



UNDP Project Document

Government of Botswana

and the

**United Nations Development Programme (UNDP)
Global Environment Facility (GEF)**

Renewable Energy-Based Rural Electrification Programme for Botswana

The project aims at reducing Botswana's energy-related CO₂ emissions by promoting renewable and low GHG technologies as a substitute for fossil fuel (fuel wood, paraffin and coal) utilized in rural areas. The activities proposed in the project are designed to remove barriers to the wide-scale utilization of renewable energy and low GHG technologies to meet the basic electricity needs of individual households in terms of lighting, power for radio-cassette/TV and income-generating activities. In turn, this project will help with the initiation of the intended renewable energy programme of the Government of Botswana and to encourage the development of the private sector industry in the provision of renewable energy in the country.

LIST OF ACRONYMS AND ABBREVIATIONS

BOTEC	Botswana Technology Centre
BPC	Botswana Power Corporation
BRET	Botswana Renewable Energy Technology
CP	UNDP Country Programme for Botswana (2003 -2007)
EAD	Energy Affairs Division
GHG	Greenhouse Gas
GEF	Global Environment Facility
GEF-SGP	Global Environment Facility – Small Grants Programme
JICA	Japanese International Cooperation Agency
LPG	Liquefied Petroleum Gas
MFDP	Ministry of Finance and Development Planning
MMEWR	Ministry of Minerals, Energy and Water Resources
MOU	Memorandum of Understanding
MPS	JICA Master Plan Study on Photovoltaic Rural Electrification
MYFF	UNDP Multi-year Funding Framework
NDP	National Development Plan
NEX	National Executed modality
NGO	Nongovernmental Organisations
NPV-REP	National PV Rural Electrification Programme
PDF B	Project Development Facility Block B
PIMS	Project Information Management System
PSC	Project Steering Committee
PV	Photovoltaic
RIIC	Rural Industries Innovation Centre
SADC	Southern African Development Community
SHS	Solar Home System
TRAC	Target for Resources Allocation from Core
UNDP	United Nations Development Programme
UNDAF	United Nations Development Assistance Framework

SECTION I: Elaboration of the Narrative

Section I-PART I: Situation analysis

Context and global significance

For people and markets located away from the main electricity grid, the absence of reliable and affordable renewable energy technologies for electricity generation has meant that the only possibility for the provision of electricity services is through small fossil fuel-based generators. In the absence of petrol or diesel generation, rural households rely largely on paraffin for lighting and dry cells/batteries to power radio-cassettes/TV. In addition to the respiratory and eye problems associated with prolonged exposure to paraffin, smoke and soot (poor indoor air quality), continued reliance on paraffin for lighting also adds to ever-increasing emissions of greenhouse gases (GHG). Recent advances in the renewable energy field, especially in photovoltaic (PV), have meant that some of these remote areas can now be provided with clean electricity services through renewable energy on a least-cost basis.

According to the Botswana Energy Master Plan prepared for the Energy Affairs Division (EAD) of the Ministry of Minerals, Energy and Water Resources (MMEWR) in June 1996, Botswana has an explicit commitment to equalizing the distribution of economic benefits between all parts of Botswana society. Energy, like education and health services, is a basic household need. For the long-term success of Botswana's economy and its society, access to basic energy services (cooking, heating and lighting) is essential.

The renewable energy resource situation that has been assessed during the implementation of the PDF B phase confirms that solar energy is available in abundant quantities, more or less equally distributed over the country throughout the year. Other renewable energy sources such as wind are limited, location specific and unevenly distributed during the year. Biomass energy is one of the main renewable energy sources currently being used in Botswana for cooking and heating. However, available biomass resources (both woody biomass and agricultural residues) are insufficient to generate and distribute electricity on a sustainable basis. As a result, the main focus for making use of renewable energy resources in Botswana will be on solar energy to be used with various PV-based electricity generation technologies; i.e., mobile solar systems, solar home systems, battery charging stations and mini-grids.

The Energy Master Plan proposes access to electricity through connection to the national grid, off-grid connection or PV to all those households where it makes economic and social sense, and improving the affordability of electricity to households. It also identified the following factors:

- Electrification planning should be integrated with other development planning; and
- Rural electrification should be regarded as part of the national electrification programme, albeit with different objectives and requirements to urban electrification.

With regard to renewable energy-based electrification, the Energy Master Plan states that PV electrification should be part of national electrification planning. Planning of PV electrification needs to take cognizance of grid expansion plans, and should be funded under the same principle that justifies grid rural electrification.

Rural electrification has been an important component of the national development agenda for Botswana. However, the high cost of rural grid electrification programmes have been a barrier, with the result that approximately 17% of the total rural population has access to grid electricity services, compared to 36% in the urban areas.

There are several previous / ongoing studies conducted in respect of PV. These include the JICA Master Plan Study on Photovoltaic Rural Electrification (MPS). The MPS was designed to formulate a master plan for the promotion of rural electrification in Botswana by using PV systems over a ten-year period, starting in 2003. The outcomes of the MPS have been largely used for the preparation of the UNDP-GEF supported Renewable Energy Based Rural Electrification Programme and furthermore it forms the basis for the same. The objectives of the MPS were to:

- Supply solar electricity, quickly and under affordable conditions, to households in rural areas that cannot benefit from grid electrification and other energy supply services;
- Implement the PV rural electrification project at the least cost practicable and in a financially feasible and sustainable manner;
- Integrate with infrastructure projects required for a specific region or area; and
- Expand environmentally friendly energy use.

Other prior initiatives on renewable energy-based rural electrification are:

- Botswana Renewable Energy Technology Project;
- Manyana PV Project;
- National PV Rural Electrification Programme;
- Motshegaletau Centralized PV System; and
- Global Environment Facility - Small Grants Programme (GEF-SGP) Solar Lantern Project.

Barriers analysis

The following barriers to the utilisation of renewable and low GHG technologies in rural areas in Botswana were identified during the preparation phase of the full-scale project:

- *Information and perception:* Insufficient knowledge about available technologies and technological developments; financial institutions being insufficiently aware of the financing needs / possibilities associated with the renewable energy sector; consumers not aware of the technologies that are available or have a wrong perception about what that technology can / cannot do, or how it is to be used / maintained;
- *Financing:* Donor-funded projects creating unrealistic price expectations amongst consumers; private sector companies in the renewable energy sector having difficulties raising sufficient credit to finance their operations; payments required from customers being either too high or too inflexible, resulting in a very small uptake and extremely slow market growth for PV systems;
- *Technology:* The balance between component quality and price is delicate and when components are too expensive, users may choose not to use them; poor people are being asked to 'experiment' with technologies, that is something that they can not afford to do; even the smallest interventions by customers (e.g., checking battery water levels) can be problematic;
- *Legal and policy:* The existing legal / policy structure is not particularly conducive to the growth of the renewable energy sector; and
- *Institutional/organisational:* Donor-funded projects are often implemented by public sector institutions rather than by the private sector; renewable energy is not yet considered an integral part of the country's rural electrification efforts; a weak link exists between the public and private sectors in respect of renewables.

The research on barriers has identified a number of premises or preconditions that an ideal delivery model for rural electricity based on renewable energy must adhere to, namely:

- It meets the demand of the rural customer as much as possible. As the rural customer is not one homogeneous group with the same demands and equal financial means, the ideal delivery model must be flexible enough in its technology and financing mix to suit the needs of the different market segments;
- It forms an integral part of an existing rural grid electrification programme. This means that the ultimate responsibility for the delivery model should rest with the same institution/authority responsible for rural grid electrification and that a project format for the implementation of the model is avoided;
- It promotes accessibility of information, actively create awareness and allows quick incorporation of new technologies (flexibility);
- It promotes close cooperation and collaboration between the public and private sectors and allows for ongoing human resources development (training) and development of a commercially viable renewable energy sector;

- It provides affordable off-grid electricity and renewable energy to customers in an efficient and effective manner;
- Incorporates methods for reducing theft of solar equipment; and
- It includes national standards and codes of practice for renewable energy systems to ensure consumer protection.

This project is designed to remove barriers to the introduction of renewable energy -based systems (notably PV) to meet the basic energy needs of rural communities in the targeted villages. It will adopt a market transformation approach to the PV market and is consistent with the terms of GEF Operational Programme 6. To the extent that it helps stimulate greater sales of PV to households and institutions, it will also help reduce both the incidence of respiratory and eye problems attributable to paraffin 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. Please refer to a detailed incremental cost analysis, including an incremental cost matrix, in Section II, Part I.

Stakeholder analysis

The development of this project proposal has been undertaken in a participatory fashion, consulting the major stakeholders throughout the process. This process began with a detailed socio-economic study of representative rural consumers; both those who have used renewable energy products and those who have not. In addition, consultation was undertaken with a wide range of groups and organisations who are stakeholders in this process, including representatives from the supply chain (end users, dealers, importers and international suppliers), NGOs, community based organisations, consultants and training institutions. Consultation was undertaken during the three stakeholder workshops held in March, June and September 2003 in Gaborone. Numerous meetings were also held over a nine-month period with key stakeholders on an individual basis.

Specifically, stakeholder consultation was undertaken with: EAD, MMEWR, UNDP, BPC, Ministry of Finance and Development Planning, Department of Meteorological Services, representatives from local / district authorities involved with rural development, the University of Botswana, Department of Vocational Education and Training, Madirelo Training and Testing Centre, RIIC, BOTECH, the financing sector, Botswana Bureau of Standards, Japan International Cooperation Agency, private sector companies involved in providing renewable energy, the National Aids Coordinating Agency and other health -based NGOs, the Citizen Empowerment Development Agency, Botswana Community Based Organisations Network and other rural consumer representatives and the Botswana Congress of NGOs. In addition, consultation with representatives from similar UNDP/GEF projects, including the on-going project in Lesotho, was undertaken. Please refer the detailed description of the Stakeholder Participation plan in Section IV.

The project contributes to achieve UNDAF objective 1 of the environment area: fulfil its obligations under the global and regional commitments and goals that it has signed. The project is also in line with MYFF 2004-2007 Goals and Service Lines 3.3” Access to Sustainable energy services”, and wholly meets with one of its Core Results under this Service Lines: “Access to energy services, electricity or cleaner fuels in rural areas increased”. Associated outcome in the Country Programme (2003 -2007) with the project is “Improved awareness and understanding among decision makers and the public of linkages between environmental sustainability and human poverty and well-being.” The project also contributes to the Country Programme output of “National capacity building of key government institutions, NGOs, and private sector strengthened and improved”.

Baseline analysis

This project is designed to remove barriers to the introduction of renewable energy -based systems (notably PV) to meet the basic energy needs of rural communities in the targeted villages. It will adopt a market transformation approach to the PV market and is consistent with the terms of GEF Operational Programme 6. Because this project is not requesting financial assistance from GEF for a subsidy per Wp of the PV equipment installed, incremental costs associated with this project are considered to be the costs of the activities designed to remove the barriers to PV electrification and to stimulate the PV market in rural Botswana. For this reason, the project will focus on putting conditions in place for long-term Government subsidies, stimulating cash sales and designing rural savings, credit and leasing mechanisms by the private

sector in combination with non-finance related conditions required to expand the market further (i.e., awareness, policy framework, training and institutional strengthening).

Furthermore, market survey information suggests that rural customers in Botswana use between 8.5 and 11.5 litres of paraffin per month, costing between USD 4.5 and USD 6. Battery expenses (for radio and torch) may run to an additional USD 4 to USD 5.5 per month, raising the monthly expenditure on lighting and entertainment to between USD 8.5 and USD 11.5. Because the costs of a PV-based system are still high in Botswana – USD 160 for a mobile system and USD 1,100 for an average 65-75 Wp system, including installation and a three-year maintenance contract - there are incremental costs associated with the purchase of PV systems.

However, market surveys show that over the five-year project period, the market for PV-based system in the targeted 88 villages could reach almost 35% of the 5,152 rural customers targeted for the PV lantern / LPG systems and around 10% of the 1,373 customers targeted for SHS. This would lead to CO₂ emission reduction from the introduction of PV-based systems for the supply of electricity for lighting and entertainment of approximately 52,000 tonnes of CO₂ over a 20-year period (based on an average 10 litres of paraffin savings per month per household). CO₂ reduction per litre of paraffin is taken as 3.2 kg. It is estimated that replication of the project activities to other parts of the country could reach between 25% and 35% of the current 140,000 to 160,000 rural customers. Extrapolating from the CO₂ calculation for the 88 targeted villages, the total reduction in CO₂ as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment is equal to approximately 345,000 tonnes of CO₂ over 20-year period (including the 52,000 tonnes of CO₂ reduction from the 88 targeted villages).

Section I-PART II: Strategy

Project Rationale and Policy Conformity

There are several reasons to promote the use of PV in Botswana through the removal of barriers. First is the fact that, at present, 65% of all villages (approximately 300) and 100% of all localities (381) with more than 200 people are not connected to the grid. In terms of households, 83% of all rural households are not yet connected to the grid. Even if the grid connection is extended as planned, by 2009 there will still be 194 villages and 379 localities, or 42% of all rural villages and 99% of all localities in Botswana that still require electricity services.

Botswana has excellent solar conditions, with an average of 320 clear, sunny days per year and an average global irradiation of 21 MJ m⁻²/day throughout the country. Therefore, introducing individual PV systems would make it possible, in the long term, for an estimated 25-35% of the 140,000 to 160,000 rural households to have their basic electricity needs met from the locally available solar resource. This will have the effect of reducing the number of liters of paraffin used for this purpose by 100-115 million over the 20-year life of the equipment. This will lead to global benefits by reducing GHG emissions. Thus, it is expected that the introduction of PV systems for the provision of electricity services in Botswana will generate a reduction of approximately 345,000 tonnes of CO₂ over a 20-year period, based on an average reduction of 108 million liters of paraffin. Please refer to the incremental cost analysis and matrix in Section II, Part I for more details.

Removal of the identified barriers to the use of renewables / PV will also provide the private sector with the necessary incentive to improve their services and extend / set up new businesses for the sale of renewables/PV systems. This will benefit rural customers in Botswana in that they will have access to environmentally clean electricity services without the long wait for the arrival of grid-connected electricity, or they will have access to alternative energy services in places where the grid is already connected. The net result will be four-fold:

- Provide rural consumers with a better quality of life;
- Create opportunities for income-generating activities based on the availability of electricity services, thus assisting in poverty eradication;
- Have potential to substantially reduce the rural energy sector carbon emissions; and

- Eliminate safety hazards associated with candle and paraffin fires, while simultaneously providing better indoor air quality (decrease the number of smoke and soot-related health problems associated with prolonged exposure to paraffin fumes).

Project Goal, Objective, Outcomes and Outputs/activities

Rural energy is recognised as an important element of rural socio-economic development – not as an end in itself, but through the services it makes possible. In this way, PV systems can have a significant impact on the lives of rural users. For example, energy can provide services such as the extension of daytime activities through lighting, entertainment by means of radios and televisions and pumping of potable water. Furthermore, PV projects in Botswana have always been implemented to provide social and communal services (e.g., powering health centres, schools and communal centres). These social and communal services can spark the provision of income-generating activities. For example, small solar systems may help promote productive activities (e.g., bars, restaurants, rural cinemas, telephone shops, technical and artisan workshops), powering small tools and appliances (drills, soldering irons, blenders), lighting and radio/TV. In this way, the provision of PV has helped to contribute to rural employment creation, albeit on a small scale. The proposed initiative will take pro-active measures to promote productive uses such as these.

Global objective: To reduce Botswana's energy related CO₂ emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with PV and LPG, for the purpose of providing basic energy services to rural homes and community users.

Development Objective: To improve people's livelihoods by improving their access to and affordability of modern energy services and assist the Government of Botswana with the initiation of a renewable energy programme for the rural areas, thus reducing the dependency on imported fossil fuel.

These objectives would be achieved by project activities designed to remove barriers to the wide-scale utilization of PV and LPG for providing energy services. 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 LPG.

The project consists of six components. Each of these six components is composed of an immediate objective, specific output(s) and a number of activities. By achieving these immediate objectives, the project will contribute towards the achievement of the global and development objectives.

1. Delivery of technology packages: *To implement three different delivery models targeting different end-user groups and making use of different PV and PV/LPG-based technology packages.*
2. Policy support and policy framework: *To assist with the development of policy and institutional arrangements conducive for the integration and provision of off-grid electricity services within the existing rural grid electrification programme.*
3. Awareness raising and changing of perceptions: *To increase awareness and change perceptions among the general public, decision-makers and rural consumers on the potential role of PV and LPG in meeting basic energy needs.*
4. Private and public sector strengthening and training: *To strengthen and support the public and private sector working in the PV and renewable energy sector to provide better quality of service.*
5. Financial engineering: *To assist with the development of appropriate financing mechanisms for the larger scale dissemination of PV-based technologies to rural customers.*
6. Learning and replication: *To disseminate experience and lessons learned to promote rapid implementation of rural electrification based on renewable and low GHG technologies throughout the country.*

Project Indicators, Risks and Assumptions

In implementing the proposed initiative a number of risks exist. A first level of risk relates to the rural consumers who might not approach the rural sales outlets for either PV Lanterns and mobile systems/LPG or SHS technology packages as a result of a) lack of awareness and b) lack of sufficient funding to purchase what are very expensive technological solutions for most rural customers. This risk has been mitigated through a number of activities to increase the awareness with rural customers (components 1, 3 and 6),

design appropriate funding mechanisms tailored to the needs and abilities of rural customers (component 2) and through Government subsidies, that decrease from 80% the first year, to 60% in the fifth year of the project period.

A second level of risk relates to the fact that there will be a permanent need for subsidies for rural electrification in Botswana, whether based on grid extension, isolated mini-grids or stand alone household systems. The current allocated funding from the Central Government is committed under the NDP 9 and there is no institutionalized financial mechanism reaching beyond the project period of five years. There is clearly a risk that without continued subsidies up to levels of 80%, no (renewable energy-based) rural electrification will occur after the project period. This risk has been addressed within the project through activities that focus on awareness raising with key decision-makers (components 1, 3 and 6), policy support to include renewable energy-based electrification as a least cost option for rural electrification into national policy and plans (component 2) and by creating an implementation infrastructure for cost-effective and efficient delivery of renewable energy-based electrification to rural customers throughout Botswana (components 4, 5 and 6).

A third level of risk relates to the continued participation of the private sector who are considered to be the prime movers for implementation of the proposed initiative and to continue renewable energy-based rural electrification long after the project period has come to an end. Their active involvement could be lacking as a result of a) not having in place a skilled and informed labor force for design, implementation and maintenance services or b) not having sufficient incentives in place to justify involvement and investment by this sector. These risks have been mitigated by activities that relate to training and private sector strengthening (component 4), the provision of subsidies on hardware from Government, combined with setting up appropriate financing mechanisms for rural consumers (component 5), and by giving the private sector the lead role in implementing the proposed activities. Furthermore, the principle of Government creating the enabling environment for private sector implementation that has been adhered to in the proposed initiative – in combination with the above components - sends a clear message to the private sector that a long-term sustainable market for renewable energy-based rural electrification is being considered seriously. The learning and replication activities included under component 6 add confidence to the existence of a longer-term market.

The fourth level of risk relates to the replication of the proposed activities throughout rural Botswana. A combination of activities that have put in place the conditions for replication, such as policy support (component 2), increasing awareness (component 3), training related activities (component 4), increasing access to (rural) finance (component 5) and close monitoring of lessons learned (component 6), provide a solid basis for replication. However, this is going to be largely based on successful implementation of the here proposed activities in combination with continued Government support (mainly financial support through subsidies) after the 5-year GEF support has come to an end.

The fifth and final level of risk relates to the very high HIV/AIDS infection rates in Botswana, reaching approximately 30% of the rural adult population. This is not a risk unique to this project, but one that can be found in each and every activity being implemented in Botswana. Although the Government of Botswana is expending substantial time and effort to tackle this problem on a national basis, very few effective risk mitigation activities can be made available under the proposed initiative other than programming additional financial resources for training and capacity strengthening. This is necessary as more people will need to be trained to ensure sufficient available and qualified personnel for the longer term. It should also be mentioned that early deaths from HIV/AIDS will result in loss of income for already poor rural households that will have an immediate effect on those households' ability to purchase consumer goods, including PV systems. No effective risk mitigation activity under the proposed initiative is capable of dealing with this national macro-economic phenomenon other than the possibility to increase the already substantial Government subsidies.

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 programme design, planning and implementation are immediately dealt in the most appropriate manner.

Although this type of programming is not specifically related to an identified risk, it does increase the implementation efficiency of the proposed activities.

Expected global, national and local benefits

In summary, this project aims to integrate the use of renewables for rural electrification into Botswana's national development programming, including allocation of long-term (institutionalized) financial assistance for such programmes. The Government has allocated subsidies of between 60-80% towards the cost of providing basic electricity services to approximately 6,500 rural customers as part of the proposed project. This project also encourages the development of a strong private sector involvement in PV activities by making appropriate financing mechanisms for dealers and suppliers and consumers available, as well as training and activities to improve product and service quality (e.g. codes and standards, including enforcement).

Component 6 of the project has been designed to replicate models, approaches and lessons learned, both within the 88 targeted villages and the rest of Botswana. 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 PV companies will expand their business to other regions in the country (some are already operating country-wide), thus replicating delivery and financing modalities. This replication is dependent, however, on the provision of sustainable and long-term subsidies by the Government of Botswana. Please refer to Section IV, Part VIII for detailed information on the most prominent risk for long-term sustainability of the project's impacts; i.e. financial sustainability after the project has come to an end. Please note that the information presented in Section IV has been prepared as part of the request from the GEF Secretariat to provide detailed information on (financial) sustainability as part of the CEO endorsement documentation. A mission to Botswana was fielded early March 2005 during which the main actors have been involved in preparing this information.

Country Ownership: Country Eligibility and Country Drivenness

Botswana ratified the UNFCCC on 27th January 1994. The project has been developed in close consultation with various key Government Ministries and is supported at the highest political level. The Government attaches high priority to providing basic energy services to its rural communities, as expressed in its National Development Plan 9 and by making USD 3.8 million available from its National Budget to implement this initiative in support of this policy commitment. One of the strategic objectives for the energy sector in Botswana relates to reducing the fossil fuel dependency and promoting the use of renewable energy. Other objectives include promoting the development of the private energy sector through private participation and public-private partnerships and studying the potential role of renewable energy, particularly for rural electrification. The project is fully in conformity with the GEF Operational Programme # 6: Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. Its focus is on the strategic priority # 4: Off-grid Renewable Energy for Productive Uses.

Sustainability and Replicability

Key indicators include the number of PV systems sold over the lifetime of the project, combined with the reduced consumption of paraffin for customers switching to PV-based systems. Another important indicator is the price of PV systems and the number of dealers involved in the PV market. The project's monitoring and evaluation system will make provision for gathering 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 in the project activities and willingness at the political level to provide subsidies for renewable energy-based rural electrification. Assumptions will be monitored and the project intervention strategy adapted accordingly. Please refer to the logical framework in Section II, Part II for more details.

Section I-PART III: Management Arrangements

The programme will be executed by the Government of Botswana, under the UNDP National Executed (NEX) modality following NEX guidelines and requirements that are set out in the UNDP Programming Manual. Experience has shown that NEX provides the best opportunity for project support in conformity with Government priorities and to ensure national ownership. The EAD of the MMEWR will serve as overall executing agency for the UNDP/GEF full-scale programme. The executing agency will remain accountable

to UNDP for the delivery of agreed outputs, and for financial management, including the cost-effectiveness of project activities. The executing agency must appoint a National Director, who supports the project and serves as a focal point on the part of government.

BPC will be the implementing agency. For the day-to-day operation of the programme, one full-time advisor will be made available, fully funded through GEF. That advisor will fall under the overall management of BPC and it will operate based on agreed work plans and according to UNDP rules and procedures.

In addition, the Tripartite Project Steering Committee (PSC) which was set up to steer the implementation of the PDF B activities will continue to function throughout the life of the proposed project. It contains representatives of the executing agency (EAD), the implementing agency (BPC) and UNDP-Botswana who represents GEF. The PSC will take broad strategic decisions on project implementation. An advisory board will be set up and it will be formed from a larger audience consisting of representatives from the Government, para-statal, private sector, financial community, academia, NGOs, etc. The Terms of reference for the PSC and Chief Technical Advisor are provided in Section IV, Parts III and IV.

The private sector will have a key role in the implementation of the programme, and are seen as the 'driver' of the project. To ensure active participation from the private sector, the project will issue consultancy contracts to employ existing private sector participants to carry out awareness training, demonstration projects, work on financing packages, etc.

UNDP-Botswana provides support services upon request from the executing agency in accordance with the regulations, rules and procedures of UNDP. The nature and scope of support services is described in Section IV: Letter of Agreement between UNDP and the Government of Botswana for the Provision of Support Services. The manner and methods of cost-recovery by UNDP country office in providing the support services are specified in the attachment to Section IV, Part VI.

The Government co-sharing of 19 million Pula will be administered under the responsibility of the Ministry of Mines, Energy and Water Resources. Monitoring procedures for the administration of the co-sharing contribution will be detailed at the outset of the project and agreed upon by the Project Steering Committee in which also UNDP takes seat. In Section IV, Part VII a preliminary disbursement scheme for the Government contribution has been prepared. Please note that the information presented in Section IV has been prepared as part of the request from the GEF Secretariat to provide detailed information on financial mechanisms as part of the CEO endorsement documentation. A mission to Botswana was fielded early March 2005 during which the main actors have been involved in preparing this information.

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 acknowledgement 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.

Section I-PART IV: Monitoring and Evaluation Plan

The project will be monitored and evaluated according to standard UNDP rules for nationally executed projects. The Energy Affairs Division of the Ministry of Minerals, Energy and Water Resources will monitor activities to ensure that they are carried out appropriately and in a timely manner as per the work plan. For each of the six components, a monitoring plan will be prepared during the project's inception phase.

Following UNDP's change to results based management the country office has developed a new format for work plans. That format emphasises achievements (benchmarks and milestones), as well as cost per output/result. This format will allow for a critical assessment of programme performance as it shows, at a glance, what activities are to take place, when they take place, 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. UNDP will have the monitoring and reporting obligation for the programme. In this connection, additional monitoring and evaluation missions will be undertaken by UNDP when this is judged to be required when, for example, 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.

The impact of the proposed initiative in terms of emission reductions is of immediate interest for GEF, as this is their main mandate. Associated impacts such as market developments for PV operations and increasing income generating activities are considered important as well as both contribute to the sustainability of the proposed initiative and hence the (continued) reduction of emissions of CO₂. In order to properly and practically monitor these impacts it will be necessary that baselines be established prior to introducing and disseminating the PV based technologies. Further, it will be necessary to identify a number of (easily) measurable indicators that can be used for the 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 re-direct the project's implementation. Please refer to Section IV for a more detailed presentation of the project planning matrix/logical framework, including its indicators for monitoring and evaluation. Please note that the information presented in Section IV has been prepared as part of the request from the GEF Secretariat to provide detailed information on the logical framework indicators as part of improving the Monitoring and Evaluation strategy/activities as part of the CEO endorsement documentation. A mission to Botswana was fielded early March 2005 during which the main actors have been involved in preparing this information.

