THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: October 1, 2001

TO: Mr. Ken King, Assistant CEO, GEF Secretariat
Att: GEF PROGRAM COORDINATION

FROM: Lars Vidaeus, GEF Executive Coordinator 

EXTENSION: 3-4188

SUBJECT: **Mozambique: Energy Reform and Access Program, Renewable Energy Component Submission for Work Program Inclusion**

Please find enclosed the electronic attachment of the above mentioned project brief for work program inclusion. We would appreciate receiving any comments by October 9, 2001.

The proposal is consistent with the *Criteria for Review of GEF Projects* as presented in the following sections of the project brief:

- Country Drivenness: Please see Section B-2 (Main Sector Issues and Government Strategy) at page 3, "Recent Government Actions" at page 5, and Section D-4 "Indications of Borrower Commitment and Ownership" at page 20. Private-sector led expansion of electricity access, using renewable energy technologies as appropriate, is a key goal of the government energy strategy, and matches well with the power sector reform goals.
- Endorsement: Endorsement letter was signed August 28, 2000.
- Program Designation & Conformity: please see Section 1(c) (Global Environmental Objective) at page 2 and Section B.1b (GEF Operational Program supported by the project), page 3. Also see "Introduction and GEF Program Rationale" in Annex 2 – Incremental Costs and Global Environmental Benefits", page 34.
- Project Design: please see Section 4 (Project Description Summary) starting page 10 and Annex 1 (Project Design Summary) at page 28; also see 'Phase I Choices' at page 37 and "The Alternative" at page 39 (Annex 2).
- Sustainability: please see Section F 1 (Sustainability and Risks) starting at page 25, and "Sustainability" at page 46 (Annex 2). The proposed project is a two-phase Adaptable Program Loan (APL); Phase II will build on the experience gained and the capacity built during Phase I.
- Replicability: please see Sections D.3 (Lessons Learned and Reflected in the Proposed Project Design) at page 18 and F.1 (Sustainability) at page 25, and also, "Sustainability" at page 46 (Annex 2). A key purpose of Phase II investments is to help accelerate the replication of successful experiences of Phase I.
- Stakeholder Involvement: please see Section E.6.2 "Participatory Approach" on page 23.

- Monitoring & Evaluation: Please see "Monitoring and Evaluation, and Dissemination" at page 47 (Annex 2). Phase I M&E is a critical building block for Phase II design and implementation.
- Financing Plan: please see the project cost summary tables at page 1, costs by components at page 13, and 'Cost and Financing of Renewables Promotion Program" at page 40 (Annex 2).
- Core Commitments and Linkages: please see the discussion of the project's linkage to the WB Country Assistance Strategy in Section B.1a at page 3, and "Introduction and GEF Project Rationale" at page 34 (Annex 2).

Response to GEFSEC Review at the time of pipeline entry: At the time of PDF B approval, the Secretariat team recommended that the preparation address the following prior to WP entry:

1. *A revised budget reflecting domestic and other donors:* Please see "Cost and Financing of Renewables Promotion Program" at page 40 (Annex 2).

2. *"Based on current national policies, investment plans and programs describe the problems preventing viable generation of global environmental benefits associated with RE based electrification."* Please see "Barriers to Renewable Energy Development and Barrier Removal Strategy" at page 36 (Annex 2).

3. "*Determine the system boundaries for intervention with quantitative indicators characterizing the target system, i.e., number of households and communities where changes in energy supply patterns are expected, their current energy use by source and associated annual GHG emissions (baseline).* Please see Section B.2 "Main sector issues and Government Strategy", in particular "Access to Modern Energy", at page 3. There are about 3 million households without electricity, including those in provincial and district capitals currently being served by the main EdM grid or independent grids. Most of these unserved households and communities rely on kerosene lamps , car batteries, and gasoline or diesel generators, and will largely continue to do so in the absence of interventions proposed here. Phase I of the proposed program focuses on unelectrified district capitals and surrounding areas in three provinces with an estimated unserved market of about 800,000 households. The near-term technical market for household PV systems in these areas is estimated at about 5,000 to 7,000 systems, rising to about 50,000 systems over the longer term as incomes rise and barriers to RE technologies are lowered.Based on the experience gained and capacity built, Phase II will expand the RE promotion program to other provinces. Similar considerations apply to the market for 'large" PV systems and renewable technologies for independent grids. Please see "The Baseline" at page 39, and estimates of the numbers of solar PV and small grid-renewables at pages 43-44 (Annex 2).

4. *"Forecast likely changes in energy supply patterns, e.g., number of households/communities that are expected to introduce RE based energy supply and their annual consumption; number and capacity of related RE investments and associated annual GHG abatement: a. by the time of project completion; b. over the medium term, taking into account replication (alternative)"* See "The Alternative" and "Incremental Cost Summary" at pages 39 through 45 (Annex 2). These are generic estimates for users of PV systems and investors in RE; specific supply agents and sites for Phase I will be firmed up during the course or project preparation (likely to be in the provinves of Cabo Delgado, Zambesia and Nampula). Those for Phase II will be identified during the course of Phase I. At this time, the gross GHG

reductions have been calculated on the basis of 15-year project life without taking into account replication beyond Phase II of the proposed program.

5. *"Taking into account lesson learned in earlier interventions determine the services/activities/ modalities needed to address constraints hampering introduction of RE based energy supplies and their (perceived) incremental costs; identify and involve all interested domestic and international partners in planning and delivery of relevant services:"* See pages 19-20 on 'Lessons Learned' from other solar PV systems projects, in particular regarding the choice of institutional models. Also see pages 36-37 on 'Barriers to Renewable Energy Development and Barrier Removal Strategy" (Annex 2). There have been limited RE promotion interventions in Mozambique in the past decade – solar PV installations for rural health clinics (under a NORAD program, expected to be expanded over the coming year), and (on a commercial basis) for telecoms, radio communications, navigational aid, and water pumps. Micro hydro development has mainly involved the rehabilitation of units installed before independence. For both, business development, capacity and institutional problems, high costs, and quality have been major constraints, that the project aims to address. A consultative workshop with stakeholders was held at the beginning of project preparation and others are planned. Furthermore, several international donor partners have welcomed the 'cross-sectoral' activities, in particular, the investments in solar PV systems for rural public health and education facilities.

6. "T*aking into account that rural electrification is indeed associated with a wide range of local benefits, appropriate cost sharing arrangements would be expected in this case.* The 'Renewables Promotion Program" leverages GEF funds in a roughly 1:3 proportion – for financing investment costs as well as the costs of technical assistance and capacity building activities. See page 40 "Cost and Financing of Renewables Promotion Program" (Annex 2). In Phase II, the TA/CB component is geared much more towards business support and use of non-grant financing – for direct investments or for upfront transaction costs – for which GEF funds are ideally suited. Accordingly, the amount of TA/CB/`business support' funds proposed for Phase II are higher and GEF share of it also somewhat higher than is the case in Phase I.

7. *"Assessment of the availability of mainstream financing sources to enable large scale introduction of RE technology, determination of suitable modalities to address constraints preventing relevant win/win investments (e.g., doubts about economic feasibility, access to finance problems, perceived risks, increased initial transaction costs etc).* In Phase I, a small amount of financing is expected to come from the household customers, and the 'mainstream' financing sources would include IDA and other donors. Subsidies will be provided via the proposed national rural electrification fund, and debt via commercial financial institutions. In Phase II, private sector financing would gradually increase, and a portion of GEF funds combined with IDA/other donor funds will be used for non-grant financing. Some GEF funds will continue to be used as grants in new areas to be covered in Phase II, and will be leveraged with the proposed national rural electrification fund (to be financed in part through levies on grid-supplied electricity and mega-projects, as well as from concession fees).

8. *"GEF may also help to cover increased initial transaction costs, facilitate the set-up (sic) dedicated credit lines, vendor financing programs and other mainstream financing mechanisms to enable access to finance. It may share some part of the perceived technology performance risks through contingent financing arrangements (guarantees, loans, contingent grants)."* It is estimated that with the current prices of petroleum products and

projected cost reductions in the Mozambican market, the incremental costs of RE investments would decline substantially, and in some cases close to the point of being competitive with the petroleum-based alternatives. See page 43 for unit incremental costs for solar PV – on average, declining from \$30/t CO_2 in Phase I to less than \$10/t CO_2 in Phase II – and for grid-renewables – on average, declining from around \$19/t CO_2 to \$13/t CO_2 respectively. As for financial intermediation options such as dedicated credit lines or vendor financing programs, these will be explored during project preparation, and provision will be made to develop them in Phase I for Phase II implementation. The World Bank-supported PODE project (which assists with funding for consultancy and investment to SMEs, through commercial banks) may be a suitable avenue for some of the financial intermediation needs during Phase I.

9. *'Outline of a comprehensive M&E and dissemination plan to enable measurement/verification forecasted changes/benefits/impacts, and to promote widespread replication over the medium term."* See p. 47 of the Annex 2 'Incremental Costs and Global Environmental Benefits'.

