ANNEX 4
INCREMENTAL COSTS AND GLOBAL ENVIRONMENTAL BENEFITS

INTRODUCTION

This is one of the first projects that will be prepared in the context of the **World Bank/Global Environment Facility Strategic Partnership for Renewable Energy**. The key features and operational modalities of the Partnership embodied in this project are:

Increase in GEF resources with significant leveraging. The GEF related targets in this project are ambitious, and the GEF contribution proposed in this project is one of the highest for the World Bank's operations in the sub-Saharan Africa region (see also the PCD section F *Sustainability and Risks* and the section later in this annex for a discussion about sustainability). At the same time, there is significant leveraging of GEF resources, particularly for the investment components, where the GEF incremental costs are expected to decline over time.

Long-term orientation with a focus on the private sector. In this project, there is a long-term orientation, targeted at building effective bridges to private sector market development and financing capabilities to ensure commercial sustainability. The Bank's lending instrument for this project is an Adaptable Program Loan (APL). Instead of an ex-ante definition of the entire project and a linear implementation path, this APL: (i) provides phased and sustained implementation support for long term development of technologies and markets; (ii) at the private sector level, provides different entry points to encourage investment in market development, and permits a logical maturation to commercial delivery and finance mechanisms, and (iii) includes financial resources for an increased level of pre-investment studies that would lead to a long-term private sector investment pipeline.

Creation and utilization of country-based Intermediaries: To overcome constraints in the Bank's capacity to oversee a growing number of individual project transactions, as well as to increase the commitment and in-country "ownership" of renewable energy development, this project will develop new intermediary entities that would identify and appraise renewable energy projects with the Bank playing a capacity building and oversight role. The role of the WBG-GEF would be to provide assistance to help select appropriate intermediaries, establish sub-project selection/appraisal criteria, assess the capacity of potential intermediaries, build the capacity of intermediaries, and undertake ex-post verification.

Retain incremental cost and operational strategy principles. This project is firmly rooted in Operational Program 6, and the incremental cost calculations are in line with the conventional methodology. This annex describes the approach to assessing and provides initial estimates of the incremental costs associated with global environmental benefits and GEF co-financing of this project. While these estimates will be refined during the course of project preparation, the refined estimates are expected to be fairly close to those presented here. The incremental cost estimates for Phases II and III are estimates, and will be revised prior to the time that these becomes operational, taking account of the actual situation at that time. (see *box 1)*.

Box 1 Phasing and processing of APL

This 10-year APL program is divided into three phases (see PCD section A.) During project preparation, Phase I will be designed in detail along with more general designs and triggers for release of the second and third phases. In keeping with the Bank's APL procedures, this document describes Phase I of the program, including triggers for moving to subsequent phases (see PCD Section 4), and provides indicative cost estimates for Phases II and III. Detailed design of subsequent phases, including detailed incremental cost analyses, will be completed prior to their implementation for review and approval by Bank and GEF management.

It is proposed that the processing of this project be based on parallel GEF/Bank approval of an initial tranche within a defined funding envelope. The overall cost, implementation period, cost-benefit justification, financing plan, and general description of program activities will be developed and agreed up-front with the Government of Uganda, and approved during Bank Board consideration of the first phase loan, which is well defined. Subsequent loan releases would be approved by the relevant World Bank Regional Vice President within the funding and timing parameters defined in the program and are based on performance and progress toward agreed program goals. It is proposed that corresponding GEF tranches be released according to similar, pre-established criteria.

At present, the **power sector in Uganda is in a state of transition**, moving from a state-owned vertically-integrated power utility to a competitive, unbundled, privatized mode, with transmission being retained as a monopoly (see PCD Section B2a). This shift has direct implications for renewable energy small-scale power producers (SPPs), as, over time, these SPPs will no longer be able to sell their power to "the power utility," but would instead have to sell either directly to individual large consumers or to distribution companies under a "Multiple Buyer, Multiple Seller" model. In the long run, the sale of power *from small, renewable energy resources*, such as sugar mills, that are close, or already connected, to the main grid. would be to third-party customers *via* wheeling through the main grid, i.e., in the long run, there would be no power purchase agreement between the generator and the main grid, which would merely serve, for a fee, as the "highway" over which power is transported from the generator to a third-party customer. However, in the short run until the Bujugali project comes online, there would likely be a power purchase agreement between the main grid and the renewable energy power generators; further, after Bujugali comes online, there would likely be a transition period during which the renewable energy generators would have some assurance of the sales of their power, after which the long run wheeling mechanism would be utilized.