Two independent external evaluations will be carried out. One mid-term evaluation after approximately 2.5 years of project implementation and one evaluation will be carried out towards the end of the programme. 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. A terminal evaluation will assist programme stakeholders to draw lessons learned for use in improving the quality of future development interventions with similar activities. UNDP regulations have no formal requirements for an end-of programme evaluation, so it should be needs-based. The evaluation could be done in collaboration with other development partners.

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. The project shall be audited on a yearly basis for each financial year starting in January and ending in December as per the National Execution and Global Environment Facility requirements. The Energy Affairs Division of the Ministry of Minerals, Energy and Water Resources shall also certify the yearly Combined Delivery Reports issued by UNDP based on financial statements prepared by the Chief Technical Advisor. Provisional approval of reports shall be submitted in accordance with the required deliverables and shall take place as per the defined milestones indicated in the delivery schedule at the start of the project. It is expected that such approval shall not exceed 10 working days from the notification of the completion of a specific milestone. On submission of the final report, the Executing Agency shall consult all stakeholders and respond within 21 working days.

Please refer to Section IV-Part IX for a proposed detailed M&E plan including an indicative budget.

Section I-PART V: Legal Context

This document shall be the instrument referred to as “Project Documents or other instruments” in Article 1 of the Standard Basic Assistance Agreement between the Government of Botswana and the United Nations Development Programme, signed by the Parties on 14th May 1975. The Government counterpart shall, for the purpose of the Standard Basic Assistance Agreement refer to the Government cooperating agency described in that Agreement.

UNDP acts in this project as Implementing Agency of the Global Environment Facility (GEF), and all rights and privileges pertaining to the UNDP as per the terms of Standard Basic Assistance Agreement shall be executed ‘*mutatis mutandis*’ to GEF.

The UNDP Resident Representative in Botswana is authorized to effect in writing the following types of revisions to this project document, provided s/he has verified the agreement thereto by the UNDP-GEF unit and is assured that the other signatories of the project documents have no objections to the proposed changes:

1. Revisions in, or addition of, any of the annexes to the project document;
2. Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of inputs already agreed to or by cost increases due to inflation;
3. Mandatory annual revisions, which rephrase the delivery of agreed project inputs or reflect increased expert or other costs due to inflation, or take into account cooperating agency expenditure flexibility; and
4. Inclusion of additional annexes and attachments relevant to the Project Document.

Audit Clause

The Government will provide the Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

Section I-PART VI: Annual Budget

Please find presented on the next page an overview of the Annual Budget that will be available for project activities. The available budget has been divided by source; i.e. from GEF and from the Government of Botswana. In Section III a detailed work plan and subsequent budget has been presented in the ERP (Atlas) format (i.e. the UNDP internal project management and accounting software).

Section I-Part VI: Annual Budget / Cash contributions of the GEF and the Government of Botswana

All amounts in US Dollars		Year 1	Year 2	Year 3	Year 4	Year 5	Total
Component 1 Implementing Hardware	Total	435,834	401,638	605,483	770,310	755,792	2,969,057
	GEF	240,000	180,000	80,000	60,000	40,000	600,000
	Govt.	195,834	221,638	525,483	710,310	715,792	2,369,057
Component 2 Policy/Institutional	Total	76,820	70,620	66,400	66,400	66,400	346,640
	GEF	50,000	50,000	50,000	50,000	50,000	250,000
	Govt.	26,820	20,620	16,400	16,400	16,400	96,640
Component 3 Awareness Raising	Total	207,280	182,480	165,680	170,880	173,280	899,600
	GEF	100,000	100,000	100,000	100,000	100,000	500,000
	Govt.	107,280	82,480	65,680	70,880	73,280	399,600
Component 4 Training	Total	198,162	103,362	312,262	215,880	218,280	1,047,946
	GEF	40,000	20,000	200,000	145,000	145,000	550,000
	Govt.	158,162	83,362	112,262	70,880	73,280	497,946
Component 5 Financial Engineering	Total	426,820	70,620	66,420	58,000	58,000	679,860
	GEF	400,000	50,000	50,000	50,000	50,000	600,000
	Govt.	26,820	20,620	16,420	8,000	8,000	79,860
Component 6 Learning and Replication	Total	105,820	99,620	95,420	95,400	95,400	491,660
	GEF	79,000	79,000	79,000	79,000	79,000	395,000
	Govt.	26,820	20,620	16,420	16,400	16,400	96,660
Monitoring & Evaluation	Total	47,820	41,620	37,420	37,420	37,420	201,700
	GEF	21,000	21,000	21,000	21,000	21,000	105,000
	Govt.	26,820	20,620	16,420	16,420	16,420	96,700
TOTAL	Total	1,498,557	969,960	1,349,086	1,414,290	1,404,572	6,636,463
	GEF	930,000	500,000	580,000	505,000	485,000	3,000,000
	Govt.	568,557	469,960	769,086	909,290	919,571	3,636,463

SECTION II: Strategic Results Framework and GEF Increment

Section II-PART I: Incremental Cost Analysis

Project Activity	Baseline	Alternative	Increment
<p>Component 1:</p> <p>Implementing three delivery models with different technology packages and financing aimed at different socio-economic strata</p>	<p>The JICA initiated fee-for-service model in three pilot villages and the BOTEC implemented mini-grid in one pilot village will be the only delivery models actively supported.</p> <p>Cash sales of SHS and PV lanterns through private sector as is currently the case will continue although at a limited scale with relative small (or no) growth.</p> <p>Bottled LPG for cooking will focus on urban and urbanised rural areas only.</p> <p>Cost: USD 50,000 (in-kind BPC, BOTEC)</p>	<p>5,152 households in 88 selected villages will be targeted for the implementation of PV lantern/LPG systems.</p> <p>1,373 households in 88 selected villages will be targeted for the implementation of SHS via cash sales, lay bye and credit models.</p> <p>In one village a mobile PV mini-grid will be installed, operated and closely monitored.</p> <p>Cost: USD 50,000 (in-kind BPC, BOTEC) USD 600,000 (GEF) USD 2,369,057 (Govt. of Botswana) USD 1,197,145 (end-users) <u>USD 90,000 (in-kind Government)</u> Total: USD 4,306,202</p>	<p>Increased application of PV-based systems and increased use of LPG for cooking in rural areas (notably in the 88 villages).</p> <p>Increased activity and growth within the private sector community dealing with PV and LPG systems.</p> <p>Increased understanding on PV mini-grid operations leading to recommendations for possible scaling up of such systems as a means of rural pre-electrification units.</p> <p>Incremental cost: USD 600,000 (GEF) USD 2,369,057 (Govt. of Botswana) USD 1,197,145 (end-users) <u>USD 90,000 (in-kind Government)</u> Total: USD 4,256,202</p>
<p>Component 2:</p> <p>Policy support and policy framework</p>	<p>Renewable energy-based rural electrification activities will not be integrated into national (rural electrification) planning.</p> <p>Recommendations provided by the Master Plan Study on PV rural electrification will not be implemented as a result of lacking political support and funding.</p> <p>Various initiatives on rural energy, renewables and rural electrification will be un-coordinated.</p> <p>Existing standards and codes of practice for PV systems will not be enforced or will be insufficient.</p>	<p>Assessments on how renewable energy-based rural electrification can be made part of national policy and plans, including recommendations for such inclusion.</p> <p>Review and if necessary amend/update the currently existing PV standards and codes of practice, including recommendations for an implementation and enforcement mechanism of the same.</p>	<p>Renewable energy-based rural electrification activities are integrated into national plans, including the allocation of funding for its implementation.</p> <p>PV standards and codes of practice have been updated and mechanisms for enforcement have been designed, including recommendations for implementation.</p>

	<p>Cost: USD 0</p>	<p>Cost: USD 250,000 (GEF) USD 96,640 (Govt. of Botswana) USD 50,000 (in-kind Government) Total: USD 396,640</p>	<p>Incremental cost: USD 250,000 (GEF) USD 96,640 (Govt. of Botswana) USD 50,000 (in-kind Government) Total: USD 396,640</p>
<p>Component 3: Awareness raising and changing of perceptions</p>	<p>Decision-makers not fully sensitized with regard to the role that PV/renewable energy can play in rural electrification.</p> <p>Consumers are not fully aware of the potential of utilizing PV, as an alternative to paraffin, candles and dry cells to obtain safe and efficient lighting/electricity services in off-grid situations.</p>	<p>To develop targeted awareness and information packages for both decision makers as well as rural end-users.</p> <p>Organise appropriate ways of delivering these awareness and information packages such as field trips (decision makers), multi-media, local schools, PV powered video (road) shows (rural end-users), etc.</p>	<p>Increased awareness and changed perceptions with (key) decision makers, thereby creating a basis for putting in place the policy and institutional framework for increased use of PV/renewable energy for rural electrification.</p> <p>Increased awareness with rural end-users, thereby creating a necessary but not sufficient condition for increased uptake of PV and PV/LPG systems through (subsidized) cash sales, lay bye, savings, lease and credits models.</p>
	<p>Cost: USD 0</p>	<p>Cost: USD 500,000 (GEF) USD 399,600 (Govt. of Botswana) USD 100,000 (in-kind Government) Total: USD 999,600</p>	<p>Incremental cost: USD 500,000 (GEF) USD 399,600 (Govt. of Botswana) USD 100,000 (in-kind Government) Total: USD 999,600</p>
<p>Component 4: Private and public sector strengthening, training</p>	<p>Capacity for design and implementation of national policy and plans that incorporate renewable energy-based rural electrification will be limited.</p> <p>Private sector capacity for quality interventions with regard to PV based systems (installation, monitoring, after sales services) will be low and available with a small number of entrepreneurs only.</p> <p>Business development services in the renewable energy sector are weak and/or non-existing.</p>	<p>Assist BPC (the implementing agency) with the setting up and running of a unit that manages renewable energy-based rural electrification.</p> <p>To assist EAD with capacitating the existing human resource base through provision of earmarked training for matters related to policy development.</p> <p>Develop and implement a variety of technical courses on relevant topics such as a) financing small-scale renewable energy systems, b) sizing, installation and maintenance of PV systems, c) best practices</p>	<p>Public sector's ability to provide a policy framework and to provide services to further renewable energy-based rural electrification (notably PV) has been strengthened.</p> <p>The technical knowledge on the installation, monitoring and after sales services for PV-based systems has been improved to acceptable quality levels.</p> <p>Business development services in the renewable energy sector (notably PV) have been strengthened amongst (emerging) businesses that focus on rural</p>

	<p>The PV sector businesses will not join forces to organise and lobby for activities that could assist the sector as a whole (information, labelling, addressing the theft issue, etc.)</p>	<p>on PV activities. These courses to be made available to local PV entrepreneurs.</p> <p>Provide business planning and development services and earmarked on-the-job training for local PV entrepreneurs focusing on emerging businesses in rural areas.</p> <p>Provide assistance for activities that could be proposed by a newly set up 'PV association of Botswana'</p>	<p>clients.</p> <p>Sector wide assistance will be provided, thereby improving the overall sector performance and quality of the interventions to be made by PV companies</p>
	<p>Cost: USD 10,000 (in-kind Government) USD 10,000 (in-kind private sector)</p>	<p>Cost: USD 20,000 (in-kind Gvt/Private) USD 550,000 (GEF) USD 497,946 (Gvt. of Botswana) USD 100,000 (in-kind Government) Total: USD 1,167,946</p>	<p>Incremental cost: USD 550,000 (GEF) USD 497,946 (Gvt. of Botswana) USD 100,000 (in-kind Government) Total: USD 1,147,946</p>
<p>Component 5: Financial Engineering</p>	<p>Despite some interest, very little actual lending for or investment in the PV market occurs.</p> <p>As the market slowly expands, the lack of financing to PV consumers and industry will become a major bottleneck to the expansion of the market.</p> <p>Limited funds are available for financing PV consumers and companies.</p> <p>Long-term (necessary) subsidy schemes for renewable energy-based rural electrification will not be designed and put into operation.</p>	<p>To design, test and evaluate viable financing options / mechanisms for disseminating renewable energy-based rural energy services.</p> <p>Put in place a retailer financing scheme that meet rural conditions in Botswana.</p> <p>To design a sustainable (long-term) subsidy scheme for PV and PV/LPG systems, including recommendations for its implementation.</p>	<p>Valuable experiences on setting up appropriate financing schemes for rural energy services are obtained.</p> <p>Access and availability of investment capital for retailers has been made available through for example an acceptable guarantee schemes.</p> <p>Longer-term financing in the form of subsidy schemes for renewable energy-based rural electrification have been designed and recommendations for their implementation have been put forward for consideration by the Botswana Government (EAD and Ministry of Finance).</p>
	<p>Cost: USD 10,000 (in-kind private sector)</p>	<p>Cost: USD 10,000 (in-kind Private) USD 600,000 (GEF) USD 79,860 (Gvt. of Botswana) USD 50,000 (in-kind Government)</p>	<p>Incremental cost: USD 600,000 (GEF) USD 79,860 (Gvt. of Botswana) USD 50,000 (in-kind Government)</p>

<p>Component 6: Learning and replication</p>	<p>No structured learning and dissemination of activities in the baseline scenario. Limited ability to learn from projects both with and outside the country.</p>	<p>Total: USD 739,860</p> <p>Closely follow the implementation of component 1 and initiate a national programme to replicate the use of PV to generate electricity to supply off-grid consumers. Closely monitor and document the implementation of the fee-for-service model in three villages (JICA project) and draw conclusions for possible up-scaling of the fee-for-service model. Evaluate the impact of the project intervention in the project area (88 villages and one village where mini-grid is operated) Document experiences disseminate to a larger audience in/outside Botswana</p>	<p>Total: USD 729,860</p> <p>Recommendations for inclusion of renewable energy-based rural electrification are made based on experiences gained under component 1. Basis for decision making on fee-for-service model exists. Improved understanding of impact of PV on rural livelihoods and poverty alleviation. Lessons learned documented and a dissemination programme for such is in place.</p>
<p>Component: (Impact) Monitoring and Evaluation</p>	<p>Cost: USD 20,000 (in-kind Government)</p> <p>No monitoring of impacts on CO2 emission reduction and improvement of rural livelihoods will occur.</p> <p>Cost: USD 0</p>	<p>Cost: USD 20,000 (in-kind Government) USD 395,000 (GEF) USD 96,660 (Govt. of Botswana) USD 105,000 (in-kind Government) Total: USD 616,660</p> <p>To design a baseline, indicators and means of verification for monitoring impacts on a) CO2 emission reduction, b) PV market development and c) income generating activities in rural areas. Implement the impact monitoring and evaluation scheme on an annual basis.</p> <p>Cost: USD 105,000 (GEF) USD 96,700 (Govt. of Botswana) Total: USD 201,700</p>	<p>Incremental cost: USD 395,000 (GEF) USD 96,660 (Govt. of Botswana) USD 105,000 (in-kind Government) Total: USD 596,660</p> <p>Impacts resulting from the proposed intervention have been measured, analysed and serve as a management tool for the project management team.</p> <p>Incremental cost: USD 105,000 (GEF) USD 96,700 (Govt. of Botswana) Total: USD 201,700</p>
<p>Total Costs</p>	<p>Cost: USD 100,000 (in-kind Govt./Private)</p>	<p>Cost: USD 3,000,000 (GEF) USD 5,428,608 (Others)</p>	<p>Overall Incremental cost: USD 8,328,608</p>

		Total: USD 8,428,608	(exc. USD 365,000 for PDF B)
Global Environmental Benefits	An estimated 10,000 tonnes of CO2 emissions avoided over 20 years in Botswana due to anticipated baseline activities.	In the project area an amount of 52,000 tonnes of CO2 avoided over 20 years through PV adoption as a direct result of the proposed initiative. Nationwide reduction of approximately 345,000 tonnes of CO2 over a period of 20 years through PV adoption.	Nationwide, approximately 335,000 tonnes of CO2 will be reduced over 20 years.
Domestic Benefits	The inclusion of renewables for rural electrification into national development plans remains at policy levels with limited translation to large-scale implementation. PV market continues with slow growth. Most rural households continue using paraffin for lighting, being exposed to smoke and soot.	Renewable energy based rural electrification as a cost-effective alternative to be considered (and budgeted for) in planning and implementation of rural electrification activities. Over 5 years, in the project area an approximate 6,500 households and in 20 years nationwide 45,000 households will be provided with basic electric energy services based on PV systems. Significant reduction in exposure to paraffin smoke and soot.	Nationwide 108 million litres of paraffin will be saved over a period of 20 years. Significant reduction in exposure to indoor air pollution from paraffin.

Section II-PART II: Logical Framework Analysis / Project Planning Matrix

Please note that the information presented below is an updated version of the Project Planning Matrix and has been prepared as part of the request from the GEF Secretariat to provide detailed information on the logical framework indicators as part of improving the Monitoring and Evaluation strategy/activities. A mission to Botswana was fielded early March 2005 during which the main actors have been involved in preparing this information.

Baseline year: PDF B activities finished in September 2003 and since project inception is anticipated in the 3rd Quarter of 2005, the data for the baseline needs to be updated. This will be done at the inception of the project by the Project Management Unit. This updating will be based on outcomes of the PDF B as well as methodologies and approaches used to generate the baseline information as are included in the reports produced as part of the PDF B consultancy; notably the *socio-economic assessment* report.

Impact Monitoring: To the extent possible the indicators presented in the logical framework have been selected to allow for monitoring project **impacts** rather than ‘just meeting project objectives and outputs’.

STRATEGY	INDICATORS	MEANS OF VERIFICATION	CRITICAL ASSUMPTIONS
Global objective: To reduce Botswana’s energy related CO ₂ emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with PV and LPG for the purpose of providing basic energy services to rural customers and community users.	By the end of the project, consumption of paraffin reduced by 80% in households using PV-based systems for lighting compared to the baseline.	End-user surveys.	Paraffin prices will not significantly drop.
	By the end of the project small-scale PV-based business activities increase by 30% when compared to baseline year.	Dealer surveys. Market surveys.	The proposed disbursement scheme for Government subsidies is implemented successfully.
	Renewable energy main-streamed into national policy making and planning within 10 years.	NDP 9 and 10 and other Government planning reports.	
	Incidence of paraffin-related respiratory and eye diseases reduced by 10% over 20 years within those households using PV-based systems. ¹	Medical survey in the project area.	

¹ *The project logical framework presents indicators at different levels: At the level of global and development objective, energy consumption indicators are expressed over 20 years as it is required by the GEF to monitor impacts. Other more intermediary indicators are included for immediate objectives. As the project duration is only 5 years, measuring impacts after 20 years will lie with the Government of Botswana who will be involved in collecting and analyzing information on renewable energy based rural electrification in any event in order to steer and revise as appropriate their (subsidy) interventions in this regard. The project will ensure that CO₂ monitoring – which essentially is indirectly monitored through determining the reduced fossil-fuel consumption/increased PV-based electricity consumption – will be included in Government impact monitoring schemes after the project has ended. The same is the case for health related impacts such as respiratory and eye diseases.*

<p>Development Objective: To improve people's livelihoods by improving their access to and affordability of modern energy services and assist the Government of Botswana with the initiation of a renewable energy program for the rural areas, thus reducing the dependency on imported fossil fuel.</p>	<p>Volume of sales by PV dealers increased by 60% by the end of the project.</p> <p>The number of PV dealers operating in the Botswana market increased by 30% by the end of the project.</p> <p>The number of income generating activities emerged in combination with the turnover / profit of these activities / businesses. It is anticipated that in 2 years 1% and in 5 years 3% from the households supplied with PV systems will be involved in income generating activities</p>	<p>Dealer surveys.</p> <p>End-user surveys.</p>	<p>Paraffin prices will not significantly drop.</p> <p>The Government will actively support PV-based systems through – among others – implementing subsidy schemes as proposed under this initiative..</p>
<p>Immediate Objective 1: To implement three different delivery models targeting different end-user groups and making use of different PV and PV/LPG-based technology packages.</p>	<p>The number of PV systems sold in the targeted 88 villages during the 5-year project period will be 6,525 as compared to the baseline scenario of a few hundred.</p>	<p>Dealer surveys</p>	<p>The Government is willing to provide subsidies on the cost of the systems, initially of 80% and dropping to 60% over the five year project</p>
<p>Output 1.1: In 88 villages, 5,152 households will be offered basic lighting and cooking facilities.</p>	<p>By the end of the project 5,152 PV/LPG systems are being used for lighting and cooking.</p> <p>Paraffin consumption for lighting has been reduced by 80% by the end of the project.</p>	<p>Project implementation and progress reports.</p> <p>End-user surveys</p>	<p>The Government is willing to provide subsidies on the cost of the systems, initially of 80% and dropping to 60% over the five year project</p> <p>End-users are able and willing to adopt new technologies.</p>
<p>Output 1.2: In 88 villages, 1,373 households will be offered SHS.</p>	<p>By the end of the project 1,373 SHS are being used for lighting, entertainment and small-scale income-generating activities.</p> <p>Paraffin consumption for lighting has been reduced by 80%.</p>	<p>Project files, including monitoring reports.</p>	<p>The PV mini-grid hardware at Motshagaletau is made available for use by the project.</p>
<p>Output 1.3: In one village, a mobile PV mini-grid will be installed, operated and closely monitored.</p>	<p>220 V electricity - by means of a PV mini-grid - is being supplied in one village in Year 2 of the project connecting a minimum of 15 Households.</p>	<p>NDP 10 and other Government documents prepared in the process of developing institutional</p>	<p>Government is amenable to change and decision-makers willing to base decisions on knowledge acquired.</p>
<p>Immediate Objective 2: To assist with the development of policy and institutional arrangements conducive to the integration and provision of off-grid electricity services within the existing rural electrification program.</p>	<p>By the end of the project, renewable energy-based (rural) electricity features are integrated in national policy plans (NDP 10) as a cost-effective alternative.</p>		

<p>Output 2.1: A policy and implementation framework for renewable energy-based rural electrification (mainly PV systems) will be defined and is in place.</p>	<p>The rate of reported system faults has decreased by 30% compared to the baseline year.</p>	<p>and policy frameworks for integrated RE-based rural electrification.</p>	
<p>Output 2.2: Standards for PV and PV/LPG components and systems will be updated and their use enforced.</p>		<p>End-user surveys. Dealer surveys.</p>	<p>Dealers and installers are willing to adopt updated standards, and enforcement mechanisms are implemented and strictly applied.</p>
<p>Immediate Objective 3: To increase awareness and change perceptions among the general public, decision makers and rural customers on the potential role of PV and LPG in meeting basic energy needs.</p>			
<p>Output 3.1: Awareness program for decision-makers will be developed and implemented.</p>	<p>Not less than 20% of the targeted 88 villages have been visited by (key) decision-makers during no less than five field trips during the implementation of the 5-year program.</p>	<p>Reports prepared on these field trips as part of the project progress docs.</p>	<p>Willingness of high-level decision-makers to undertake multi-day field trips to remote, rural villages.</p>
<p>Output 3.2: A rural customer awareness program will be formulated and implemented.</p>	<p>Number of customers enquiring for information about PV systems at local (rural) dealer/retailer shops has increased by 100% by Year 3 of the project implementation and by 200% by the end of the project compared to the baseline year.</p>	<p>Dealer surveys, including local rural retailer shops. End-user surveys</p>	<p>Market actors are willing to cooperate in providing this information.</p>
<p>Immediate Objective 4: To strengthen and support the public and private sector working in the PV and renewable energy sector to provide better quality of service to rural areas.</p>	<p>Number of businesses dealing with PV systems increased by 30% by the end of the project compared to the baseline year.</p>	<p>Dealer surveys.</p>	<p>Market actors are willing to cooperate and businesses are eager to expand.</p>
	<p>Level of end-user satisfaction with installation and after sales service increased by 50% by the end of the project compared to the baseline year.</p>	<p>End-user surveys.</p>	
	<p>The percentage of PV-based systems introduced as part of the project that is still fully operational at mid-term of the project is 70% or above and 60% or above at the end of the project.</p>	<p>Evaluation reports End-user surveys</p>	

<p>Output 4.1: Business development services in the renewable energy sector (mainly PV) will be strengthened.</p>	<p>At least 50% of all PV dealers/ companies participated in at least one capacity building activity offered by the project.</p>	<p>Project files. Dealer surveys.</p>	<p>Willingness of private sector to invest time in training.</p>
<p>Output 4.2: Technical knowledge of PV and PV/LPG systems will be strengthened.</p>	<p>70% of all technical training courses offered to vendors, dealers, technicians, etc. are completed.</p>	<p>Project files.</p>	<p>Willingness of private sector to invest time in training.</p>
<p>Output 4.3: The ability of the public sector and para-statal to provide a policy framework and assistance to further renewable energy-based rural electrification (notably PV) will be strengthened.</p>	<p>70% of all staff at EAD involved in renewable energy development has participated in at least one of the capacity strengthening activities offered through the project.</p>	<p>Project files.</p>	<p>Willingness of public sector to invest time in training.</p>
<p>Output 4.4: An association looking after the business interests of the PV sector will be set up and is operational.</p>	<p>70% of all staff in the Off-Grid Electricity Unit at BPC has participated in at least one of the capacity strengthening activities offered through the project.</p>	<p>Project files.</p>	<p>Willingness of BPC to act as the Implementing Agency and invest time in training.</p>
<p>Output 4.4: An association looking after the business interests of the PV sector will be set up and is operational.</p>	<p>50% of all PV businesses are member of the newly formed association, possibly called 'PV Association of Botswana'.</p>	<p>Project files.</p>	<p>Willingness of private sector to invest time in the association's running and activities that are prepared.</p>
<p>Immediate Objective 5: To assist with the development of appropriate financing mechanisms for the larger scale dissemination of PV-based technologies to rural customers.</p>	<p>The association meets at least 4 times per year and 2 major activities are implemented each year.</p>	<p>Project files.</p>	<p>Willingness of financial sector to get involved in financing renewable / PV energy systems.</p>
<p>Output 5.1: A financing scheme to reach rural customers will be designed and implemented.</p>	<p>The proposed subsidy disbursement scheme (as per Section IV-Part VII) is operational and functions properly.</p>	<p>Data from the Fund Account Manager, micro-lenders, project files</p>	<p>Willingness of financial sector (e.g., Penrich) to provide savings and credit schemes.</p>
<p>Output 5.1: A financing scheme to reach rural customers will be designed and implemented.</p>	<p>Financing schemes are operational so that rural customers can purchase subsidized PV-based systems during the 5-year project period via retail shops.</p> <p>A minimum of 50% of all PV purchases in the selected villages are being made using the financing scheme two years after introduction of that scheme.</p>	<p>Data from the Fund Account Manager, project micro-lenders, project files, end-user surveys, contractors (dealer) surveys. End-user surveys. Dealer surveys.</p>	<p>Willingness of private financial sector (e.g., Penrich) to provide savings and credit schemes.</p>

