion of RETs, all stakeholders must have a benefit, either currently or in the future. For example DOE formed several co-ordinating committees for information sharing and enhancing efficiency in planning and implementation, however, virtually all the different committee and professional bodies like the Lesotho Solar Energy Society (LESES) have either collapsed or are not very active because there were no immediate benefits.
    - The Government has to concentrate on enhancing an enabling environment for implementation of projects by the private sector.
    - Most of the projects were donor driven or city driven and have collapsed. Therefore, it is very important that the projects are demand driven. This means that the intended beneficiaries, often the rural communities have to be empowered by way of providing education and skills about RETs so that they can effectively participate in the promotion of RETs.
    - The market for RETs, in particular PV industry has not reached maturity and consequently, financial support is essential for PV market infrastructure development.
    - Where dissemination initiatives require demonstration plants for use by the consumers, the plants should not be given free, without any financial contribution; otherwise the consumers do not value such plants. This has largely been true with the dissemination of biogas digesters in the country.

Barriers

20. The main barriers identified that hamper the large-scale utilisation of renewable energy-based technologies can be classified into four broad headings, namely:
    - institutional

- economic, commercial and market
- technical and information
- education and training

21. Institutional barriers
    - Lack of an effective infrastructure for delivering renewable energy-based energy services on a sustainable basis.
    - Fragmented institutional responsibilities and lack of integrated planning and implementation by various stakeholders including government, the research institutions, the academic institutions, the NGOs, community based organisations (CBOs) and the private sector with regard to the applications of renewable energy technologies. The involvement of community participation in the promotion of RETs is essential. Lack of community participation has led to PV components theft.
    - Removal of institutional barriers remains one of the greatest challenges in the country.

22. Economic, commercial and market barriers
    - Limited private sector capacity supply, distribution, installation and maintenance of renewable energy systems. The situation is severe with maintenance since all the PV suppliers and installers are all in Maseru and not in rural areas where maintenance is required. In addition, ordinary retail shops do not sell PV components. Consequently, the consumers need to travel long distances to get the required maintenance services or even to replace a light. In some cases, the consumers prefer not to pursue the maintenance but rather stop using the PV technology. This is one of the greatest barriers in the utilisation of PV electricity.
    - Limited business skills, while there are some people with energy expertise the appropriate business skills to start energy enterprises are lacking.
    - Lack of or very limited in-country experience with many of the relevant renewable energy systems options.
    - Lack of suitable financing arrangements for renewable energy companies and end users, and the need for training of in-country financial institutions to lend for renewable energy enterprises and projects. This is one of the greatest barriers to the development of the market of PV industry in the country. Appropriate financing mechanisms will be in place to remove the barrier.

23. Technical barriers
    - Poor workmanship in the installation, operation and maintenance of renewable energy technologies (RETs), including PV systems.

24. Information, education and training barriers
    - Lack of access to necessary information
    - Lack of public awareness of the technologies
    - Lack of trained manpower at all levels and in particular
    - Insufficient qualified personnel for maintenance for renewable energy systems including PV.

Rationale and justification

25. Almost 90% of energy consumption in the rural areas is sourced from indigenous biomass fuels consisting of shrubs, firewood, crop residues and cow-dung. Paraffin is mainly used for cooking, heating and lighting. Many rural people have to travel long distances to get fuels such as paraffin, often at very high price. The declining number of trees in rural areas has resulted in rural people having to walk 5-10 kilometers a day to collect firewood. Other fuels such as liquefied petroleum gas (LPG) and coal play relatively minor role in rural areas. Finally, very few households in the rural areas use solar Photovoltaic (PV) systems or diesel/petrol generators.

26. The population of Lesotho is about 2.2 million persons, of which three-quarters live in rural areas. With an average of 6 persons per households, this leads to approximately 282,000 households residing in rural areas. At present only about 8% of households in Lesotho have access to electricity, with most of these being located in urban areas. It is estimated that only 1% of rural households have access to reliable electricity. The GOL objective is to increase the electrification targets from this current 8% to at least 35% by 2020.

27. The potential for grid connection in the next 5 years is approximately 10,000 households in the rural areas. Connected and potential for isolated diesel generator sets is about 1414 customers. The existing number of SHS stands at 1100. The national potential market is about 142,000 customers and it will not be possible to meet this market without the intervention of the GEF project.

28. The Vision 2020 and the Poverty Reduction Strategy Paper (PRSP) have identified community priority needs as employment creation, infrastructure development and food security and rural development. Availability of reliable and affordable energy supply is a prerequisite for the needs to be satisfied. To be specific electricity is an important energy carrier in this respect, see Table 2.

Community Priority Needs	**Sectoral Intervention to respond to the challenges**	**Electricity (energy) contribution**
1. Employment Creation	• Entrepreneur ship development	• Energy (electricity) enhances income-generating activities such as small local tourism, knitting and sewing industry. • Existing local shops can now extend their operating hours beyond the daylight period.
2. Food Security and Rural Development	• Food security and Nutrition. • Soil fertility and crop Husbandry methods.	• Agricultural productivity might be enabled through irrigation. • Lighting for commercial production of birds (chicken). • Alternative energy options will enable increased use of animal dung and crop residues for soil fertility and conditioning while their use for energy purposes will decline.

3. Increasing access to quality basic education.	• Free basic education for all. • Increases access to quality Early Childhood Care Development (ECCD).	• Electricity availability at home and schools enables access to educational media and distance learning. • Good quality lighting enables home-based study. • Lighting in schools allows evening classes and study, and helps retain teachers, especially if their accommodation has electricity. • Availability of electricity services free children's and especially, girls' time from helping with survival activities such as fetching water and collecting firewood.
4. Promoting access to quality essential health care and social welfare	• Improving access to quality essential health care and social welfare services. • Strengthen health promotion and disease prevention.	• Electricity for refrigeration allows vaccination and medicine storage for prevention and treatment of diseases and infections • Enables access to health education media through information communication technology. • Cleaner energy technologies are expected to reduce energy-related health problems/diseases. • Safe disposal of used hypodermic syringes by incineration prevents re-use and potential further spread of HIV/AIDS. • Electricity in health centres enables night availability, helps to retain qualified staff and allows equipment use.
5. Safety and Security	• Improved working environment for police personnel.	• Provision of efficient lighting at police stations. • Communication can be enhanced in rural areas.
6. Water and Sanitation	• Improve supply of clean potable water supply to rural areas.	• Electricity can be used to pump ground water locally and thereby reducing time spent collecting it.