Distribution:

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PROJECT BRIEF

1. IDENTIFIERS:

Project Number	MZ-P069183
Project Name	**Mozambique: Energy Reform and Access Program – Renewable Energy Component, Phase I**
Duration	Seven years
Implementing Agency	World Bank
Executing Agency	Ministry of Minerals, resources and Energy
Requesting Country	Mozambique
Eligibility	Ratified Climate Change Convention on August 25, 1995
GEF Focal Area	Climate Change
GEF Programming Framework	OP #6 (Renewable Energy)

2. SUMMARY: The proposed APL's development objectives are to: (a) accelerate, in a commercially viable manner, the use of electricity for economic growth and improved quality of life in underserved areas; and (b) strengthen Mozambican capacity to expand the energy sector for both domestic and export markets. Phase I of the program aims to lay the foundations for accelerating electricity access via commercially oriented rural electrification – improving efficiencies and cost recovery, employing lower-cost options and "smart" subsidies as well as for small-scale renewable energy development. The global objective of the project is to promote renewable technologies to reduce GHG emissions. The project has three components: (i) Grid electrification and power sector reforms; (ii) Renewable energy promotion; and, (iii) Institutional strengthening and capacity building. The renewable energy promotion component will in turn consist of (a) investments in large, institutional size solar PV systems, household PV systems, and grid-connected renewables technologies (in particular, wind and micro-hydro, possibly biomass gasification); and (b) technical assistance and capacity building in both public and private sectors. It is expected that Phase I activities – with GEF financial contribution of $2.9 million - for renewable energy promotion will provide the framework for rapid and sustained removal of barriers to the acceptance and financing of renewables-based electricity supply options for both retail and grid-connected uses. Adequate M&E provision will be made for the development of a replication and acceleration strategy for Phase II via technical assistance, training, and information dissemination.

3. Costs and Financing (Million US$):		**Phase I**	**Phase II (indicative)**
GEF:	-Project	2.900	6.500
	-PDF Grant	0.275	
	Subtotal GEF	**3.175**	**6.500**
CO-FINANCING:			
	-IA (IDA proposed credit) and Other International	5.400	12.300
	-Government of Mozambique	0.700	2.100
	-Other	0.900	3.200
	Subtotal Co-Financing:	**7.000**	**17.600**
	Total Cost (Renewables Component):	**10.175**	**23.100**
	GRID ELECT.& POWER SECTOR REFORM	34.700	
	INST. STRENGTHENING & CAP. BLDG	7.000	
	TOTAL PROJECT COST:	**51.175**	

4. OPERATIONAL FOCAL POINT ENDORSEMENT:
Name: Francisco Mabjaia **Organization:** Ministry for Coordination of Environmental Affairs
Title: Vice-Minister, GEF Focal Point **Date:** August, 25, 2000

5. IA CONTACT: Christophe Crepin, AFTES, Tel. 202-473-9727 Fax: 202-473-8185, e-mail: ccrepin@worldbank.org

A: Program Purpose and Project Development Objective

1. (a) Program purpose and program phasing (see Annex 1)

The purpose of the proposed long-term program is to increase access to modern energy in peri-urban and rural areas, thereby facilitating improved quality of life of the respective communities. The program will comprise reforms necessary for improved performance of the energy sector (in particular power), and accelerated access, as well as investments in energy supply infrastructure. It will involve grid-based and isolated grid electricity (including renewables). The global purpose of the program is to promote the adoption of modern energy in rural areas by removing the barriers identified, and mitigate CO_2 emissions.

Phasing. It is proposed to divide the 7-year APL into two phases. First, would be for three years and would create a conducive environment for commercially viable acceleration of access to modern forms of energy, finance some investments, in a process of learning by doing; it would also identify actions necessary to improve performance of the power sector. The second phase would comprise ~~of~~ scale-up of the investment activities commenced in the first phase, provided the reforms planned for the first phase are adequately implemented, and implementation of the measures required to improve the power sector's performance.

1. (b) Project development objectives: (see Annex 1)

The proposed project's development objectives are to: (a) accelerate, in a commercially viable manner, the use of electricity for economic growth and improved quality of life in un-served and underserved areas (peri-urban and rural); and, (b) strengthen Mozambican capacity to expand the energy sector. It seeks to achieve this objectives via supporting the design and implementation of the Government of Mozambique (GoM) National Energy Strategy that, inter alia, aims at reforming the Mozambican energy sector and implementing an enabling environment for greater private sector participation in the sector.

1. (c) The Global Environment Objective:

The proposed global environment objective is to initiate the process of eliminating the barriers that impede the development of renewable energy, in particular solar photovoltaic (PV) systems and develop micro hydro capacity. The global objective would contribute to the reduction of GHG as some of the use of diesel for power generation would be displaced by the renewable energy.

2. Key Performance Indicators (see Annex 1)

Key performance indicators for the project would be as follows:

(i) Project areas demonstrate more rapid economic growth and customer willingness to pay for improved energy services;

(ii) Project experience is viewed favorably by key stakeholders and the policy/regulatory framework is seen adequate for a rapid "scale-up", as demonstrated by Electricidade de Moçambique (EdM) and private sector business plans;

(iii) Operational and financial performance of EdM improves; and,

(iv) Increase in the numbers of viable solar PV distributors and other renewable energy businesses, such as micro hydro and wind;

(v) adoption by GoM of a renewable energy development plan acceptable to the Bank.

B: Strategic Context

1a. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

CAS Document number: 20521-MOZ Date of latest CAS discussion: April 2000

The key approach adopted in the proposed project – working with other donors to build public and private sector capacity to promote development of commercially-oriented expansion of access to modern energy – is consistent with the June 2000 CAS 2001-2004 strategic priorities of (i) maintaining an enabling private sector environment; (ii) developing infrastructure; and (iii) promoting rural development and agriculture (under CAS pillar "Increasing Economic Opportunities through Private Sector Led Growth"). It also conforms to the specific sectoral target of the Government's Poverty Reduction Strategy Paper – (a) to ensure that all district capitals are supplied with electricity; and (b) the electrification of 60,000 new houses in urban, peri-urban and rural areas. This is in support of the objective to expand electrification and promote its use for agro-industrial and domestic purposes"), and aims to assist in the achievement of selected PRSP targets for other sectors – namely, to expand access to technical-vocational Education, particularly in rural and, to improve the access to and quality of health care for women and infants.

The program approach enables the Government to adopt the most appropriate delivery systems for the country through the process of learning by doing (in the first phase). It would thus scale up only those delivery options most appropriate for the country.

1b. GEF Operational Program supported by the project: (see Annex 1)

The proposed project is fully consistent with the GEF Operational Program 6: *Promoting renewable energy by removing barriers and reducing implementation costs.* GEF support would help to (i) remove information and awareness barriers within Mozambique about solar pv systems, (ii) reduce the costs, and improve the acceptance of, solar pv systems in Mozambique by forging partnerships among the donors and with the private sector, and (iii) prepare a strategy for long-run development of renewable energy.

2. Main sector issues and Government strategy:

The three primary challenges facing the Mozambican energy sector are: (a) increasing access to modern energy, in particular electricity; (b) mitigating adverse environmental, livelihood, and health impacts of traditional biofuels production and use; and, (c) promotion and prudent management of export-oriented energy projects. In recent years, the GoM, with the help of the Bank and other donors, has taken some significant steps toward adopting a legislative and policy framework to reform the sector to meet these challenges. Its recent (October, 2000) approval of a national energy strategy provides the blueprint for further reforms and competitive private sector participation. Each of these issues is summarized below.

- **Access to modern energy**: Only 5-6% of Mozambican households have access to electricity, and over a half of them are in Maputo and surrounding areas. All the provincial capitals besides Maputo, and most of the other 20 or so municipalities, are served by EdM main grid or isolated diesel grids at uniform national tariff. Even in these areas, supply reliability is low, household electricity access rate is only about 15-20%, and the implicit cross-subsidies (from Maputo area to the rest of the country)

are heavy. Outside these main urban areas, electricity access is minimal, and there has been practically no increase in the last 25 years. Of the 120 or so "district capitals", some 55 are without any form of public electricity supply, or have sporadic supplies from small diesel-fueled gensets to a handful of customers via old and poorly maintained small grids. Popular access to liquid fuels is similarly limited to the main cities and the main road network, and even there to a relatively small segment of the population, even though petroleum products distribution has been liberalized, and the extent of cross-subsidies largely removed. *The key issue in expanding electricity access is supplementing the traditional approach of main grid expansion with a package of technical and institutional changes that lower the costs of service, enhance affordability, employ performance-oriented subsidies, and bring in competitive participation by the private sector. Also, decentralized electricity technologies based on renewable energy sources hold a considerable promise to meet potential small, disperse demands for "high value" applications of electricity.*

- **Mitigating adverse environmental, livelihood, and health impacts of traditional biofuels production and use**: Most of Mozambique's primary energy consumption is met by traditional biofuels – wood, charcoal, and agro/animal wastes – that are produced and/or used inefficiently. The transition to modern cooking fuels is hampered, even in urban areas, by limited access to such fuels or high initial costs; most of the kerosene the poor purchase is used for lighting purposes due to lack of access to electricity. Heavy urban reliance on woodfuels, while a significant source of income and employment to the supplying communities in rural areas, imposes significant environmental costs. On the supply side, the growing demand for charcoal and fuelwood in the principal cities (Maputo, Beira, Nampula and Quelimane), combined with inefficient charcoaling practices, has led to a significant depletion of the forest stocks around those cities and in some cases as far away as 200+ kms. As such stocks are depleted, supplying communities lose a significant source of their cash incomes and risk a loss of land productivity. On the end-use side, traditional combustion technologies and practices cause significant indoor air pollution, with adverse health consequences, particularly for women and children. *The key issues in mitigating these adverse impacts are (a) reforming the legal and regulatory framework for land use, wood extraction, and charcoal production and transport; (b) strengthening the resource management capabilities of rural communities and creating substitute means of income generation (than woodfuels exploitation) for them; (c) expanding access to modern cooking fuels; and, (d) employing more efficient and/or cleaner technologies of woodfuels production and use*.