<p>Output 5.2: Sustainable (long-term) subsidy schemes for PV and PV/LPG systems will be designed and recommendations on how to implement these schemes will have been made.</p>	<p>Design and implementation strategies for subsidy schemes documented. This will be based on the proposed preliminary scheme presented in Section IV-Part VIII.</p>	<p>Government documents and National Budget.</p>	<p>Willingness of the Government to make available the long-term subsidy that is necessary.</p>
<p>Immediate Objective 6: To disseminate experience and lessons learned to promote rapid implementation throughout the country of rural electrification based on renewable and low GHG technologies.</p> <p>Output 6.1: A program for replication of activities implemented under component 1 will be prepared.</p>	<p>After Year 4 of the project, 1,500 PV systems per year are being sold outside the project area.</p>	<p>National rural electrification program and project files.</p>	<p>Successful implementation of activities under component 1.</p>
<p>Output 6.2: Lessons learned from the current pilot activities in three villages using fee-for-service with SHS will be documented and used for decision-making on possible continued developments with this delivery model.</p>	<p>Discussions (leading to decisions) on possible up-scaling and/or inclusion of the fee-for-service model in the renewable energy-based rural electrification plans/activities. These discussions will be initiated by the PMU before the 1st year of the Project ends.</p>	<p>Monitoring and analysis reports of the fee-for-service pilot project and project files.</p>	<p>Willingness of the Government to make substantial additional subsidies available if it is decided to continue the fee-for-service model.</p>
<p>Output 6.3: The impact of PV and PV/LPG systems in the project area will be evaluated.</p>	<p>Methodology for determining the impact of the project interventions exists and is applied. As impact monitoring is a guiding principle (see remark at the top of the logical framework matrix) this methodology will be designed ready for use in the 3rd Quarter after the project has commenced.</p>	<p>Impact evaluation report.</p>	<p>Willingness / ability of rural customers to provide necessary socio-economic information to assess impact.</p>
<p>Output 6.4: Support has been provided to disseminate the learning and replication experiences in the project area into the SADC region.</p>	<p>Experiences from this project will be shared with at least 3 countries in the SADC region before the end of the project.</p> <p>The experiences of at least three countries outside Botswana will be monitored and used to steer the Botswana project implementation and design future developments.</p> <p>At least three trips have been organized for a combined target group of Government and Donor representatives (both from inside and outside Botswana) to the project area to observe PV systems in order to learn and share experiences.</p>	<p>Lessons learned reports and project files.</p>	<p>Willingness of actors in other countries to actively share information on their renewable energy-based rural electrification activities.</p>

SECTION III: Total Budget and Work Plan

Award: tbd

Award Title: PIMS 1771 CC FSP: Botswana PV

Project ID: tbd

Project Title: PIMS 1771 CC FSP: Renewable Energy Rural-Based Electrification Programme for Botswana
Implementing Partner/ Executing Agency: NEX

GEF Outcome/ ATLAS Activity	Responsible Party/ Implementing Agent	Source of Funds	ERP/ATLAS Budget Description	Planned Budget					Total (US\$)	
				2004	2005	2006	2007	2008		
OUTCOME 1: Delivery of Technology Packages	Energy Affair Division	GEF								
		62000	71200	Inter. Consult.	40,000	30,000	10,000	0	0	80000
		62000	71300	Local Consult.	30,000	25,000	7,500	0	0	62500
		62000			60,000	65,000	52,500	50,000	30,000	257500
		62000	72100	Contractual Services Companies.	100,000	50,000	0	0	0	150000
		62000	72200	Equipment	10,000	10,000	10,000	10,000	10,000	50000
		Sub-Total	240,000	180,000	80,000	60,000	40,000	600,000		
		GOVNT								
		62040	74500	Miscellaneous	195,834	221,638	509,719	710,310	715,792	2,369,057
		Sub-Total			195,834	221,638	525,483	710,310	715,792	2,369,057
OUTCOME 2: Policy Support & Policy Framework	Energy Affair Division	GEF								
		62000	71300	Local Consult.	15,000	15,000	15,000	15,000	15,000	75000
		62000	71400	Contractual Services: Individual.	35,000	35,000	35,000	35,000	35,000	175000

Energy Affair Division	62000	72100	Contractual Services. Companies.	0	0	86,000	50,000	50,000	18600
	62000	71600	Travel	7,000	7,000	100,000	80,000	80,000	274000
Sub- Total	40,000			20,000	200,000	145,000	145,000	145,000	550,000
GOVNT									
62040	21,255	72200	Equipment	17,499	2,632	2,874	5,802	5,802	50062
62040	70,000	72400	Communication & Audio visual	2,000	40,000	0	0	0	112000
62040	50,000	73100	Rental & Maintenance	50,000	50,000	50,000	50,000	50,000	250000
62040	8,162	74100	Professional Services	8,362	12,262	12,880	12,279	12,279	53945
62040	8,745	74500	Miscellaneous	5,501	7,368	5,126	5,198	5,198	31938
Sub- Total	158,162			83,362	112,262	70,880	73,280	73,280	497,946

OUTCOME 6: Learning and Replication	Energy Affair Division	GEF	71300	Local Consultant	35000	35000	35000	35000	35000	175000
		62000								
		62000		Travel	44000	44000	44000	44000	44000	220000
	Sub-Total	GOVENT			79000	79000	79000	79000	79000	395000
			72100	Contractual Services- Companies	10000	10000	10000	10000	10000	48000
			74200	Visual & Print	9820	2420	2400	2400	2400	25660
			72200	Equipment	2195	1381	1507	1508	1508	8099
			74500	Miscellaneous	4805	2619	2493	2492	2492	14901
	Sub-Total				26820	16420	16400	16400	16400	96660

SECTION IV: Additional Information

Section IV-Part I: Government Endorsement Letter

11/3/03

TELEPHONE: (267) 390 2050
TELEFAX: (267) 390 2051

mail: envirobotswana@gov.bw



REPUBLIC OF BOTSWANA

National Conservation Strategy
Coordinating Agency
Ministry of Environment, Wildlife and Tourism

All Correspondence to be addressed to
The Executive Secretary

PRIVATE BAG 0068
GABORONE
BOTSWANA

REF NO: NCS/EV 8/10 V (60)

19 November 2003

The Resident Representative
UNDP
P.O. Box 53
GABORONE

Dear Sir

**RE: GEF - (BLOCK A) RENEWABLE ENERGY-BASED RURAL
ELECTRIFICATION PROGRAMME FOR BOTSWANA**

We refer to the above-mentioned proposal that has been submitted to us as the GEF National Focal Point by the Permanent Secretary, Ministry of Finance and Development Planning for endorsement.

We fully endorse the proposal for submission to the Global Environmental Facility for funding, as it will promote both developments by supplying a source of energy to the rural areas while being environment friendly in its wise use of renewable energy.

Thank you.

Yours faithfully


Mushanana L. Nchunga
EXECUTIVE SECRETARY

Cc: Permanent Secretary, Ministry of Finance and Development Planning
Director, Meteorological Services
Director, Energy Affairs

11
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Section IV-Part II: Government Co-financing Letter

TELEPHONE: 350100
FAX: 356806/300379
REFERENCE: FDP 4/163/2/31 21



MINISTRY OF FINANCE & DEVELOPMENT PLANNING
PRIVATE BAG 008
GABORONE

15th October 2003

REPUBLIC OF BOTSWANA

The Resident Representative
United Nations Development Programme
United Nations Place
Khama Crescent
P.O. Box 54
Gaborone

Dear Sir/Madam

**GOVERNMENT OF BOTSWANA COMMITMENT TO
RENEWABLE ENERGY BASED-RURAL ELECTRIFICATION PROGRAMME**

The Government of Botswana, through the Ministry of Minerals, Energy and Water Resources, is undertaking a study on "Identifying and Removing of Barriers to Widespread Adoption of Renewable Energy-Based Rural Electrification" in collaboration with the Global Environmental Facility (GEF) (Tender No.BOT/00/G41/A/1G/99).

As the solar energy resource in the country is abundant, a project document is being prepared that has components of providing rural electrification using solar or other renewables, with different models being considered.

This is therefore to inform you and GEF Council that the Government of Botswana is committed to the implementation of the Renewable Energy-Based Rural Electrification Programme. An amount equivalent to P19 million has been set aside for this activity under the National Development Plan 9.

The Government of Botswana looks forward to cooperating with UNDP and GEF in implementing the outcome of this project.

Thank you.

Yours faithfully

W. J. Mandlebe
FOR /PERMANENT SECRETARY

Section IV-Part III: Terms of Reference for the Chief Technical Advisor

Outline

A Chief Technical Advisor (CTA) will be recruited locally according to UNDP recruiting procedures and appointed by UNDP to serve as a full-time manager for the day-to-day operation of the Project. The PM will be based in the Botswana Power Corporation (BPC).

Tasks

This is a full-time position, with delegated executive authority and adequate flexibility. The PM is fully accountable to PSC and, through PSC, to the Government, UNDP and other stakeholders. The PM has the responsibility for the day-to-day programme support administration and management including financial resources, coordination, monitoring and progress reporting, liaison, etc. The PM has the ultimate responsibility for delivery of the project outputs and for its success.

More specifically the duties of the PM will include, but are not limited to the following:

- Provide administrative support services for the day-to-day management of project activities and liaising with all stakeholders to be involved in the project activities;
- Develop and update project work plan and Terms of References for various sub-contracts;
- Lead efforts to build partnerships for the support of project outcomes;
- Facilitate and preparation of project progress report;
- Prepare minutes of PSC and other related work as a Secretary to PSC;
- Ensure that implementing agencies mobilize and deliver inputs in accordance with agreement;
- Liaise with UNDP on financial management of the project funds and manage the project resources, e.g. vehicles, office equipment;
- Ensure that NEX modality is closely followed and successfully implemented;
- Facilitate and cooperate with audits processes;
- Prepare the required reports as scheduled and liaise with UNDP to organize the Annual Review, evaluation missions and project site visits; and
- Undertake any other duties as may be required to ensure the success of the project.

Qualifications

The CTA will be an experienced manager, a good leader and organizer. He/She should be highly -motivated and has excellent inter-personal skills, and be able to listen and communicate effectively both orally and in writing with politicians and senior decision-makers as well as with scientists and technical experts, industrialists, the teaching profession, NGOs, community leaders, special interest groups, the private sector and the general public. Minimum qualification is a degree in Environmental Science or other related field, and has had at least 15 years of experience in various activities that are to be undertaken during the Project. He/She should have the ability to work with minimum supervision. Regional experience will be an advantage.

Section IV-Part IV: Terms of Reference for the Project Steering Committee

Outline

The Tripartite Project Steering Committee (PSC) which was set up to steer the implementation of the PDF B activities will continue to function throughout the life of the proposed project. It contains representatives of the executing agency (EAD), the implementing agency (BPC) and UNDP -Botswana who represents GEF. The PSC will take broad strategic decisions on project implementation. An Advisory Board will be set up and it will be formed from a larger audience consisting of representatives from the Government, parastatals, private sector, financial community, academia, NGOs, etc.

Function of the PSC

The project will be directed by PSC. The functions of PSC shall be to:

- Review project progress with respect to objectives, outputs, activities, and work plan;
- Provide guidance and direction for project to capitalize upon successes, to overcome constraints, and to modify activities as appropriate;
- Review, modify as appropriate and approve the work plan and TOR provided by the Chief Technical Advisor (PM);
- Liaise with any other stakeholders for the benefit of the project;
- Review the use of project funds;
- Assess progress report from PM as well as monitor the performance of the PM; and
- Advise EAD and BPC on efficient and proper execution & implementation of the project.

The PM will be responsible for the implementation of PSC policy and direction, and for reporting back on progress with all aspects of the Project.

Composition of the PSC

The Energy Affairs Division will set up the PSC initially consisting of the following entities. Please note that during project implementation the composition of the PSC could change and such will be agreed upon by the then PSC members:

- Energy Affairs Division (EAD);
- Botswana Power Corporation (BPC);
- United Nations Development Programme (UNDP);
- Ministry of Minerals, Energy and Water Affairs – Planning Unit;
- Ministry of Finance and Development Planning (MFDP);
- National Conservation Strategy Agency;
- Rural Industries Innovation Centre;
- Department of Meteorological Services;
- Somareleng Tikologo (NGO);
- A representative of the private sector active in Solar Energy – preferably a representative from for example an association that represents the entire Solar Energy sector; and
- Botswana Technology Centre.

Membership of PSC shall comprise of one representative from above organizations together with PM and other major stakeholders, the private sector and the NGO community. The National Director will chair PSC, and the PM will act as Secretary to PSC. Observers, advisors and other participants will attend on the invitation and at the discretion of the Chair. Membership of PSC will be on an honorary basis and no fees will be paid. The Steering Committee business is conducted on a consensus basis.

Frequency of Meetings

The PSC will meet at every 4 months, or more frequent if required. A small Executive Group comprising the Chair, the Chief Technical Advisor, EAD, BPC, UNDP and MFDP may be established to attend to salient matters that require immediate attention between scheduled PSC meetings.

Section IV-PART V: Stakeholder Involvement Plan

The development of this project proposal (i.e. the PDF B phase) has been undertaken in a participatory fashion, consulting the major stakeholders throughout the process. This process began with a detailed socio-economic study of representative rural consumers; both those who have used renewable energy products and those who have not. In addition, consultation was undertaken with a wide range of groups and organisations who are stakeholders in this process, including representatives from the supply chain (end users, dealers, importers and international suppliers), NGOs, community based organisations, consultants and training institutions. Consultations were undertaken during the three stakeholder workshops held in March, June and September 2003 in Gaborone. Numerous meetings were also held over a nine-month period with key stakeholders on an individual basis.

Specifically during the PDF B phase, stakeholder consultations were undertaken with: EAD, MMEWR, UNDP, BPC, Ministry of Finance and Development Planning, Department of Meteorological Services, representatives from local / district authorities involved with rural development, the University of Botswana, Department of Vocational Education and Training, Madirelo Training and Testing Centre, RIIC, BOTEC, the financing sector, Botswana Bureau of Standards, Japan International Cooperation Agency, private sector companies involved in providing renewable energy, the National Aids Coordinating Agency and other health-based NGOs, the Citizen Empowerment Development Agency, Botswana Community Based Organisations Network and other rural consumer representatives and the Botswana Congress of NGOs. In addition, consultation with representatives from similar UNDP/GEF projects, including the on-going project in Lesotho, was undertaken.

The same stakeholders as identified and listed above are invited to actively participate in the implementation of the 5-year project. Please note that this list is not static and will be critically assessed during project implementation with the view to include additional stakeholders as considered appropriate:

As was the case during the PDF B phase the stakeholders will be actively involved in the project implementation by means of active involvement in the implementation of the project's activities – especially the contractors, micro lenders and end-users living in the pre-selected 88 villages – or through awareness raising and information sharing activities or as an active member of the Project Steering Committee. The Project Steering Committee will at minimum include the following members:

- Energy Affairs Division (EAD);
- Botswana Power Corporation (PBC);
- United Nation Development Programme (UNDP);
- Ministry of Minerals, Energy and Water Affairs – Planning Unit;
- Ministry of Finance and Development Planning (MFDP);
- National Conservation Strategy Agency;
- Rural Industries Innovation Centre;
- Department of Meteorological Services;
- Somareleng Tikologo (NGO);
- A representative of the private sector active in Solar Energy – preferably a representative from for example an association that represents the entire Solar Energy sector; and
- Botswana Technology Centre.

Furthermore, it is proposed that the monitoring and evaluation activities of the project will also involve (independent) local actors combined with 1-2 international experts. If needed the capacity for such specific monitoring and evaluation of climate change projects can hereby be developed as part of on-the-job training throughout the project implementation.

In summary the main beneficiaries of this 5-year project will be the rural customers who will be supplied with affordable, reliable and clean modern energy services by means of PV-based systems. The energy hence provided will be used for consumptive and productive uses thereby contributing to social and economic of the rural population in Botswana.

Section IV-PART VI: UNDP-Botswana Country Office Support Services

Letter of Agreement between UNDP and the Government of Botswana for the Provision of Support Services

“Identifying and Overcoming Barriers to Widespread Adoption of Renewable Energy-Based Rural Electrification in Botswana (BOT/00/G41)”

Dear Mr. Tumelo,

1. Reference is made to consultations between officials of the Government of Botswana (hereafter referred as “the Government”) and officials of UNDP with respect to the provisions of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the project document for “Identifying and Overcome Barriers to Widespread Adoption of Renewable Energy-Based Rural Electrification in Botswana” as described below.

2. The UNDP country office may provide, at the request of the Energy Affairs Division, the following support services for the activities of the project:

- a.) Identification and/or recruitment of project personnel and consultants;
- b.) Identification and facilitation of training activities;
- c.) Procurement of goods and services;
- d.) Direct payment to contractors and suppliers; and
- e.) Shipment, custom clearance, vehicle registration, and accreditation.

3. The procurement of goods and services and the recruitment of project personnel and consultants by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies, and procedures. Support services described in paragraph 2 are detailed in the Attachment hereto. If the requirements for support services by the country office change during the life of the project, this letter of Agreement will be revised with the mutual agreement of the UNDP Resident Representative and the designated institutions.

4. UNDP manages funds contributed by GEF and provides these funds to the Energy Affairs Division through advances of funds in accordance with progress towards achieving result. The Government co-sharing of 19 million Pula will be administered under the responsibility of the Ministry of Mines, Energy and Water Resources. Monitoring procedures for the administration of the co-sharing contribution will be detailed at the outset of the project and agreed upon by the Project Steering Committee in which also UNDP takes seat.

5. The relevant provisions of the UNDP Standard Basic Assistance Agreement (SBAA) between the Government of the Republic of Botswana and UNDP, signed on 14 May 1975, including the provision on liability and privileges and immunities, shall apply to the provisions of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution.

6. The manner and methods of cost-recovery by UNDP country office in providing the support services described in paragraph 2 above is specified in the attachment hereto.

7. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

8. The UNDP country office shall submit quarterly progress reports on the support services provided to the Government of Botswana.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between UNDP and the Government of Botswana on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

Signed on behalf of UNDP:

Mr. Bjoern Foerde
Resident Representative

For the Government:

Mr. S.S.G. Tumelo
Permanent Secretary
Ministry of Finance and
Development Planning

Date:

Date:

Attachment

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between the Energy Affairs Division (EAD) of the Ministry of Minerals, Energy and Water Resources (MMEWR), the institution designated by the Government of Botswana and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project, “Identifying and Overcoming Barriers to Widespread Adoption of Renewable Energy-Based Rural Electrification in Botswana, hereafter referred to as “the Project”

2. The UNDP country office shall provide support services for the Project as described below.

3. Support services to be provided:

Support services	Schedule for the provision of the support services	Cost to UNDP of providing such support services	Amount and method of reimbursement to UNDP
1. Identification and recruitment of project personnel and consultants	As and when the Government requests, from inception to closure of the project	Admin cost directly paid by GEF to UNDP Head Quarters	N/A
2. Identification and facilitation of training activities	As and when the Government requests, from inception to closure of the project	Admin cost directly paid by GEF to UNDP Head Quarters	N/A
3. Procurement of goods and services	As and when the Government requests, from inception to closure of the project	Admin cost directly paid by GEF to UNDP Head Quarters	N/A
4. Direct payment to contractors and suppliers	As and when the Government requests, from inception to closure of the project	Admin cost directly paid by GEF to UNDP Head Quarters	N/A
5. Shipment, custom clearance, vehicle registration, and accreditation	As and when the Government requests, from inception to closure of the project	Admin cost directly paid by GEF to UNDP Head Quarters	N/A

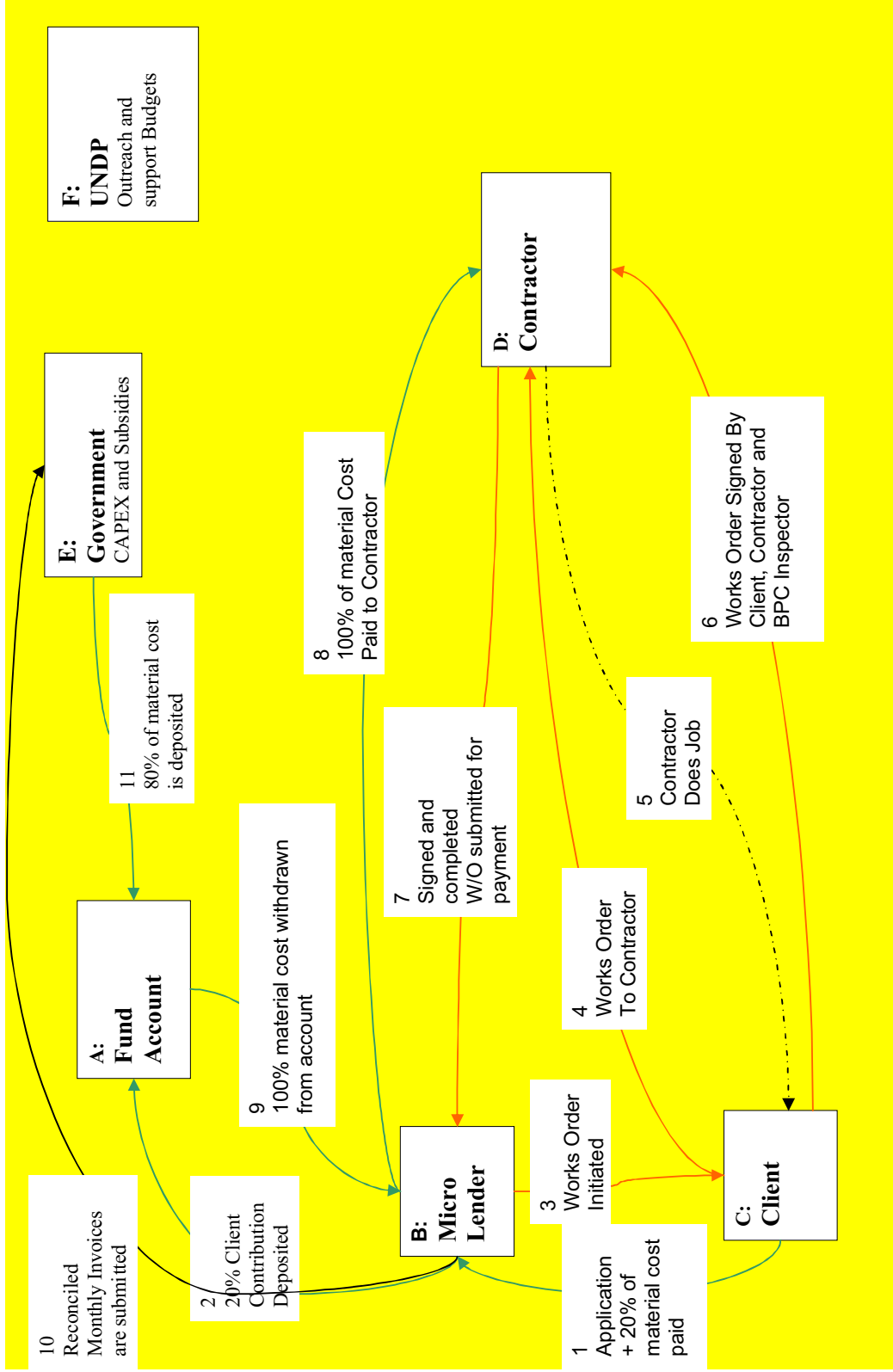
4. Description of functions and responsibilities involved:

4.1 Managerial functions and responsibilities of the Energy Affairs Division:

- 4.1.1. Ensure expected results from the project are achieved.
- 4.1.2. Ensure that the outputs are produced through effective process management and use of allocated budget.
- 4.1.3. Submit quarterly progress reports to UNDP.
- 4.1.4. Ensure provision of in-kind contribution.
- 4.1.5. Arrange and manage Annual Project Review (APR) meetings.
- 4.1.6. Maintain an up-to-date inventory of equipment acquired and disposed of.
- 4.1.7. Over-all responsibility for all UNDP/GEF supported activities.
- 4.1.8. Direct supervision of project staff including consultants.

- 4.1.9. Address grievances of project staff, carry out disciplinary action and recommend further action to UNDP.
 - 4.1.10. Assess performance of project staff and recommends renewal/termination of contracts and/or increment to UNDP.
- 4.2 Financial functions and responsibilities of the Energy Affairs Division:
- 4.2.1 Manage the resources allocated to achieve expected results.
 - 4.2.2 Plan financial disbursements in accordance with work plan and Project Document.
 - 4.2.3 Maintain an up-to-date accounting system that contains records and controls to ensure accuracy and reliability of financial information and reporting.
 - 4.2.4 Record the receipt and disbursement of allocated budget.
 - 4.2.5 Verify that disbursements do not exceed the available funds or the amount allocated to each component of the project.
 - 4.2.6 Review and approve of Combined Delivery Reports (CDR) submitted quarterly by UNDP.
 - 4.2.7 Requests an advance of funds in the standard financial report format on the basis of a corresponding work plan and budget.
 - 4.2.8 Submit quarterly Financial Reports at the time of requesting for the advance of funds.
 - 4.2.9 Arrange for audit of the project at least once during implementation.
- 4.3 Managerial functions and responsibilities of UNDP:
- 4.3.1 Arrange Tripartite Review (TPR) Meetings chaired by the Permanent Secretary or Deputy Permanent Secretary of MMEWR.
 - 4.3.2 Prepare TPR Meeting report within two weeks of the meeting.
 - 4.3.3 Form part of the project Steering Committee.
 - 4.3.4 Monitor progress of project through field visits as necessary.
 - 4.3.5 Conduct monitoring and evaluation visits to project sites at least once every six months.
 - 4.3.6 Arrange for terminal evaluation in consultation with EAD.
 - 4.3.7 Institute personnel measures upon recommendation of EAD.
- 4.4 Financial functions and responsibilities of UNDP:
- 4.4.1 Advance Energy Affairs Division with project funds on quarterly basis.
 - 4.4.2 Process direct payments related to project expenditure on request of government and receipt of three quotations.
 - 4.4.3 Provide government with financial up-dates, including the CDRs on quarterly basis.
 - 4.4.4 Monitor budget and ensure that it is kept up-to-date.
 - 4.4.5 Prepare and sign annual mandatory budget revisions in consultation with Government.
- 4.5 Financial functions and responsibilities of Ministry of Finance and Development Planning :
- 4.5.1 Review and approve annual budgets for the project
 - 4.5.2 Review and approve budget revisions in consultation with EAD(MMEWR) and UNDP

Section IV-PART VII: Proposed financing mechanism for subsidizing hardware for modern energy services



Legend for proposed financing mechanism for subsidizing hardware for modern energy services

1. The client (C) approaches a micro lender (B) for a loan, hire-purchase etc. and the client pays 20% of the complete purchase price.
2. The micro lender deposits the receive 20% into the fund account (A).
3. When the client has paid the complete 20% of the purchase price, the micro lender will issue a work order for the client (2 copies; 1 for the client and 1 for the contractor).
4. The client will take both copies of the work order to the contractor (D). The contractor will sign and date both copies of the work order to indicate he has accepted the job and that it is in his work programme. The contractor remains with a copy and the client also takes his copy.
5. The contractor carries out the job in line with the work order.
6. On completion of the work, the contractor, the client and the BPC inspector sign both copies of work order to indicate that the job was completed satisfactorily.
7. The contractor takes his copy to the micro lender to be paid 100% of the material costs. The micro lender indicates in work order book that the contractors work order's copy is signed by the 3 parties concerned and that the work is completed satisfactorily.
- 8&9. The micro lender draws 100% of material cost from the fund account and pays the contractor.
10. At the end of each month, the micro lender prepares a record of all completed work orders and invoices the Government for 80%.
11. The Government (E) deposits into the fund account as i invoiced. This could be on a quarterly or bi-annually basis. Please note that for ease of administration, an annual amount of money could be deposited into the fund account in advance. If the rate of connection is good requiring further deposits during the year, then such requests could be motivated based on actual need for such additional funding into the fund account.