Table 2 Energy (electricity) contribution towards achieving community needs

29. Electricity is required for income generating activities namely small local tourism industry, knitting and sewing, local shops to extend operating hours beyond the daylight period. Good quality lighting is required at homes, for study purposes, and for schools, under the policy of universal primary education, which calls for increased access to Early Child Care Development. In terms of Health, reliable source of energy for vaccine and medicine refrigeration is needed. Communication is poor in most of the rural areas, especially in the mountainous places. One of the greatest barriers for communication networks to cover these areas has been reported as lack of electricity.

30. Renewable energy technologies (RETs), particularly PV systems have a formal history of about thirty years in Lesotho. Despite several initiatives in the development and promotion of RETs, RETs are still not widely used in the country due to a number of barriers. Efforts to address the barriers have been implemented in the country. Positive progress has been recorded in addressing the issue of lack of awareness of RETs, poor workmanship in the installation of RETs and lack of qualified personnel for maintenance of RETs. Progress includes the design and implementation of dissemination strategies, the preparation of the code of practice for solar home systems, RETs have been introduced in the teaching programme of secondary schools. Despite the progress, the barriers as identified in section 0 still apply though they are not ranked high on the priority list. The issues of institutional set up and high initial investment costs for RETs continue to be the greatest barriers in the promotion and utilisation of these technologies and consequently they are of high priority.

31. The successful removal of the barriers will not be realised through national initiatives alone. The GEF project is expected to play a pivotal role in removing the barriers to wider adoption of renewable energy based rural electrification thus leading to the availability of electricity for needed service delivery to meet the urgent community needs in rural areas of the country.

32. Lesotho has excellent renewable energy resource base, ranging from extensive mini hydropower potential, small-scale wind potential to abundant solar radiation. The exploration of these energy sources using renewable energy technologies would make it possible to meet the basic energy needs of the rural population and thus improving their quality of life. Providing clean energy for basic services will give a tremendous improvement in the quality of life of the rural population. Clean energy resources will mainly replace paraffin currently used for lighting purposes and dry cell batteries for entertainment purposes. Local benefits are a reduction in the exposure to smoke and soot from paraffin and reduced expenditure on dry cell batteries.

33. Removal of the identified barriers to the use of renewable energy technologies will also provide the private sector with the necessary incentive to improve and expand their services. This will benefit customers in the whole country, not only in the rural areas or the target areas of the project.

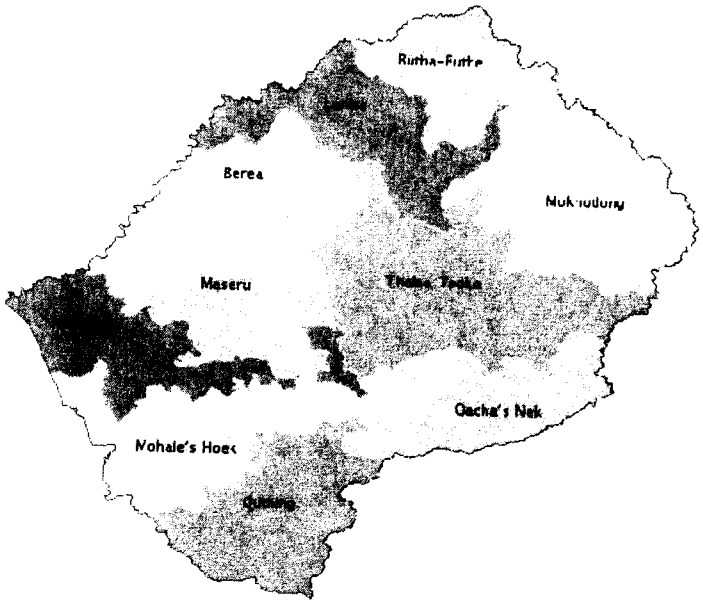

Figure 2 Administrative boundaries Lesotho

34. As mentioned earlier, the Access to Electricity Study report had identified existing and potential customers within and outside the future service territory of LEC. The main focus was on supply of reliable electricity on what the Ministry of Local Government has identified as "Rural Service Centres". These centres provide at least both economic and social services to a number of surrounding villages and are seen as growth centres, and the provision of reliable energy services is seen as a priority for stimulating their economic activities. Households energy and village development surveys were conducted in 29 selected un-electrified villages (including the rural service centres) outside the LEC's service territory and these villages were prioritised based on points allocated to various institutions found in the village and such institutions included hospital/clinic, police station, post office, schools, businesses, agricultural extension offices, local court and churches. Again, based on energy requirements per village and potential for economic development, energy supply options were recommended and they included the network/grid extension, diesel mini-grid, stand-alone solar home systems, cross border connection with Eskom South Africa, wind-diesel hybrid and hydro-diesel mini-grids.

35. One of the ongoing activities as described in section 0 is the Electricity Access Pilot Project (EAPP). The EAPP is an integral part of the current privatisation process of the electricity utility LEC. The only renewable energy based pilot of the EAPP will take place in the Mokhotlong district and will be limited to Solar Home Systems. The delivery model of the EAPP PV subproject has not yet been decided upon. Both the WB supported EAPP PV project and the UNDP-GEF project will be managed and coordinated by DoE thus making sure that the maximum synergies are being achieved. As the EAPP will focus its attention to the Mokhotlong district, it was decided that the best synergies can be achieved

when the UNDP/GEF project would target the same district and in addition the districts of Thaba-Tseka and Qacha's Nek.

36. The Mokhotlong district has at least eleven (11) un-electrified rural service centres and stand-alone solar home systems have been found appropriate for addressing the present and future energy needs. Other mountainous districts like Qacha's Nek and Thaba-Tseka have un-electrified rural service centres, which are suitable for electrifying through mini-grids.

37. The population of Mokhotlong district is 106 286 and 63% resides in rural areas. The average household size is 6 persons and there are 11 160 households in the rural areas. Due to the mountainous terrain, access to grid electricity is 1.2% and is mainly in town. It is estimated that only 500 rural customers can be connected to the rural grid network with the average grid connection costs of above M15 000 (US$2 143). The PV market potential in the district is 5637 customers for systems between 18kWp and 42kWp depending on income group levels, and does not include other PV technologies markets.