- **Promotion and prudent management of export-oriented energy projects**: Mozambique is rich in modern energy resources – hydro power, natural gas, and coal – and can exploit them for exports (as energy or in the form of energy-intensive materials) and for domestic use. Currently the largest part of the power sector in Mozambique is the "export-oriented" market, centered around Cahora Bassa hydro power plant. In addition, GoM has recently reached agreements with foreign companies for the development of Pande and Temane gas fields, and building a gas transmission line for exports to South Africa and to supply a new iron and steel plant whose output will mostly be exported. A number of similar export-oriented, private sector-led energy projects - based on hydroelectricity, natural gas or coal for energy – are at various stages of planning. Prudent management of these energy and industrial projects via careful contracting and fiscal policies can yield significant revenues for macroeconomic stability and developmental expenditures, and provide an impetus for other foreign direct investments; conversely, inappropriate management can expose the country to significant adverse risks – contract disputes, delays in financial closures and project investments, potential adverse environmental and social impacts of project development. *The key issue in managing these energy-related "mega" projects is providing technical assistance and policy guidance that would (i)help develop the appropriate legal and regulatory frameworks, (ii) strengthen GoM institutional capabilities, and (iii) guide the GoM, based on international best practice, in contract negotiations.*

Recent Government actions

In recent years (with assistance under UHEP and other donor programs) GoM has changed relevant legislation for the power, petroleum, and forestry sectors signaling a move away from the role of an investor/manager to that of a business facilitator. It also has changed the corporate status of energy parastatals (EdM and Petromoc), and opened up downstream petroleum products marketing and distribution to competition.

- *In the power sector*. The Electricity Law of 1997 opened the power sector in Mozambique for participation of new entrants, through concession contracts, without geographic exclusivity. Implementing regulations to permit private sector participation in all stages of electricity business were passed in April, 2000. In the interim, the GoM has

  (i) Passed a decree establishing a power sector regulatory body, CNELEC.
  (ii) Declared that the generation, transmission and distribution/supply functions of EdM will be unbundled (at a date yet to be determined), and that EdM will manage a national transmission grid, with an obligation for third party access.
  (iii) Established an "energy fund" (Fundo Nacional de Energia or FUNAE) to collect specific levies (e.g., on new concessions for electricity supply or transmission or for petrol stations) and donor grants, and to channel subsidies to specific projects to expand access to modern energy and/or for demonstration projects.

In 1996, GoM corporatized EdM and instituted Performance Contract agreements with it, incorporating targets for loss reduction, collection, employment, productivity, and number of new connections. Under the rolling three-year Performance Contracts beginning in 1996, EdM has accelerated new connections and reduced distribution losses. However, the planned pace of access expansion along the main grid is woefully slow – e.g., only 27,000 net new customers were added between 1995 and 1998, and only 27,000 new connections are targeted for the 2000-03, compared to some 150,000+ new households that will be formed in those three years.

Successful rehabilitation of transmission lines destroyed by the civil war has meant that beginning in 1998, EdM has displaced much of its high-cost oil-based generation in, and ESKOM (South Africa) imports to, the Southern Grid by much cheaper HCB electricity. In turn, EdM has reduced its operational losses drastically – in 1999, to about 23 billion MT or about $1.65 million on sales of around 865 billion MT or about $65 million. It has even reported a small, overall profit for both 1998 (25 billion MT) and 1999 (23 billion MT), thanks to favorable "extraordinary results". In early 2000, it won a modest tariff increase from the GoM and is expected to show a small operating profit, depending on exchange rate movements and the effects of floods earlier in the year, on energy sales (needs to be updated).

While EdM financial situation does not seem overly worrisome, and it has ceased to be a significant drain on the government budget, its aggregate accounts fail to show an accurate picture of the viability of its operations over the longer term, if current practices continue. An overwhelming part of EdM's bulk power is acquired at a cost of less than US 1 cent/kWh, and yet it barely breaks even at an average revenue over seven times as much because of high operating costs (labor as well as depreciation). The high-voltage transmission network it continues to extend essentially displaces the high-cost local generation (usually diesel-based) of its independent grids with "cheap" Cahora Bassa power with high transportation costs. Under a regime of uniform national tariffs and without aggressive marketing of its power to the underserved urban and peri-urban areas, the implicit cross-subsidies will become heavier.

There is a considerable room for efficiency improvements and access expansion on the EdM system (main grid as well as independent grids owned and operated by EdM):

- Total distribution losses – reduced from 30% in 1995 to about 16% in 1999 – can be further reduced, especially by reducing "non-technical" losses (e.g., thefts) that are still high in some areas;
- Collection rates – improved from 84% of billings in 1995 to 92% in 1999 – can also be further increased, through, for instance, more aggressive collection practices, outsourcing collection and the use of pre-payment meters, where appropriate;
- Improved power marketing could improve the utilization rate of existing and new transmission network, especially outside of Maputo;
- Commercial viability of EdM could be considerably improved if EdM distribution activities were to be organized along regional "profit centers" and these were permitted to charge differentiated distribution tariffs – even if not on a full cost-recovery basis, then at least in such a way as to better reflect the changes in the costs of service.

GoM has recognized the high costs and heavy implicit cross-subsidies in expanding electricity access via EdM to distant areas with low levels of demand. Under UHEP, the GoM began rehabilitating isolated grids in relatively distant towns and introduced management contracts in these systems. Two such grids were rehabilitated and expanded by early 1998 – with average capital cost including generation of about $3,700 per connection ($2,500 per connection in Vilanculos, the larger system) – and their management contracted out to private operators by Fall 1999. Another independent mini-grid was made operational in November 1999, and a fourth one is expected to begin operations soon. All these grid systems permit cost-reflective tariffs that are significantly higher than the EdM uniform national tariff; experience so far with the first two systems has indicated that people are able to pay the high tariffs, and that access stimulates new demands. GoM plans to privatize all four independent grid systems at the end of the three-year management contracts. GoM has also recognized the potential economic and environmental promise of decentralized renewables-based electricity technologies to serve very small, disperse loads, and has accordingly requested help to expand the renewable electricity sector.

- *In the petroleum product sector*. The GoM ratified the petroleum law (1997) and adopted a retail price-setting mechanism for petroleum products to reflect changes in c.i.f. costs (except for aviation fuels, whose prices are de-controlled). The 1997 law also ended import monopoly of Petromoc, the state-owned company in downstream petroleum business, substituting it with a non-profit procurement company jointly owned by all products marketers in the country. As with EdM, Petromoc's legal status was changed from a state enterprise to that of a limited liability company subject to the commercial law. These changes have attracted a number of new entrants in the downstream products market, though there have been some concerns about the price-setting mechanism over the past year. Liberalization has also meant that Petromoc has been losing market share and oil companies are not obliged to expand the rural distribution network.

- *In the woodfuels sector*: The GoM recognized the high costs of, and low returns from, the afforestation programs of earlier years, and designed and implemented (under UHEP) a pilot community-based biofuel supply management project in the Licuate forest. The pilot has been viewed favorably, and has been extended with assistance from bilateral donors. Early this year, a National Investment Plan for sustainable woodfuels supply management based on the participatory approach piloted under the UHEP was completed. The GoM has made the necessary revisions in the forestry and land tenure laws to facilitate its implementation.

Government strategy

The "national energy sector strategy" (also initiated under UHEP assistance) approved by the Cabinet in early October, 2000 proposes specific actions by the GoM broadly directed at two objectives: expanding domestic access to modern energy, and promotion of export-oriented energy projects, encouraging private sector participation in a reformed sectoral environment toward these two objectives.

The strategy's main reform elements are as follows:

- Electricity sector: Adopting the main principles of the "minimum policy platform" (see Annex 4), it seeks to establish a market structure and regulatory framework that (i) permits full cost recovery and establishing cost-based, regionally differentiated tariffs; (ii) requires unbundling of Electricidade de Mocambique (EdM) costs and tariffs by supply segments and geographical area; (iii) allows for "light" regulation of small independent grids; and, (iv) creates a transparent subsidy transfer and financing mechanism with pre-established rules. This would facilitate the entry of private sector service providers and alternative delivery modalities instead of relying exclusively on EdM and/or grid-based rural electrification. In addition, it also targets development of an investment plan for district capital electrification, and another such plan for new household connections along the main grid urban and peri-urban areas. The PRSP (for the period 2001-2004) incorporates an objective to expand electrification and promote its use for agro-industrial and domestic purposes, (i) ensure that all district capitals are supplied with electricity" and (ii) electrification of 60,000 new houses in urban, peri-urban and rural areas". Also, a "Rural Electrification Strategy Plan" (draft, October 2000) – with the main near-term goal of electrifying all district capitals by 2004 – has been prepared, and will be a main basis for site selection and institutional design under the proposed project. Its analysis and recommendations call for selective promotion of decentralized, renewable electricity technologies for access expansion.