Notes:

- The here proposed scheme is already largely in use for the normal rural electrification activities; i.e. extension of the existing grid into rural areas. Using this scheme for PV-based rural electrification has the advantage that one makes use of an existing, well-known and functioning scheme. Besides, it is a clear signal that the Government of Botswana is serious about main-streaming PV-based rural electrification;
- For successful implementation and long-term sustainability of the proposed set-up it is of utmost important that the incentives for the main actors involved (micro lenders, contractors and clients) are sufficiently attractive:

- Micro lenders – they are allowed to generate interest from the cash contributions of the clients as well as from the proposed advance payments to be made by Government into the fund account. This should generate sufficient income to ensure their active and long-term participation;
 - Contractors – in the proposed scheme they are guaranteed of a market for their products and services (PV systems and 3-year maintenance contracts) and furthermore they are informed about the size of their market as they are being giving copies of the work orders. This reduces their operational risk and furthermore it will allow them to properly plan the stock of PV systems required at any given point in time. The latter translates directly to financial savings as the working capital required can be substantially reduced and hence the capital costs for running a solar business. This should ensure their active and long-term participation; and
 - Clients – clients as referred to here are the rural customers who will be provided with modern energy services to be applied for consumptive and productive uses alike. With only 20% down-payment they get an immediate installation of the PV systems and as such they are in effect receiving 80% subsidized rural electrification services. No doubt that this will generate sufficient interest and ensures their long-term involvement.
- As can be seen from the proposed financing mechanism, UNDP has no direct role to play as part of the financing mechanism as the GEF grant funding will not be used to cover investments to be made in hardware for modern energy services; i.e. PV systems (lanterns, SHSs and mini-grids). The specific role for UNDP is to provide all necessary conditions to ensure that the hardware investments will result in the actual effective and efficient delivery of the modern energy services. In summary these are the activities under components 1 to 6 as outlined in this project document. Directly related to the financing mechanism, UNDP is playing an important role in assisting with the set-up and functioning of the combined micro-lender and fund account. Also the necessary training for the contractors and its workers will be assisted through UNDP;
 - Please note that further detailing of the here proposed financing mechanism will be done at the inception of the project. Although different subsidy schemes exist (dealer subsidy, retailer subsidy and consumer subsidy) the Government has expressed clear interest in developing the presented one above for reasons referred to under the first bullet point. However, at the inception of the report a final decision will be made on the proposed subsidy scheme by the Project Steering Committee based on a presentation of the various options (for which background material has been developed during the PDF B) at the outset of the project. Whatever subsidy scheme will be selected, it is anticipated that the scheme should be fully operational no later than 6 months into the programmes implementation;
 - Please note that the information presented here has been prepared as part of the request from the GEF Secretariat to provide detailed information on the proposed financing mechanisms and (financial) sustainability as part of the CEO endorsement documentation. A mission to Botswana was fielded early March 2005 during which the main actors have been involved in preparing this information; and
 - Please refer to the next section (Section IV-Part VIII) for more detailed information on the proposed activities to ensure long-term financial sustainability of the here proposed subsidy-based financing mechanism.

Section IV-PART VIII: Proposed cross-subsidy scheme to ensure long-term (financial) sustainability

To ensure medium and long-term financial sustainability (i.e. after the 5-year project has come to an end) of the PV-based rural electrification activities, a kWh levy will be applied to the grid-connected urban domestic (and commercial if required, but not industry) which will be equivalent to the Governments 80% subsidy injection. The first 30-50kWh would not pay the levy depending as to ensure that the lower income households would not be affected by this proposed cross-subsidy scheme. As per the below spreadsheet, this would require a contribution of 21 Pula per annum (USD 4.25) per connected customer. This is believed to be a very realistic amount that could be requested for rural electrification as part of the nation's social and equity objectives. Please note that a more detailed, complete and concise design is required before introducing it. This will form part of the project's activities under component 5, output 5.2.

No.	Type Of System	Number of Customers	Payment Contributions For a 5 Year Period		Number of System	Payment Contributions For a Typical Year		
			Total	Govt		Total	Govt	
1	Mobile Systems/Gas	5,152	4,121,600	3,297,280	1,030	824,320	659,456	164,864
2	SHS (50Wp)*	1,373	7,661,340	6,129,072	275	1,532,268	1,225,814	306,454
	Total	6,525	11,782,940	9,426,352	1,305	2,356,588	1,885,270	471,318
	* The price is inclusive of a three year maintenance contract							
	It is therefore the intention to raise P 1,885,270 per annum (i.e. the Government subsidy) from a levy to maintain the PV drive at the annual rate as indicated rate							
Proposal On Raising The Required Subsidy Amount								
No.	Category	Customers						
1	Mining	4						
2	Commercial	10,995						
3	Domestic	100,810						
4	Government	3,248						
5	Water	193						
	Total	115,250						
NOTES:								
i)	The 115250 customers are only from towns and villages with more than 500 customers (February 2005 statistics). This is to ensure that we do not burden those customers who are in the small villages.							
ii)	Only 80% of the domestic and commercial customers in (i) are to be levied to raise the required subsidy. It is recognized that there are low consumption users in the large villages and towns. They are not to be levied.							

Section IV-Part IX: Proposed detailed M&E Plan and indicative budget

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Country Office (UNDP -CO) with support from UNDP/GEF. The Logical Framework Matrix in Section II-Part II provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities. Attached is the M&E Plan combined with an indicative budget.

1. MONITORING AND REPORTING

1.1. Project Inception Phase

A Project Inception Workshop will be conducted with the full project team, relevant government counterparts, co-financing partners, the UNDP-CO and representation from the UNDP-GEF Regional Coordinating Unit, as well as UNDP-GEF (HQs) as appropriate.

A fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's logical framework matrix. This will include reviewing the logical framework (indicators, means of verification, assumptions), including updating the baseline as the currently used baseline dates back to September 2003 when PDF B activities ended. This updating will be based on outcomes of the PDF B as well as methodologies and approaches used to generate the baseline information as are included in the reports produced as part of the PDF B consultancy; notably the *socio-economic assessment* report. On the basis of this exercise, including the updating of the baseline, finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

Additionally, the purpose and objective of the Inception Workshop (IW) will be to: (i) introduce project staff with the UNDP-GEF expanded team which will support the project during its implementation, namely the CO and responsible Regional Coordinating Unit staff; (ii) detail the roles, support services and complementary responsibilities of UNDP-CO and RCU staff vis à vis the project team; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR), Tripartite Review Meetings, as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the project team on UNDP project related budgetary planning, budget reviews, and mandatory budget re-phrasings.

The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and decision-making structures will be discussed again in order to clarify for all, each party's responsibilities during the project's implementation phase.

1.2. Monitoring responsibilities and events

A detailed schedule of project review meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Tripartite Reviews, Steering Committee Meetings, (or relevant advisory and/or coordination mechanisms) and (ii) project related Monitoring and Evaluation activities.

Day to day monitoring of implementation progress will be the responsibility of the Chief Technical Advisor based on the project's Annual Work Plan and its indicators. The Project Team will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

The Chief Technical Advisor will fine-tune the progress and performance/impact indicators of the project in consultation with the full project team at the Inception Workshop with support from UNDP -CO and assisted by the UNDP-GEF Regional Coordinating Unit as appropriate. Specific targets for the first year implementation progress indicators together with their means of verification will be developed at this Workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. Targets and indicators for subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the project team.

Measurement of impact indicators related to global benefits will occur according to the schedules defined in the Inception Workshop and tentatively outlined in the indicative Impact Measurement Template (see further on). The measurement, of these will be undertaken through sub-contracts or retainers with relevant institutions or through specific studies that are to form part of the projects activities (e.g. measurement carbon benefits from reduced paraffin consumption or through surveys for capacity building efforts).

Periodic monitoring of implementation progress will be undertaken by the UNDP-CO through quarterly meetings with the project proponent, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.

UNDP Country Offices and UNDP-GEF RCUs as appropriate, will conduct yearly visits to projects that have field sites, or more often based on an agreed upon schedule to be detailed in the project's Inception Report / Annual Work Plan to assess first hand project progress. Any other member of the Project Steering Committee can also accompany, as deemed appropriate. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the project team, all PSC members and UNDP -GEF.

Annual Monitoring will occur through the ***Tripartite Review (TPR)***. This is the highest policy-level meeting of the parties directly involved in the implementation of a project. The project will be subject to Tripartite Review (TPR) at least once every year. The first such meeting will be held within the first twelve months of the start of full implementation. The project proponent will prepare an Annual Project Report (APR) and submit it to UNDP-CO and the UNDP-GEF regional office at least two weeks prior to the TPR for review and comments.

The APR will be used as one of the basic documents for discussions in the TPR meeting. The project proponent will present the APR to the TPR, highlighting policy issues and recommendations for the decision of the TPR participants. The project proponent also informs the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

Terminal Tripartite Review (TTR)

The terminal tripartite review is held in the last month of project operations. The project proponent is responsible for preparing the Terminal Report and submitting it to UNDP -CO and LAC-GEF's Regional Coordinating Unit. It shall be prepared in draft at least two months in advance of the TTR in order to allow review, and will serve as the basis for discussions in the TTR. The terminal tripartite review considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can be captured to feed into other projects under implementation or formulation.

The TPR has the authority to suspend disbursement if project performance benchmarks are not met. Benchmarks are provided will be developed at the Inception Workshop, based on delivery rates, and qualitative assessments of achievements of outputs.

1.3. Project Monitoring Reporting

The Chief Technical Advisor in conjunction with the UNDP -GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and strictly related to monitoring, while (g) through (h) have a broader function and the frequency and nature is project specific to be defined throughout implementation.

(a) *Inception Report (IR)*

A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/Annual Work Plan divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This Work Plan would include the dates of specific field visits, support missions from the UNDP-CO or the Regional Coordinating Unit (RCU) or consultants, as well as time-frames for meetings of the project's decision making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time -frame.

The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation.

When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, the UNDP Country Office and UNDP -GEF's Regional Coordinating Unit will review the document.

(b) *Annual Project Report (APR)*

The APR is a UNDP requirement and part of UNDP's Country Office central oversight, monitoring and project management. It is a self -assessment report by project management to the CO and provides input to the country office reporting process as well as forming a key input to the Tripartite Project Review. An APR will be prepared on an annual basis prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work.

The format of the APR is flexible but should include at minimum the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome;
- The constraints experienced in the progress towards results and the reasons for these;
- The three (at most) major constraints to achievement of results;
- AWP, CAE and other expenditure reports (ERP generated);
- Lessons learned; and
- Clear recommendations for future orientation in addressing key problems in lack of progress.

(c) *Project Implementation Review (PIR)*

The PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for Chief Technical Advisors and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by the CO together with the project. The PIR can be prepared any time during the

year (July to June) and ideally prior to the TPR. The PIR should then be discussed in the TPR so that the result would be a PIR that has been agreed upon by the project, the executing agency, UNDP CO and the concerned RC.

The individual PIRs are collected, reviewed and analysed by the RCs prior to sending them to the focal area clusters at the UNDP/GEF headquarters. The focal area clusters supported by the UNDP/GEF M&E Unit analyze the PIRs by focal area, theme and region for common issues/results and lessons.

The focal area PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.

The GEF M&E Unit (at headquarters in New York) provides the scope and content of the PIR. In light of the similarities of both APR and PIR, UNDP/GEF has prepared a harmonized format for reference. Format available from the UNDP Office in Gaborone.

(d) *Quarterly Progress Reports*

Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF regional office by the project team. Format available from the UNDP Office in Gaborone.

(e) *Periodic Thematic Reports*

As and when called for by UNDP, UNDP-GEF or the Implementing Partner, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNDP and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. UNDP is requested to minimize its requests for Thematic Reports, and when such are necessary will allow reasonable timeframes for their preparation by the project team.

(f) *Project Terminal Report*

During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs of the Project, lessons learnt, objectives met, or not achieved, structures and systems implemented, etc. and will be the definitive statement of the Project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the Project's activities.

(g) *Technical Reports* (optional)

Technical Reports are detailed documents covering specific areas of analysis or scientific specializations within the overall project. As part of the Inception Report, the project team will prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary this Reports List will be revised and updated, and included in subsequent APRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas, and will be used in efforts to disseminate relevant information and best practices at local, national and international levels. Please note that such technical reports are optional and not obligatory.

(h) *Project Publications* (optional)

Project Publications will form a key method of crystallizing and disseminating the results and achievements of the Project. These publications may be scientific or informational texts on the activities and achievements of the Project, in the form of journal articles, multimedia publications, etc. These publications can be based

on Technical Reports, depending upon the relevance, scientific worth, etc. of these Reports, or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if any of the Technical Reports merit formal publication, and will also (in consultation with UNDP, the government and other relevant stakeholder groups) plan and produce these Publications in a consistent and recognizable format. Project resources will need to be defined and allocated for these activities as appropriate and in a manner commensurate with the project's budget. Please note that such project publications are optional and not obligatory.

2. INDEPENDENT EVALUATION

The project will be subjected to at least two independent external evaluations as follows: -

(i) *Mid-term Evaluation*

An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the Chief Technical Advisor in close collaboration with the UNDP Office in Gaborone based on guidance from the Regional Coordinating Unit and UNDP-GEF.

(ii) *Final Evaluation*

An independent Final Evaluation will take place three months prior to the terminal tripartite review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

3. LEARNING AND KNOWLEDGE SHARING

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums. In addition:

- The project will participate, as relevant and appropriate, in UNDP/GEF sponsored networks, organized for Senior Personnel working on projects that share common characteristics. UNDP/GEF shall establish a number of networks, such as PV-Network that will largely function on the basis of an electronic platform; and
- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identify and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP/GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

TABLE: INDICATIVE MONITORING AND EVALUATION WORK PLAN AND CORRESPONDING BUDGET

Type of M&E activity	Responsible Parties	Budget US\$ <i>Excluding project team Staff time</i>	Time frame
Inception Workshop	<ul style="list-style-type: none"> ▪ Chief Technical Advisor ▪ UNDP CO ▪ UNDP GEF 		Within first two months of project start up
Inception Report	<ul style="list-style-type: none"> ▪ Project Team ▪ UNDP CO 	None	Immediately following IW
Measurement of Means of Verification for Project Purpose Indicators	<ul style="list-style-type: none"> ▪ Project Coordinator will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members 	To be finalized in Inception Phase and Workshop.	Start, mid and end of project
Measurement of Means of Verification for Project Progress and Performance (measured on an annual basis)	<ul style="list-style-type: none"> ▪ Oversight by Project GEF Technical Advisor and Project Coordinator ▪ Measurements by regional field officers and local IAs 	To be determined as part of the Annual Work Plan's preparation.	Annually prior to APR/PIR and to the definition of annual work plans
APR and PIR	<ul style="list-style-type: none"> ▪ Project Team ▪ UNDP-CO ▪ UNDP-GEF 	None	Annually
TPR and TPR report	<ul style="list-style-type: none"> ▪ Government Counterparts ▪ UNDP CO ▪ Project team ▪ UNDP-GEF Regional Coordinating Unit 	None	Every year, upon receipt of APR
Steering Committee Meetings	<ul style="list-style-type: none"> ▪ Project Coordinator ▪ UNDP CO 	None	Following Project IW and subsequently at least once a year
Periodic status reports	<ul style="list-style-type: none"> ▪ Project team 	5,000	To be determined by Project team and UNDP CO
Technical reports	<ul style="list-style-type: none"> ▪ Project team ▪ Hired consultants as needed 	15,000	To be determined by Project Team and UNDP-CO
Mid-term External Evaluation	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP- CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 	20,000	At the mid-point of project implementation.
Final External Evaluation	<ul style="list-style-type: none"> ▪ Project team, ▪ UNDP-CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 	30,000	At the end of project implementation
Terminal Report	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP-CO ▪ External Consultant 	None	At least one month before the end of the project
Lessons learned	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP-GEF Regional Coordinating Unit (suggested formats for documenting best practices, etc) 	15,000 (average 3,000 per year)	Yearly
Audit	<ul style="list-style-type: none"> ▪ UNDP-CO ▪ Project team 	5,000 (average \$1000 per year)	Yearly
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	<ul style="list-style-type: none"> ▪ UNDP Country Office ▪ UNDP-GEF Regional Coordinating Unit (as appropriate) ▪ Government representatives 	15,000 (average one visit per year)	Yearly
TOTAL INDICATIVE COS T <i>Excluding project team staff time and UNDP staff and travel expenses</i>		US\$ 105,000	

IMPACT MEASUREMENT TABLE

These indicators will be drawn from the Logical Frame Matrix and are related to the measurement of global benefits achieved by the project rather than project implementation progress. They will have to be fine-tuned and detailed in the Inception Workshop.

Impact to be monitored	Indicators to be used	Means of verification
CO ₂ emission reduction	- Litres of paraffin reduced - Operational PV systems	- End-user surveys - Dealer surveys
Increased PV market activities	- Number of PV business in combination with the turn over/profit of each business	- Market surveys - Dealer surveys
Increased income generating activities in the project target area	- Number of income generating activities emerged in combination with the turnover / profit of these activities / businesses - It is anticipated that in 2 years 1% and in 5 years 3% from the households supplied with PV systems will be involved in income generating activities	- End-user surveys

ANNEX A: Approved GEF Full-Scale Executive Summary

AGENCY'S PROJECT ID: PIMS #1771
COUNTRY: Botswana
PROJECT TITLE: Renewable Energy-Based Rural Electrification Programme for Botswana
GEF AGENCY: UNDP
OTHER EXECUTING AGENCY: None
DURATION: 5 Years
GEF FOCAL AREA: Climate Change
GEF OPERATIONAL PROGRAMME: OP #6: Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs
GEF STRATEGIC PRIORITY: CC 4: Off-Grid Renewable Energy for Productive Use
ESTIMATED STARTING DATE: July 2005
IA FEE: US\$382,000

FINANCING PLAN (US\$)	
GEF PROJECT/COMPONENT	
Project:	3,000,000
PDF B:	305,000
Subtotal GEF	3,305,000
CO-FINANCING*	
Government (in kind)	495,000
Government (in-kind, during PDF B)	50,000
GEF Agency (cash, during PDF B)	10,000
Government (cash)	3,636,463
End-users (cash)	1,197,145
<i>Subtotal Co-Financing</i>	<u>5,388,608</u>
<i>Total Project Financing</i>	<u>8,693,608</u>
FINANCING FOR ASSOCIATED ACTIVITIES IF ANY:	
LPG Part (Govt. subsidy + end-users)	247,129
LEVERAGED RESOURCES IF ANY:	n.a.

* Details provided under the financial modality and cost effectiveness section

CONTRIBUTION TO KEY INDICATORS OF THE BUSINESS PLAN:

- For the 88 targeted villages, the reduction in CO₂ emissions as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment amounts to approximately 52,000 tonnes of CO₂ over a 20-year period. This calculation is based on an average savings of 10 liters of paraffin per month per customer, for each of the customers that will be reached during the five-year project period.
- It has been estimated that replication of the project activities to other rural customers will reach between 25% and 35% of Botswana's current 140,000 to 160,000 rural customers. If the CO₂ calculation for the 88 targeted villages serves as a basis for extrapolation, the total CO₂ reduction as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment amounts to approximately 345,000 tonnes of CO₂ over a 20-year period (including the 52,000 tonnes of CO₂ reduction from the 88 targeted villages).

RECORD OF ENDORSEMENT ON BEHALF OF GOVERNMENT:

Mr. Mushanana L. Nchunga, Executive Secretary
National Conservation Strategy Coordinating Agency

Date: 19 November 2003

Approved on behalf of the *United Nations Development Programme (UNDP)*. This proposal has been prepared in accordance with GEF policies and procedures and meets the standards of the GEF Project Review Criteria for work programme inclusion.



Yannick Glemarec
 Deputy Executive Coordinator
 Date: 9 January 2004

Project Contact Person:
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1. Project Summary

(a) Project rationale, objectives, outputs and activities

Global objective: To reduce Botswana's energy related CO₂ emissions by substituting fossil fuels (petrol / diesel, woodfuel, paraffin and coal) with PV and LPG, to provide basic energy services to rural homes and community users.

Development Objective: To improve people's livelihoods by improving their access to and affordability of modern energy services and to assist the Government of Botswana with the initiation of a renewable energy programme for the rural areas, thus reducing the dependency on imported fossil fuel.

These objectives will be achieved by project activities designed to remove barriers to the wide-scale utilisation of PV for providing energy services. 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 using PV.

The project consists of six components. Each of these components is made up of an immediate objective, specific output(s) and a number of activities. By achieving the immediate objectives, the project will contribute towards the achievement of the global and development objectives:

1. **Delivery of technology packages:** *To implement three different delivery models targeting different end-user groups and making use of different PV and PV/LPG-based technology packages.*
2. **Policy support and policy framework:** *To assist with the development of policy and institutional arrangements conducive for the integration and provision of off-grid electricity services within the existing rural grid electrification programme.*
3. **Awareness raising and changing of perceptions:** *To increase awareness and change perceptions among the general public, decision-makers and rural consumers on the potential role of PV and LPG in meeting basic energy needs.*
4. **Private and public sector strengthening and training:** *To strengthen and support the public and private sector working in the PV and renewable energy sector to provide better quality of service.*
5. **Financial engineering:** *To assist with the development of appropriate financing mechanisms for the larger scale dissemination of PV-based technologies to rural customers.*
6. **Learning and replication:** *To disseminate experience and lessons learned to promote rapid implementation of rural electrification based on renewable and low GHG technologies throughout the country.*

Project activities are focused on introducing different PV-based technology packages in 88 targeted villages; to review and make recommendations for improving the policy environment for renewables, notably PV; launching awareness campaigns for both decision-makers and end-users; strengthening the capacities of the public and private sectors to deal with the design and implementation of PV programmes; assisting PV companies in business planning and training of technicians; testing end-user and supply-chain financing mechanisms; and putting in place the necessary conditions for replication of the activities implemented under the 5-year UNDP/GEF supported initiative.

(b) Key indicators, assumptions and risks (from Annex A/Project Brief: Logical framework)

Key indicators include the number of PV systems sold over the lifetime of the project, combined with the reduced consumption of paraffin for customers switching to PV-based systems. Another important indicator is the price of PV systems and the number of dealers involved in the PV market. The project's monitoring and evaluation system will make provision for gathering 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 in the project activities and willingness at the political level to provide subsidies for renewable energy-based rural electrification. Assumptions will be monitored and the project intervention strategy adapted accordingly.

2. Country Ownership

(a) Country Eligibility

Botswana ratified the UNFCCC on 27th January 1994.

(b) Country Drivenness

The project has been developed in close consultation with various key Government Ministries and is supported at the highest political level. The Government attaches high priority to providing basic energy services to its rural communities, as expressed in its National Development Plan 9 and by making USD 3.8 million (19 million Pula) available from its National Budget to implement this initiative in support of this policy commitment. One of the strategic objectives for the energy sector in Botswana relates to reducing the fossil fuel dependency and promoting the use of renewable energy. Other objectives include promoting the development of the private energy sector through private participation and public-private partnerships and studying the potential role of renewable energy, particularly for rural electrification.

3. Programme & Policy Conformity

(a) Fit to GEF Operational Program and Strategic Priority

There are several reasons to promote the use of PV in Botswana through the removal of barriers. First is the fact that, at present, 65% of all villages and 100% of all localities with more than 200 people are not connected to the grid. In terms of households, this means that 83% of all rural households are not yet connected to the grid. Even if the grid connection programme is extended as planned, by 2009 there will be 194 villages and 379 localities in Botswana (or 42% of all rural villages and 99% of all localities) that still lack electricity services.

Botswana has excellent solar conditions, with an average of 320 clear, sunny days per year and an average global irradiation of 21 MJ m⁻²/day throughout the country. Therefore, introducing individual PV systems would make it possible, in the long term, for an estimated 25-35% of the 140,000 to 160,000 rural customers to have their basic electricity needs met from the locally available solar resource.

The main barriers identified during the implementation of that PDF B project include the following:

- **Information and perception:** Insufficient knowledge about available technologies and technological developments; financial institutions being insufficiently aware of the financing needs / possibilities associated with the renewable energy sector; consumers not aware of the technologies that are available or have a wrong perception about what that technology can / cannot do, or how it is to be used / maintained.
- **Financing:** Donor-funded projects creating unrealistic price expectations amongst consumers; private sector companies in the renewable energy sector having difficulties raising sufficient credit to finance their operations; payments required from customers being either too high or too inflexible, resulting in a very small uptake and extremely slow market growth for PV systems.
- **Technology:** The balance between component quality and price is delicate and when components are too expensive, users may choose not to use them; poor people are being asked to try experimental technologies, which is something that they can not afford to do; even the smallest interventions by customers (e.g., checking battery water levels) can be problematic.
- **Legal and policy:** The existing legal / policy structure is not particularly conducive to the growth of the renewable energy sector.
- **Institutional/organisational:** Donor-funded projects are often implemented by public sector institutions rather than by the private sector; renewable energy is not yet considered an integral part of the country's rural electrification efforts; a weak link exists between the public and private sectors in respect of renewables.

In response to these barriers, a programme has been designed that seeks to overcome and/or lower these barriers, using the private sector as its vehicle to provide basic electricity services based on renewables / PV.

The proposed project also recognises that energy is an important element in rural development through the services it makes possible. In this way, PV systems can have a significant impact on the lives of rural users. For example, energy can provide the extension of daytime activities through lighting, entertainment by means of radios and televisions and pumping of potable water. Furthermore, PV projects in Botswana can be implemented to provide social and communal services (e.g., health centres, schools and communal centres), which can spark the provision of income-generating activities. Small solar systems may help promote productive activities (e.g., bars, restaurants, rural cinemas, telephone shops, technical and artisan workshops), powering small tools and appliances (drills, soldering irons, blenders), lighting and radio/TV. PV applications, and especially those for productive activities, have considerable potential to serve both environmental concerns and improve the situation of people rural areas. PV systems are also increasingly being used for agricultural applications (e.g., livestock watering, PV electric fences, pest control, PV-powered drip irrigation systems, aeration pumping for fish farming and poultry lighting, etc.) For these reasons, special attention will be given during the design and implementation stages of the proposed project to promote productive uses that could be generated through the use of PV-based systems.

The activities proposed for implementation in the full UNDP-GEF project are in line with Government policies and the recommendations of the September 2000 GEF Marrakech workshop “Making a difference in emerging PV Markets: Strategies to promote PV energy generation”, especially with regard to P V service businesses, financing, standardised quality products and creative partnerships.

Incremental Costs

This project is designed to remove barriers to the introduction of renewable energy-based systems (notably PV) to meet the basic energy needs of rural communities in the targeted villages. It will adopt a market transformation approach to the PV market and is consistent with the terms of GEF Operational Programme 6. To the extent that it helps stimulate greater sales of PV to households, businesses and institutions, it will also help reduce both the incidence of respiratory and eye problems attributable to paraffin soot and the risk of hut fires. The proposed project activities would not take place without UNDP and GEF support, making the project activities largely incremental.

Much of the present demand for modern lighting and electricity in rural Botswana is not being met due to the lack of appropriate financing mechanisms and an undeveloped or immature state of the PV market. One of the goals of this project therefore is to stimulate the growth of the PV market in Botswana, starting with the 88 targeted villages, so that costs will go down as the number of systems installed increases, thereby leading to greater satisfaction of this demand. However, no incremental cost subsidy per system or per Wp is being requested from GEF.