38. Compared to other two rural districts like Thaba-Tseka and Qacha's Nek, Mokhotlong district accounts for 12.4 percent of the country's rural poor and 14.6 percent of the urban poor while Thaba-Tseka accounts for 28.1 percent of the rural poor and 10.5 percent of the rural urban and Qacha's Nek contributes 6.1 percent of the poorest rural population, and 19.5 percent of the poorest urban population. The highest prevalence of rural poor is in Thaba-Tseka with 28.1 percent of all the rural poor. The highest prevalence of urban poverty is in Qacha's Nek with 19.5 percent of all urban poor in the country.

39. The global benefits of the project will result from the reduction of the use of paraffin for lighting in the three target districts by those customers targeted by the PV credit and cash sales component, the elimination of the use of paraffin for those household customers targeted by the proposed Sani Top wind/PV mini-grid, the elimination of the use of diesel generator sets by the productive users at Sani Top, as well as the replaced diesel generation capacity at Semonkong. Detailed calculations of the GHG emissions by the project activities can be found in **Error! Reference source not found.** of this proposal.

Objectives, outputs and activities

40. The *global objective* of the project is "*to reduce Lesotho's energy related CO_2 emissions by substituting fossil fuel (paraffin and diesel) with renewable energy sources (PV, wind and hydro) for household and productive uses through the provision of basic energy services to rural homes and community users*".

41. The *development objective* is "*to improve people's livelihoods by promoting the utilisation of renewable energy to provide basic electricity services to the rural areas in Lesotho starting in the Mokhotlong district, thus reducing the country's dependency on fossil fuels*".

42. These objectives would be achieved by project activities designed to remove barriers to the wide-scale utilisation of PV, mini hydro-diesel hybrids and wind-

PV hybrids. The project will consider the institutional, financial and market instruments necessary to demonstrate the viability of using the private sector to participate in the process of sustainable development in rural areas through the delivery of basic energy services through PV and renewable energy based mini-grids.

43. The project consists of six components. Each of these components is composed of an immediate objective, specific outputs and a number of activities. By achieving these immediate objectives, the project will contribute towards the achievement of the global and development objectives. These components are:

1. **delivery of renewable energy-based technology packages**: *To implement different delivery models for renewable energy-based rural electrification targeting different end-user groups and making use of different technology packages*
2. **awareness raising**: *To increase awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas*
3. **private and public sector strengthening and training**: *To strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas*
4. **policy support and policy framework**: *To assist the development of policy and institutional arrangements needed for the widespread adoption of renewable energy sources for off-grid electricity services*
5. ***financial mechanisms**: To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers*
6. **learning and replication**: *To disseminate experience and lessons learned in order to promote replication throughout the country of rural electrification based on renewable energy technologies*

The components as discussed above are related to the barriers identified (see page 46) as summarised in Table 3

Barrier	Component
Lack of an effective infrastructure for delivering renewable energy-based energy services on a sustainable basis	1, 4
Fragmented institutional responsibilities and Lack of integrated planning and implementation by various stakeholders including government, the research institutions, the academic institutions, the NGOs, community based organisations (CBOs) and the private sector with regard to the applications of renewable energy technologies.	1, 4
Limited private sector capacity supply, distribution, installation and maintenance of renewable energy systems.	3
Limited business skills, while there are some people with energy expertise the appropriate business skills to start energy enterprises are lacking	3
Lack of or very limited in-country experience with many of the relevant renewable energy systems options.	6
Lack of suitable financing arrangements for renewable energy companies and end users, and the need for training of in-country financial institutions to lend for renewable energy enterprises and projects.	5
Poor workmanship in the installation of renewable energy technologies (RETs), including PV systems.	3
Lack of access to necessary information	2, 6
Lack of public awareness of the technologies	2, 6
Lack of trained manpower at all levels and in particular insufficient qualified personnel for maintenance for renewable energy systems including PV.	3

Table 3 Link between the barriers identified and the project components

44. The six components are to a large extent inter-dependant; hence all have to be addressed to remove the identified barriers. With this in mind the activities to be undertaken are planned as in Table 4

		year 1		year 2		year 3		year 4		year 5	
1	delivery of renewable energy based technology packages										
2	awareness raising										
3	private and public sector strengthening and training										
4	policy support and policy framework										
5	financial mechanisms										
6	learning and replication										

Table 4 Planning of the project activities over the five years

45. **Component 1: Delivery of renewable energy based technology packages**
The immediate objective is "*to implement different delivery models for renewable energy-based rural electrification targeting different end-user groups and making use of different technology packages*".

This component of the project will be executed in close collaboration with the Electrification Access Pilot Project (EAPP). The delivery models that will be implemented under the GEF project will focus on credit sales and cash sales.

Furthermore this component will demonstrate the potential to use mini hydropower plants to power local mini-grids by focusing on the existing hydro/diesel mini-grid at Semonkong and the identified hydro hybrid at Seforong, as well as the potential for wind energy through a wind/PV mini-grid using prepaid meters.

The EAPP will increase the customer base of the Semonkong mini-grid from the current 42 customers to 250 customers. Installing additional diesel generation capacity will enlarge the generating capacity. The project will investigate the potential to limit the additional diesel capacity needed by increasing the installed capacity of the hydro station. Based on the conclusions of the investigations, donors will be approached for the actual investments needed.

At the Sani Top location the GEF project will build on the foundations laid by the feasibility study carried out as part of the DANCED support to the GOL. The DANCED project investigated the potential for large-scale grid connected wind energy. For Sani Top it concluded that there is potential for small-scale wind electricity generation, but as it fell outside the scope of the project, DANCED was not able to implement it. The scope of the DANCED project was limited to the technical and economic viability of wind electricity generation. The current GEF project will demonstrate that wind generation is a viable option for certain locations in the country.

The total costs for component 1 are US $ 4,223,600. GEF is requested to contribute US$ 600,000 towards these costs. The total costs are as follows:

donor	description	amount
EAPP	PV project Mokhotlong district	$ 816,500
EAPP	expansion of Semonkong mini-grid	$ 234,000
DRWS	PV water pumping	$ 73,000
GEF		$ 600,000
NREF		$ 2,500,000
TOTAL		**$ 4,223,500**

Table 5 Cost breakdown component 1

The nine outputs of component 1 will be:

Output 1.1
In Mokhotlong, Thaba-Tseka and Qacha's Nek districts 1000 customers purchased PV-systems through a credit scheme or through cash sales annually
Activities:

- Design a delivery model that uses customer credit in collaboration with the PV industry and the financial sector.
- Implement the designed delivery model.