- Petroleum sector: An upstream petroleum law has been prepared and submitted to parliament for passage. The strategy proposes the creation of a regulator for third party access to gas pipelines and encouraging private sector participation in upstream activities as well as gas distribution within Mozambique. It also proposes further liberalization in the downstream (products) business segment, strengthening Petromoc via staff retrenchment and "association with a strategic partner", and encouraging new operators in liquefied petroleum gas (LPG) distribution.

The strategy sets specific deadlines for some of the reform activities and their evolution over time – e.g., approving the operating procedures of the electricity regulator, CNELEC in the near future (2000/1), and transforming it into an independent autonomous agency for electricity as well as gas regulation five years hence.

Institutional and human resource capacity

While in some respects Mozambique has gone far in legislative changes to liberalize the energy sector, the pace of implementation - and of showing concrete results on the ground - has been slow and will remain so because of limited absorptive capacity as well as limited institutional and human resource capacity. A principal challenge in the design and implementation of the GoM energy strategy therefore is to make the most of the extremely limited capacity in the public as well as private sectors, and to boost this capacity via well-coordinated technical assistance and "learning by doing".

IDA's operational approach to date

At present, the Bank's only ongoing operation in the energy sector is the Gas Engineering Credit (Credit 2629-MOZ). Originally designed to provide technical assistance for gas development, the project was amended and extended in 1999 to also provide technical and advisory services for developing and negotiating export-oriented energy projects. Other recent technical assistance services have included consultant assistance in GoM negotiations of the MOTRACO concession and in developing implementing decrees for concessions arrangements under the 1997 Electricity Law (financed under the Industrial Restructuring Project, Credit 2081-MOZ).

3. Sector issues to be addressed by the project and strategic choices:

IDA's future operational approach consists of three elements: (i) engaging in policy dialogs and providing technical assistance for sector reforms leading to power sector un-bundling and competitive private sector participation; (ii) working in partnership with other donors, given the considerable bilateral/multilateral donor involvement in the energy sector and the Government's request that the Bank assist it in donor coordination; (iv) laying the foundations, via investments as well as technical assistance, for commercially oriented expansion of access to modern energy, in particular electricity.

The proposed project reflects these elements; a separate Bank project addresses the last element (woodfuels supply management) under the aegis of the Regional Program for the Traditional Energy Sector (RPTES). Additionally, in response to GoM's request, IDA has helped them obtain a PPIAF (Private Participation in Infrastructure Advisory Facility) grant for a study to help develop the details of supporting framework for private investment in the energy sector. The results of the study are expected to be available by the end of 2001.

The project concept outlined here reflects several strategic choices.

The *first* strategic choice was to *develop a commercially-oriented, institutionally viable program to expand electricity access specifically targeted at underserved areas, which is a break from the "business-as-usual" unsustainable approach relying exclusively on high-cost transmission line extensions and heavy implicit cross-subsidies*. Achievements under UHEP and other recent assistance programs of other donors – namely, first round of legislative and policy changes for sector reforms, investments in independent grids with a cost-recovery pricing regime and private management, main grid loss reduction and "credit payment" programs – provide an opportunity to the GoM and the Bank to initiate a four-pronged approach to the power sector investments and expansion of electricity access:

- lower costs, by promoting competition, using standards (distribution and generation) more appropriate to rural areas, and design/construction approaches in capital projects, and improving operational efficiencies (in the case of renewables, adopting appropriate standards and establishing service and maintenance networks);

- increase revenues, by (a) employing cost-based distribution tariffs, (b) promoting income-generating uses of electricity, and (c) selectively exploiting cross-sectoral synergies to build new demands;

- employ "smart" subsidies, i.e., subsidies that are explicit and transparent, limited in advance, and are judiciously selected and designed to reward performance in access expansion and building future loads. These are expected to consist of capital grants to lower the transaction costs and/or initial customer service connection costs in such a way as to provide continuing incentives for

cost-minimization and scaling up. In turn, this means avoiding, and beginning to entirely do away with, implicit (and operating) subsidies that lead to waste and non-accountability, and provide strong disincentives for expansion of access.

- maximize indirect benefits of access, so that people who are not initially able to afford access under a commercially-oriented approach still benefit from the improvements, through electricity service provision, in the quality of other services such as education (e.g., adult literacy, vocational training) and health (e.g., lighting and refrigeration for rural health facilities and vaccination programs).

Taken together, these four prongs – in a policy and regulatory environment that provides appropriate incentives for market expansion and taking risks – are expected to provide a workable model for financial sustainability that can be scaled up subsequently. Recognizing that advancing these themes in a coherent package of assistance requires a gradual approach – building consensus, partnerships and capacity for new approaches - and using investment assistance for "learning by doing" that can help scale up at a later stage, the proposed project reflects several strategic choices.

A *second* strategic choice is to *work in partnership with other donors and begin to forge selective links with non-energy sector projects*. This is consistent with the Country Assistance Strategy (CAS) and the Poverty Reduction Strategy Paper (PRSP), as well as the Comprehensive Development Framework (CDF) approach. A major implication of this choice is that in this project, the Bank will function as a "knowledge bank" as well as the "lending bank". This approach also reflects the judgment that electricity alone is insufficient to catalyze economic growth and improvements in quality of livelihoods, but that, together with other infrastructure investments (physical or social), synergistic benefits can be expanded and electricity service can be made commercially viable by exploiting opportunities of further load growth.

A *third* strategic choice is that the project *focus on laying the foundation* for future private-sector led, commercially-oriented expansion of access to electricity, with the Government playing the role of a market enabler. This choice in part reflects the judgment that the private sector investors and financing institutions are not yet ready to undertake full-fledged commercially-oriented electrification projects for the domestic market and that the "rules of the game" for private sector participation still remain to be defined. Under the UHEP-financed independent grids, it was found that the private sector considered investments in electricity business too risky and that local financial intermediaries were not prepared to provide term debt. In the last three years, however, it has been demonstrated that such independent grids are viable and growing, that private sector is interested in management contracts, and that, with the sector reforms contemplated in the energy strategy, private sector may be attracted to investing in independent grids as well as main grid distribution concessions.

This strategic choice includes improving the efficiency and transparency of EdM, and private participation is not precluded. The first phase of the program would focus its assistance to EdM on (a) implementation of low-cost distribution options; (b) close scrutiny of its budgets and investment plans; (c) progress toward enabling third party access – including for distribution concessions – to the national transmission grid; (d) clear "rules of the game" for potential EdM competition, directly or via joint ventures, in concessions for independent grids; (e) company's restructuring with separation of the main functions as profit centers and (f) a study of options for private sector participation in the utility as a whole, as well as preparation of the "rules of the game" for private investments in grid distribution, and demonstration of the viability of such participation in distribution.

A *fourth* strategic choice is to introduce renewables-based decentralized electricity technologies in the Mozambican market and initiate the process of eliminating market barriers to these technologies. This reflects the judgment that decentralized, renewables-based electricity technologies are an economically and environmentally superior choice for certain end-users, but that their market development is constrained by low levels of awareness, significantly higher prices compared to other countries in Africa or other parts of the world, and lack of efficient supply chains. Some grant donors have initiated the employment of solar PV systems in Mozambique development projects, and valuable experience has been gained in installation and operation of such systems, for example in rural health clinics. There has been some -- albeit limited – assessment of micro-hydro potential in Mozambique[1], and significant efforts have been made over the years by NGOs working with various local stakeholders to demonstrate the viability of micro-hydro options. With the assistance of these NGOs local entrepreneurs have rehabilitated some micro-hydro sets dating back to pre-independence days, to produce shaft power to run grinding mills[2]. There has also been some investments in wind systems for ware pumping.

The project concept focuses on larger institutional-size solar PV systems that can be paid for in cash by grant donors in other sectors, and also aims to expand awareness of and marketing of smaller household solar PV systems that may be partly credit-financed by solar dealers. For micro-hydro, the project focuses on technical intermediation to allow for continuous operation of the plant and its expansion to include power generation, as well as entrepreneurial capacity building. For both green-field micro-hydro sites and sites for wind generation, detailed, site-specific resource assessments are required.

It is recognized that even with more efficient supply chains and support of competitive distribution agents in the Mozambican market, renewable energy options will face a significant financing constraint, and that initially these technologies will have to be provided direct subsidies and other types of business support (e.g., marketing campaigns). This support will come from the Global Environmental Facility (GEF) and bilateral donors, and will leverage subsidy support of other donors in the non-energy sectors (e.g., health, education, or rural ICT development).

Information available at this stage indicates that it is unlikely that commercially viable micro-hydro investments – including rehabilitating and/or strengthening any existing micro-hydro-based independent grids – can be identified soon enough to be included in Phase I of the proposed program (about 2002-2005). Therefore, Phase I activities are likely to be focused on technical assistance and capacity building initiatives (in short, TA) – at the central level and perhaps selected provinces – aimed at initiating and rapidly scaling up micro-hydro investments during Phase II of the program (about 2005-2008) so that the technology becomes a routine option for all interested investors for own use or for electricity supply business.