Because this project is not requesting financial assistance from GEF for a subsidy per Wp of the PV equipment installed, incremental costs associated with this project are considered to be the costs of the activities designed to remove the barriers to PV electrification and to stimulate the PV market in rural Botswana. For this reason, the project will focus on putting conditions in place for long-term Government subsidies, stimulating cash sales and designing rural savings, credit and leasing mechanisms by the private sector in combination with non-finance related conditions required to expand the market further (i.e., awareness, policy framework, training and institutional strengthening).

Furthermore, market survey information suggests that rural customers in Botswana use between 8.5 and 11.5 litres of paraffin per month, costing between USD 4.5 and USD 6. Battery expenses (for radio and torch) may run to an additional USD 4 to USD 5.5 per month, raising the monthly expenditure on lighting and entertainment to between USD 8.5 and USD 11.5. Because the costs of a PV-based system are still high in Botswana – USD 160 for a mobile system and USD 1,100 for an average 65-75 Wp system, including installation and a three-year maintenance contract - there are incremental costs associated with the purchase of PV systems.

However, market surveys show that over the five-year project period, the market for PV-based system in the targeted 88 villages could reach almost 35% of the 5,152 rural customers targeted for the PV lantern / LPG systems and around 10% of the 1,373 customers targeted for SHS. This would lead to CO₂ emission reduction from the introduction of PV-based systems for the supply of electricity for lighting and entertainment of approximately 52,000 tonnes of CO₂ over a 20-year period (based on an average 10 litres of

paraffin savings per month per household). CO₂ reduction per litre of paraffin is taken as 3.2 kg. It is estimated that replication of the project activities to other parts of the country could reach between 25% and 35% of the current 140,000 to 160,000 rural customers. Extrapolating from the CO₂ calculation for the 88 targeted villages, the total reduction in CO₂ as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment is equal to approximately 345,000 tonnes of CO₂ over 20-year period (including the 52,000 tonnes of CO₂ reduction from the 88 targeted villages).

(b) Sustainability (including financial sustainability)

This project aims to integrate the use of renewables for rural electrification into Botswana's national development programming, including allocation of long-term (institutionalised) financial assistance for such programmes. The Government has allocated subsidies of between 60-80% towards the cost of providing basic electricity services to approximately 6,500 rural customers as part of the proposed project. This project also encourages the development of a strong private sector involvement in PV activities by making appropriate financing mechanisms for dealers and suppliers and consumers available, as well as training and activities to improve product and service quality (e.g. codes and standards, including enforcement).

(c) Replicability

Component 6 of the project has been designed to replicate models, approaches and lessons learned, both within the 88 targeted villages and the rest of Botswana. 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 PV companies will expand their business to other regions in the country (some are already operating country-wide), thus replicating delivery and financing modalities. This replication is dependent, however, on the provision of sustainable and long-term subsidies by the Government of Botswana.

(d) Stakeholder Involvement

The development of this project proposal has been undertaken in a participatory fashion, consulting the major stakeholders throughout the process. That process began with a detailed socio-economic study of representative rural consumers; both those who have used renewable energy products and those who have not. In addition, consultation was undertaken with a wide range of groups and organisations who are stakeholders in this process, including representatives from the supply chain (end users, dealers, importers and international suppliers), NGOs, community based organisations, consultants and training institutions. Consultation was undertaken during three stakeholder workshops held in March, June and September 2003 in Gaborone. Numerous meetings were also held over a nine-month period with key stakeholders on an individual basis.

(e) Monitoring and Evaluation

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 the project's inception phase. A Project Planning Matrix has been developed and is part of the submission (Annex B). Appropriate and specific performance benchmarks will be established to effectively monitor project progress and to make crucial management decisions. Lessons from other PV projects have been incorporated into the design of this project. The PDF B team participated in the African PV workshop in May 2003 in Pretoria where exchange of lessons and horizontal learning took place.

4. Financing Modality and Cost-Effectiveness

Co-financing Sources				
Name of Co-financier (source)	Classification	Type	Amount (US\$)	Status
Ministry of Finance	Government	Cash	3,636,463	Letter attached
Energy Division Power Cooperation Others	Government	In-Kind	545,000*	
End-Users	Private Sector	Cash	1,197,145	
UNDP TRAC	Implementing Agency	Cash-Grant	10,000*	
Sub-Total Co-financing			5,388,608	

*Please note that 50,000 of the listed 545,000 government is -kind co-financing and the 10,000 from UNDP TRAC have already been spent during the PDF B phase. A detailed breakdown of the government in-kind financing contribution is included in the project brief.

As shown on the cover of this summary, the co-financing ratio is 1:1.63 which means that for every GEF dollar spent, 1.63 dollars will be spent by the Government of Botswana and the customers towards the global and development goals of this project. Please note that a cash contribution of USD 3,636,463 has been committed to this project by the Ministry of Finance of the Government of Botswana.

GEF Project Budget by Component

Component description:	GEF Budget (USD)
Component 1: Implementing hardware	600,000
Component 2: Policy/Institutional	250,000
Component 3: Awareness raising	500,000
Component 4: Training	550,000
Component 5: Financial engineering	600,000
Component 6: Learning and replication	395,000
Monitoring and evaluation	105,000
TOTAL	3,000,000

5. Institutional Coordination & Support

(a) Core commitments & Linkages

Energy and Environment has been identified in the UNDP Country Cooperation Framework (CCF) as a practice area.

(b) Consultation, Coordination and Collaboration between IAs, and EAs

No initiatives from UNEP or the World Bank have been planned for design and/or implementation in Botswana in the broad fields of renewable energy and rural electrification. Nevertheless, this project will closely follow possible future activities of UNEP and the World Bank and will seek active collaboration in the event that related activities are being designed and implemented.

(c) Project Implementation Arrangement

The programme will be executed by the Government of Botswana, under the UNDP National Executed (NEX) modality. The EAD of the MMEWR will serve as overall executing agency for the UNDP/GEF full-scale programme. BPC will be the implementing agency. For the day-to-day operation of the programme, one full-time advisor will be made available, fully funded through GEF. That advisor will fall under the overall management of BPC. In addition, the Tripartite Project Steering Committee (PSC) which was set up to steer the implementation of the PDF B activities will continue to function throughout the life of the proposed project.

ANNEX B: Approved GEF Full-Scale Project Brief

1. Identifiers:

PIMS Number	1771
Project Number	BOT/00/G41/A/1G/99
Project Name	Renewable Energy-Based Rural Electrification Programme for Botswana
Duration	Five years
GEF Implementing Agency	United Nations Development Programme
Executing Agency	Energy Affairs Division (EAD) of the Ministry of Minerals, Energy and Water Resources (MMEWR)
Implementing Agency	Botswana Power Corporation (BPC)
Requesting Country	Botswana
Eligibility	Botswana ratified the UNFCCC on 27th January 1994
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 Botswana's energy-related CO₂ emissions by promoting renewable and low GHG technologies as a substitute for fossil fuel (fuel wood, paraffin and coal) utilized in rural areas. The activities proposed in the project are designed to remove barriers to the wide-scale utilisation of renewable energy and low GHG technologies to meet the basic electricity needs of individual households in terms of lighting, power for radio-cassette/TV and income-generating activities. In turn, this project will help with the initiation of the intended renewable energy programme of the Government of Botswana and to encourage the development of the private sector industry in the provision of renewable energy in the country.

<u>3. Costs and Financing</u>		<u>US Dollar</u>
GEF	Project	3,000,000
	PDF B	<u>305,000</u>
	Subtotal GEF	3,305,000
Co-financing (Parallel)	Government (in kind)	495,000
	PDF B: Government (in-kind)	50,000
	PDF B: UNDP (cash)	10,000
	Government (cash)	3,636,463
	End-users (cash)	<u>1,197,145</u>
	Subtotal Co-Financing	<u>5,388,608</u>
TOTAL PROJECT FINANCING		8,693,608
Associated Financing	LPG part (Government of Botswana + customers)	247,129

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LIST OF ACRONYMS AND ABBREVIATIONS

BOTEC	Botswana Technology Centre
BPC	Botswana Power Corporation
BRET	Botswana Renewable Energy Technology
EAD	Energy Affairs Division
GHG	Greenhouse Gas
GEF	Global Environment Facility
GEF-SGP	Global Environment Facility – Small Grants Programme
JICA	Japanese International Cooperation Agency
LPG	Liquefied Petroleum Gas
MMEWR	Ministry of Minerals, Energy and Water Resources
MPS	JICA Master Plan Study on Photovoltaic Rural Electrification
NDP	National Development Plan
NEX	National Executed modality
NGO	Nongovernmental Organisations
NPV-REP	National PV Rural Electrification Programme
PSC	Project Steering Committee
PV	Photovoltaic
RIIC	Rural Industries Innovation Centre
SADC	Southern African Development Community
SHS	Solar Home System
TRAC	Target for Resources Allocation from Core
UNDP	United Nations Development Programme

Exchange rate:

1 US \$ = 5 Pula (October 2003)

1. Background and Context

1. For people and markets located away from the main electricity grid, the absence of reliable and affordable renewable energy technologies for electricity generation has meant that the only possibility for the provision of electricity services is through small fossil fuel-based generators. In the absence of petrol or diesel generation, rural households rely largely on paraffin for lighting and dry cells/batteries to power radio-cassettes/TV. In addition to the respiratory and eye problems associated with prolonged exposure to paraffin smoke and soot (poor indoor air quality), continued reliance on paraffin for lighting also adds to ever-increasing emissions of greenhouse gases (GHG). Recent advances in the renewable energy field, especially in photovoltaic (PV), have meant that some of these remote areas can now be provided with clean electricity services through renewable energy on a least-cost basis.

2. According to the Botswana Energy Master Plan prepared for the Energy Affairs Division (EAD) of the Ministry of Minerals, Energy and Water Resources (MMEWR) in June 1996, Botswana has an explicit commitment to equalizing the distribution of economic benefits between all parts of Botswana society. Energy, like education and health services, is a basic household need. For the long-term success of Botswana's economy and its society, access to basic energy services (cooking, heating and lighting) is essential.

3. The renewable energy resource situation that has been assessed during the implementation of the PDF B phase confirms that solar energy is available in abundant quantities, more or less equally distributed over the country throughout the year. Other renewable energy sources such as wind are limited, location specific and unevenly distributed during the year. Biomass energy is one of the main renewable energy sources currently being used in Botswana for cooking and heating. However, available biomass resources (both woody biomass and agricultural residues) are insufficient to generate and distribute electricity on a sustainable basis. As a result, the main focus for making use of renewable energy resources in Botswana will be on solar energy to be used with various PV-based electricity generation technologies; i.e., mobile solar systems, solar home systems, battery charging stations and mini-grids.

4. The Energy Master Plan proposes access to electricity through connection to the national grid, off-grid connection or PV to all those households where it makes economic and social sense, and improving the affordability of electricity to households. It also identified the following factors:

- Electrification planning should be integrated with other development planning.
- Rural electrification should be regarded as part of the national electrification programme, albeit with different objectives and requirements to urban electrification.

5. With regard to renewable energy-based electrification, the Energy Master Plan states that PV electrification should be part of national electrification planning. Planning of PV electrification needs to take cognizance of grid expansion plans, and should be funded under the same principle that justifies grid rural electrification.

6. Rural electrification has been an important component of the national development agenda for Botswana. However, the high cost of rural grid electrification programmes have been a barrier, with the result that approximately 17% of the total rural population has access to grid electricity services, compared to 36% in the urban areas.

Prior and ongoing assistance

7. There are several previous / ongoing studies conducted in respect of PV. These include the JICA Master Plan Study on Photovoltaic Rural Electrification (MPS). The MPS was designed to formulate a master plan for the promotion of rural electrification in Botswana by using PV systems over a ten -year period, starting in 2003. The objectives of the MPS were to:

- Supply solar electricity, quickly and under affordable conditions, to households in rural areas that cannot benefit from grid electrification and other energy supply services.

- Implement the PV rural electrification project at the least cost practicable and in a financially feasible and sustainable manner.
- Integrate with infrastructure projects required for a specific region or area.
- Expand environmentally friendly energy use.

The MPS was conducted in three phases:

- Phase I Preliminary Study (September 2000 - March 2001).
- Phase II Field verification of the PV promotion project (April 2001 - March 2002).
- Phase III Formulation of the master plan (April 2002 - March 2003).

Implementation of the MPS was scheduled to begin sometime in 2003.

8. The MPS was to be used as the basis for developing a business plan for PV rural electrification. The MPS analysed various problems that were encountered in different PV projects around the country, and on the basis of the lessons learned, made recommendations for a new institutional framework to promote PV rural electrification and an operation and management methodology, among other issues. The MPS also established criteria for the selection of villages to be covered by the PV electrification project in order to ensure that selection is made on the basis of the minimum cost principle. Key planning parameters, such as the target electrification rate and PV systems sizes, were established by taking into account the results of a pilot dissemination project conducted in three villages and by checking the effectiveness of the programme recommended in the MPS. A preliminary business plan for PV rural electrification was formulated to incorporate all necessary elements and its feasibility was evaluated through a financial and economic analysis. Finally, necessary government support was identified to allow the project to be operated on a sustainable basis. A PV pilot dissemination project was set up in three villages (Lorolwana, Kudumatse and Motlhabaneng), based on a fee-for-service principle with Solar Home Systems (SHS) and a Battery Charging System in Lorolwana. The Government of Botswana is currently evaluating the MPS. Its ultimate implementation will depend on the outcome of the current UNDP/GEF study.

9. Other prior initiatives on renewable energy-based rural electrification are:

- Botswana Renewable Energy Technology Project.
- Manyana PV Project.
- National PV Rural Electrification Programme.
- Motshegaletau Centralised PV System.
- Global Environment Facility - Small Grants Programme (GEF-SGP) Solar Lantern Project.

10. The Botswana Renewable Energy Technology (BRET) Project was in operation during the 1980's. The BRET project was jointly funded by the Governments of Botswana and the United States (through USAID). The scope of the project activities was to explore the potential for various renewable energy technologies for use in rural areas of Botswana. Technologies that were evaluated included:

- fuel conserving wood stoves
- retained heat cookers
- small scale water heaters
- renewable energy pumping systems (wind and PV pumps), and
- various applications of solar energy.

The use of PV technologies included: lighting and refrigeration in rural clinics (at Lentsweletau, Mabule and Shoshong), lighting in primary schools (at Oodi, Dishegwane, Shoshong and Molapowabojang) and PV water pumping (5 systems installed). The BRET project was also involved in the installation of approximately 25 anemometers throughout Botswana that resulted in the development of a wind map for Botswana.

11. In 1991, EAD started arrangements for a pilot project to install, monitor and evaluate solar energy technologies in the village of Manyana, which is located approximately 50 km from Gaborone. The Manyana

PV project started in 1992 and was set up to assess the socio-economic viability of solar energy technologies so that they could be replicated in other parts of the country and to provide data to facilitate the formulation of policies regarding the use of renewable energy. In 1995, the project was changed from a pilot to a commercial project, managed by the Rural Industries Innovation Centre (RIIC). A credit scheme was offered to 42 users with instalment payments over two years. An evaluation of the Manyana project was carried out in 1994, during which 36 of the 42 users were interviewed. The following is noted from that evaluation:

- The users' highest priority item was for a refrigerator (64%), followed by televisions (61%), irons (36%) and Hi-fi/radios (31%).
- Fifteen percent of the households surveyed already had gas powered refrigerators.
- It was considered that a gas-powered refrigerator is a good complement to PV lighting since the investment in extra PV panels for a PV powered refrigerator can be prohibitively expensive.
- There is already an infrastructure for gas use since at least 85% of the respondents already used gas for cooking.
- Irons are often heated by gas or paraffin stoves.
- It was concluded that almost all households paid off their loans and were satisfied with the performance of their systems.

12. The National PV Rural Electrification Programme (NPV-REP) started in 1997 with the aim of disseminating PV electrification throughout Botswana after the successful implementation of PV in Manyana. The programme offered loans on nationwide basis to households and small businesses enabling them to purchase a SHS. RIIC was the implementing agency for the programme. Although the NPV-REP reduced the barrier of high up-front payments of SHS, the actual uptake remained low, with only approximately 300 SHS installed over four years. The following represent the key findings / limitations of the NPV-REP:

- The programme was understaffed and the staff that was available was under-qualified.
- No proper system sizing method was used in preparation of quotations and there were inconsistencies in the pricing of quotations and considerable delay in the provision of quotations to applicants.
- Companies did not experience problems supplying PV components.
- System costs increased by fifty percent after inception of the programme.
- There was no adherence to the contracts signed between RIIC and the rural customers.
- Many systems were installed without down payments.
- Not enough pay-points were available where installments could be paid.
- There was a very high rate of defaulters.
- Systems were scattered over the country, which hampered maintenance efforts.
- There was no planned maintenance programme to support periodic inspections.
- Customer service was poor.
- The accounting package and financial management system that were used in the programme were not appropriate.
- There was no proper financial auditing of the project.
- Over half of the interviewees were not aware of the existence of the NPV-REP.
- There was no apparent complementarity between the Rural Collective Scheme (initiated to reduce the barriers for the uptake of grid electrification) and the NPV-REP.

The main restraining factors of the NPV-REP were summarised as follows:

- Unclear strategies on how to achieve target of 237 installations per year.
- Lack of adherence to policy procedures.
- Poor communication links between the implementing office and its clientele.
- Poor record keeping on payment status of end users.
- Rapid increase in component prices, which made total system costs very high.

13. A centralized PV system with a capacity of 5.5kWp started commercial operation in August 1998 in Motshegaletau Village. That system employs two inverters with an AC output of 4.5 kVA and supplies electricity to 14 customers through a 240 V distribution network with a length of approximately 2 km. Most of the electricity is supplied to a school, a clinic, the Kgotla (the village / tribal meeting place) and individual households. Two TVs, which were donated by a private company, were installed in the school and the clinic. Electricity is also supplied to streetlights. The electric tariff is P0.25/kWh (USD 0.05/kWh), which is the same as the Botswana Power Corporation (BPC) tariff. A combination of conventional and pre-paid metering systems is applied. Conventional meters were installed at nine households, with pre-paid systems installed at the remainder of the households. Cards with different values are provided with the pre-paid metering systems. No electricity fee is charged to public facilities, such as the school and the clinic, because the District Council pays for them. Three-day training sessions are provided to the District Council four times a year, which covers maintenance and repair of the system.

14. A project that provides users with solar lanterns and solar batteries is ongoing in the villages of Malatswae, Dimajwe, Majwana-adipitse and Tsimoyapula, all located in the Central District. The project is coordinated by the Serowe North Development Trust and is financed through the GEF -SGP. One hundred households obtained solar lanterns and batteries through a hire-purchase scheme with a down payment, and pay the remainder in monthly installments over a period varying between 12 and 18 months. The objectives of the project are to:

- Provide affordable high quality lights and solar batteries in a sustainable way to households in four villages.
- Build an institutional and financial framework based on the needs of the people that enables the execution of a solar lantern and battery hire-purchase scheme.
- Gain experience with a hire purchase scheme on a cost recovery basis.
- Encourage wider use of solar lanterns and batteries as a viable renewable energy source through replication in other villages in Botswana.

The solar lantern project is ongoing. Some initial findings are:

- There is a high breakage of solar panels of one manufacturer (solar panels of two different manufacturers were used in the project).
- Potential cost savings due to diminishing purchases of paraffin, candles, dry cell batteries and reduced charging of car batteries by solar lantern users, are on average not more than P30 (USD 6) per month per household.
- Having five different hire purchase schemes is unnecessarily complicated for users and administrators.
- Many users are behind with installment payments, probably due to insufficient incentives to pay installments and insufficient financial administration by the responsible people in the villages.

The following observations can be made regarding the implementation of this project:

- The implementing organisation, Serowe North Development Trust, is potentially very well suited for distributing the lanterns because of its presence in the region.
- A well-organized system of fee collection, administration and after-sales service is required for a project of this type to be financially viable.
- Financial records are currently incomplete, incentives for fee collection at village level appear insufficient and the organization's response to complaints of users is slow or absent.
- Spare bulbs and in-house wiring should be locally available in the project area.

15. Following and parallel with some of the above initiatives, GEF approved a PDF B Project for 'Identifying and Overcoming the Barriers to Widespread Adoption Renewable Energy-based Rural Electrification in Botswana'. The main objective of that project – which led to the formulation of the present project brief –was “the development of a coherent action plan for establishment of a sustainable

infrastructure for providing energy services to off-grid communities, using low-GHG emission energy technologies". As such, the project looked into:

- Available renewable and low GHG energy resources.
- Suitable technologies to harness these resources.
- The characteristics of rural customers.
- Barriers to renewable energy use in rural electrification.
- The establishment of suitable financing mechanisms for suppliers and end users.
- The reduction / mitigation of risk to BPC, among others, when designing and implementing delivery models (e.g., the expansion of BPC's role to include the widespread use of decentralised clean energy options for off-grid energy supply and services).
- Infrastructure and capabilities needed to ensure sustainability of the project activities long after the initial GEF seed funds are exhausted.

This preparatory phase was conducted with a view towards presenting this full-size project brief for GEF funding.

Barriers encountered in Botswana

16. The following barriers to the utilisation of renewable and low GHG technologies in rural areas in Botswana were identified during implementation of the PDF B Project mentioned above:

Information and Perception barriers:

- Information and perception barriers occur at several levels of the renewable energy sector. At the country level, there is insufficient knowledge about available technologies and technological developments. Information about available technologies and technology developments might be available at the level of individual (research) institutions and donor sponsored projects, but is not centralized nor easily accessible. Exchange of information between different stakeholders regarding data, experiences gained with different technologies, financing mechanisms and organizational/institutional delivery set-ups is not formalized. As a result, development of a best practice delivery model is slow and costly and in many cases ends up in reinventing the wheel, with the same mistakes repeated over and over again.
- Partly because of the aforesaid information barrier, and partly because of the fragmentation of the financial markets, commercial financial institutions are insufficiently aware about the financing needs and possibilities associated with the renewable energy sector. Financial institutions lack information about the technologies, their transaction costs, risk management and contract enforcement issues and hence are not in a position to assess potential profit opportunities. This information barrier inhibits financial institutions from entering the renewable energy market, which in turn inhibits the growth of a commercially viable renewable energy sector in the country.
- Further, there exists an information and perception barrier at the level of the end-user or consumer, especially with regard to PV. Either they are not aware about which technologies are available or have a wrong perception, due to insufficient information, about what a particular technology can / cannot do or how this technology needs to be used and maintained. This latter perception barrier often leads to unrealistic expectations and subsequently to disappointments about the technologies offered, resulting in consumers discarding the technology as 'useless'. The perception that once a village receives renewable energy services it will be excluded from grid connection has also turned out to be a powerful barrier to widespread adoption.

Financial barriers:

- As with the information and perception barriers, financial barriers occur at several levels of the renewable energy sector. The first financial barrier is often created by donor-funded projects that want to promote the use of renewable energy in a country, particularly PV. By offering these technologies at heavily subsidised consumer prices during an often short project period, these projects create unrealistic price expectations among consumers that the commercial private sector cannot meet once the project comes to a close. Another weakness often observed is that donor funded projects offer services on credit, which the private sector cannot afford to do. Moreover,

credit is often offered at below market interest rates and repayments are not efficiently / effectively enforced. These practices negatively influence the payment culture of consumers, which in turn creates problems for the private sector after the project has ended. The result is a market distortion or financial barrier that is extremely difficult to overcome and hence inhibits the growth of the renewable energy market. If subsidies, favorable credit schemes and other short-term market distortions are introduced during projects, there needs to be a longer-term vision on how these financial instruments (subsidies, favorable credit) will be continued after a project finishes or how they can be scaled down over time. In summary, a programme approach needs to be taken as compared to a project approach that introduces severe financial barriers.

- The second financial barrier is partly a result of the information barrier that exists at the level of financial institutions. Even without the existence of a project-induced market barrier, private sector companies in the renewable energy sector have difficulties raising sufficient credit to finance their operations and/or expand their businesses, and if credit is to be found it is often very expensive.
- The third financial barrier is at the level of consumers and constitutes one of the biggest barriers of them all. This financial barrier is in the form of the level of payments, as well as the mode of payments. In general, it can be concluded that the level and/or the mode of payments offered by the delivery agent do not tally with the income levels and structures of the potential rural consumer. The payments required are often either too high or too inflexible, resulting in a very small uptake and extremely slow market growth.

Technology barriers:

- Technology becomes a barrier to its own widespread adoption when it is too expensive, too complex or is inappropriate, i.e., when it is pursued for its own sake or developed without regard for its practical end-use. Research on PV panels continues to focus on improved energy efficiency with its associated cost, whereas most of the poorer users and countries would benefit more from research into improvements in component quality and robustness and manufacturing efficiency that leads to lower overall costs. The balance between component quality and price is delicate and when components are considered too expensive, users may choose not to use them. Promising new technologies are usually expensive and unproven. Poor people who need cheap reliable forms of energy can not afford, and are not prepared, to act as guinea pigs for experimental technologies. Witnessing the normal set-up and running problems associated with new technology may be enough to put people off adopting that specific technology. To poorly informed users something as simple as maintaining levels of battery water is a technological bridge too far. As such, technological barriers are intertwined with barriers to the dissemination of information. Training programmes for correct installation and maintenance also impact on the effectiveness of a particular technology. New or unfamiliar technologies need to be introduced with appropriate and accessible training in their use and maintenance.

Legal and Policy barriers:

- The present legal and policy arrangements in Botswana do not represent significant barriers to the adoption and implementation of the proposed delivery model. On the other hand, it could be argued that the existing legal / policy structure is not particularly conducive to the implementation of those models. One example of these non-conducive barriers is the relatively weak environmental regulation in Botswana, which fails to provide much incentive to use energy systems that are based on renewable energy sources. For example, the existing legislation in respect of air pollution is so weak that it offers no incentive for the use of low-GHG technology.

Institutional/Organizational barriers:

- The first institutional/organizational barrier is that renewable energy efforts are often provided through the use of donor-funded projects implemented by public sector institutions. Apart from frequently creating information and financial barriers, an additional weakness of this project-format is that they cover only a few pilot areas and villages. They are, also, by definition a high-input effort with a short-term intervention period, undertaken by an institution that has only weak links to relevant existing Government structures. These features make it so that renewable energy projects cannot be easily replicated or taken over by the public and private sector. The result is that renewable energy efforts remain at (small) pilot project levels, depending on new donor-funded projects to expand into new areas and villages without creating a viable renewable energy market.
- A second institutional/organizational barrier is the fact that renewable energy is not yet considered an integral part of Botswana's national rural electrification efforts. This results in potentially

disjointed planning and implementation of grid and renewable non-grid efforts, low government budget allocations to renewable energy efforts and insufficient capacity building and lack of institutional ownership and hence the non-translation of renewable energy policies into action.

- A third organizational/institutional barrier is the weak linkage between public and private sector and a general weakness in both sectors in terms of technical capacity, experience and organizational expertise to deal with renewable energy efforts. A concerted effort between the public and private sectors to overcome these institutional weaknesses is often absent, leaving the renewable energy market in a state of limbo.