Output 1.2
At least three business centres are established in the Mokhotlong Thaba-Tseka and Qacha's Nek districts using PV as their energy source

Activities
- Define roles and responsibilities of stakeholders involved, particularly communication institutions
- Design of the technical installation required
- Tender for equipment
- Install in the field

Output 1.3
Limited grant financing is provided to a small number of schemes proposed by the private sector to test various productive uses of renewable energy

Activities
- Develop in close consultation with local stakeholders and industry a competition to select several schemes to demonstrate productive uses of PV in Mokhotlong, Thaba-Tseka and Qacha's Nek.
- Support a small number of the best project proposals.

Output 1.4
An isolated hybrid mini-grid using wind and PV is installed at Sani Top serving at least 25 customers and two businesses

Activities:
- Update the existing information on current and expected energy use in Sani Top
- Design a mini-grid using PV and wind
- Prepare a tender for the installation of the mini-grid
- Implement the mini-grid

Output 1.5
The wind energy potential for small-scale power generation, in particularly hybrid mini-grids at selected sites that are favorable for hybrid mini-grids using wind is assessed

Activities:
- Assist LMS in the assessment of wind measurements
- Build capacity to interpret wind data for assessing the wind energy potential (Department of Energy, private sector and LMS)
- Evaluate wind regime and judge the feasibility of a wind mini-grid at the measurement location

Output 1.6
In Mokhotlong, Thaba-Tseka and Qacha's Nek districts three villages have been provided with PV water pumping systems. This output will be reached in close collaboration with the Department of Rural Water Supply.

Activities:

- Provide technical assistance to DRWS to install and operate water pumping systems powered by PV in line with the PV Code of Practise

Output 1.7
Feasibility study on the potential to increase the hydro component of the Semonkong hydro/diesel mini-grid

Activities:

- Investigate the current technical status of the hydro plant at Semonkong
- Investigate the technical possibilities to increase the generating capacity of the hydro plant
- Evaluate the technical options available and their economic potential

Output 1.8
The capacity of the hydro station at Semonkong is increased

Activities:

- Evaluate the outcome of the activities under output 1.7
- Find an appropriate financier for the expansion of the hydro plant
- Implement the recommended activities from the feasibility study

Output 1.9
The use of hydropower generation is included in the Seforong mini-grid

Activities:

- Assess the hydropower potential at the location of the Seforong mini-grid
- Integration of the hydropower in the tendering documents for the Seforong mini-grid

46. **Component 2: Awareness-raising**
The immediate objective of this component is "*to increase awareness among the general public, decision-makers and rural customers on the potential role of renewable energy in meeting basic energy needs in rural areas*".

The cost of component three is estimated to be US$ 350,000, of which GEF is requested to contribute $ 300,000.

donor	description	amount
GEF		$ 300,000
GOL	in kind	$ 50,000
TOTAL		**$ 350,000**

Table 6 Cost breakdown component 2

The three outputs of component two will be:

Output 2.1
Information and awareness packages have been developed and made available to the general public
The main focus is the development of information and awareness raising materials that address the merits and technical limitations of PV systems and that of management issues regarding mini-grids

Activities:
- Identify the type of information that is needed by the general public (facts as well as tone needed).
- Develop a recognisable layout/format of all information material.
- Prepare all information in the developed format.
- Disseminate the developed information materials.
- Develop materials to be used during demonstrations
- Train presenters for the demonstrations (know-how and media training)
- Engage specialised media company to develop TV and radio advertisements.

Output 2.2
Awareness programme for decision makers is developed and implemented

Activities:
- Identify key decision-makers that need to be targeted in this component
- Develop targeted awareness and information packages about renewable energy and mini-grid management for rural electrification purposes
- Organise field trips for identified key decision-makers to the project area to witness the implementation of the project

Output 2.3
A rural customer awareness programme is formulated and implemented

Activities:
- Identify the type of information that is needed by rural customers (facts, language as well as tone needed).
- Develop a recognisable layout/format of all information material.
- Prepare all information in the developed format.
- Disseminate the developed information materials.
- Develop materials to be used during demonstrations
- Train presenters for the demonstrations (know-how and media training)

47. **Component 3: Private and public sector strengthening and training.**
The immediate objective of this component is "*to strengthen and support the public and private sector working in the renewable energy sector to provide better quality of service to the rural areas*". The implementation of this component will be done through on-the-job training as appropriate, supported by theoretical / class room type of training. The main focus will be on the private sector and NGOs.

The cost of component three is estimated to be US$ 400,000. GEF is requested to fully fund this.

donor	description	amount
GEF		$ 400,000
TOTAL		**$ 400,000**

Table 7 Cost breakdown component 3

The three outputs of component 3 will be:

Output 3.1
Business development services in the renewable energy sector will be strengthened

Activities:

- Provide business planning and development services through one-on-one meetings with business to develop business plans, marketing plans, and promotional opportunities, making reference, as appropriate, to the resources and opportunities available for support.
- Assist local PV wholesalers and importers to develop stronger linkages with international companies;
- Make available, reassess; refine; and update the PV market data for the key product lines in order to support further business development.
- Carry out training on PV business "best" practice, including service warranties and maintenance contracting.

Output 3.2
Technical knowledge of renewable energy technologies is strengthened

Activities:

- Develop a variety of courses (short/long) for various target groups on financing for small-scale renewable energy systems; the correct sizing, installation, operation, repair and maintenance. The courses will cover all technologies promoted through this project including PV systems, Wind-PV and Hydro-Diesel Minigrids and other relevant topics tailored to the needs of the following groups:
  - NGOs, micro-finance institutions (MFI's); banking staff, and others;
  - Technicians and sales people;
  - Engineers; and
  - Vendors.
- Work with (local) training institutes to develop an appropriate curriculum for the training of PV technicians, including training in standards, international best practice, and codes of practice/conduct.