BROAD DEVELOPMENT GOALS

The development objectives of the proposed program are to provide:

rural households the direct and indirect benefits of increased access to adequate and reliable supplies of electricity, which could be in the form of conventional alternating-current (AC) power or direct-current (DC) power produced by stand-alone solar photovoltaic (PV) systems. The indirect benefits would arise from the increased electricity access of rural public institutions, such as health and educational facilities.

rural enterprises, the benefits of increased productivity and income arising from electricity access -- with technical assistance provided to accelerate switch over to electricity – and/or more efficient use of traditional fuels, whose use is likely to continue in *heat-intensive* applications such as brick-making.

The global objective of the proposed program is contribute to global environmental protection by promoting the use of stand-alone solar photovoltaic (PV) systems and the generation of conventional power from small renewable energy resources.

BARRIERS TO RENEWABLE ENERGY DEVELOPMENT AND BARRIER REMOVAL STRATEGY

Uganda is at a very early stage in renewable energy development, even after taking account of the results of the ongoing UNDP-GEF solar pv project. At present, the critical barriers that impede renewable energy development are:

Renewable energy resource data are not readily available. While it is widely accepted that Uganda is well endowed with exploitable renewable resources, including biomass, hydro, solar, geothermal and possibly even wind, the detailed resource assessment information required to prepare specific projects is not readily available.

Capacity to promote renewable energy as well as identify, prepare, and appraise projects is inadequate. There is a critical lack of adequate local capacity to develop renewable energy projects, with significant needs in all areas such as project identification, technical design, and managerial.

Regulatory environment and financing intermediation mechanisms are inadequate. While Uganda is making changes in the power sector structure, at present, the regulatory environment needed to independent grids, many of which would generate power from renewable energy resources, is still to be developed. Further, the overall weakness in the financial sector makes it difficult for renewable energy developers to get adequate financing.

Costs are high and product range is limited for solar pv products. At present, costs in Uganda are much higher than in Asian countries for comparable systems, and the range of products available is not wide enough to meet the needs of the potential consumers.

The requested GEF support for rapid energy transformation that includes a significantly increased use of renewable energy technologies is predicated on the costs of reducing existing market barriers to RET commercialization: These barrier removal costs include:

Institutional

Improve institutional and regulatory capabilities for this new type of business by educating GOU officials at the central government and municipal levels and the private sector on the benefits of creating a sustainable market for energy services in dispersed areas, using least-cost, environmentally clean technologies where available and appropriate.

Remove capacity and institutional barriers through support to regulatory bodies (for the light-hand regulation support, tariff advice, and dissemination of learning from pilots).

Perform technical assistance work and information dissemination to overcome both real and perceived increased technology risks, and to address limited customer awareness and residual expectations of grid service.

Financial

Address the up-front capital cost investment requirements and initial transactions costs to encourage entrepreneur activity in developing local hydro and biomass generators for sale to the grid and to local isolated small grids by provision of 'smart subsidies' to businesses and to reduce initial higher costs to households for shifting from traditional fuel use to SHS use.

Reduce entrepreneur risks to market entry by facilitating critical mass for business and attracting larger, better organized private companies with own sources of financing

Providing seed capital for additional projects (and potentially guarantees and contingent grants for pre-feasibility and feasibility work) through a Rural Electrification Fund.

Business

Demonstrate multiple renewable energy technologies as a basis for initial market entry across several rural regions far from the grid to demonstrate technology performance, project organizations and business models responsive to the new power law

Facilitate availability of smaller systems and services better aligned with customer needs and ability to pay.

Assist in establishing adequate delivery model and standards for rural and renewable energy service delivery that ensure quality equipment and services to consumers.

Actively assist in implementation of the private power law through tangible hardware installations and financing arrangements that assure service for rural areas while implementing the concepts of 'light regulation' and local variable tariffs that assure a fair return to investors while minimizing use of and reliance on concessional support.