4. Program description and performance triggers for the second phases

Phase 1

The main purpose of this phase is to lay the foundations for commercially viable expansion of access to modern energy, and to commence implementation on a small scale. The proposed components in this phase are: (i) grid electrification and power sector reform, (ii) renewable energy promotion and development,and (iii) institutional development and capacity building

[1] Smail Khennas and Andrew Barnett, 2000. *Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries*. Final synthesis report. ESMAP Technical Paper 006. Washington, DC.
[2] PWC; *Mozambique: Private Sector Participation in the Energy Sector, Diagnostic Report*; July, 2001

Phase 2

This phase would comprise scale-up of the investments commenced in the first phase, using the selected delivery mechanisms, including implementation of the adopted private participation option for EdM. The triggers for Phase 2 would be linked to the accomplishment of the objectives of Phase 1. These will be finalized during preparation but will include: (i) significant adoption of elements of the minimum policy framework, which will facilitate the commercial approaches to increasing access to modern energy, and implementation of an off-grid and a grid-connected component and (ii) adoption by GoM of a suitable option for private participation in EdM.

The activities specific to renewable energy would follow from those initiated in the first phase, and would consist of building in-country capabilities, resource data dissemination, continuing dissemination and promotion of international best practices, and scaling up.

1. Project components (Phase 1): (see Annex 1)

The proposed project would finance investments as well as technical assistance. Investments, to be implemented by both public and private sectors, will be directed at expanding electricity access via the main grid, independent grids, and individual/ institutional solar systems. Technical assistance would consist of various discrete elements that would collectively aim to: (i) strengthen the Government's capacity (including via a functioning regulatory structure) and commercialize/restructure public energy institutions to achieve efficient development of the energy sector; (ii) facilitate the Government's efforts to put in place the enabling framework as well as capacity for a competitive and sustained expansion of access to electricity and other modern energy; and (iii) build the domestic private sector's capacity to scale up electricity access.

Project activities are proposed to be clustered around three main components, with tentative cost estimates as provided in the following table. Co-financing is expected in the form of (i) GEF grants; (ii) bilateral grants and concessional credits; (iii) other multilateral (Nordic Development Fund) credits; (iv) GoM capital contributions; (v) EdM contributions from internal cash generation; and, (vi) private equity. Agreements on precise amounts are yet to be achieved.

Component	Sector	Indicative Costs (US$M)	% of Total	Bank-financing (US$M)	% of Bank-financing
Grid Electrification and Power Sector Reforms		**34.0**	%		
Main grid sub-component					
- commercial infrastructure		5.0			
- distribution investments		15.0			
Independent grids sub-component		10.0			
Technical assistance sub-component		2.0			
- Main grid unbundling		1.0			
- Rules (technical, tariff) for third party access and independent grids		1.0			
- Design and rules for subsidy transfer					
Renewable Energy Promotion		**10.2**			
- Solar PV investments		4.4			
- Grid-renewables		1.7			
- Renewables TA/capacity building		3.8			
- PDF Gran		0.3			
Institutional Stre ngthening and Capacity Building		**7.0** 5.0			
- Regulatory capacity (electricity, gas)		2.0			
- Business development and support Services					
Total Project costs		51.2	100.0	33	65

A. Grid Electrification and Power Sector reforms:

Investments: These will in turn consist of those on the main grid (distribution only), and for independent grids (generation as well as medium and low voltage reticulation).

1. Main grid investments: Along with the policy changes contemplated under the technical assistance component, this component would demonstrate that main-grid based access can be made commercially attractive via use of cost-based, regionally differentiated distribution tariffs and providing up-front capital subsidies.

This component would be implemented primarily by EdM and would include:

(i) Infrastructure for third party access, which would include provision of equipment – e.g., switches, meters, possibly some telecommunications equipment and SCADA - to improve grid operations and facilitate metering for third party access.

(ii) Distribution investments on a supply and install basis in peri-urban and rural areas, aimed at

- introducing, with the aim of main-streaming, proven lower-cost distribution network designs, standards, and construction/management procedures, in order to substantially reduce the cost per new customer connection and per unit load (kW) served;
- employing more effective connection financing and power marketing strategies (e.g., supplier financing of household meters and connection fees, and utilizing market-specific tariff structures);
- proving the effectiveness under Mozambican conditions of other options for further cost reductions with a view to mainstreaming them at a later stage; and
- demonstrating a model of private sector distribution concession with bulk supply from EdM.

Pending a study (to be supported during the project) to develop the most appropriate model for reform of the main-grid electricity distribution business, including ownership arrangements and involvement of the private sector, GoM and EdM have requested technical assistance, during the course of project preparation, for improvement of EdM's commercial performance (marketing, connection, billing and collection). A first-cut consultant case study has already identified cost reduction potentials of 20 to 50% in various parts of main grid distribution extension, and EdM has expressed strong interest in implementing the recommendations of the study.

Output indicators for this component would be (a) percentage reduction in cost per household connection and per kW served; (b) percentage increase in household access; and, (c) number of private sector distribution concessions.

2. Independent grid investments: The purpose of this component is to demonstrate that it is possible to interest private businesses (investors and commercial financial institutions) to accept the commercial risks of independent grid electrification investments, while the Government provides the appropriate enabling environment. By the end of the project, the Government and the private sector ought to be able to "mainstream" this approach of private ownership in independent mini-grids. Depending on the context and at the option of the bidder, bulk supplies from the main grid may also be used for these non-EdM grids (if sector reforms advance sufficiently to permit such bulk power transactions). The independent grid suppliers will be offered capital subsidy on a competitive basis, subject to pre-specified criteria for service quality and household access.

This component will be implemented primarily by private sector for selected district capitals and other relatively concentrated areas with a potential for income-generating uses of electricity. These areas could be grouped through site profiling for competitive concession contracts with private owners/operators, each contract covering a number of district capitals. Even if it appears necessary that some of these small-scale investments be made by the public sector (e.g., GoM via local government authorities), construction (on a turn-key basis) and operation/management would be by the private sector.

Output indicators for this sub-component would be: (a) percentage reduction in cost per household connection or per kW served; (b) percentage increase in household access; and, (c) number of private rural distribution concessions.

Technical assistance:

Proposed investments in grid electrification will require, and be supported by, changes in the sector structure and creation of an enabling environment for private sector participation that would require following studies:

1. Main grid unbundling and EdM reorganization

   This would consist of a "separation of accounts" study (planned with bilateral donor assistance) that would look at various options for optimal utilization of the network and appropriate transmission pricing regimes. Results of the study would form the basis for "unbundling" EdM operations, restructuring EdM along functional and regional profit centers, and third party access to the main grid.

2. Rules for third party access and independent grids

   This would consist of a study to design regulatory framework for technical (e.g., safety, service quality) and economic (e.g., tariff, approval of capital expenditures) rules for third party access to the main grid and for independent grids (some of which might be subject to "light" regulation).

3. Design and rules for smart subsidy transfer

   This would consist of a study to create a grant-transfer window – a National Rural Electrification Fund, possibly situated as a separate window in FUNAE – to receive donor grants, budgetary subventions, and other dedicated levies (e.g., portions of concession fee or a transmission surcharge) and distribute them transparently and competitively to new entrants in energy service business (grid distribution or solar PV).

4. Options for private sector participation in EdM

   The study would recommend the most appropriate option for private participation in EdM, which would be implemented not later than the second phase of the APL.

B. Renewable Energy Promotion

This component will also consist of investments as well as technical assistance.

Investments in institutional/household solar PV systems: The purpose of this sub-component is to open up the institutional (health clinics, schools, NGO posts, and private businesses) market for solar PV systems to local competitive procurement, and to establish the financial, technical, and business development intermediation mechanisms for local suppliers.

This component will support cash purchases of institutional-size solar PV systems as well as smaller household-size solar PV systems. Financial intermediation would be via a National Rural Electrification Fund (possibly a window within FUNAE, for channeling GEF/bilateral grants). If commercial banks show interest, an on-lending window to re-finance consumer credit extended by private solar PV dealers may be considered during the course of project preparation.

(i) The first program would be directed at meeting efficiently all the modern energy needs of rural institutional consumers, such as health clinics and schools, and initiate the process by

providing light, cooling for vaccines and electricity for other appliances via solar PV systems. This would be a "cash market" by private suppliers, with the bulk of financing coming from donor-supported investment programs in the education and health sectors (as well as GoM budgets for these sectors under the PRSP), and the remainder from GEF grant support under this project;

(ii) The second program would aim to provide solar home systems for lighting and TV or lanterns to rural households and small commercial users, by private solar PV dealers on commercial terms with some subsidies. Qualifying solar PV dealers would receive competitive subsidy support, and may be able to refinance consumer credit. A suitable financing scheme will be designed.

Performance indicators for this sub-component would be: (a) percentage cost reduction; and (b) number of solar systems sold.

Technical assistance for renewables market development and business support, consisting of:

- a study to (i) prepare program design for post-project scale-up of the project's cross-sectoral energy/education/health initiatives, and (ii) prepare a broader, technology-neutral renewable energy sector development plan;
- a marketing research, market development, training and outreach program, to be operated on a cost-shared basis (with local and foreign solar businesses).
- Micro hydro program design and capacity building

C. Institutional Strengthening and Capacity Building

This component will likely have two sub-components, tentatively outlined below. Details will be identified during the course of project preparation after an institutional diagnostic study for MIREME has been completed, and the PPIAF study has progressed.