Output 3.3
The association of PV suppliers in Lesotho is operational (Lesotho Solar Energy Society, LESES)

Activities:

- Assist the local PV suppliers in re-activating the LESES.
- Involve the LESES as sounding board for the project implementation

Component 4: Policy framework and support

The immediate objective of component 4 is "*to assist the development of policy and institutional arrangements needed for the widespread adoption of renewable energy sources for off-grid electricity services*". The Government of Lesotho attaches high priority to providing rural locations in the country with basic energy services. The establishment of the National Rural Electrification Fund will be supported by this project. In particular this project will help the Government to ensure consistency between the adopted energy policy and other rural energy activities.

The cost of component four is estimated to be US$ 929,000. The contribution requested from GEF is US$ 200,000.

donor	description	amount
WB	assistance to the rural electrification unit	$ 546,000
GOL	in kind – rural electrification unit	$ 183,000
GEF		$ 200,000
TOTAL		**$ 929,000**

Table 8 Cost breakdown component 4

The two outputs of component 4 will be:

Output 4.1
A policy and implementation framework for renewable energy based rural electrification is defined and in place

Activities:

- Provide input to the Government in implementing the Lesotho Rural Electrification Fund to assure that renewable energy technologies are integrated in its activities
- Provide input to the Government in implementing the National Energy Master Plan to assure that renewable energy technologies are integrated in the plan
- Work in very close co-operation with the stakeholders involved to identify and formalise their respective roles

Output 4.2
Standards for renewable energy technologies and mini-grid are updated and enforced

Activities:

- Identify the current existing standards
- Review and if necessary update the current existing codes of practise for technicians regarding PV systems and mini-grids.
- Facilitate the formulation and adoption of national standards, code of practice and minimum requirements for PV systems and mini-grids (in collaboration

with the Ministry of Trade, Industry, Marketing and Co-operatives and the Lesotho Electricity Authority).
- Make the standards and codes available and publicly known.

48. **Component 5: Financial mechanisms**
The immediate objective of this component is "*To assist with the implementation of a performance grant and a credit guarantee scheme for the larger scale dissemination of renewable energy based technologies to rural customers*"

The cost of component five is estimated to be US$ 435,000. GEF is requested to contribute US $ 400,000 towards this.

donor	description	amount
private sector	in kind	$ 10,000
GOL	in kind	$ 25,000
GEF		$ 400,000
TOTAL		**$ 435,000**

Table 9 Cost breakdown component 5

The outputs of component five will be:

Output 5.1: The performance based grant scheme is implemented and used by suppliers/ installers

Activities:
- The Performance Grant Scheme, that has been designed in detail during the PDF B phase (please see ProDoc), will be implemented. Formal agreements (including signatures) on the PGS between the Central Bank of Lesotho and DoE will be reached. All drafts and templates have been prepared and agreed upon verbally during the negotiations at the PDF B stage. Details on these draft agreements can be found in the Financing Report.

Output 5.2: The credit guarantee scheme is operational and used by financial institutions/ supplier credit entities

- The Credit Guarantee Scheme, that has also been designed in detail during the PDF B phase (please see ProDoc), will be implemented. Formal agreements (including signatures) on the CGS between the Central Bank of Lesotho and DoE will be reached. All drafts and templates have been prepared and agreed upon verbally during the negotiations at the PDF B stage. Details on these draft agreements can be found in the Financing Report.

49. **Component 6: learning and replication.**
The immediate objective is "*to disseminate experience and lessons learned to promote replication throughout the country of rural electrification based on renewable energy technologies*". The implementation of component 1 will be closely followed and lessons learned will be actively considered to develop an

improved understanding on what conditions have to be in place for large scale dissemination of renewable energy-based technologies and mini-grids.

The cost of component six is estimated to be US$ 527,000, GEF is requested to contribute towards this with US $ 500,000.

donor	description	amount
UNDP	PDF B phase	$ 10,000
GOL	PDF B phase	$ 17,000
GEF		$ 500,000
TOTAL		**$ 527,000**

Table 10 Cost breakdown component 6

The three outputs of component six will be:

Output 6.1:
A programme for replication of the activities implemented under immediate objective 1 is prepared

Activities:
- Closely follow the implementation of component 1 and distil the necessary elements for up-scaling these activities beyond the target villages.
- Design a roll-out programme throughout the country.

Output 6.2
Evaluation of the impact of renewable energy technologies on rural livelihoods

Activities:
- Review and adapt existing methodology for the evaluation and measurement of the impact of renewable energy-based energy services on the livelihoods and standards of living of the customers.
- Apply the most appropriate methodology to a representative sample of customers in the project area.
- Summarise the impact of renewable energy-based systems on customers based upon the project experiences.

Output 6.3
Support has been provided to disseminate the learning and replication experiences in the project area

Activities:
- Prepare publications on the lessons learned and results of the PV and mini-grid management initiative in the project area for distribution to other sites in Lesotho;
- Organise site visits to the project area for other donors/investors and private sector entrepreneurs interested in implementing a similar initiative nationally in other regions or internationally;

- Engage with other projects in the country, region and world to exchange lessons, experiences, and solutions encountered to perceived challenges in the renewable energy field; and
- Present the results achieved in the three target district and the Semonkong mini-grid through presentations at national and international seminars and workshops.

The GEF budget for the entire programme is provided in Table 11. The detailed incremental cost analysis is provided in Annex A

Component description	Estimate GEF budget
1. delivery of renewable energy based technology packages	US$ 600,000
2. awareness raising	US$ 300,000
3. private and public sector strengthening and training	US$ 400,000
4. policy support and policy framework	US$ 200,000
5. financial mechanisms	US$ 400,000
6. learning and replication	US$ 500,000
M&E	US$ 100,000
Total	**US$ 2,500,000**

Table 11 GEF project budget

Flexible programming: The proposed initiative will allow changes during the implementation according to market developments. However, it is necessary to remain within the programme boundaries presented here. Moreover, no additional financial resources will be made available by GEF to innovations and/or to address newly arisen barriers.

Risk and sustainability

50. The first level risk relates to the policy environment. The project is being designed in the wake of power sector restructuring. However, this risk is being minimised as GOL is committed to operating efficiency of the utilities, especially LEC, and sustainability of the electricity sector in general. In components 3, 4 and 5 the link with the emerging national policy on (renewable) rural electrification is looked into. Associated uncertainty is with the institutions envisaged to implement the Government policy on rural electrification. The active role the Department of Energy is playing in this respect will assure a positive outcome that will not jeopardise the role of this project.