THE BASELINE

Without GEF participation, the Energy for Rural Transformation project could still proceed, but it would do so without a focus on renewable energy. This baseline would be characterized by:

Widespread use of diesel generation for rural electrification – Diesel power generation would remain the technology of choice for remote power applications. The expanded coverage envisioned by the program would mean substantial increase in the use of diesel in rural areas.

Continued reliance on 19th century energy - The majority of dispersed area households will rely on low quality traditional energy forms (with some served with diesel generation). For lighting, this will generally be by use of kerosene in inefficient wick lamps, and dry cells will be used for torches and radios. The local solar PV will remain small with limited penetration in rural areas with limited entrepreneurial skills, little replication, and relatively high prices. While the industry has shown some initial gains from the existing UNDP solar program in terms of increased customer awareness, this has not yet translated into a measurable increase in sales and commercial activity outside of Kampala remains limited. Current sales of about 500 SHS per year will likely not reach beyond 10,000 systems over the project's 10 year period.

Virtually no local capacity for renewable energy project identification, design, and implementation - Due to various market barriers, investment in renewable energy projects will be rare, allowing little or no appreciable creation of local project development capacity. As a result, the scale and experience base of technology development will remain low and the rural areas will suffer from an acute lack of locally-based equipment vendors, systems integrators, and affordable supply options.

CO2 emissions for the country will continue to grow, and (with the exception of growth in large scale hydro resources which will not be provided to most rural areas in the foreseeable future) will be driven by a primarily fossil-fuel based energy path for the country.

THE ALTERNATIVE (THE PROJECT)

The proposed alternative consists of a multiple technology approach, integrated over time into local economic and business development, with a range of activities to remove market barriers of high first-cost, lack of information, and lack of appropriate institutional capacity, and provide maximum responsiveness to the opportunities offered under the private power and restructuring regime now beginning to emerge in the country. The project approach will:

Support and accelerate entry of private power producers with technical and financial assistance, facilitating third-party transactions via wheeling through the main grid, with concessional support to encourage renewable energy technologies and fuels where available and appropriate;

Facilitating development of isolated grids to stimulate local agricultural and business development, again with renewables where appropriate, where the risk of market entry would otherwise remain too high.

Support rapid development of local PV markets, including an initial per-watt subsidy to reduce first costs for consumers and stimulate sales, concessional support to 'institutional' systems in schools, health facilities, and community centers to establish a local hardware and service 'anchor' for additional local sales, establishing low cost supply linkages (initially with Asian equipment), and introduction of smaller, more affordable systems more suited to customer needs.

INCREMENTAL COST SUMMARY

With regard to the GEF-related components of the proposed ERT program, the baseline and GEF alternatives are described below:

Component 1 – ***Main Grid Related Power Distribution And Generation***

In the **Baseline case,** the current severe capacity constraints would result in a continued reliance on diesel for standby generation and, in cases where the unreliability of the main grid seriously disrupts the industrial process, as full-time generation. This capacity constraint would be abruptly lifted when the Bujagali plant is commissioned, at which point grid-tied diesels would be taken out of full-time service, but retained for emergency supply. This assumes that distribution system repair and upgrades are timed to allow full uptake of the newly available power. Sugar mills would expand their operations only enough to provide power for self-generation, and would not produce excess power for sale. Local capacity to develop large-scale renewable energy generation (biomass, wind, geothermal) would remain weak.

For the sugar mills, the base case would include cogeneration capacity expansion to provide 13 MW of capacity for plant use. Diesel generation of about 14 MW would be installed by industrial facilities which could not receive adequate UEB supplies. The investment, operation and maintenance costs of this base case option are estimated at $50 million over a 20 year analysis horizon.

For distribution, the baseline case would be slow expansion of the distribution system until sufficient connected capacity exists to serve existing customers as well as new customers. All expansion of the main grid prior to commissioning of new hydro capacity would require new fossil-powered generation. A 5 MW diesel unit, connected to the main grid would have a base case cost of about $10.5 million over 20 years.