17. The research on barriers has identified a number of premises or preconditions that an ideal delivery model for rural electricity based on renewable energy must adhere to, namely:

- It meets the demand of the rural customer as much as possible. As the rural customer is not one homogeneous group with the same demands and equal financial means, the ideal delivery model must be flexible enough in its technology and financing mix to suit the needs of the different market segments.
- It forms an integral part of an existing rural grid electrification programme. This means that the ultimate responsibility for the delivery model should rest with the same institution/authority responsible for rural grid electrification and that a project format for the implementation of the model is avoided.
- It promotes accessibility of information, actively create awareness and allows quick incorporation of new technologies (flexibility).
- It promotes close cooperation and collaboration between the public and private sectors and allows for ongoing human resources development (training) and development of a commercially viable renewable energy sector.
- It provides affordable off-grid electricity and renewable energy to customers in an efficient and effective manner.
- Incorporates methods for reducing theft of solar equipment.
- It includes national standards and codes of practice for renewable energy systems to ensure consumer protection.

18. A programme has been formulated to avoid, overcome and/or lower the above-mentioned barriers utilising the private sector as a vehicle for providing basic electricity services from renewables / PV. The activities proposed for implementation in the full UNDP-GEF project are in line with Government policies and the recommendations of the September 2000 GEF Marrakech workshop “Making a difference in emerging PV Markets: Strategies to promote PV energy generation”, especially with regard to PV service businesses, financing, standardised quality products, and creative partnerships.

19. GEF will contribute towards the incremental costs for the full project, both to encourage the adoption of renewable/PV technology for providing rural electricity services and to establish a replicable framework for future rural electrification.

2. Rationale and Justification

20. There are several reasons to promote the use of PV in Botswana through the removal of barriers. First is the fact that, at present, 65% of all villages (approximately 300) and 100% of all localities (381) with more than 200 people are not connected to the grid. In terms of households, 83% of all rural households are not yet connected to the grid. Even if the grid connection is extended as planned, by 2009 there will still be 194 villages and 379 localities, or 42% of all rural villages and 99% of all localities in Botswana that still require electricity services.

21. Botswana has excellent solar conditions, with an average of 320 clear, sunny days per year and an average global irradiation of 21 MJ m⁻²/day throughout the country. Therefore, introducing individual PV systems would make it possible, in the long term, for an estimated 25-35% of the 140,000 to 160,000 rural

households to have their basic electricity needs met from the locally available solar resource. This will have the effect of reducing the number of litres of paraffin used for this purpose by 100-115 million over the 20-year life of the equipment. This will lead to global benefits by reducing GHG emissions. Thus, it is expected that the introduction of PV systems for the provision of electricity services in Botswana will generate a reduction of approximately 345,000 tonnes of CO₂ over a 20-year period, based on an average reduction of 108 million liters of paraffin.

22. Removal of the identified barriers to the use of renewables / PV will also provide the private sector with the necessary incentive to improve their services and extend / set up new businesses for the sale of renewables/PV systems. This will benefit rural customers in Botswana in that they will have access to environmentally clean electricity services without the long wait for the arrival of grid-connected electricity, or they will have access to alternative energy services in places where the grid is already connected. The net result will be four-fold:

- Provide rural consumers with a better quality of life.
- Create opportunities for income-generating activities based on the availability of electricity services, thus assisting in poverty eradication.
- Have potential to substantially reduce the rural energy sector carbon emissions.
- Eliminate safety hazards associated with candle and paraffin fires, while simultaneously providing better indoor air quality (decrease the number of smoke and soot-related health problems associated with prolonged exposure to paraffin fumes).

23. Off-grid energy delivery is not confined to electricity. Studies in rural areas in Botswana have shown that the highest demand for energy delivery is for heating/cooking. Currently this energy need is generally satisfied by biomass. Off-grid electricity can not cater for this demand as it would be far too expensive. Offering gas (LPG) – already a popular commodity for heating/cooking in urban areas as an integral part of an energy package would not only stimulate the uptake of electricity for lighting, but would also drastically reduce the dependence on biomass. Substituting gas for biomass would also reduce GHG emissions and enhance people's well-being.

24. In addition to bringing about local, national and global benefits, the project is consistent with Botswana's national development priorities. It will increase the use of renewable energy and decrease both the consumption of paraffin for lighting and wood fuel for cooking and coal required to power the additional generating capacity of any grid extension / captive electricity generation.

25. The technologies that were identified during the PDF B phase to meet the diverse requirements for consumptive and productive uses are:

- Small mobile PV systems (e.g., solar lanterns and PV battery packs).
- Solar Home Systems.
- Battery Charging Stations.
- PV mini-grids.
- PV-LPG hybrid mini-grids

The financing mechanisms that were identified are:

- Donations.
- Long-term (sustainable) subsidy schemes.
- Cash and lay-by sales.
- Saving schemes.
- Credit / hire purchase / leasing.
- Fee-for-service.

26. The following table combines the various technology options with the various financing mechanism options. Squares marked with '✓✓✓' indicate potentially the most viable and first preferred options, '✓✓' indicate less viable and second preferred options, '✓' indicate possible but not preferred options, whereas the squares marked with 'X' are not recommended for use. The main criteria for reaching the conclusions

included in this table are experiences from other projects in- and outside Botswana, and the power needs for economic use combined with the power potential of the various technology options. Battery charging is mainly considered as a technology option for social, consumptive use, although cases do exist where battery charging can be seen as an economic use, but these are minor. Another way of looking at the table is to look at the column headed 'Social' as referring to stand-alone systems, and the 'Economic' column as referring to mini-grid.

Financing Mechanisms	Technology Options				
	Social Consumptive Use			Economic Productive & Consumptive Use	
	Solar Lanterns and Portable Systems	SHS	PV-Battery Charging Station	PV Mini-grid	Hybrid PV-LPG Mini-grid
Donations	✓	✓	✓	✓	✓
Cash	✓✓✓	✓✓✓	X	X	X
Lay-Bye	✓✓✓	✓✓✓	X	X	X
Savings Scheme	✓✓✓	✓✓✓	X	X	X
Credit	✓	✓✓✓	X	X	X
Fee for Service	✓	✓✓	✓✓	✓✓	✓

27. Rural energy is recognised as an important element of rural socio-economic development – not as an end in itself, but through the services it makes possible. In this way, PV systems can have a significant impact on the lives of rural users. For example, energy can provide services such as the extension of daytime activities through lighting, entertainment by means of radios and televisions and pumping of potable water. Furthermore, PV projects in Botswana have always been implemented to provide social and communal services (e.g., powering health centres, schools and communal centres). These social and communal services can spark the provision of income-generating activities. For example, small solar systems may help promote productive activities (e.g., bars, restaurants, rural cinemas, telephone shops, technical and artisan workshops), powering small tools and appliances (drills, soldering irons, blenders), lighting and radio/TV. In this way, the provision of PV has helped to contribute to rural employment creation, albeit on a small scale. The proposed initiative will take pro-active measures to promote productive uses such as these.

28. PV systems are also increasingly being used for agricultural applications. The technology for some of these applications, such as livestock watering and PV electric fences, are already available commercially in Botswana. Interesting applications such as pest control, aeration pumping for fish farming, powered drip irrigation systems and poultry lighting have scope in Botswana. PV applications, and especially those for productive activities, have considerable potential to serve both environmental concerns and improve the situation of people rural areas.

29. There are a great number of ongoing projects and programmes in Botswana that could benefit from the efforts of rural electrification using renewable energy sources, including the following:

- Citizen Empowerment Development Agency.
- National Master Plan for Agricultural Development.
- National Aids Coordinating Agency.
- African Comprehensive HIV/AIDS Partnerships.

- Community Based Natural Recourse Management.

30. These projects / programmes may benefit from renewable energy-based electricity, as many operate in rural areas where grid electricity is not readily available. It appears that the coordinators of these activities are often not aware of the potential of PV systems for providing services to their target groups. Similarly, it is unlikely that the beneficiaries of these programmes are aware of how these systems can serve them. What is required, therefore, is awareness creation targeted at these and other projects / programmes.

3. Objectives, Outputs and Activities

31. *Global objective:* To reduce Botswana's energy related CO₂ emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with PV and LPG, for the purpose of providing basic energy services to rural homes and community users.

Development Objective: To improve people's livelihoods by improving their access to and affordability of modern energy services and assist the Government of Botswana with the initiation of a renewable energy programme for the rural areas, thus reducing the dependency on imported fossil fuel.

32. These objectives would be achieved by project activities designed to remove barriers to the wide-scale utilisation of PV and LPG for providing energy services. 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 LPG.

33. The project consists of six components. Each of these six components is composed of an immediate objective, specific output(s) and a number of activities. By achieving these immediate objectives, the project will contribute towards the achievement of the global and development objectives.

1. Delivery of technology packages: *To implement three different delivery models targeting different end-user groups and making use of different PV and PV/LPG-based technology packages.*
2. Policy support and policy framework: *To assist with the development of policy and institutional arrangements conducive for the integration and provision of off-grid electricity services within the existing rural grid electrification programme.*
3. Awareness raising and changing of perceptions: *To increase awareness and change perceptions among the general public, decision-makers and rural consumers on the potential role of PV and LPG in meeting basic energy needs.*
4. Private and public sector strengthening and training: *To strengthen and support the public and private sector working in the PV and renewable energy sector to provide better quality of service.*
5. Financial engineering: *To assist with the development of appropriate financing mechanisms for the larger scale dissemination of PV-based technologies to rural customers.*
6. Learning and replication: *To disseminate experience and lessons learned to promote rapid implementation of rural electrification based on renewable and low GHG technologies throughout the country.*

34. The components are related to the barriers previously identified in the following manner:

Barrier	Component
Information and perception	Components 1,3,6
Financial	Components 1,5
Technical	Components 1,4
Policy/legal	Components 1,2
Institutional / organizational	Components 1,2,6

35. These components are to a large extent inter-dependent hence all have to be addressed to remove the barriers. With this in mind, the activities to be undertaken are planned as follow:

Component	Year 1	Year 2	Year 3	Year 4	Year 5
1: Implementing hardware					
2: Policy/institutional					
3: Awareness raising					
4: Training					
5: Financial engineering					
6: Learning, replication					

36. Component 1: Delivery of technology packages

The **immediate objective** is to implement three delivery models, each with its own technology and financing package and each targeted at different socio-economic strata. The delivery models/ financing schemes selected during the PDF B are a combination of cash sales, lay by and savings schemes. Two critical assumptions to lower the barriers associated with the delivery models are given right now but have to be monitored during implementation, namely:

- Renewable energy forms an integral part of rural electrification programme in Botswana.
- Subsidies are made available by the Government of Botswana.

The following table indicates the number of villages and households that will be targeted under the full -scale programme:

Subsystem	Total No of Villages targeted	No. of HH targeted	% of total HH	Target Period
Mobile systems/Gas	88	5,152	31	5 years
SHS	88	1,373	8.3	5 years
PV Mini-Grid	1	40	6	5 years

The cost of component 1 is estimated at USD 4,256,202 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding (design, planning, implementation, PV mini-grid)	600,000
Government of Botswana, cash funding (PV lanterns/ mobile systems and SHS)	2,369,057
End-users, cash contribution (PV lanterns/ mobile systems and SHS)	1,197,145
Government of Botswana, in-kind contribution (BOTECH, BPC)	90,000
Total	4,256,202
<i>Government of Botswana, cash associated financing (LPG part)</i>	<i>163,537</i>
<i>End-users, cash associated financing (LPG part)</i>	<i>83,592</i>
Total associated financing for the LPG part	247,129

As can be seen from the above table, an estimated USD 247,129 will be made available for the LPG -part of the delivery model. This is not strictly considered to be co-financing, but rather it is associated financing provided by the Government of Botswana and the rural customers.

The three outputs of component 1 will be:

Output 1.1: In 88 villages, 5,152 households will be offered basic lighting and cooking facilities

Activities:

- The design of a package consisting of a PV-based mobile system (PV lantern or PV battery pack) and LPG system to meet basic lighting and cooking needs in the targeted villages that are considered representative for the rural areas in Botswana.
- The planning of an implementation programme for the above system over a five-year period.
- Preparation of tenders for the possible delivery of 5,152 technology packages by the private sector, including the process of financing these packages.
- Roll-out of the implementation programme by means of actual delivery of the energy packages by the Botswana private sector, coordinated by BPC.

Output 1.2: In 88 villages, 1,373 households will be offered Solar Home Systems

Activities:

- The design of SHS's to meet lighting, entertainment and possibly basic small-scale income-generating activities in the 88 targeted villages.
- The planning of an implementation programme for the above system over a five-year period.
- Preparation of tenders for the possible delivery of 1,373 SHS packages by the private sector, including the process of financing these packages.
- Roll-out of the implementation programme by means of actual delivery of the SHS packages by the Botswana private sector, coordinated by BPC.

Output 1.3: In 1 village a mobile PV mini-grid will be installed, operated and closely monitored

Activities:

- The design of a mobile PV mini-grid, which it is anticipated can use the main components of the PV mini-grid system that is currently operating in Motshegaletau village once it is dismantled after the introduction of the national electricity grid. Main available components include 20 PV panels (285 Wp), 48 properly sized batteries, 2 sine wave inverters, a power management unit and data acquisition equipment. Additional hardware (to be financed by GEF), will consist of mobile containers and a low voltage distribution network. GEF has earmarked an amount of USD 150,000 specifically for scaling up the PV mini-grid from 5.7 kWp to an approximate 20-25 kWp if the power demand situation in the targeted village so dictates.
- Selection of an appropriate village where the PV mini-grid can be installed. Main criteria for selection are: a) the potential for income generating activities making use of high power PV systems such as a mini-grid; b) the planned roll out of the national electricity grid to rural areas as the PV mini-grid systems should function as pre-electrification units for a period of between 5 -10 years; and c) proximity to Gaborone, as the unit will be monitored intensively.
- Design of a data acquisition and monitoring plan for the PV mini-grid. This includes automatic data collection of electricity production and consumption, but also information on the fee collection system and customer perception, etc.
- Installation and close monitoring of the PV mini-grid system.

37. Component 2: Policy support & policy framework

The **immediate objective** is to review and, if necessary, refine the policy framework and the institutional arrangements necessary for the widespread adoption of PV for providing off-grid electricity services. The Government attaches high priority to providing basic energy services to the country's off-grid rural communities. This project will help the Government ensure consistency between the adopted policy and other rural energy support activities and find mechanisms to enforce new and/or existing standards and codes of practice for the assembling, utilisation and financing of PV systems in Botswana. The current National Development Plan (NDP 9) ends in March 2009 and for the sustainability of renewable energy-based rural electrification it will be necessary that continued support be available thereafter. The here proposed GEF

assisted initiative will provide valuable outputs that will justify the integration of renewable energy-based rural electrification into the country's rural electrification plans and the nation's Energy Master Plan, thereby securing political and financial assistance for the longer-term.

The cost of component 2 is estimated at USD 396,640 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding	250,000
Government of Botswana, cash contribution	96,640
Government of Botswana, in-kind contribution (EAD, Min. of Finance)	50,000
Total	396,640

The two outputs of component 2 will be:

Output 2.1: A policy and implementation framework for renewable energy-based rural electrification (mainly PV-based systems) is defined and in place

Activities:

- Continue monitoring how other energy services are priced, taxed or subsidised in order to ensure consistency between policies to support conventional fuels and those relating to renewable energy-based systems.
- Assist the Government to identify niche areas for the inclusion of renewable energy-based systems into national policies to deliver efficient and cost-effective energy services to the rural population.
- Closely monitor the outputs of the proposed GEF supported initiative and distil the necessary information to justify inclusion of renewable energy-based rural electrification into future national plans, including the allocation of financial resources for a continuation of activities as will be implemented under the full-scale programme proposed.

Output 2.2: Standards for PV, PV/LPG components and systems are updated and their use enforced

Activities:

- To review – and if necessary update - the currently existing standards, codes of practice and minimum warranty requirements.
- To review – and if necessary update – the currently existing codes of practice for technicians to follow to correctly size, install and maintain PV, PV/LPG systems.
- To facilitate the formulation and adoption of national standards, codes of conduct and minimum warranty requirements for PV, PV/LPG components and systems.
- To design and implement mechanisms to enforce the updated national standards, codes of practice and minimum warranty requirements, both during and after project completion.

38. Component 3: Awareness raising and changing of perceptions

The **immediate objective** is to increase awareness and change perceptions among the general public, decision-makers and rural customers on the potential role of PV and LPG in meeting the basic energy needs of rural communities. Knowledge, awareness and perceptions are important links in the process to successfully introduce renewable energy-based systems (notably PV, PV/LPG) for off-grid rural electrification. Market growth has been limited by the lack of knowledge about such systems among the population at large and the potential market stakeholders, in particular.

The cost of component 3 is estimated at USD 999,600 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding	500,000
Government of Botswana, cash contribution	399,600
Government of Botswana, in-kind contribution (EAD,BPC)	100,000
Total	999,600

The two outputs of component 3 will be:

Output 3.1: Awareness programme for *decision-makers* has been developed and implemented

Activities:

- To develop targeted awareness and information packages about renewable energy systems (main focus on PV systems) and their potential to offer (rural) development benefits.
- To organise field trips for key decision-makers (Ministers, representatives of key ministries [energy, environment, rural development, finance], representatives of the [rural] financial community, nongovernmental organisations (NGO), dealers etc.) to witness the utilisation of PV and PV/LPG systems in villages, as well as their local deployment and acceptance.

Output 3.2: A *customer* awareness programme has been formulated and implemented

Activities:

The main focus of the activities will be to address the usefulness and availability of 12V DC appliances (such as radios, lamps, video/TV, cell phone chargers) and low power AC appliances. that PV systems can power 12 VDC appliances and low power AC appliances. the technical limitations of PV systems and the inherent worth and value in PV systems and low power DC/AC appliances. Specific activities are:

- To prepare and disseminate information and awareness packages of printed materials (in local languages and/or in pictorial format) to raise a wareness of the benefits of PV and PV/LPG systems.
- To prepare and disseminate an outreach programme utilising multi-media to raise awareness of the benefits of PV and PV/LPG systems.
- To prepare educational material on PV and PV/LPG systems to be disseminated through schools located in the regions of the 88 targeted villages.
- To organise general awareness campaigns (e.g., free PV -powered video shows on local markets, etc.) including the active involvement and support of local PV dealers.
- To raise awareness on the potential for income generating activities such as bars, restaurants, rural cinemas, telephone shops, solar battery charging, technical and artisan workshops, by powering small tools and appliances (drills, soldering irons, blenders), lighting, radio/TV and cell-phone services in order to stimulate the setting up of small business activities made possible as a result of the introduction of PV-based electricity services.

39. Component 4: Private and public sector strengthening, training

The **immediate objective** of this component is to strengthen and support the private sector working in the PV sector to provide better quality of service and to develop models for providing PV -based electricity services to rural areas. The implementation of this objective will be done in an on-the-job training mode as appropriate, and will be supplemented with theoretical / class room type of training. The focus will be on both the public sector (mainly EAD, BPC and the Botswana Technology Centre (BOTECH) as well as the private sector (from installers and maintain personnel to importers and dealers of PV, PV/LPG equipment).

The cost of component 4 is estimated at USD 1,147,946 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding	550,000
Government of Botswana, cash contribution	497,946
Government of Botswana, in-kind contribution (EAD, BPC)	100,000
Total	1,147,946

The four outputs of component 4 will be:

Output 4.1: Business development services in the renewable energy sector (mainly PV) have been strengthened

Activities:

- To provide business planning and development services through one-on-one meetings with (emerging) rural businesses to develop business plans, marketing plans and promotional opportunities, making reference, as appropriate, to the resources and opportunities available for support.
- To assist local PV wholesalers and importers to develop stronger linkages with international companies as appropriate.
- Following the outcomes of the PDF B activities, there will be a continued need to study and discuss alternative service delivery modes and the roles of various potential stakeholders in the provision of electricity service for rural areas.
- To make available, reassess, refine and update PV market data for the key product lines in order to support further business development.
- To carry out training on PV business best practices, including service warranties and maintenance contracting.

Output 4.2: Technical knowledge of PV, PV/LPG systems has been strengthened

Activities:

- To develop a variety of courses (short/long) for various target groups on financing for small-scale renewable energy systems, the correct sizing, installation, and repair and maintenance of PV and PV/LPG systems and other relevant topics, tailored to the needs of the following groups:
 - NGOs, micro-finance institutions, financing organisations and others.
 - Technicians and sales people.
 - Engineers.
 - Entrepreneurs.
- To work with training institutions to develop an appropriate curriculum for the training of PV technicians, including training in standards, international best practice and ethical behaviour.

Output 4.3: The ability of the public sector and parastatals to provide a policy framework and assistance to further renewable energy-based rural electrification (notably PV) has been strengthened

Activities:

- To assist BPC with the setting up, staffing and initial years of operation of the off-grid electricity unit. This includes training, as appropriate.
- To capacitate the existing human resource base at EAD and/or other relevant Government agencies through provision of training to acquire the necessary knowledge and skills for policy development leading to strategies that can be realistically implemented.

Output 4.4: An association looking after the business interests of the PV sector has been set up and is operational

Activities:

- Once businesses in the PV sector have taken the initiative to form an institutional set-up such as, for example, the 'PV association of Botswana', assistance for activities of the newly formed association will be made available with earmarked GEF funding of USD 50,000. However, such funding cannot be used to staff the PV association nor for the initial set-up costs. The initiative should come from the private sector internally and should not be 'pushed' by external sources such as GEF. Typical activities to be supported include, for example: frequent meetings; exchange programmes with other PV associations in the region, newsletters and/or other forms of information documentation and sharing, sector-wide technical assistance activities (equipment testing, equipment labelling, addressing the theft issue, cross-sectoral linkages between health, education, water, rural development, etc.)

40. Component 5: Financial engineering

The **immediate objective** of this component is to design, test and evaluate viable financing options / mechanisms for disseminating rural energy services. The lack of financing - either to consumers or entrepreneurs - is considered to be an important barrier to the incipient growth of the PV market in Botswana. As a result, this component will be designed to test and evaluate financing schemes/delivery models. Cash sales with extensive subsidies from the Government of Botswana will be the main financing model in which both public and private sector play important roles given the origin of investment capital.

The cost of component 5 is estimated at USD 729,860 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding	600,000
Government of Botswana, cash contribution	79,860
Other in-kind contribution	50,000
Total	729,860

The three outputs of component 5 will be:

Output 5.1: A financing scheme to reach rural customers has been designed and implemented

Activities:

- To evaluate the experience of rural customers with the financing of (mainly) household goods / appliances by the private sector and with the 'Rural Collective Scheme' when financing connections to the national grid.
- To evaluate the possibilities that financial services offered by the private sector could have for distributing PV and PV/LPG systems and select the most appropriate approach to be followed by designing a detailed roll-out programme.
- The PDF B phase identified a need for a 'guarantee scheme' to reduce the (perceived) risks to entrepreneurs of entering into this new area of business. This scheme could take the form of working capital for entrepreneurs, a separately administered separately guarantee fund or any other appropriate mechanism. Part of the activities will be, therefore, to assess and recommend the most appropriate risk mitigation scheme, followed by the design and implementation. GEF is making an amount of USD 400,000 specifically available for this sub-activity, including the setting up and capitalisation of the risk mitigation scheme. (Note: GEF will not actively support the set-up of a new micro-credit scheme, rather it will make use of existing schemes that could be extended by including PV products for rural customers.)

Output 5.2: Sustainable (long-term) subsidy schemes for PV, PV/LPG systems will be designed and recommendations on how to implement these schemes will be made

Activities:

- To assess the share that renewable energy-based rural electrification could possibly have considering a) the power needs of rural areas and b) the cost-effectiveness of providing rural energy services.
- To assess the long-term subsidy requirements for different penetration levels of rural electrification making use of a) grid extension, b) PV / LPG mini-grids and c) renewable energy for those locations where it is considered the most appropriate 'fuel' source.
- To design long-term (sustainable) subsidy schemes for renewable energy-based rural electrification and make recommendations on how to integrate these schemes into national policy so as to enhance their implementation. The latter anticipates that inclusion into national policies is coupled with making financial resources (subsidies) available for implementation.

41. Component 6: Learning and replication

The **immediate objective** is to improve the understanding (i.e., learning) about the practicalities of renewable energy-based rural electrification followed by the dissemination of experience and lessons learned

to promote rapid implementation of the rural electrification activities throughout the country. 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 larger scale dissemination of PV and PV/LPG to provide basic electricity services to rural communities.

The cost of component 6 is estimated at USD 596,660 and divided as follows:

Source and type of funding	Amount in USD
GEF, cash funding	395,000
Government of Botswana, cash contribution	96,660
Other in-kind contributions (BPC, EAD)	105,000
Total	596,660

The four outputs of component 6 will be:

Output 6.1: A programme for replication of activities implemented under component 1 will have been prepared

Activities:

- To closely follow the implementation of the activities under component 1 and to distil the necessary elements for up-scaling these activities beyond the 88 villages that are currently targeted.
- To design a roll-out programme for PV and PV/LPG systems based on the activities under component 1 for inclusion in the national rural electrification programme.

Output 6.2: Lessons learned from the current pilot activities in three villages on fee-for-service SHS basis have been documented and used for decision making on possible continued developments with fee-for-service PV-based systems

Activities:

- To closely follow the pilot activities in respect of fee-for-service SHSs that are currently being implemented in three villages under the MPS (Lorolwana, Kudumatse and Motlhabaneng) and collect relevant data (technical, institutional, socio-economic and financial) that can be used for decision making on possible continued developments with fee-for-service PV-based systems.
- If warranted by the results of the above activity, a fee-for-service could be designed, making use of GEF financial resources. However, the implementation of a possible fee-for-service programme has not been budgeted for within this proposed initiative and hence financial resources have to come from non-GEF sources.

Output 6.3: The impact of PV, PV/LPG systems in the project focus area has been evaluated

Activities:

- Define a methodology targeting households adopting PV and PV/LPG systems to evaluate and measure the impact of those systems on livelihoods and standards of living.
- Apply that methodology to a limited, but carefully selected, sample of households and villages in the project area (88 villages).
- Summarize the impacts of PV, PV/LPG systems on households based upon project experiences.

Output 6.4: 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 initiative in the project area for distribution to other sites in Botswana.
- Organise site visits to the project area for Government agencies and donors 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 PV, PV/LPG field.
- Present the results achieved in the project region through presentations at national, regional and possibly international seminars/workshops.

42. 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.

4. Risks and Sustainability

43. A first level of risk relates to the rural consumers who might not approach the rural sales outlets for either PV Lanterns and mobile systems/LPG or SHS technology packages as a result of a) lack of awareness and b) lack of sufficient funding to purchase what are very expensive technological solutions for most rural customers. This risk has been mitigated through a number of activities to increase the awareness with rural customers (components 1, 3 and 6), design appropriate funding mechanisms tailored to the needs and abilities of rural customers (component 2) and through Government subsidies, that decrease from 80% the first year, to 60% in the fifth year of the project period.