51. The second level risk is associated with the high up-front investment cost of renewable energy technologies. This risk will be minimised by engaging the National Rural Electrification Fund in the project. The NREF is mandated to financially support the provision of rural electrification. Components 1, 2 and 5 will mitigate this risk. Financial institutes will be involved to implement the credit schemes for customers that are not able to pay the full costs up-front. To mitigate the risk that customers, even though financing packages are available, do not approach the participants in the project, a substantial component on awareness-raising is included in the project.

52. The third level of risk resides in the replication of the project activities in other areas of the country. The project cycle for the three target districts will provide "lessons learned" that will largely contribute towards mitigating this risk.

53. A fourth level of risk is that the project will become an institution on its own without proper embedding into the arena of other projects. To mitigate this risk the project has been "marketed" from the start as combining all forces working on the provision of rural electrification. It will follow an open approach towards information sharing. As there is already a good base of geographic information available in GIS format in Lesotho, the project will build upon this and facilitate the use of GIS to the maximum extend possible.

54. The fifth and last risk is related to the very high HIV/AIDS infection rates in Lesotho. This is not a risk unique to this project, but one that can be found in every activity implemented in the country. Although the Government of Lesotho is expending substantial time and effort to this problem on a national basis, very few effective risk mitigation activities can be made available under this programme other than programming additional financial resources for training and capacity building. This is necessary, as more people will need to be trained to ensure sufficient available and qualified personnel for the longer term.

55. It should be mentioned that providing the basic energy services to HIV/AIDS sufferers will certainly relieve their situation, but on the other hand early deaths resulting from HIV/AIDS will result in loss of income in already poor households that will have an immediate effect on their ability to pay for energy services.

56. In addition to the above listed activities to mitigate the identified risks, there will be permanent monitoring of risks and activities to mitigate these risks by the project management team. Instead of following a cast-in-stone project plan, the project management team will adhere to flexible programming to ensure that pitfalls in the programme design, planning and implementation are immediately dealt with in the most appropriate manner. In this respect the link with other ongoing activities in other SADC countries is very important. Risks encountered by these projects will be evaluated to judge their applicability to the Lesotho programme and if necessary mitigation tasks will be initiated.

57. The proposed project is viewed as a support initiative to the on going national efforts to effectively promote rural electrification and as such its management, planning and implementation will be an integral part of the sustainable national rural electrification programmes. GOL considers rural electrification essential to support income generating activities thus contribution to poverty alleviation. In this respect, the establishment of NREF is a positive step. According to the NREF regulations, NREF will provide early stage funding and enterprise development services to entrepreneurs, helping build successful business that supply clean energy technologies and services to rural and peri-urban areas in the country. The project will stimulate market for RETs which will be sustained due to different components in the project, especially component 3, on private and public sector strengthening and training.

Stakeholders participation and implementation arrangements

58. Participation of the stakeholders involved is seen as crucial for the success of the programme. Without proper consultation and involvement, the success of the programme will be jeopardised. During the PDF-B implementation, individual stakeholders were consulted and in addition, a stakeholders' workshop was convened on 20th -22nd August 2003. This workshop helped in identifying additional stakeholders and in defining their respective roles in barrier removal. The key stakeholders include: Rural communities, NGOs, Local Authorities, Energy Regulators, Department of Energy, Financial Institutions, Solar providers/dealers, Technical institutions, Media institutions and professional associations. Furthermore, extensive consultations were conducted during the PDF B top-up phase with PV dealers, financial institutions and PV customers.

Implementation arrangements

59. The proposed GEF/UNDP supported project will be executed within the guidelines of UNDP National Executing (NEX) modality. NEX in principle creates a platform for Government flexibility to ensure that UNDP supported projects are executed in consistent with national development priorities. In particular, NEX enhances integration, thus increased prospects for sustainability, of UNDP supported projects into the overall activities of the executing agency. The Department of Energy (DOE) of the Ministry of Natural Resources will serve as overall Executing Agency for the project. DOE is responsible for overall national energy policy, coordination and monitoring of energy programmes and projects. DOE is fully responsible for the planning and implementation of rural electrification in Lesotho.

60. The proposed project is viewed as a support initiative to the national efforts to effectively promote rural electrification and as such its management, planning and implementation will be part of the activities of the Rural Electrification Unit (REU) whose Chief will report directly to the Department of Energy. In order for this integration to be practically realised, the Chief of REU is ideal to be the project manger. The project manager will report to the Director of DOE for the primary purpose of managing the project within the context of approved project document and any other authorised project reports. The Technical staff, and other DOE staff, of the REU will be responsible for technical input to the project.

61. In addition, the existing Rural Electrification Working Group (REWG), which composes of members from a spectrum of stakeholders including private, NGOs, Consumers and Government, and whose main responsibility is to advise on issues of rural electrification, will include the project in its project portfolio. REWG will advise the Director of Energy on policy issues relating to rural electrification and will include the proposed project as well. The REWG will replace the usual Project Steering Committee (PSC). There are prospects that REWG, in integrating the project into its portfolio, will require expanded membership. The Energy and Environment Unit of UNDP is an example. The Director of DOE will report rural electrification progress to Principal Secretary (PS) of the Ministry of Natural Resources (MNR). Regarding the rural communities, the Ministry of Local Government, NGOs and consumers are part of the REWG to ensure that rural

electrification programmes and projects, including the proposed project, respond to the community needs and that mechanisms are in place to empower the communities to effectively participate in their programmes and projects. The organisational structure is reflected in Figure 3.