It is anticipated that some of these activities would be similar to those under the ongoing (about to be completed) Gas Engineering Credit. Additional specific requirements will be identified during the course of project preparation.

1. Institutional strengthening of MIREME: The Ministry of Mineral Resources and Energy (MIREME) needs to be strengthened with additional, properly skilled staff, and its organization and operations streamlined in order to reflect its evolving role. The National Directorate of Energy (DNE) now has more and more diverse responsibilities as compared to its creation about five years ago, and these are expected to increase and become more complex over the next five years. Bilateral grant donors have been supporting MIREME with some institutional development and capacity building efforts, and have expressed willingness to work with the Bank in expanding these efforts (including, e.g., via the PPIAF study). MIREME now needs to conduct a comprehensive institutional diagnostic study and prepare an action plan for reorganization, staffing and consultants (local or ex-patriate) for DNE, DNCH, FUNAE, UTIP and CNELEC, and, wherever appropriate, the provincial branches of these agencies. Specific requirements identified so far include:

Operating rules for CNELEC, FUNAE, and DNE: GoM's current plan is to prepare and approve the operating procedures of the electricity regulator, CNELEC in the near future (2000/1), and transforming it into an independent autonomous agency for electricity as well as gas regulation five years hence. Also, the current charter for FUNAE gives it a wide authority for channeling grants to

third parties, to act as a financial intermediary, and to invest directly on behalf of the GoM; this risks dilution of capacity, potential conflicts of interest, and broader government control than appropriate.

Regulatory capacity for electricity sector: Until an independent autonomous regulator is established, GOM contemplates an interim arrangement wherein DNE is expected to conduct the grant and negotiations of concession contracts for independent grids.

2. Business Development and Support Services to the Private sector: The recent experience with bidding for the management contracts for the natural gas-based independent grids has shown considerable foreign private sector interest in managing independent grids. In the future, as private sector participation is sought in the form of investments, it would be necessary to foster stronger links between the foreign and Mozambican private sector entities, and to strengthen the domestic private sector capacity – among investors as well as financial intermediaries – to prepare, appraise, finance, implement, or operate and manage such investments. Expanding and exploiting the solar PV and other "retail" energy products, and promoting productive uses of electricity, will also require a variety of training and capacity building activities. Support for some of the private sector capacity building could be delivered via existing vehicles (e.g., IDA-financed PODE project) for investment promotion in non-energy sectors. Alternatively, an "energy business support unit" could be established in the public or private sector (depending on the recommendations of the PPIAF study and their acceptance by key stakeholders).

2. Key policy and institutional reforms to be sought:

See Section B.2 "Future Government Strategy" and Annex 3 – "minimum policy platform" discussed among the GoM and the donors - for policy reforms to be designed and implemented during the course of the project.

The key institutional reform to be sought is in developing MIREME organizational structure and human resource capacity that is better able to advance the agenda of these sector reforms and to accelerate the development of export-oriented energy projects. In addition, the project would also seek to develop an institutional mechanism to selectively coordinate activities of the GoM line ministries for rural infrastructure – e.g., particular directorates in the Ministries of Agriculture, Transport, Telecommunications, and State Administration – and for investment promotion – e.g., in the Ministries of Planning and Finance or Industry.

3. Benefits and target population:

The benefits of the project are: (i) improvements in the productivity and quality of life for communities that directly get electricity access; (ii) improvements in the quality of life of households that get electricity access indirectly via rural public institutions such as health clinics, schools, and via public lighting; (iii) increases in the viability of small and medium rural enterprises who use electricity in their operations; (iv) contribution of large energy resource development projects to government revenues; and, (v) improvement in the quality of governance (by government agencies and energy parastatals).

Geographic targets for grid-based electricity access (via the main grid or independent grid) remain to be defined during the preparation phase, and private sector concessionaires will to a certain extent be permitted to select the locations, customer base, and service delivery options. A site profiling study to be carried out during the preparation phase will cover most of the remaining district capitals – particularly those in the Northern and Central regions – and selected peri-urban areas, and will focus on identifying anchor customers (e.g., agro/fisheries small industry operations), complementary

infrastructure, and opportunities to increase affordability of commercial electricity service. (Also see Section E.6 below).

4. Institutional and implementation arrangements of stakeholders involvement:

The overall responsibility for the project coordination will be with MIREME. Electrification investment components will be implemented by a number of agencies. In particular, the *main grid* component will be implemented by EdM and the private sector; the independent grid component will be executed primarily by the private sector; and the renewables component will be implemented entirely by the private sector. (It is recognized that some of the district capitals the GoM wishes to electrify may not be viable in their own right to attract private sector entry, and some form of public ownership may be required. In such cases, however, IDA financing would be contingent on (a) private sector participation in operation and management, and (b) in accordance with the tariff-setting and grant transfer rules applicable for private equity participation.

D: Project Rationale

1. Project alternatives considered and reasons for rejection:

The option of not undertaking any rural electrification operation at all at this time was rejected, as this would simply delay significant benefits for the unserved areas and go counter to the GoM priorities identified by the Poverty Reduction Strategy Paper. The option of pursuing the conventional electrification approach – EdM high-cost extensions over long distances to serve tiny demands under a regime of uniform national tariff (and thus heavy implicit cross-subsidies) – was also rejected for the obvious reason that such investments are unsustainable and run counter to the sector reforms envisaged in new legislation and corresponding elements of the national energy strategy.

The option of to limit the project strictly to technical assistance and institutional strengthening for sector reforms and promotion of energy export projects, and postponing investment financing to a later date was also considered and rejected for several reasons. One, compared to most other countries, Mozambique has already achieved the legislative change for demonopolizing electricity business and permitting private sector participation, and there is no near-term need for new power generation for the main grid. Indeed, GoM does not contemplate that any new bulk power supplies to the main grid come from EdM. Earlier this year, GoM also passed the secondary legislation for competitive award of electricity concessions. In other words, the stage has been set for pursuing the next round of reforms – in a "learning by doing" manner – finance both EdM as well as non-EdM investments as the rules for cost-based tariffs are devised and implemented, and implicit cross-subsidies are gradually replaced by "smart" subsidies.

The option of a Learning and Innovation Loan (LIL) was considered, but found unsuitable for an environment where one of the main imperatives is policy changes for sector reform and capacity building in both public and private sectors. In addition, the smaller size of a LIL would have made it difficult to exploit the economies of scope in an operation that included components related to investments in electrification, and technical assistance to support sector reforms, and institutional strengthening.

The option of a Sector Investment Credit was also considered, but found less appropriate for the required long-term engagement by the Bank, to lay foundations for accelerated access, to adopt the most appropriate delivery systems through the process of learning by doing, and commence to make significant progress on access expansion.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned):

Sector issue	Project	Latest Supervision (Form 590) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
Bank-financed			
Grid-based rural electrification			
Uganda Energy for Rural Transformation		Under preparation	
Eritrea Rural Electrification		Under preparation	
Ghana National Electrification (P000953)		S	S
Vietnam Rural Electrification		Under preparation	
Independent mini-grids			
Mozambique Urban Household Energy Project		S	S
Sri Lanka Energy Service Delivery Project		S	S
Laos Southern Province Rural Energy (P044973)		S	U
Solar pv			
India Renewable Energy Development I			
Indonesia Solar Home Systems (P035544)		U	U
Sri Lanka Energy Service Delivery (P010498)		S	S
China Renewable Energy (P046829)		S	S
Togo-Benin Rural Energy (P057881)		Under preparation	
Argentina – Renewable Energy Rural Markets (P006043)		S	S
Mexico – Offgrid Rural Electrification (P064848)		Under preparation	
PV Market Transformation Initiative		(IFC project)	
Viet Nam – PV project.		(IFC project)	
Bangladesh – Grameen Shakti		(IFC project)	
Bangladesh		Under preparation	

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

3. Lessons learned and reflected in proposed project design for Replicability:

Main-grid based rural electrification. In recent years, development agencies have supported few utility-executed main-grid rural electrification projects, primarily because of the generally poor past performance. In Africa, few power utilities have had any significant success in rural electrification. In general, grid-based rural electrification executed by state-owned power utilities, together with a uniform national tariff to cross-subsidize rural consumers, as has been common in the Bank's client countries, rarely delivers any significant development impact; frequently, it leads to extension of the grid to rural areas, but without actually connecting any significant number of households or small and medium enterprises or providing reliable services. Thus, one of the key lessons is that it is best to shift to commercially-oriented rural electrification, employing cost-based, regionally differentiated distribution tariffs that provide market signals for expansion and scale-up. One implication of this approach is that subsidies should be directed at expanding access – grant-financing initial capital costs – rather than at consumption, which tend to limit benefits to a privileged few "first-comers".

A second key lesson is that it is possible to reduce the costs of rural electrification significantly with little, if any, loss in quality of service. The standards and procedures utilized by most power utilities are mostly too costly for rural conditions, and often reflect past practice in developed countries. As a result, it possible to introduce lower-cost technical standards and operational procedures that have already been tested and found acceptable in other places in the world, including some countries in Africa, such as Ghana and South Africa. However, state-owned utilities are frequently unenthusiastic about or unable to implement quickly such changes, which indicates that there should be greater reliance on the private sector and/or some incentives should be provided to the utility.