The first phase **GEF Alternative** would include: i) expansion of generating capacity at two sugar mills to provide up to 14 MW of excess capacity for sale to third party customers; and ii) possibly an additional grid-tied renewable energy site (mini-hydro or biomass). Capacity building is described separately below. Phases 2 & 3 of the ERT program would include additional mini-hydro and biomass investments, as well as wind and/or geothermal investments if initial investigations identified attractive candidates.

Phase 1 costs for the GEF alternative costs for the two mills are estimated $57 million. Additional grid-tied renewable energy investments , for phase 1 or future ERT program phases, would have a 20 year cost of $12 to $13 million per 5 MW installation.

Phases 2 and 3 would have similar baselines on a unit capacity basis, but for a greater installed capacity (20 MW in Phase 2, 36 MW in Phase 3). Also, the incremental cost would decrease in successive phases, as shown in the table below.

Component 2 – *Independent Grid Systems*

Baseline case - With appropriate assistance in areas such as creation of an enabling regulatory environment, business development, design, and financing, the growth of independent mini-grids would be slow at first, but then expand rapidly as the concept became accepted. The existing trend in Uganda (and worldwide) is to use diesel gensets for such applications. Thus the base case is that remote diesel gensets would become a common sight in rural Uganda.

For the mini-grids at Kisizi, Lwamagwa, and Mbale, the base case would be expanded use of diesel gensets for productive uses, and continued use of kerosene, automotive batteries, and traditional fuels at the household level. In total, the base case cost would be $2 million.

The **GEF Alternative** would include significant emphasis on renewable energy options, with an especially strong focus in the early years of the program when trends are being set. GEF support would include both capacity building and catalytic subsidies for initial renewable energy investments to overcome the high perceived risk of these vanguard projects. Proven technologies, such as small-, mini-, and micro-hydro would be promoted, as well as biomass gasification.

The GEF costs for the Phase 1 investments are estimated at $2.5 million over a 15 year horizon.
In Phase 2 it is anticipated that 10 isolated grids with renewable energy generation would be installed, and 21 such isolated grids would be installed in Phase 3. Again, the incremental cost per installed system would decline through the 10 year period as shown in the table below.

Component 3 – *Individual/Institutional Solar PV Systems* -

The base case would build on the market development gains over the past several years which have now brought the solar PV market to about 500 systems per year. This market would grow slowly but steadily, reaching an aggregate of about 10,000 systems in 10 years. Some institutional systems would be installed on the basis of available donor funds, with widely varying technical standards, resulting in operation and maintenance difficulties. There would be no additional technical assistance targeted at solar market development. The base case cost is estimated at $3 million.

The GEF alternative would accelerate PV market development by taking advantage of the potential to dramatically lower retail prices to make quality PV systems affordable to many rural Ugandans. Based on experience in other countries, a package of interventions could include: (i) strengthening the local PV capabilities in business, finance and technical areas through direct assistance, supplier support, linkages between the institutional and consumer market segments, and encouraging additional investors and entrepreneurs to enter the sector; (ii) increasing the access of PV businesses to financial institution credits and customer access to end-user microfinance; (iii) increasing consumer awareness and confidence; (iv) increasing access to best price sourcing opportunities, including possibly the local production of some components; (v) establishing a sound market framework in terms of tax and duty treatment and technical standards; (vi) providing a per Wp subsidy to reduce first costs and enable PV to extend sales and service networks, improve product and service quality, and strengthen their financial and business capabilities;

This package of interventions, while lowering retail PV system prices, would increase consumer affordability, acceptance and choice and reduce the technology and market risk perceptions of entrepreneurs for investments in expansions of distribution infrastructure and human resources. The package would be implemented in ways which would reduce the pipeline development and transaction costs and technology and market risk perceptions of interested microfinance and financial sector institutions. The expected result would be competitive, commercial PV sales and service networks extending into rural areas, offering consumers a wide product and price range, with robust product standards and strong after sales and warranty services.

In early years, cash sales of the smaller systems would dominate the market. The demand for larger systems by the more affluent consumers and the smaller systems by the less affluent consumers would grow as: (a) consumer confidence and awareness of the products grows, (b) consumer ability to pay increases due to economic development and evolution of credit markets; and (c) prices come down due to improved sourcing of components and economies of scale in component purchasing and distribution.