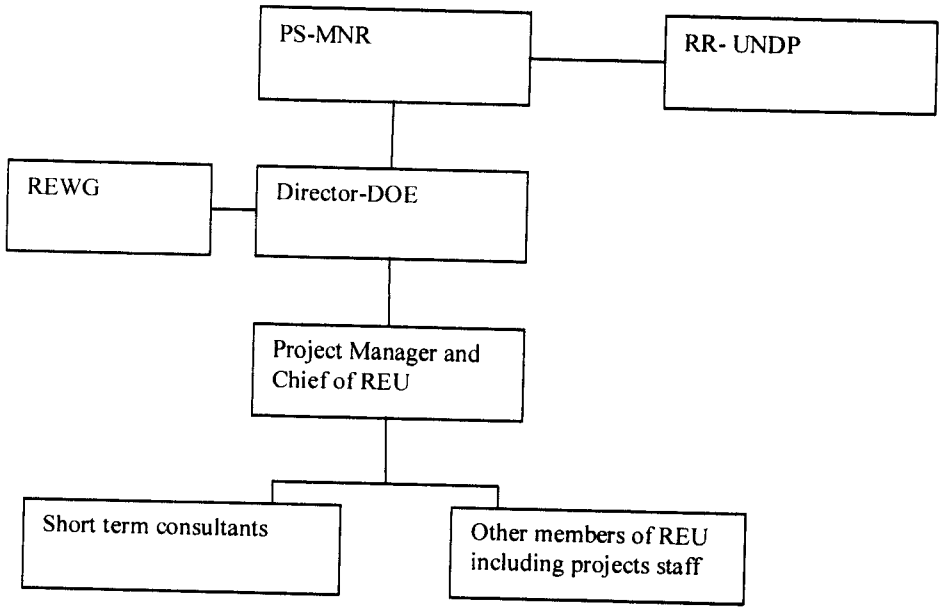

Figure 3 Proposed implementation arrangements

Currently, there are WB supported rural electrification pilot projects whose main objective is to test various institutional delivery mechanisms for energy service delivery in rural areas. The WB is also providing seed money for testing of these institutional models in the form of capital subsidies to consumers. On the other hand, the GEF support will concentrate on barrier removal and the project activities will include market conditioning activities such as training and capacity building, promotion, technical assistance in RET, feasibility studies, setting and enforcing quality standards, monitoring, and establishment of sustainable delivery infrastructure.

Integration of the projects, in terms of planning and resource utilization is expected to yield important benefits that include stimulation of the PV market, replication and sustainability.

Incremental costs and project financing

62. This project is designed to remove barriers to the introduction of renewable energy technology-based systems to meet the basic energy needs of rural communities in the three target districts and to increase the use of hydropower at existing and proposed mini-grids. It will adopt a market transformation approach to the PV and wind market in the three target districts, and is consistent with the terms of GEF Operational Program 6. To the extent that it helps stimulate greater sales of PV's and wind technology to households and institutions, it will also help reduce both the incidence of respiratory and eye problems attributable to kerosene

soot and the risk of hut fires. The proposed project activities would not take place in the absence of UNDP and GEF support, making the project activities largely incremental.

63. A detailed assessment of incremental costs is presented in **Error! Reference source not found.**. According to the available information on the current energy consumption, a household uses approximately 7.5 litres of paraffin per month for lighting purposes, costing approximately M 25.50 (US $ 3.65 / month). In addition to this, a household in rural areas spends approximately M 36.00 on dry cell batteries to power radios and torches. In the case of Hi-Fi or TV appliances, a monthly battery charging rate of about M 20.00 has to be paid by the household.

64. For the targeted 5,000 PV systems in the three districts, the estimated CO_2 emissions reduction as a result of substituting paraffin based lighting with electrical lighting, amounts to 25,000 tonnes over a 10 years' period. This is based on an average of nearly 6 litres paraffin savings per month per customer. CO_2 reduction per litre of paraffin has been taken as 3.2 kg. (source: IPCC draft Guidelines for National Greenhouse Gas Inventories, Volume 3. UN energy Statistics Yearbook 1992)

65. For the hybrid wind/PV mini-grid at Sani Top, 30 households will save the consumption of nearly 6 litres of paraffin per month, while two of the three businesses that will be connected (a general dealer and a tourist accommodation) will each save the use of 3 kW Lister diesel generator for 3 hours every evening. The household customers will reduce their carbon emissions by 130 tonnes of CO_2 over a 20 years' time horizon, while the two businesses will save a similar amount. This total emissions reduction for the Sani Top mini-grid will add to 260 tonnes of CO_2.

66. The replacement of two planned diesel generator of 100 kW each at the Semonkong mini-grid by expanded hydro capacity will reduce the GHG emissions by 30,000 tonnes of CO_2 over a 20 years' time horizon.

67. Spin-offs of the direct project activities are additional sales of PV systems throughout the country and the implementation of the Seforong mini-grid using mini hydropower will contribute to an additional 16,000 tonnes of CO_2 emissions reduction.

68. The total CO_2 emission reductions that can be directly attributed to the project are 55,000 tonnes of CO_2 over the lifetime of the equipment. This results in a cost of US$ 45/ ton of CO_2 (2,500,000/ 36,000).

69. Because this project is not requesting a subsidy per W of renewable energy capacity installed, the incremental costs associated with this project are considered to be the costs of the activities designed to remove the primary barriers to rural electrification and stimulate the renewable energy market in Mokhotlong district and Lesotho in general. It will focus primarily on stimulating cash sales, experimenting various credit mechanisms which might be used in future projects to expand the market further.

70. The budget for the entire project is provided in the table below. The detailed incremental cost analysis is provided in Annex A

Component description	Estimate project budget	
	GEF	Co-funding
1. delivery of renewable energy based technology packages	US$ 400,000	US$ 3,389,500
2. awareness raising	US$ 300,000	US$ 50,000
3. private and public sector strengthening and training	US$ 400,000	US$ 0
4. policy support and policy framework	US$ 200,000	US$ 729,000
5. financial mechanisms	US$ 400,000	US$ 35,000
6. learning and replication	US$ 500,000	US$ 27,000
M&E	US$ 100,000	US$ 25,000
Total	**US$ 2,500,000**	**US$ 4,255,500**

Table 12 Total project budget

Annexes

Annex A - Market for PV in Lesotho

Almost 90% per cent of energy consumption in the rural areas is sourced from indigenous biomass fuels consisting of shrubs, firewood, crop residues and cow-dung. Paraffin is mainly used for cooking, heating and lighting. Many rural people have to travel long distances to get fuels such as paraffin, often at very high price. The declining number of trees in rural areas has resulted in rural people having to walk 5-10 kilometers a day to collect firewood. Other fuels such as liquefied petroleum gas (LPG) and coal play relatively minor role in rural areas. Finally, very few households in the rural areas use solar Photovoltaic (PV) systems or diesel/petrol generators.

PV market potential in rural areas

The market for electricity in Lesotho is characterized by the country's geography and in particular the small, largely rural, and sparsely distributed population of about 2.2 million. Of the estimated 370 000 households, only about 37 267 are connected to a formal electricity supply.

The table 1 below, using basic assumptions shows that the potential number of households that are likely to be serviced through stand-alone PV systems when PV is compared to other options.