Independent grids. This is still an emerging option for rural electrification, with only limited experience available, which has so far been favorable. In any case, it is clear that in a number of circumstances, independent mini-grids are not only lower cost than grid extension, but also that governments find it easier to permit cost-based tariffs for these mini-grids. Here also it is important to introduce lower cost designs, technical standards and operational procedures, so that the cost-based tariffs are affordable for a larger segment of the population. Experience under the UHEP has shown that, in the absence of a broader enabling environment for regulation and financing, the private sector considers investments in independent grids too risky, but is willing to participate via management contracts incorporating performance incentives. Consultations with Mozambican and foreign private companies has suggested that with the sector reforms and regulatory approaches contemplated under the proposed project, they would be interested in equity and debt participation if the "rules of the game" provide sufficient incentives and protection against risks. Experience in other parts of the world has shown that even in the absence of a regulatory and financing framework, small-scale entrepreneurs often do engage in electric service business to serve small loads (e.g., a few shops and households), provided the supply and financing chains for equipment and fuel exist and there is little risk of confiscation by the government.

Solar PV Systems. By now it is clear that solar pv systems are technically suitable for and workable in the rural areas of developing countries, including African countries. However, prices in Africa remain far higher than in Asian countries, where systems that meet international standards (such as those specified in Bank-supported projects) are available at prices that are up to 50% lower than in African countries. Thus, better linkages between Asian and African markets would reduce prices in Africa.

Another key lesson is that significant resources are required initially to lower the barriers that impede greater use of solar pv systems. These include for, instance, resource assessments, strategy papers, demonstration schemes, training, and building broader awareness of PV distribution as a viable retail business. At the same time, such nominally "upstream" activities, if carried out in isolation and without links to a program of actual procurement and use of, do not lead to market development. To the contrary, a viable investment financing program helps "learning by doing" and improve the quality and impact of such "upstream" activities.

Two different institutional models have been used in disseminating solar pv systems: the *vendor* model in which the end-user (e.g., household) owns the system and may have service contract with the vendor, and the *concessionaire* model, in which an energy service company owns the system, and the end-user simply pays a periodic (e.g., monthly) fee for the energy provided. The vendor model has been used in Bank-supported projects in Asia, and the concessionaire model has been used in a Bank-supported project in Argentina. In sub-Saharan Africa, the vendor model has emerged spontaneously in countries such as Kenya, which has a vigorous solar pv market, and Zimbabwe, while the Government of South Africa has opted for a concessionaire model.

In general, the practical experience with these two models does not offer conclusive guidelines as to the conditions in which each is more appropriate. However, the present scale of the solar pv market in Mozambique may be too small for the concessionaire model, where one of the objectives is to quickly provide the systems to a large number of consumers.

4. Indications of borrower commitment and ownership:

Several portions of the proposed project concept had received wide support from the government and from various agencies, such as EdM, INDER (since merged into MADER), key officials at UEM, and the private sector (in the conventional electricity business as well as solar PV dealers). A participatory workshop in September 1999 for the solar PV component elicited considerable interest from the Mozambican NGOs active in rural development. The September, 2000 mission affirmed understandings previously reached with the GoM.

5. Value added of Bank and GEF support in this project:

One of the main contributions of the Bank to this project is its ability to function as a "knowledge bank" that brings to Mozambique fresh approaches to solving its problems, taking account of Mozambique's current situation and growth potential, while incorporating the experience of and key lessons learned in other countries. Much of the sector reform work to date – preparation of 1997 electricity and petroleum laws, or of concessioning decrees – has been financed by the Bank, and Bank's assistance in the final drafting of the national energy strategy was also appreciated by the GoM. Looking forward, our knowledge assistance would be geared at fostering a consensus – in Mozambique and among the donors – toward new approaches to sector development and maximizing aid effectiveness, in order to achieve a broad, sustainable development impact of aid-financed investments. (This is all the more so since the main challenges for expansion of access are in the northern provinces where the absorptive and organizational capacity constraints are relatively more severe, non-Bank grant donors are relatively more active, and cost-based main-grid tariffs may be the highest.)

A second major contribution of the Bank would be in donor coordination - by providing donors with effective grant funding channels *and* building selective cross-sectoral partnerships in the context of the Poverty Reduction Strategy Paper under preparation. (Tentatively, such cross-sectoral activities are planned to be targeted at helping meet the energy needs of rural health and educational facilities and improving the quality of social services delivery.)

The GEF's value added goes beyond the grant support provided by it. While there have been a number of donor-supported renewable energy activities in Mozambique, their impact has been generally limited to the actual projects supported. GEF's support would make it possible to develop a more programmatic approach, within which individual projects could be developed.

E: Issues Requiring Special Attention

1. Economic

[x] Summarize issues below (e.g., fiscal impact, pricing distortions)
[ ] To be defined (indicate how issues will be identified) [ ] None

The main economic issue in this project is related to the policy component, in particular to the extent and speed with which the Government is willing and able to design and implement the policy framework for commercially-oriented expansion of access to modern energy and private sector equity/debt participation. While the Government has readily accepted the overall concept, it still remains

new to not only Mozambique but also to Africa in general, so it is possible that some difficulties may arise in implementation. A related issue is to what extent private sector investors and financial intermediaries see participation in energy investments as particularly risky or attractive, how pricing decisions of the public monopoly (EdM) affect such perceptions, and what types of incentives or assurances private sector participants may require.

The issue will be addressed by widespread consultation and participation during the preparation as well the implementation phases of the project.

Economic evaluation methodology:

[x] Cost benefit [ ] Cost effectiveness [x] Incremental Cost

2. Financial

[x] Summarize issues below (e.g., cost recovery, tariff policies, financial controls and accountability)
[ ] To be defined (indicate how issues will be identified) [ ] None

One of the key financial issues is the extent to which the Government will allow and facilitate cost-based tariffs for electricity sold by the private sector (this is part of the policy framework mentioned above). However, while EdM's current nationally uniform retail tariffs do not permit adequate cost recovery in most areas outside Maputo, and would not attract private investors in areas outside of Maputo, the Government has permitted higher, cost-based tariffs for three independent mini-grids financed by the Bank and other donors under UHEP.

A second key financial issue is the under-developed state of financial markets in Mozambique, which will make it difficult for private investors to obtain credit for investments in electricity access expansion, whether in main grid, or independent grids, or solar pv systems. Willingness of financial intermediaries to take commercial risks is critical to effective financial intermediation. This issues needs to be addressed at a broader level than this project; within this project, efforts will be made during preparation to expand the possibilities by working with interested financial institutions. To the extent possible, the project will seek to learn from, build on, and leverage Bank and other donors' projects on small and medium enterprise (SME) development – e.g., the PODE project – and micro-finance.

3. Technical

[x] Summarize issues below (e.g., appropriate technology, costing)
[ ] To be defined (indicate how issues will be identified) [ ] None

The key technical issue is the introduction of low-cost designs and equipment for grid distribution (from the main grid or via independent grids) and standards for solar pv systems. A Bank-financed case study in late 1999 has confirmed that, by using designs, equipment standards and procurement, installation, and maintenance procedures already tested and proven in other parts of the world (including Ghana and South Africa) the costs of grid distribution in Mozambique can be reduced by 20-40% without any reduction in technical performance. Whether such cost savings are easily realized, adopted for mainstreaming in all electrification projects, and further savings potentials identified, would be examined during project preparation. On the solar pv side, preparation efforts will focus on developing appropriate technical standards, and producing specific and detailed operational strategies – including the establishment of more efficient supply chains for a package of electricity supply as well as end-use equipment (e.g., solar water pumps and refrigerators) – for bringing about the cost reductions and quality improvements during the course of the project.

4. Institutional

[x] Summarize issues below (e.g., project management, M&E capacity, administrative regulations)
[ ] To be defined (indicate how issues will be identified) [ ] None

The main institutional issue during project preparation as well as project implementation is MIREME's limited human resources. One of the project's aims is to increase ~~in~~ this capacity in conjunction with bilateral donors. Since it will be difficult to increase MIREME's capacity in the short-run, efforts are being made to lighten MIREME's burden in terms of project preparation, without compromising ownership of the project. To that end, the Bank will execute the bulk of the PHRD and GEF PDF preparation grants, and all of the PPIAF grant, on behalf of the Government. (Note: PPIAF grants are not directed at project preparation activities.)

5. Environmental

a. Environmental issues:
[x] Summarize issues below (distinguish between major issues and less important ones)
[ ] To be defined (indicate how issues will be identified) [ ] None

Major:
Other: Extension of distribution lines may require land clearing, though no involuntary settlement is expected. There may be fuel spills in transport or storage at power plants. There could be minor adverse environmental consequences from the batteries that are used up in solar pv systems. The extent of this problem will be ascertained during project preparation, and appropriate measures will be incorporated in project implementation as well as monitoring and evaluation arrangements.