44. A second level of risk relates to the fact that there will be a permanent need for subsidies for rural electrification in Botswana, whether based on grid extension, isolated mini-grids or stand alone household systems. The current allocated funding from the Central Government is committed under the NDP 9 and there is no institutionalized financial mechanism reaching beyond the project period of five years. There is clearly a risk that without continued subsidies up to levels of 80%, no (renewable energy-based) rural electrification will occur after the project period. This risk has been addressed within the project through activities that focus on awareness raising with key decision-makers (components 1, 3 and 6), policy support to include renewable energy-based electrification as a least cost option for rural electrification into national policy and plans (component 2) and by creating an implementation infrastructure for cost-effective and efficient delivery of renewable energy-based electrification to rural customers throughout Botswana (components 4, 5 and 6).

45. A third level of risk relates to the continued participation of the private sector who are considered to be the prime movers for implementation of the proposed initiative and to continue renewable energy-based rural electrification long after the project period has come to an end. Their active involvement could be lacking as a result of a) not having in place a skilled and informed labor force for design, implementation and maintenance services or b) not having sufficient incentives in place to justify involvement and investment by this sector. These risks have been mitigated by activities that relate to training and private sector strengthening (component 4), the provision of subsidies on hardware from Government, combined with setting up appropriate financing mechanisms for rural consumers (component 5), and by giving the private sector the lead role in implementing the proposed activities. Furthermore, the principle of Government creating the enabling environment for private sector implementation that has been adhered to in the proposed initiative – in combination with the above components - sends a clear message to the private sector that a long-term sustainable market for renewable energy-based rural electrification is being considered seriously. The learning and replication activities included under component 6 add confidence to the existence of a longer-term market.

46. The fourth level of risk relates to the replication of the proposed activities throughout rural Botswana. A combination of activities that have put in place the conditions for replication, such as policy support (component 2), increasing awareness (component 3), training related activities (component 4), increasing access to (rural) finance (component 5) and close monitoring of lessons learned (component 6), provide a solid basis for replication. However, this is going to be largely based on successful implementation of the here proposed activities in combination with continued Government support (mainly financial support through subsidies) after the 5-year GEF support has come to an end.

47. The fifth and final level of risk relates to the very high HIV/AIDS infection rates in Botswana, reaching approximately 30% of the rural adult population. This is not a risk unique to this project, but one that can be found in each and every activity being implemented in Botswana. Although the Government of Botswana is expending substantial time and effort to tackle this problem on a national basis, very few effective risk mitigation activities can be made available under the proposed initiative other than programming additional financial resources for training and capacity strengthening. This is necessary as more people will need to be trained to ensure sufficient available and qualified personnel for the longer term.

It should also be mentioned that early deaths from HIV/AIDS will result in loss of income for already poor rural households that will have an immediate effect on those households' ability to purchase consumer goods, including PV systems. No effective risk mitigation activity under the proposed initiative is capable of dealing with this national macro-economic phenomena other than to possibility increase the already substantial Government subsidies.

48. 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 programme design, planning and implementation are immediately dealt in the most appropriate manner. Although this type of programming is not specifically related to an identified risk, it does increase the implementation efficiency of the proposed activities.

5. Stakeholder Participation and Implementation Arrangements

49. The development of this project proposal has been undertaken in a participatory fashion, consulting the major stakeholders throughout the process. This process began with a detailed socio-economic study of representative rural consumers; both those who have used renewable energy products and those who have not. In addition, consultation was undertaken with a wide range of groups and organisations who are stakeholders in this process, including representatives from the supply chain (end users, dealers, importers and international suppliers), NGOs, community based organisations, consultants and training institutions. Consultation was undertaken during the three stakeholder workshops held in March, June and September 2003 in Gaborone. Numerous meetings were also held over a nine-month period with key stakeholders on an individual basis.

50. Specifically, stakeholder consultation was undertaken with: EAD, MMEWR, UNDP, BPC, Ministry of Finance and Development Planning, Department of Meteorological Services, representatives from local / district authorities involved with rural development, the University of Botswana, Department of Vocational Education and Training, Madirelo Training and Testing Centre, RIIC, BOTECH, the financing sector, Botswana Bureau of Standards, Japan International Cooperation Agency, private sector companies involved in providing renewable energy, the National Aids Coordinating Agency and other health-based NGOs, the Citizen Empowerment Development Agency, Botswana Community Based Organisations Network and other rural consumer representatives and the Botswana Congress of NGOs. In addition, consultation with representatives from similar UNDP/GEF projects, including the on-going project in Lesotho, was undertaken.

Implementation arrangements

51. The programme will be executed by the Government of Botswana, under the UNDP National Executed (NEX) modality. Experience has shown that NEX provides the best opportunity for project support to conform Government priorities and ensure national ownership. The EAD of the MMEWR will serve as overall executing agency for the UNDP/GEF full-scale programme. BPC will be the implementing agency. For the day-to-day operation of the programme, one full-time advisor will be made available, fully funded through GEF. That advisor will fall under the overall management of BPC.

52. In addition, the Tripartite Project Steering Committee (PSC) which was set up to steer the implementation of the PDF B activities will continue to function throughout the life of the proposed project. It contains representatives of the executing agency (EAD), the implementing agency (BPC) and UNDP - Botswana who represents GEF. The PSC will take broad strategic decisions on project implementation. An advisory board will be set up and it will be formed from a larger audience consisting of representatives from the Government, parastatals, private sector, financial community, academia, NGOs, etc.

53. The private sector will have a key role in the implementation of the programme, and are seen as the 'driver' of the project. To ensure active participation from the private sector, the project will issue

consultancy contracts to employ existing private sector participants to carry out awareness training, demonstration projects, work on financing packages, etc.

6. Incremental Costs and Project Financing

54. This project is designed to remove barriers to the introduction of renewable energy-based systems (notably PV) to meet the basic energy needs of rural communities in the targeted villages. It will adopt a market transformation approach to the PV market and is consistent with the terms of GEF Operational Programme 6. To the extent that it helps stimulate greater sales of PV to households and institutions, it will also help reduce both the incidence of respiratory and eye problems attributable to paraffin 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.

55. According to market survey information, households use between 8.5 and 11.5 liters of paraffin per month, costing between USD 4.5 and USD 6. Battery expenses (for radio and torch) may run to an additional USD 4 to USD 5.5 per month, raising the monthly expenditure on lighting and entertainment to between USD 8.5 and USD 11.5. Because the costs of a PV-based system are still high in Botswana – USD 160 for a mobile system and USD 1,100 for an average 65-75 Wp system, including installation and a three year maintenance contract - there are incremental costs associated with the purchase of PV systems. However, the market survey shows that the market for PV-based system in the targeted 88 villages could reach almost 35% of the households (5,152 households) over a 5-year period for the PV lantern/LPG systems and around 10% of the households (1,373 households) for SHS. However, at the moment, much of the pent-up demand for modern lighting and electricity in rural Botswana is not being met due to the lack of appropriate financing mechanisms and an undeveloped or immature state of the PV market. The purpose of this project is to stimulate the growth of the PV market in Botswana, starting with the 88 targeted villages, so that costs will reduce as the numbers of installed systems increases, thereby leading to a greater satisfaction of this pent-up demand. However, no incremental cost subsidy per system or per Wp is being requested from GEF in this project.

56. For the 88 targeted villages, the CO₂ emission reduction as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment amounts to an approximate 52,000 tonnes of CO₂ over a 20-year period. This is based on an average 10 liters of paraffin savings per month per household, for the households that will be reached during the project period of five years. CO₂ reduction per liter of paraffin has been taken as 3.2 kg. Replication of the project activities to other rural consumers has been estimated to reach between 25% and 35% of the current 140,000 to 160,000 rural households. If the CO₂ calculation for the 88 targeted villages serves as a basis for extrapolation, the total national CO₂ reduction as a result of introducing PV-based systems for the supply of electricity for lighting and entertainment amounts to an approximate 345,000 tonnes of CO₂ over a period of 20-years (this includes the amount of 52,000 tonnes of CO₂ that will be reduced in the 88 targeted villages).

57. Because this project is not requesting financial assistance from GEF for a subsidy per Wp of PV installed (PV Lanterns/ mobile systems and SHS), the incremental costs associated with this project are considered to be the costs of the activities designed to remove the primary barriers to PV electrification and stimulate the PV market in rural Botswana. It will focus primarily on putting in place the conditions for long-term necessary Government subsidies, stimulating cash sales and designing rural savings, credit and lease mechanisms by the private sector in combination with non-finance related conditions required to expand the market further; i.e., awareness, policy framework, training and institutional strengthening.

58. In terms of the electricity service to be provided to the 88 targeted villages, consumers will be made aware of the limitations on the electrical loads that PV can supply. Also, in conjunction with the introduction of PV systems, the use of energy-efficient compact fluorescent lamps, LED lamps and other DC and AC appliances (e.g., low-wattage radio-cassette recorders/TV sets) will be promoted and consumers will be trained in the appropriate use of electricity. In addition, all batteries used for energy storage will be recycled.

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

Table: Project Budget

Component description:	Estimated Budget (USD)		
	GEF, cash	Cash co-funding	In-kind co-funding
Component 1: Implementing hardware	600,000	2,369,057 (Govt.) 1,197,145 (end-users)	90,000
Component 2: Policy/Institutional	250,000	96,640	50,000
Component 3: Awareness raising	500,000	399,600	100,000
Component 4: Training	550,000	497,946	100,000
Component 5: Financial engineering	600,000	79,860	50,000
Component 6: Learning and replication	395,000	96,660	105,000
Monitoring and evaluation	105,000	96,700	
TOTAL	3,000,000	(Govt: 3,636,463) 4,833,608	495,000

A breakdown of the proposed in-kind co-funding is given in the table below.

Table: Overview of proposed in-kind co-funding in US Dollars

Component	EAD	BPC	Ministry of Finance	Private Sector	Other (BOTEC, RIIC, etc.)	Total in-kind contribution (USD)
1. Implementing hardware	5,000 monitoring and steering	5,000 monitoring and steering	20,000 monitoring subsidies		60,000 equipment from Motshegaletau	90,000
2. Policy/ Institutional	30,000 policy development		20,000 long-term subsidy scheme development			50,000
3. Awareness raising	30,000 (PR and awareness campaigns)	20,000 (PR and awareness campaigns)		40,000 (PR and awareness campaigns)	10,000 PR and awareness campaigns	100,000
4. Training	15,000 involvement in training activities	40,000 involvement in training activities		30,000 involvement in training activities	15,000 involvement in training activities	100,000
5. Financial engineering			15,000 monitoring subsidies and financial schemes	15,000 interest on working capital 20,000 setting up rural finance networks		50,000
6. Learning/ replication	30,000 integration into national policy	40,000 integration into rural electrification work plans	20,000 long-term subsidy scheme integration in national budget		15,000 assistance provided via R&D to EAD and BPC	105,000
Totals (USD)	110,000	105,000	75,000	105,000	100,000	495,000

7. Monitoring, Review and Evaluation

UNDP Monitoring

60. 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 the project's inception phase. A Project Planning Matrix has been developed and is part of the submission (Annex B). Appropriate and specific performance benchmarks will be established 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.

61. Following UNDP's change to results based management the country office has developed a new format for work plans. That format emphasises achievements (benchmarks and milestones), as well as cost per output/result. This format will allow for a critical assessment of programme performance as it shows, at a glance, what activities are to take place, when they take place, 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.

62. UNDP will have the monitoring and reporting obligation for the programme. In this connection, additional monitoring and evaluation missions will be undertaken by UNDP when this is judged to be required when, for example, 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

63. 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

64. Two independent external evaluations will be carried out. One mid-term evaluation after approximately 2.5 years of project implementation and one evaluation will be carried out towards the end of the programme. 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. A terminal evaluation will assist programme stakeholders to draw lessons learned for use in improving the quality of future development interventions with similar activities. UNDP regulations have no formal requirements for an end-of programme evaluation, so it should be needs-based. The evaluation could be done in collaboration with other development partners. An amount of USD 50,000 from GEF has been specifically earmarked for these two external evaluations.

GEF specific monitoring and evaluation

65. The impact of the proposed initiative in terms of emission reductions is of immediate interest for GEF, as this is their main mandate. Associated impacts such as market developments for PV operations and increasing income generating activities are considered important as well as both contribute to the sustainability of the proposed initiative and hence the (continued) reduction of emissions of CO₂. In order to properly and practically monitor these impacts it will be necessary that baselines be established prior to introducing and disseminating the PV based technologies. Further, it will be necessary to identify a number of (easily) measurable indicators that can be used for the 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 re-direct the project's implementation. It is proposed that the following indicators (including the indicated means of verification) be used:

Impact to be monitored	Indicators to be used	Means of verification
CO ₂ emission reduction	- Litres of paraffin reduced - Operational PV systems	- End-user surveys - Dealer surveys
Increased PV market activities	- Number of PV business in combination with the turn over/profit of each business	- Market surveys - Dealer surveys
Increased income generating activities in the project target area	- Number of income generating activities emerged in combination with the	- End-user surveys

	turnover / profit of these activities / businesses - It is anticipated that in 2 years 1% and in 5 years 3% from the households supplied with PV systems will be involved in income generating activities	
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66. Please note that the baseline methodologies and monitoring and evaluation plans as they are being used as part of the Clean Development Mechanism project development cycle could be used to further fine-tune the impact monitoring scheme indicated above. An amount of USD 55,000 from GEF has been specifically earmarked for these GEF specific monitoring and evaluation activities.

Monitoring Environmental Impacts

67. Waste generated due to the use of PV systems consists of two elements: discarded PV panels and balance of system components, such as batteries, regulators, lights, etc.

Discarded PV panels - Silicon is the basic material for the production of most solar panels. Since silicon is not toxic, there is minimal pollution risk. PV cell materials other than silicon, such as cadmium-telluride or other toxic materials may cause a pollution risk. During normal operation there is no leaking and even if the panel is broken, there is only limited risk to humans from toxic materials. The aluminum used in frames does not cause an environmental hazard, but frames are fairly easy to remove and recycling of aluminum is a well established industry, although not in Botswana.

Balance of system components - Of the balance of system components, batteries pose the highest potential for pollution since they contain lead and sulphuric acid, or other toxic materials. There are more discarded batteries than solar panels since batteries have to be replaced several times during the lifetime of the panels. Batteries may be easily recycled and one manufacturer in Botswana is in the process of setting up a recycling plant for car batteries. To a limited extent, recycling of car batteries is already in operation in Botswana, since batteries are sent to South Africa for recycling. The logistics for recycling batteries, particularly batteries that are used in PV systems, may pose a challenge since there is a long route from the user to the recycling plant and batteries are only recycled when there are incentives to do so. Other balance of system components do not pose an environmental risk, however, these components should be disposed off in a similar manner as other electronic apparatus.

68. The environmental impact of mainly the batteries will be closely monitored under the proposed initiative and measures for collection and recycling will be included in the operation and maintenance procedures that will be designed and implemented under the programme.

8. Legal Context

69. This document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of Botswana and the 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 recruited personnel/experts to undertake specific activities under the project.
- Identification and facilitation of training services.
- Procurement of goods and services.

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

71. The following types of revisions may be made to this document with the signature of the UNDP Resident Representative of the country office only, provided that 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 document.
- Revisions that 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.
- 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.

Annexes

Annex A – Incremental Costs – *included in Project Document*

Annex B – Project Planning Matrix – *included in Project Document*

Annex C – UNDP Budget – *included in Project Document*

Annex D – STAP Review and response to STAP Review

Annex E – Endorsement Letter – *included in Project Document*

Annex F – Co-financing Letter – *included in Project Document*

Annex G – Terms of Reference of Chief Technical Advisor and PSC – *included in Project Document*

Project Brief Annex D – STAP Review and response to STAP Review

STAP Reviewer: Abel Mbewe (mbewes@aol.com)

December 21, 2003

General:

This annex presents the response to the STAP Review. The original STAP review is included as well (*italic*). Most issues raised in the STAP review can be responded to making use of information presented in a final report entitled ‘Consultancy on identifying and overcoming barriers to widespread adoption of renewable energy-based rural electrification in Botswana’. The contents of this report has been reviewed and discussed during three project steering committee meetings and presented during three national workshops over the course of the implementation of the PDF B in 2003. In responding to the STAP review, reference will be made to this final report as appropriate.

This report forms the basis for the project brief and will further prove to be very useful reference material for the implementation of the proposed full-scale programme. For information purposes the table of contents (including its annexes) has been attached to this Annex D2. For copies of the final report on CD -Rom please contact the UNDP office in Botswana.

Summary:

The aim of this project is to contribute to the reduction of CO₂ emissions through the use of renewable energy technologies and low GHG technologies as substitutes for fossil fuels in rural areas. The project will remove barriers to wide scale dissemination of renewable technology and low GHG technologies. The project will establish a model for private sector participation in the dissemination of renewable energy in Botswana. This will give the private sector a larger role and stimulate the creation of sustainable PV markets. The project is recommended for approval. However, a major issue that needs to be addressed is battery replacement fund. One of the most crucial aspects of the operation of PV technology is that batteries are well cared for, and that there is a provision to replace batteries once they are worn out. In order to cater for this need, a battery replacement fund should be created as part of the project.

The issue of battery replacement has been the focus of multiple discussions with the main project stakeholders in Botswana. For the replacement of the battery, the end-user is expected to fully pay the costs for such. Since the need for battery replacement announces itself as a result of less and less battery performance the end-user will have sufficient time to set aside small amounts of money for when the time comes that the battery needs to be replaced. The end-users will have the choice to purchase (used) car batteries (cheapest) or sealed solar batteries (most expensive) or any other kind of ‘suitable’ battery easily available on the Botswana market. Setting up a battery replacement fund has been discussed, but given the fact that the project is focusing mainly on (heavily subsidized) cash sales this would mean setting up a completely new administrative structure for such a fund and this is considered too expensive for such a small, largely scattered market.

As part of the project’s awareness raising activities the end-users will be made aware of the differences between batteries (technical characteristics, upfront and lifetime costs); how to operate, maintain and extend the lifetime of batteries; how to save enough cash to replace the battery after its lifetime and how to discard fully used up batteries. With regard to the latter the Monitoring of Environmental Impacts as described in the project brief will focus on disposal (and recycling) of batteries used for solar lanterns, solar home systems and solar based (hybrid) mini-grids.

Major comments:

Project Executive Summary

Page 7, 3(b) Sustainability: To ensure sustainability, there is need to consider the following issues:

- Provide basic maintenance services to the solar systems. However, this is only possible if skilled human resources are locally available. Experience from previous projects in Botswana such as

NPV-REP (page 8 of Project Brief) shows that it has not been easy to recruit skilled personnel. This is one of major problems facing dissemination of PV systems in the Eastern and Southern African region. Skilled people are not available in the areas where solar systems have been installed.

Component 4, output 4.2 (Technical knowledge of PV, PV/LPG systems has been strengthened) as included in the project brief includes the following activities that specifically focuses on strengthening – among others – the skills of those rural service providers to be involved in basic maintenance services of solar systems. It is anticipated that these activities will sufficiently address the need for (semi-)skilled rural service provision to operate and maintain solar systems:

- To develop a variety of courses (short/long) for various target groups on financing for small-scale renewable energy systems, the correct sizing, installation, and repair and maintenance of PV and PV/LPG systems and other relevant topics, tailored to the needs of the following groups:
 - NGOs, micro-finance institutions, financing organisations and others;
 - Technicians and sales people;
 - Engineers; and
 - Entrepreneurs.
- To work with training institutions to develop an appropriate curriculum for the training of PV technicians, including training in standards, international best practice and ethical behaviour.

Cost of maintenance is another issue that will affect sustainability of the project. Most if not all solar dealers/companies are based in towns and cities. For these dealers to provide after sales service, they will need to send technicians to the rural areas – a matter that is very costly for end-users. The dealers/companies charge their customers a mileage fee of about US\$0.50/kilometer when technicians are sent to the rural areas. Since most of the rural areas are far from the towns and cities, the cost of transporting technicians is prohibitive. Consideration should be given to training local technicians in housekeeping of the solar panels (cleaning of the panels to remove leaves and dust to enhance operational efficiency of the systems) and basic maintenance of the systems. Local technicians could be individuals who are interested in the solar business or drawn from local community based organizations. This aspect has been successful in Zambia and Zimbabwe.

In the final report maintenance aspects are being dealt with in chapter 9, for example in section 9.6.2. “Maintenance of the Mobile Systems - the mobile systems are completely sealed and they utilize a gel-type battery that does not require any maintenance. The minimum expected lifetime of this battery is two years, after which it may need replacement. In the tender documentation minimum technical specifications of the equipment should be specified, together with minimum guarantee periods, which should be longer than the usual guarantee period of one year”.

Furthermore, in section 9.6.3, “The supply of the SHS package is to be tendered to private sector delivery agents, who will be responsible for delivery, installation and after-sales operations. Delivery, installation and maintenance should be tendered to the same company in one package to encourage better performance. For cash sales, a minimum guarantee period should be given, which should be longer than the usual guarantee period of one year. A maintenance contract may be part of the cash sale. To ensure that proper maintenance is carried out to the required standards, the terms of reference for the tender must specify that the agent will not be paid for part of the contract of his tender offer until he has successfully completed the (three year) maintenance contract”.

How maintenance contracts are to be dealt with (for example to be included in the overall service package or separate maintenance contracts) will be a combination of public sector involvement who provides the framework within which tenders will be developed and implemented and the market mechanism (private sector operators) as a reaction on these tenders.

- *Battery life span is usually between 3-5 years depending on the type of battery. Cost of replacement of batteries is a major problem for most of the rural people. There may be need to introduce a "battery fund" to take care of this problem.*

See page 1 for a response on the battery replacement issues, including a battery fund.

Page 7 (c) Replicability: Solar energy projects have a tremendous replicability value. However, the cost of solar technology is a major limiting factor in the dissemination of the technology. Due to the high cost of solar systems, it is unlikely that an average income household can afford to buy a system outright. In the proposed project, affordability has to a large extent been addressed by the financial support from GEF and government subsidy. Replicability may be possible if the government provides subsidies. Another approach may be the establishment of Energy Service Companies (ESCO). The ESCO model of solar energy dissemination has proven to be successful both in Zambia and Zimbabwe. In the ESCO approach, government in collaboration with donors gives solar energy equipment on lease to local companies whose owners have undergone basic training in main aspects of solar business. The ESCOs are established in rural areas and lease the solar systems to rural households and businesses and collect a monthly fee which is usually affordable to some people. The ESCOs are responsible for installation and maintenance of the solar systems. In this way, the issue of affordability is addressed.

Regardless the fact that the STAP reviewer claims that the ESCO model has been successful in Zambia and Zimbabwe, for the Botswana context this approach has been considered and found inappropriate. The viability for a fee-for-service system for solar systems that would be the basis main delivery model for any ESCO approach has been discussed in great detail in section 9.2 and appendix 9.1 of the final report. The main conclusion presented in the final report is that the fee-for-service model that is currently being tested in three villages should be closely monitored and lessons learned from it should be carefully analysed to possibly revisit the current position expressed by the PDF B consultant team that the fee-for-service is inappropriate for Botswana for the following main reason:

- The threshold for commercial viability cannot be met under Botswana conditions; i.e. the population is too small and scattered over a very large area.

Page 7 (d) Stakeholder Involvement: Two important stakeholders in this project are targeted communities and the informal sector. It is not clear from the Project Summary document (page 7 (d)) whether the representative rural consumers are from the targeted communities. An important stakeholder omitted in this project is the informal sector. The informal sector is very crucial to national development in many developing countries although activities of the informal sector are rarely documented. Since the project is expected to create opportunities for income generation, it may be worthwhile to include representatives of the informal sector as key stakeholders.

It is acknowledged that the informal sector could be an important element in (rural) development and to the extent possible representatives will be included in the proposed initiative. However, it must be realized that almost per definition the informal sector has no formal structures and hence no dedicated representation. The closest one would find are the village representatives of the 88 selected villages who will deal with the requirements of both households as well as the (informal) emerging business in their villages. These representatives will be part of the design, implementation and monitoring of solar-based energy initiatives in their respective villages.

Annex A: Incremental Cost Analysis - Component 3: Awareness raising and changing of perceptions: One suggestion to raising awareness is to install demonstration projects in targeted areas. Through demonstration projects, rural people may become aware of the solar technology. UNESCO used this approach in implementing the World Solar Programme.

Many renewable energy initiatives in Botswana over the past years have included demonstration projects and the Botswana Government has made it very clear that the time for larger scale implementation of renewable energy-based rural electrification initiatives has arrived. It is believed that the best possible way of creating awareness and changing perceptions is the actual successful installation of almost 6,500 solar based systems in 88 villages. In addition, more (generic) awareness activities are included in component 3 of the project

brief. The latter activities have twofold objectives; a) to create the appetite for the target groups in the 88 villages to be involved in the programme as a cash purchasing customer and b) to create the basis for replication the successful activities implemented within the 88 villages to a larger nation-wide customer base.

Project Brief

Background and Context

6. *Rural Electrification: What are the actual figures of the population?*

1996 estimate of the population is 1.5 million.

23. *Off-grid energy delivery: Reduction on dependence on biomass can also result in reducing drudgery especially for women who spend a lot of time collecting firewood and dung for cooking. The savings in time and labor could be devoted to income generation activities and welfare of the family.*

Acknowledged.

29 & 30. *The projects and programmes mentioned could be used to help in awareness campaigns and demonstration projects.*

Acknowledged.

36. *Component 1: What is the justification in estimating US\$1,197,145 as end-users' contribution when experience from previous and on-going projects shows that the majority of the recipients of the technologies have defaulted in payments? The Project Brief document gives details based on the following projects:*

- *National PV Rural Electrification Project page 8*
- *Solar lanterns and batteries project page 9*

Two main differences exist between past experiences as mentioned in the project brief and the proposed activities under the full-scale programme. Firstly payments to be made by end-users are based on a savings model – so money will be put aside (saved) prior to purchasing the subsidized solar systems. It is anticipated that there is an interest and willingness to save money to purchase a heavily subsidized solar system as it provides an important energy service that improves the quality of life and opens up the possibilities for small-scale income generating activities. The awareness campaigns will include the aspect of savings for future purchase in their activities. Secondly, the private sector will be the main actor in providing energy services to the selected 88 villages and they will put in place a workable model to ensure that end-users will pay their contribution. In comparison, past solar based activities were carried out by public sector agencies, who were having less interest in the financial aspects of the project.

37. *Component 2: Policy support and policy framework*

Comments under this component are based on experience from the Eastern and Southern African region. Under this component, I suggest that the following issues be taken into consideration:

- *Institutional Structure: An existing institutional infrastructure is one of the key factors influencing the implementation and promotion of renewable energy technology (RET) programmes. Although not accorded as much attention as other factors such as finance, a conducive institutional framework has often been shown to be a prerequisite for successful technology dissemination. Institutions should provide the enabling environment required to ensure that regulations are adhered to. Important institutional stakeholders in renewable energy sub-sector are government and commercial agencies. Key agencies in government include EAD, government departments whose activities have something to do with energy (finance, environment, rural development) and research institutions.*

Acknowledged.