An average household which would be a potential solar home system customer spends about $3.85 per month on kerosene and batteries which could be displaced by solar. This implies a 15 year net present value of costs of about $320. The 15 year net present value of a 20W solar home system is estimated at $360 for Phase 1, implying an incremental cost of $40 per system, or $2 per Wp for the estimated 7000 SHS in Phase 1. In addition, Phase 1 would support installation of about 50 large institutional systems (1000 W each) and 100 small institutional systems (100 W each). In general, such systems will have a lower usage factor, which would imply a larger incremental cost. However, it is proposed to provide the same incremental cost for all systems. Thus the total 200,000 Wp for Phase 1 would imply an incremental cost for hardware of $400,000 over the base case scenario. Targeted solar capacity building efforts would require an additional $600,000 over the base case.

The capacity installed during Phase 2 would treble, to about 600,000 Wp, and in Phase three would increase still further to about 2,200,000 Wp, bringing the total capacity installed by the project to around 3,000,000 Wp. As the market expands, the incremental cost is expected to decline due to increases in market knowledge, broad expansion of sales and service infrastructure, and the wider availability of consumer level financing for solar PV. As a result, the per Wp subsidy would reduce to about $1.7 in Phase 2, and $0.5 in Phase 3, as shown in the table below.

Capacity Building

In the absence of GEF support, some limited capacity building would still be undertaken by Government and the private sector. The cost of this base case capacity building is estimated at $0.25 million during each of the three Phases.

The GEF Alternative also would include resource assessment and local capacity building to ensure local abilities to identify, design, finance, and implement additional renewable energy investments, to be supported in Phases 2 and 3 of the ERT program. Capacity building would be weighted toward the initial Phase of the program, to secure the establishment of core expertise at the local level. In addition, capacity building during Phase 1 would support establishment of the contractual framework and rules/obligations for wheeling power over the main rid for third party sales, related pricing, penalties/remedies for non-performance, etc. (see section B2, *Government strategy*).

The technical assistance and capacity building would be in line with the principles of the Global Environment facility (GEF)-World Bank Strategic Partnership for Renewable Energy: (i) develop a strategy and implementation plan for building the capacity of in-country intermediaries to identify, develop, appraise and move towards financial closure renewable energy investments, (ii) prepare a renewable energy resource information collection and dissemination system that provides reliable data that enables interested private sector investors to initiate their own assessment of potential projects; and (iii) activities to help reduce the gap in solar photovoltaic product prices, quality and range by moving Uganda in the direction of international best practices, as applicable to Uganda.

Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefits	Rural and off-grid market grows, albeit slowly, and primarily with diesel. Power availability remains constrained, with prices high and reliability low. Limited development of private power and PV business models or acumen.	Stimulation of business entry into private power service for grid and isolated applications. Institutional strenghthening in development of regulation, pricing, contracts, etc. Energy costs decline and availability improves, with linkages to productive use applications and development of local small power entrepreneurs.	Barriers (information, first cost, etc.)to commercial development removed. Successful demonstration of a wide range of alternative technologies and business approaches. Technology improvement that benefits renewable energy producers and enhances competition with diesel sources.
Global Environmental Benefits	None, rural energy development relies primarily on diesel and unsustainable use of traditional fuels w/ low efficiencies	Significant offset of GHG emissions through range of renewable technology options, displacing 10-30% of what would otherwise be diesel gensets.	600,000 t of carbon avoided Cost reduction for range of technologies in rural developing country setting and long-term programmatic APL strategy demonstrated.

Cost by Component (million US$)			
Phase 1			
C1 – Main Grid	50	57	7
C2 – Independent Grid	2	2.5	0.5
C3 – PV Market Devel.	3	4	1
Monitoring & Evaluation	0	0.25	0.25
Capacity Building	.25	3.5	3.25
Subtotal Phase 1	**55.25**	**67.25**	**12**
Phase 2[1]			
C1 – Main Grid	70	75	5
C2 – Independent Grid	3	5	2
C3 – PV Market Devel.	10	11	1
Monitoring & Evaluation	0	0.25	0.25
Capacity Building	.25	2	1.75
Subtotal Phase 2	**83.25**	**93.25**	**10**
Phase 3[1]			
C1 – Main Grid	131	135	4
C2 – Independent Grid	7	9	2
C3 – PV Market Devel.	35	36	1
Monitoring & Evaluation	0	0.25	0.25
Capacity Building	.25	1	0.75
Subtotal Phase 3	**173.25**	**181.25**	**8**
GEF Incremental Costs	311.75	341.75[2]	30 (APL Total)

Notes:
[1]These are indicative estimates. Incremental costs for Phases 2&3 will be calculated during preparation of these phases and will be subject to GEF Secretariat review and approval.
[2]Totals are for renewable energy investments only and do not include other project investments. Therefore, these totals are a subset of total project cost.