Table 1: Total Potential Market for Solar Home Systems

Number	Parameter	Assumption
2 233 266	Total Population	From Electricity Market and Economic Analysis Report.
372 000	Total households	76% of population is "rural"
282 880	Rural Households	6 people per household
2 829	Rural HH Already Connected	1% of rural population connected to

		grid
10 000	Potential for Grid Connection in 5-10 years	At least 2 000 connections per year (additional 4% will be connected to the grid in 5 years)
1 414	Connected and potential for isolated generator sets	At least 0.5% of rural HH could connect more cost effectively to isolated gensets in the next 5 years
1 100	Existing PV connections	
267 537	Total Number of Potential PV SHS	

In the following sections, this base market is screened using simple models to estimate what the actual *cash* market is based on estimated spending power of rural populations. The *average* rural income is less than $400 per year, of which approximately 40% is used for energy (mostly wood and paraffin). In Lesotho several realities suggest that, if products were available and awareness was increased, a small sustainable demand would develop. For example, the market for consumer goods such as cassette players and radios is increasing. If PV is the most effective method to power such items, it will be utilised by off-grid people.

The table below breaks potential markets into 4 groups based on the country income and energy expenditure. This breakdown is fairly arbitrary; owing to the lack of data. However it does provide a useful indicator to possible purchasing trends, and an indicator for what might happen as the market develops. Note that the models below are based on *cash,* not financed systems.

Rural Household Income Groupings

Income Group	**Approximate Percentage**	**Characteristics**
"Elite" (has roots in village/rural area, seeking to make investment)	<1%	Investors and business people in small towns. Returnees from overseas setting up businesses. Incomes over $4 700 p.a.
Upper-middle income (village)	3-9%	Business & NGO employees and management. Expected HH incomes range between $1600-4700 p.a.
Middle income (agricultural, village dweller)	15-20%	Traders and farmers. HH income between $800-1600 p.a. Some access to remittances.
Low income & subsistence	>70%	Casual workers, farmers, street vendors, etc. HH incomes below $400.

Using the above classifications, it is possible to break the purchasing groups into the following categories of systems:

Table 2: Rural Household Income and Interest in PV Systems

HH Income ($/annum)	Relative Percentage of Population	Most Likely Interest in PV System Size
<$400	<70-80%	No System
$800-1600	15-20%	One Light System and a radio (12 Wp)
1600-4700	3-9%	2 light & radio system (20 Wp)
>4700	<1%	4 light system or higher (40 Wp or more)

It can be readily demonstrated that such stand-alone PV systems provide lower cost service --- and better quality service --- than existing off-grid solutions. Annualized PV costs for families that require decent lighting and regular radio or music system power are slightly lower for equivalent service from dry cells and kerosene (see table below).

Compared Expenditures of 2 Basic Lighting/Power Systems

Main energy source	Annualized energy costs US$/year
Lamp paraffin	$160
Lantern/a system and a radio	$150[2]

By breaking the market for solar into several groups, and by making assumptions about purchasing power, a rough picture of the demand for Solar Home Systems can be made, as shown below. Several scenarios are presented, including "optimistic", baseline and "conservative".

[2] A lantern prices are taken from Kenya. Compared to local prices, systems costs are twice the ones in Kenya or South Africa.

Table 3: Estimated Market Demand for Solar Home Systems in Lesotho (3 Cases)

Scenario 1: Baseline						
System Description	**Average Size**	**Cost**	**% of Population**	**No HH**	**Size of Market**	**Cash Value**
	Wp	$			kWp	1000's/$
No System	0	0	80	214,030	0	0
One Light & Radio	11	319	11	29,429	324	9,388
2 lights and radio	20	456	8	21,403	428	9,760
4 light system, colour TV and radio or higher	40	794	1	2,675	107	2,124
			100	**267,537**	**859**	**21,272**
Scenario 2: Optimistic						
No System	0	0	77	206,004	-	-
One Light & Radio	11	319	12	32,104	353	10,241
2 light and radio system	20	456	9	24,078	482	10,980
4 light system, colour TV and radio or higher	40	794	2	5,351	214	4,248
			100	**267,537**	**1,049**	**25,470**
Scenario 3: Conservative						
No System	0	0	90	240,783	-	-
One Light & Radio	11	319	4.5	12,039	132	3,840
2 light and radio system	20	456	5.0	13,377	268	6,100
4 light system, colour TV and radio or higher	40	794	0.5	1,338	54	1,062
			100	**267,537**	**454**	**11,002**

As can be seen from these calculations, the potential reachable cash market for SHS is between 454 kWp and 1.049 MWp. This represents a value between 11 and 25 million dollars worth of PV equipment sales. In terms of households the national market potential is 14175 consumers. This figure constitutes the sum of all the three options, excluding the No system, under all the scenarios. This does not include the potential finance market *or* the market for other PV technologies such as water pumping, vaccine fridges, small rural businesses and communications systems.

Other Potential PV Product Markets:

Micro-PV Systems: These are 1-5 Wp systems that could power very small lights or radios. Although the technology development in this field is at an early stage, these low cost products have a good market. They would meet the needs of the rural poor for radio power systems.

PV Pumps: PV for water pumping has been an important market in Lesotho. So there is a good experience in using PV as a water pumping source, particularly for community water supply.

School Lighting & Radio Education: There are at least 1287 primary and 184 secondary schools in the country that are un-electrified. The primary schools can benefit from solar for powering small radios that are used for radio learning programmes. On the other hand the rural secondary schools can have access to educational devices such as microscopes, computers and photocopying machines.

Health Clinics: Vaccine refrigeration and lighting for both health clinics and veterinary centres has been a growing market. The vaccine refrigeration in the health centres in rural areas use mainly LPGas and most cases it is difficult to transport. Moreover, the PV installations in most rural clinics need maintenance and upgrading to cater for growing energy needs.

Churches: Churches require lighting and audio systems for their normal day-to-day operation. They also are able to raise their own support from community, and can be seen, to some degree as non-donor dependant markets. There are some churches off-grid, many of which already use generator sets for their power requirements.

Small Off-Grid café's and Businesses: There are currently 101 000 small scale and medium enterprises in the country, and only 1790 had electricity in January 2003. There is growing demand for power in off-grid rural trading centres, and this opens up opportunities for PV systems.