- *Does Botswana have an energy policy? If so, what are government policies on renewable energy technologies? Introduction and success of renewable energy technology will, to a large extent, depend on existing government policy. Energy policy is an important factor that can guide implementation of various energy programmes. Government policies are an important factor in terms of their ability to create an enabling environment for RET dissemination and mobilizing resources as well as encouraging private sector investment. Through this component, the project could help government to have a clear-cut policy on the development and promotion of RETs. In the absence of an explicit energy policy, RETs will continue to be undertaken within an energy planning and policy vacuum. As a result, development of RETs will follow an ad hoc path.*

Botswana's energy policy is in place and is being extensively discussed in chapter 10 of the final report / Legal and Policy Analysis:

- 10.2 Supply and Delivery of Electricity
- 10.3 National Development Plan (9)
- 10.4 Botswana Energy Master Plan
- 10.5 Rural Development Policy
- 10.6 Privatization Policy
- 10.7 Environmental Legislation

Furthermore, component 2 of the proposed initiative focuses on improving the policy framework and providing policy support – among others to integrate renewable energy into the overall energy policy.

- *While the role played by the private sector is crucial, there is need for establishing an inspectorate that will inspect the systems and ensure that they meet minimum standards. The private sector is an important stakeholder in the dissemination of RETs. Although private sector concerns are largely motivated by the need to make profits, experience in many parts of the world show that their dynamism and willingness to take risks has been instrumental in the dissemination of RETs. The benefits of the of private participation include faster commercialization of RETs, reduced public sector funding, increased competition and more cost effective prices for RETs. While the private sector creates an environment of competition that lowers commodity prices, it can also lead to quality problems if not monitored properly. Evidence of this fact includes examples of Kenya PV industry where many poor quality PV systems (incorrectly sized, coupled to the wrong battery, fitted with inadequate controls) were sold to many users at very low prices. While the sales generated short-term sales income for the companies that scrambled to meet this demand, the long-term impact of poor field performance on the PV industry had been negative. In 1997, Seychelles had no regulations restricting the importation of electrical appliances. This resulted in importation of many solar systems with inappropriate ratings and low efficiencies` In Zambia, some companies supplied wrong voltage regulators which resulted in battery life span being reduced. Customer's confidence was seriously eroded and some rural health centers opted to switch to diesel generators. To overcome this problem, in Zambia, the Energy Regulation Board established an inspectorate that makes pre-installation and post-installation inspections of solar energy systems. In this way end-user interests are safeguarded.*

The here referred to issues are in detail being addressed in the final report, chapter 3 – Technology Assessment. Especially in the following sections:

- 3.12 Technical Standards
 - 3.12.1 Introduction
 - 3.12.2 Global PV Standards
 - 3.12.3 Regional Standards
 - 3.12.4 PV Standards in Botswana
 - 3.12.5 Recommendations

38. Component 3: Awareness raising and changing of perceptions

This is a very important component in the project in that renewable energy, as is the case for many innovative technologies, suffer from initial lack of confidence on the part of investors, governments and users, caused by lack of familiarity with their technical and economical potential and a general resistance to change and new ideas. This component should not only be restricted to key decision makers but local community, grassroots organizations and social units. Studies conducted by the World Bank have revealed that these organizations are critical for the successful implementation of projects. These organizations are familiar with and understand local resources and needs, and are often willing to assume responsibility for implementing projects. It is, therefore, advisable in this component to include:

- *Members of Parliament for the areas to be visited and representatives of community based organizations from future target areas.*

The above suggestion is included under component 3, output 3.1 (Awareness programme for *decision-makers* has been developed and implemented):

- To organise field trips for key decision-makers (Ministers, representatives of key ministries [energy, environment, rural development, finance], representatives of the [rural] financial community, nongovernmental organisations (NGO), dealers etc.) to witness the utilisation of PV and PV/LPG systems in villages, as well as their local deployment and acceptance.
- *Introduce rural energy fairs to promote awareness. This could be done in collaboration with agricultural shows done by the Ministry of Agriculture/Rural Development.*

Acknowledged.

56. How was the figure 52,000 tonnes of CO₂ arrived at?

Based on information given:

$$\begin{aligned} \text{CO}_2 \text{ emissions over a 20-year period} &= 10 \times 3.2 \times 5152 \times 12 \times 20 / 1000 \\ &= 39,567 \text{ tonnes of CO}_2 \end{aligned}$$

The information presented in the project brief in paragraph 56 refers to all households being reached as a result of the project activities. This includes the 5,152 households for the PV Lanterns; the households for the 1,373 for the solar home systems and the 40 households for the solar-based mini-grid, thus the correct calculation is:

$$\begin{aligned} \text{CO}_2 \text{ emissions over a 20-year period} &= 10 \times 3.2 \times 6,565 \times 12 \times 20 / 1000 \\ &= 50,419 \text{ tonnes of CO}_2 \end{aligned}$$

An approximate 1,500 tonnes of CO₂ has been added for anticipated increased (baseline) household use over time, thus reaching a total of 52,000 tonnes of CO₂.

60. No annexes included in the document sent.

All existing annexes were included as part of the Project Executive Summary; i.e. the Incremental Costs Analysis (Annex A) and the Project Planning Matrix (Annex B). Furthermore the endorsement letter from the Botswana GEF Operational Focal Point and the co-financing letter from the Botswana Ministry of Finance and Development Planning were provided for the STAP review.

References

European Commission (2000), Energy for the Future: Renewable Sources of Energy, Communication from the Commission. White Paper for a Community Strategy and Action Plan

Gustavo, B. et al (2000), Solar Photovoltaics for Sustainable Agriculture and Rural Development, Working Paper No.2, Food and Agricultural Organization, Rome

Karekezi, S. and Ranja T. (1997), Renewable Energy Technologies in Africa, Zed Books, London

Mbewe, A. (2003), Renewables and Energy for Rural Development in Zambia, African Energy Policy Research Network, Nairobi

SEI (2000), Rural Energy Service Companies – Experiences from Zambia, Final Report Phase I 1998 -2000, Stockholm Environment Institute/Ministry of Energy and Water Development, Government of the Republic of Zambia

Venkata, R. P, (1997), Rural and Renewable Energy: Perspectives from Developing Countries, Tata Energy Research Institute, New Delhi

World Bank (1996), Improving Energy Supplies for Two Billion People - Rural Energy and Development, The World Bank, Washington DC

ANNEX C: GEF Council Comments and UNDP Response

Comments from Germany:

We support the project without a need for further comments.

Comments from France:

The project aims at initiating a renewable energy programme for rural areas by substituting fossil fuels with photo-voltaic and LPG. 88 villages are targeted (1 373 solar home systems) in 5 years. The GoB will subsidize at 66% rate the equipments. The GEF will support mainly soft activities such as awareness, assistance, training, and communication.

The cost of the technical project is estimated at 4,8 M\$. The GEF's additional support with 3 M\$ is quite high for a rather limited number of SHS. To illustrate this aspect, a comparison with the case of Morocco can be made. French GEF (FGEF) brings an additional support of 1,2 M\$ for a project which is able to install 500 SHS per month. The 1 500 SHS in 5 years is rather slow and will not ensure the creation of innovative "fee for services" which can take care of the replacement of the batteries and the general maintenance of the SHS over 10 years.

UNDP response:

The project activities are not only directed towards the implementation of SHS but also include smaller, mobile systems and a mobile PV mini-grid. Please refer to paragraph 36 of the Project Brief where the number of households that are targeted are given:

Subsystem	Total No of Villages targeted	No. of HH targeted	% of total HH	Target Period
Mobile systems/Gas	88	5,152	31	5 years
SHS	88	1,373	8,3	5 years
PV Mini-Grid	1	40	6	5 years

The numbers given in the Project Brief are based on research carried out under the PDF-B and are believed to give a realistic estimation of implementation rates. Project designs in the past have highly overestimated the implementation rate of SHS.

Please note that the project design is not in support of a fee-for-service system. Reasons are discussed in the Final Report of 15 October 2003, Appendix 9.1.

Comments from Switzerland:

General Commentaries

The proposed UNDP-GEF project entitled "Renewable Energy-Based Rural Electrification Programme for Botswana" aims at reducing Botswana's energy-related CO₂ emissions by promoting renewable and low GHG technology as a substitute for the fossil fuels (firewood, paraffin and coal) used in rural areas. The activities proposed in the project are designed to remove barriers to the wide-scale use of renewable energy sources and low GHG technology in order to meet the basic electricity needs of individual households in terms of lighting, power for radio-cassette/TV and income-generating activities. In turn, the proposed project will help the government of Botswana to launch the renewable energy sources programme it is planning and to encourage the development of private industry in the provision of energy from renewable sources in the country.

The project falls under the competence of GEF Operational Programme 6: "Adoption of renewable energy sources by removing barriers and reducing implementation cost". The project consists of the following six

components: (i) Delivery of technology packages; (ii) Policy support and policy framework; (iii) Raising awareness and changing perceptions; (iv) Private and public-sector strengthening and training; (v) Financial engineering; (vi) Learning and replication. Activities and outputs of the project are designed to achieve the *global objective* of reducing Botswana's energy-related CO₂ emissions by substituting fossil fuels with PV and LPG, and the *development objectives* of improving people's livelihoods by making modern forms of energy more accessible and affordable, as well as assisting the government of Botswana to reduce dependence on imported fossil fuel.

Main Concerns:

- (1) *Continuing need for large government subsidies:* In the Project Brief the issue of the high level of subsidies required to cover the considerable cost of rural electrification through PV is discussed at several points. Also the risk that the government of Botswana will stop providing such subsidies upon completion of the project is addressed. Nevertheless crucial questions remain in this context. Firstly, the proposed level of subsidies (80% in the first year, decreasing to 60% in the fifth year of the project) is not directly compared with the required level of subsidies for other forms of rural electrification, such as grid extension (opportunity cost).

UNDP response:

As part of the PDF-B study extensive life cycle cost (LCC) analyses have been carried out comparing rural electrification using SHS with grid extension and other technologies such as diesel powered and PV-mini-grids, and battery charging stations (see attached annex 1 Chapter 8 and Appendices 8.1 to 8.6 of the Final Report of 15 October 2003). From this exercise it is concluded that SHS become competitive with grid extension (least LCC), even a few kilometers from the electric grid with the cost of connection to the grid being the most important parameter that determines the break-even point. For ease of reference please refer to the conclusions of the PDF B study regarding LCC analyses of different technologies which are attached as annex 2.

Furthermore, an in-depth study has been carried out by the JICA team regarding the 'hidden' subsidies on grid extension, taking into account the cost of grid electrification of 72 villages in Botswana. From this study it was concluded that with a per household electricity consumption of 50kWh/month (which is high in a rural Botswana context), the lifetime cost recovery is 6.8%. (Source: Table 7.2 -2, Final Report for the Master Plan Study on Photovoltaic Rural Electrification in the Republic of Botswana, February 2003). This results in a subsidy level of over 93% for providing grid electricity to rural households. This subsidy level is even higher if the connecting rate of households is lacking behind predictions, as is the case in many villages. The subsidy on rural electrification even extends to O&M systems in the villages because in most of the villages the revenue streams are not sufficient to cover O&M due to low number of connections and consumption.

Concluding from the above it follows that providing 80% subsidy on rural electrification using PV is a least cost alternative compared to grid extension. For the government the question is not whether to provide or not to provide subsidies. Rural electrification (through grid extension) has been subsidized for decades and will be subsidized for decades to come. For the government the question is if part of these (and future) subsidies could be redirected towards a more cost effective scheme that would benefit more people. A subsidy of 80% or 60% for SHSs appears to be high but it is a least cost alternative compared to 93% subsidy for rural grid extension.

Please note that GEF funds will not be used for the subsidy scheme. Subsidies are coming from the government co-financing contribution towards this project. The fact that the Botswana government is committing substantial amounts of co-financing towards subsidizing PV is an impressive sign of commitment.

Swiss comments (continued):

Secondly, such high subsidies may cause future barriers to the use of PV by creating unrealistic price expectations among consumers that cannot be met once the subsidies are phased out after project completion.

UNDP response:

The assumption that subsidies will be phased out after project completion is not necessarily true. The effect of subsidies will be monitored and should be adjusted depending on the level of uptake of PV electrification. It is expected that a certain level of subsidies will be required after project completion for a widespread uptake of PV electrification, as is the case with grid electrification.

The Government of Botswana is committed to long term funding of PV electrification and has expressed this in the Energy Master Plan. This is discussed in paragraph 5 of the Project Brief: "With regard to renewable energy-based electrification, the Energy Master Plan states that PV electrification should be part of national electrification planning. Planning of PV electrification needs to take cognizance of grid expansion plans, and should be funded under the same principle that justifies grid rural electrification."

Swiss comments (continued):

Thirdly, the private sector may be reluctant to invest and get involved in the PV business if there is substantial doubt that the government will be able to continue providing subsidies on a long-term basis. Generally the issue will have to be monitored closely throughout the project to minimize the risk associated with a sudden abolition of government subsidies.

UNDP response:

There are already half a dozen of companies dedicated to providing PV electrification services, mainly for institutional use (schools, clinics, staff houses, etc). Despite a number of unsuccessful PV projects in the past, these companies are determined to continue providing and extending their services, together with newly formed companies entering the PV market. In general the private sector is used to adapting to the changing markets. As pointed out earlier for the government the question is not whether to provide or not to provide subsidies. Rural electrification (through grid extension) has been subsidized for decades and will be subsidized for decades to come. For the government the question is if part of these (and future) subsidies could be redirected towards a more cost effective scheme that would benefit more people providing basic electricity services. A subsidy of 80 or 60% for SHSs appears to be high but it is a least cost alternative compared to 93% subsidy for rural grid extension.

Swiss comments (continued):

- (2) *Hardware financing by GEF:* On page 21 of the Project Brief it is proposed that GEF finances hardware (mobile containers, low-voltage distribution network). There is no explanation provided as to why GEF should finance hardware in the case of this project. This aspect needs to be closely scrutinized before final approval.

UNDP response:

Out of the GEF contribution of USD 3,3 million, USD 150,000 have been earmarked for hardware. This is less than 5% of GEF's contribution. Almost all the hardware is financed by the end-consumers, private sector and government. The only component where a small GEF contribution to the hardware costs is envisaged is for the mobile PV mini-grid. The total costs of the mobile mini-grid component are estimated at USD 600,000. USD 450,000 would be contributed by the co-financing partners and USD 150,000 by GEF. For this mobile mini grid it is anticipated that the main components of the PV mini-grid system that is currently installed in Motshegaletau village can be used free of charge once it is dismantled. Main available components include 20 PV panels (285 Wp each), 2 sine wave inverters, and probably the power management unit. Additional hardware that is needed to convert the stationary into a mobile grid will

consist of mobile containers and a low voltage distribution network. GEF has earmarked an amount of USD 150,000 specifically for scaling up the PV mini-grid from 5.7 kWp to an approximate 20-25 kWp if the power demand situation in the targeted village so dictates.

Without the GEF contribution the mobile PV mini-grid cannot be realized. According to the LCC analysis PV minigrids are cost-effective compared to SHSs for systems that are larger than approximately 10kWp if connection costs are low, that is when household density is high. Therefore the PV mini-grid option to rural electrification is an integral part of the project strategy and should not be dismissed.

Swiss comments (continued):

(3) *Unclear cooperation with other initiatives:* In the Project Brief other initiatives are described with respect to the promotion of PV for rural electrification, most importantly the JICA-funded Master Plan Study on Photovoltaic Rural Electrification (MSP) which should now be in the implementation phase. However, in the Project Brief it is not mentioned whether any cooperation or coordination is planned between the proposed UNDP-GEF project and the MSP, even though the two initiatives obviously have very similar objectives.

UNDP Response:

The MPS is not a project or programme, it is a study. The UNDP-GEF project is part of the government's response to the findings and recommendations of the MPS. The MPS was designed to formulate a master plan for the promotion of rural electrification in Botswana by using PV systems over a ten-year period, starting in 2003.

The MPS was conducted in three phases:

- *Phase I Preliminary Study (September 2000 - March 2001).*
- *Phase II Field verification of the PV promotion project (April 2001- March 2002).*
- *Phase III Formulation of the master plan (April 2002 - March 2003).*

The MPS was used as the basis for developing a business plan for PV rural electrification. The MPS analyzed various problems that were encountered in different PV projects around the country, and on the basis of the lessons learned, made recommendations for a new institutional framework to promote PV rural electrification and an operation and management methodology, among other issues. The MPS also established criteria for the selection of villages to be covered by the PV electrification project in order to ensure that selection is made on the basis of the minimum cost principle. A preliminary business plan for PV rural electrification was formulated to incorporate all necessary elements and its feasibility was evaluated through a financial and economic analysis. Finally, necessary government support was identified to allow the project to be operated on a sustainable basis. In addition a PV pilot dissemination project was set up in three villages (Lorolwana, Kudumatse and Motlhabaneng), based on a fee-for-service principle with Solar Home Systems (SHS) and a Battery Charging System in Lorolwana.

The Government of Botswana is currently evaluating the findings of the MPS which coincide with the recommendations of the PDF B studies. Implementing the MPS recommendations will not happen as a separate project or in parallel to the UNDP-GEF project. The government will have only one PV Electrification Programme. The MPS has focused on how to go about doing PV electrification or the plan while the GEF project concentrates on removing barriers. This UNDP-GEF project is – to a large extent – the government's follow up to the results of the MPS.

With regard to the three pilot villages which are part of the MPS please note that the UNDP-GEF project will follow up closely the pilot activities in respect of fee-for-service SHSs and collect relevant data (technical, institutional, socio-economic and financial) that can be used for decision making on possible continued developments with fee-for-service PV-based systems. Please refer to output 6.2 of the project brief.

Swiss comments (continued):

(4) *Technology focus on PV systems:* Although renewable energy sources in general are frequently mentioned in the Project Brief, the proposed project is in fact mostly focused on PV. This may make sense in view of the prevailing climatic and topographic conditions in Botswana and the limited funds available under the project. However, since the objective of component 2 of the project (Policy support and policy framework) is to support the government in adjusting the policy framework for renewable energy sources, the concern is that PV may be assumed to be the preferred type of energy on a weak factual basis. In many cases other renewable energy sources such as biomass or wind may well be viable alternatives.

UNDP response:

Under the PDF B all renewable energy sources have been assessed (Please refer to Chapter 2 of the Final Report of 15 October 2003: 2. Renewable and low GHG Energy Resource Assessment). The results of these assessments which provide a strong factual basis confirm that solar energy is available in abundant quantities, more or less equally distributed over the country throughout the year. Other renewable energy sources such as wind are limited, location specific and unevenly distributed during the year. Biomass energy is one of the main renewable energy sources currently being used in Botswana for cooking and heating. However, available biomass resources (both woody biomass and agricultural residues) are insufficient to generate and distribute electricity on a sustainable basis. As a result, the main focus for making use of renewable energy resources in Botswana will be on solar energy to be used with various PV-based electricity generation technologies; i.e., mobile solar systems, solar home systems, battery charging stations and mini-grids.

Swiss comments (continued):**Conclusions and Recommendations**

The project is recommended for approval. It is generally well conceived and structured. The project also adopts strategic choices that are fully consistent with GEF strategies. A major concern is the high level of subsidies required from the government of Botswana to support PV-based rural electrification, and the risks associated with a possible sudden discontinuation of these subsidies after completion of the project. Further concerns are related to the unclear cooperation and coordination with other initiatives in the field of PV-based rural electrification, as well as the focus of the project mainly on PV, thus excluding other renewable energy sources. The project proponents are recommended to carefully monitor the issue of the subsidies throughout the duration of the project. Furthermore, project activities should be coordinated with other initiatives wherever possible in order to avoid duplication. While providing support for improving the policy framework for renewable energy sources, all possible renewable energy sources should be taken into consideration.

UNDP response:

Please refer to our responses on the previous pages on all issues raised in this paragraph.

Swiss comments (continued):**Further Commentaries**

- (1) Project Planning Matrix, page 13: The timeframe for some indicators provided in the matrix is longer than the duration of the project (5 years). However, for evaluation purposes, all indicators should be measurable by the end of the project at the latest.

UNDP response:

This comment will be taken into account during the inception phase when the indicators will be refined. Nevertheless we would like to point out that some of the impacts can best be measured after completion of the project.

Comments from U.S.A. (final comments, corrected version):

Summary: The project will reduce Botswana's energy related CO2 emissions by substituting fossil fuels with PV and LPG for providing basic energy services to rural consumers. The project will reduce CO2 emissions by 52,000 tons over a 20 year period for the 88 villages targeted by this project and as much as a 345,000 ton reduction if replicated to between 25% and 35% of all rural customers.

The PV systems are heavily subsidized by the government. How sustainable is this over time? When does GEF assume a subsidy will no longer be necessary and the costs fully covered by consumers and the private sector?

U.S. Position: Postpone. There is considerable merit in this project, and the Government's commitment to it is impressive. However, the project does not appear sustainable or replicable without substantial long-term subsidies from the Government. Is there some cost-benefit analysis that has been done to justify the subsidies? What are the lessons learned from similar projects? What is GEF policy on subsidies?

UNDP response:

As part of the PDF-B study extensive life cycle cost (LCC) analyses have been carried out comparing rural electrification using SHS with grid extension and other technologies such as diesel powered and PV-minigrids, and battery charging stations (see attached annex 1 Chapter 8 and Appendices 8.1 to 8.6 of the Final Report of 15 October 2003). From this exercise it is concluded that SHS become competitive with grid extension (least LCC), even a few kilometers from the electric grid with the cost of connection to the grid being the most important parameter that determines the break-even point. For ease of reference please refer to the conclusions of the PDF B study regarding LCC analyses of different technologies which are attached as annex 2.

Furthermore, an in-depth study has been carried out by the JICA team regarding the 'hidden' subsidies on grid extension, taking into account the cost of grid electrification of 72 villages in Botswana. From this study it was concluded that with a per household electricity consumption of 50kWh/month (which is high in a rural Botswana context), the lifetime cost recovery is 6.8%. (Source: Table 7.2 -2, Final Report for the Master Plan Study on Photovoltaic Rural Electrification in the Republic of Botswana, February 2003). This results in a subsidy level of over 93% for providing grid electricity to rural households. This subsidy level is even higher if the connecting rate of households is lacking behind predictions, as is the case in many villages.

Concluding from the above it follows that providing 80% subsidy on rural electrification using PV is a least cost alternative compared to grid extension. For the government the question is not whether to provide or not to provide subsidies. Rural electrification (through grid extension) has been subsidized for decades and will be subsidized for decades to come. For the government the question is if part of these (and future) subsidies could be redirected towards a more cost effective scheme that would benefit more people. A subsidy of 80% or 60% for SHS appears to be high but it is a least cost alternative compared to 93% subsidy for rural grid extension.

Please note that GEF funds will not be used for the subsidy scheme. Subsidies are coming from the government co-financing contribution towards this project. The fact that the Botswana government is committing substantial amounts of co-financing towards subsidizing PV is an impressive sign of commitment.

The assumption that subsidies will be phased out after project completion is not necessarily true. The effect of subsidies will be monitored and should be adjusted depending on the level of uptake of PV

electrification. It is expected that a certain level of subsidies will be required after project completion for a widespread uptake of PV electrification, as is the case with grid electrification.

The Government of Botswana is committed to long term funding of PV electrification and has expressed this in the Energy Master Plan. This is discussed in paragraph 5 of the Project Brief: “With regard to renewable energy-based electrification, the Energy Master Plan states that PV electrification should be part of national electrification planning. Planning of PV electrification needs to take cognizance of grid expansion plans, and should be funded under the same principle that justifies grid rural electrification.”

Lessons from other PV projects in Botswana and Southern Africa have been thoroughly assessed during the PDF B phase. These other projects include:

- *Botswana Renewable Energy Technology Project*
- *Manyana PV Project*
- *Motshegaletau Centralised PV System*
- *GEF-SGP Solar Lantern Project*
- *JICA / EAD Master Plan Study on Photovoltaic Rural Electrification*

Please refer to Chapter 5 of the Final Report of 15 October 2003: Assessment of Renewable Energy Initiatives in Botswana where these are discussed in great detail. The design of this project, including the subsidy scheme, is the result of lessons learned from previous initiatives.

PROJECT DOCUMENT SIGNATURE PAGE

**United Nations Development Programme
Global Environment Facility**

**Renewable Energy-Based Rural Electrification Programme for Botswana
BOT/00/G41/A/1G/99**

Country: Botswana

UNDAF Outcome(s)/Indicator(s): To assist Botswana in fulfilling its obligations under the global and regional commitments and goals that it has signed; notably the UNFCCC and the Kyoto Protocol.

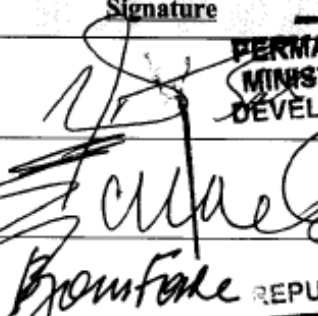
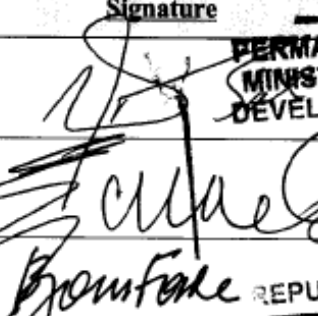
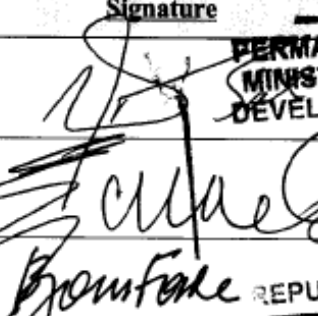
Expected Outcome(s): Improved awareness and understanding among decision makers and the public of linkages between environmental sustainability and human poverty and well-being. The project is linked to MYFF 2004-2007 - Goals and Service Lines 3.3 "Access to sustainable energy services" (Country Programme Outcome). Capacity for the development of strategies, action plans, systems and national communications developed in government (Country Programme Indicator).

Expected Output (s): National capacity building of key government institutions; NGO's and private sector strengthened and improved (Country Programme Output). The project is linked to a Core Result of "Access to energy services, electricity or cleaner fuels in rural areas increased" under MYFF Goal and Service Lines 3.3. The Country Programme does not show indicators for the above output.

Implementing Partner: Energy Affairs Division, Ministry of Minerals, Energy and Water Resources

<u>Project Period:</u> Country Programme 2003-2007	<u>Total budget</u>	USD	8,693,608
<u>Project Component:</u> Access to energy services, electricity or cleaner fuels in rural areas increased (MYFF Goal)	<u>Allocated resources:</u>		
<u>Project Title:</u> Renewable Energy-Based Rural Electrification Programme for Botswana	GEF	Project	USD 3,000,000
<u>Project ID:</u> PIMS 1771		PDF B	USD 305,000
<u>Project Duration:</u> 5 years	Government	(cash)	USD 3,636,463
<u>Management Arrangement:</u> National Execution		(in-kind)	USD 495,000
		PDF B in-kind)	USD 50,000
	UNDP	(PDF B cash)	USD 10,000
	End-users	(cash)	USD 1,197,145
	<u>Associated Financing:</u>		
	LPG part		USD 247,129

Agreed by:

On behalf of:	Signature	Date	Name/ Title
Implementing Partner		04 OCT 2005	PERMANENT SECRETARY MINISTRY OF FINANCE & DEVELOPMENT PLANNING Permanent Secretary Ministry of Minerals, Energy and Water Affairs
Government Coordinating Authority		04 OCT 2005	S.G. Tume Permanent Secretary Ministry of Finance and Development Planning
UNDP		04 OCT 2005	Resident Representative UNDP



UNITED NATIONS
DEVELOPMENT PROGRAMME