Mainstream financing would cover the bulk of the significant investment costs of the project. Indicative financing plan requiring GEF support on a declining basis (as summarized in the indicative financing plan summarized below) with the remainder being provide by IDA funds, other donor investments, and increasingly by the local private investment. This represents a high level of financial leverage on sub-project support.

Possible Use of Non-Grant Modalities. Due to a lack of practically implementable alternative modalities in the early stages of the program, the GEF grant for subprojects would be provided directly as a subsidy. As experience grows, in Phases II and III the use of other modalities, such as partial risk guarantees to encourage greater commercial participation will be explored; these would be particularly relevant for renewable energy power generation from sources such as geothermal, wind, and mini-hydro.

PCD Indicative Financing Plan ($M)							
	IDA	(%)	**GEF**		**Others**	(%)	**Total**
APL 1	30	40%	12	16%	33	44%	75
APL 2	55	44%	10	8%	70	56%	125
APL 3	65	37%	8	5%	92	53%	175
Total	**150**		**30***		**195**		**375**

* of the entire APL, GEF financing comprises approximately 8%

Declining GEF Grant. The existing small scale of the market, the relatively low population density, limited ability to pay for energy services, and the relative unfamiliarity with renewable energy technologies among both customers and businesses require a relatively high level of GEF support up-front in order to effect a shift if technology choices and gain critical mass during the first phase and establish the market for a long enough period to facilitate full deployment of installation, operation, and maintenance facilities. For this reason, the GEF grant is "front-end loaded" with a higher absolute amount as well as higher relative cofinancing grants and capacity building costs in the first phase of the program. Both the capacity building requirements, and the cofinancing grants will be required for delivery of an increased number of installations in subsequent phases.

Significant economies of scale are expected to emerge toward the end of the first tranche and will enable some price reductions and decline of the GEF support on a per-installation basis. Initial market areas are generally anticipated to become economically self-sustaining by the end of the second tranche and serve as examples for replication in broader (and more remote) rural market areas. At the end of the project all of the project components are expected to be operating on a commercial basis (reflecting an increase in local project development and implementation capacity, decline in system prices from reduced transaction costs, larger volume, greater experience by entrepreneurs and customers, use of less expensive equipment etc.) and will be stimulating additional replication of local mini-grid, individual system installations, and entry of additional private power and renewable energy entrepreneurs.

Domestic Benefits: It is recognized that the rural electrification services made available as a result of the project include significant domestic benefits (including local economic development, increased availability of household energy, local environmental benefits) – indeed, many of these are direct development objectives under the Rural Transformation approach. Thus, the estimated full incremental costs of completing project components will not be borne by GEF but will also be supported by GOU (IDA) and other donor funds to reflect appropriate costs sharing of the combined global and local benefits. A more detailed analysis of the allocation of global vs. domestic benefits will be performed during project appraisal.

Global Environmental Benefits. Based on conservative capacity factors for the sugar mills and other grid-connected renewables, the estimated annual carbon displacement comes to about 450 tons per MW-year, or 9000 tons of carbon per MW over a 20 year life. For the 14 MW in phase 1, this comes to 126,000 tons carbon, and for the 70 MW in the full program this comes to 630,000 tons. Similarly, watt of solar capacity installed should displace about 8.5 kg of carbon over a 15 year lifetime, resulting in estimated displacement of about 1,700 tons for phase 1, and 25,500 tons for the program overall. This leads to carbon displacement of about 128,000 tons in the first phase, and about 650 thousand tons of carbon over the 15 - 20 year lifetime of the investments - not accounting for any multiplier effects from the development of the various markets and project modalities. This implies a GEF investment of about $46 per ton carbon.

The calculated value of the cost of carbon of about $ 46 per ton carbon is based strictly on the supported investments, and does not take account of any multiplier effects or "programmatic effect". It is reasonable to expect that there will be a programmatic effect not just in Uganda but also in the neighboring countries of Tanzania, Kenya, Sudan and Democratic Republic of Congo, particularly from the solar pv component. The main reason for this widespread effect is that this is the first project in this region which is supporting a systematic, wide-ranging development of a number of renewable energy technologies. Under a reasonable assumption that the multiplier effect will be in the range of 2 or 3, the cost will be in the range of $ 15-23 per ton carbon.

SUSTAINABILITY

A key long-term objective of the project is to ensure the long-term sustainability of renewable energy investments, particularly after GEF grants would no longer be available. The overall approach is that, over time, sustainability will come from barrier removal, cost reductions, rising incomes, and declining GEF grants.

For renewable energy power generation, the key to sustainability will be barrier removal and declining costs, as familiarity with the technologies and institutional framework increases, and the GEF grant per unit is slated to decline over time.

For solar pv systems, the decline in costs will come from: (i) economies of scale –which are often realized when a credible expectation of a large market has been created, (ii) formation of links to suppliers in Asia, where are prices of high-quality systems are much lower than in Africa, and (iii) rising incomes, which will increase the affordability of the systems. Further, the GEF grant per unit for solar pv systems is also slated to decline over time.

Thus, the key assumptions underlying the viability and replication prospects are that cost-reductions will be realized and incomes will rise. Given the GEF share of 20-25% in total costs, it is reasonable to expect that cost reductions and income increases over a number of years will offset the need for such support after the project is over.

Apart from cost reduction, the sustainability of the renewable energy investments will be facilitated by two key factors: (i) the technical assistance and capacity building, and (ii) the opening of CDM-type investments, which would take advantage of and accelerate the barrier removal and cost reductions brought about by this project.

MONITORING AND EVALUATION, AND DISSEMINATION

Monitoring and evaluation toward the GEF objectives would be coordinated to the maximum extent with the overall APL monitoring and evaluation. GEF-specific indicators, such as market prices and penetration, number of active entrepreneurs, and quantity of installed systems and power generated, will be incorporated into the monitoring and evaluation plan during project preparation. Dissemination of program results will be accomplished through regular reporting as well as contributions to international conferences and other such fora.

The responsibility for this task will lie with the Steering Committee for Rural Electrification and Renewable Energy. The monitoring and evaluation system will be linked to the two elements – rural transformation and environmental protection – of the overall program purpose, as well the objectives, outputs and triggers for each of the phases. During the course of project preparation, baseline levels will be established with the assistance of academic experts -- preliminary discussions and initial agreements have already taken place with the Oxford Centre for African Studies and Imperial College, London. It is expected that the monitoring and evaluation system would use participatory as well as quantitative techniques.

GEF STAP REVIEW AND RESPONSE

A review of the Project Concept Document, undertaken by from Dr. Daniel Kammen, of the GEF Scientific and Technical Advisory Panel, is attached. In general, the task team is in agreement with Dr. Kammen's comments, and has incorporated relevant sections into the PCD including the lessons learned and the issue of recycling of lead-acid batteries used in the solar PV systems. The

review also describes related experience from Kenya, Nepal, Tanzania, and elsewhere, much of which the task team is familiar with but will investigate further.

The key recommendation of the STAP reviewer is the addition of an international advisory body to ensure that this project continues to benefit from the broadest possible experience base. The team will discuss this concept with the Government, who must ultimately make the final judgement of its merits. Regardless of the Government's decision, the upcoming Energy for Rural Transformation Africa conference, sponsored by the Africa Rural and Renewable Energy Initiative and various other donor agencies and currently scheduled for early 2001, would include a session devoted to review and discussion of the ERT Program. If this proves valuable, such a discussion could be continued in the future in other regional workshops. In addition, the project team recognizes that Dr. Kammen can provide valuable guidance along the lines proposed in his review, and therefore proposes to include Dr. Kammen on the Quality Assurance Team for the program[1].

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[1] This addition to the Quality Assurance Team would be subject to any possible reaction from the GEF regarding a potential conflict of interest.