Project investments are expected to contribute to environmental improvement in several ways: (i) promoting adoption of renewable energy; (ii) rehabilitating/replacing abandoned grids; (iii) encouraging a switch from individual diesel generators to grid electricity (hydroelectric or diesel/gas-based supplies); and, (iv) facilitating industrial and commercial users' switch to cleaner combustion equipment for woodfuels or to cleaner fuels.

b. Environmental category: [ ]A [x] B [ ]C

c. Justification/Rationale for category rating:

Although not expected, the extension of distribution lines may have some implications on the bio-physical as well as the human environment. An Environmental Analysis, prior to appraisal, will assess the possible impacts of the distribution lines and land clearing on the environment, sensitive areas, gazetted reserves, forest areas, and farm lands. Continuous social assessments and a framework for resettlement or compensation, to be applied as necessary, will be prepared as the project activities proceed.

d. Status of Category A assessment: EA start-up date:
Date of first EA draft:
Current status:

e. Proposed Actions:

f. Status of any other environmental studies:

g. Local groups and NGOs consulted (list names):

h. Resettlement

[ ] Summarize issues below (e.g., resettlement planning, compensation)
[ ] To be defined (indicate how issues will be identified) [x] None

i. Borrower permission to release EA: [ ] Yes [ ] No [ ] N/A

j. Other remarks:

6.1 Social

[x] Summarize issues below (e.g., significant social risks, ability to target low income and other vulnerable groups)
[ ] To be defined (indicate how issues will be identified) [ ] None

There are two key social issues. First, some uncertainty remains about the willingness of communities to accept commercially-oriented rural electrification schemes because it is likely that their tariffs would be higher than EdM's under the existing regime of uniform national tariffs, even though three independent mini-grids with higher tariffs are already operational. This issue would be addressed by discussing the commercial concepts with the community during the process of selecting the sites for independent mini-grids, and incorporating their suggestions and chosen compromises in project design. Conversely, areas where communities are more willing to accept the commercial approach, local entrepreneurs or anchor customers are interested in investing in the distribution business, and/or where community makes "in-kind" contributions to the project costs, will be stronger candidates for project investments.

A related concern with commercial approach may arise from the proposed cost-based, regionally differentiated tariffs on the main grid. These would entail that the EdM customers outside the Maputo area will have to pay higher tariffs than they do now, while those in the Maputo area may see a lowering of the tariffs. The proposed solution to the perceived regional inequity is as follows: higher-use customers in the Maputo area will continue to pay about the same average price, but a portion of it in an explicit surcharge or electrification levy that would be transparently allocated for access expansion in the rest of the country. Populations in the Central and Northern regions will be offered a regulatory bargain – in return for an increase in the average tariffs, they would get a substantial increase in access to electricity, partially grant-financed by the levies from the higher-use customers (most of whom are in the South). In other words, the system of cross-subsidies would move away from implicit taxation of Southern customers' consumption to finance the current consumption in the rest of the country toward an explicit taxation of the former to finance greater expansion of connections in the latter.

The second social issue is the need to address HIV/AIDS, which has been identified as a major national problem in Mozambique. This will be addressed in three ways: (i) project teams would be willing and able to act, during project preparation as well as implementation, as the "arms/legs, eyes/ears" for the HIV/AIDS message to be delivered to rural areas whenever they travel; (ii) "affinity marketing" of HIV/AIDS materials and supplies through agencies and businesses in the project, to be done at time of consultations, cash purchases, meter reading, bill payments, maintenance visits, etc.; and (iii) a focus on meeting the energy needs of rural health clinics and schools, both of which are vital elements of the HIV/AIDS battle plan, and helping advance HIV/AIDS prevention awareness programs at project sites.

6.2 Participatory Approach:

a. Primary beneficiaries and other affected groups:
[x] Name and describe groups (how involved, and what they have influenced or may influence.)
[ ] Not applicable (describe why participatory approach not applicable with these groups)
are identified. Their views will determine the suitability of the scheme for the community.

For the electrification investment components, there have been extensive discussions with service providers (EdM, potential private investors/financiers/retail dealers) and potential customers, which will

be continued during the course of project preparation. Visiting missions have traveled to all three of the functioning independent mini-grids under UHEP to assess their operations, and the views and needs of consumers. During the course of project preparation, discussions will be held with health and education officials to coordinate the provision of energy services to rural public facilities, and to define the proposed project's role in the fight against HIV/AIDS.

b. Other key stakeholders:

[x] Name and describe groups (how involved, and what they have influenced.)
[ ] Not applicable (describe why participatory approach not applicable with these groups)

Extensive discussions have been held with bilateral donors who have shown support for the proposed project concept and are happy with the Bank taking the lead in advancing both sector reforms and new approaches to electrification tailored to Mozambican contexts. The project team has had one or more meetings with other GoM ministries/agencies with some responsibilities in rural development – Ministries/Directorates of Agriculture and Rural Development, State Administration, Health, Education, Water, and Environment – or in investment promotion – Ministries of Industry, and of Planning and Finance, and CPI (Center for Promotion of Investments). In addition, several NGOs attended a meeting on renewable energy options and another workshop on solar PV meetings have also been held with provincial administrators, local entrepreneurs and local residents, all of whom have requested urgent support in providing access to modern energy (electricity, in particular).

7. Safeguards Policies (check applicable items):

Policy		Risk of Non-Compliance (H, M, L)
x	Environmental Assessment (OD 4.01)	L
x	Natural Habitats (OP/BP/GP 4.04)	L
x	Forestry (OP 4.36)	L
	Pest Management (OP 4.09)	
	Cultural Property (OPN 11.03)	
	Indigenous Peoples (OD 4.20)	
	Involuntary Resettlement (OP 4.30)	
	Safety of Dams (OP 4.37)	
	Projects on International Waterways (OP 7.50)	
	Projects in Disputed Areas (OP 7.60)	

8. Business Policies (check applicable items):

	Financing of recurrent costs (OMS 10.02)
	Cost sharing above country 3-yr average (OP/BP/GP 6.30)
	Retroactive financing above normal limit (OP/GP/BP 12.10)
	Financial management (OP/BP 10.02)
x	Involvement of NGO's (GP 14.70)
	Other (provide necessary details)

c. Describe issue(s) involved, not already discussed above:

F: Sustainability and Risks

1. Sustainability:

The technical assistance and capacity building components of the project do not pose a significant risk of non-sustainability, so long as the long-term policy and regulatory framework so designed provides the appropriate incentives for institutional strengthening and retaining necessary personnel. For example, if the framework is conducive to private sector participation in energy market expansion, the demands for institutional services (e.g., from GoM ministries and agencies or from private financial intermediaries) will only increase. Similarly, technical assistance to EdM restructuring would make it more efficient and commercially viable, in turn better prepared to use the capacity created under the project.

Investment components of the project pose different issues for sustainability, replicability, and potential for scaling up. In general, the sustainability of the foundation sought to be laid for private sector-led, commercially oriented expansion of electricity access depends on three factors. *First*, the policy and regulatory framework should be essentially complete – i.e., permitting third party access to the main grid for distribution, and transparent, relatively predictable price regulation and financial intermediation – and it should be viewed as attractive and long-standing by the private sector, while also being acceptable to other key stakeholders. This also means that private investors accept that there is no opportunity to exercise pressure on the government to obtain operating subsidies, and the government accepts to refrain from political pressures to change tariffs as costs change. *Second*, the Government should have adequate capacity to focus professional attention on rural electrification issues in its role as market enabler. *Third*, there must be a credible expectation on the part of the private sector that, once this project is complete, external financing and support will continue to be available for subsequent scaling up. The first two factors are being directly addressed during project implementation, while the last factor will be addressed by continuing discussions and cooperation with bilateral donors.

The sustainability of *specific* investments depend on whether the geographic area in question is a reasonable "pocket of potentiality" for catalyzing economic growth and expanding the market for electricity – i.e., whether some "anchor customers" (e.g., an agro-industrial enterprise or some public service institutions) exist – and whether the rules for cost recovery and performance targets for subsidies are complied with. Some of this risk will be sought to be mitigated during the project preparation phase – by carefully selecting areas of demonstrated ability and willingness to pay at least the operating costs of electricity provision and where electrical investments can be co-located with other investments in physical (e.g., telecommunications, water) or social service (e.g., health, education) infrastructure. Some other risks will be sought to be mitigated via the design of regulatory rules, and of financial intermediation and subsidy transfer schemes, during the project. Some risks of non-payment or changes in demand levels will of course remain; whether the private sector is willing to take such risks, and what rewards and incentives it can reliably expect, would be tested during the course of the project.

2. Critical Risks: (reflecting assumptions in the fourth column of Annex 1)

Risk	Risk Rating	Risk Minimization Measure
From Outputs to Objective 1. Government and the donors are not committed to sector reforms and the policy/regulatory changes.	S	Combined support from Bank and other donors will be provided to help the Government overcome obstacles, and it will also be made clear that future support will be contingent on steady advancement on the reforms front.

2. Low-cost options are not mainstreamed.	N	EdM is already enthusiastic about low-cost designs and standards, but needs to see their impacts in practice. The proposed unbundling and restructuring of EdM along "profit centers" is expected to provide further incentives for lowering costs and reducing waste.
3. Limited affordability to commercial approaches	**M**	**Affordability would be enhanced by promoting income-generating uses of electricity, and acceptability of commercial approach would be enhanced by promoting indirect benefits of electricity access.**
From Components to Outputs		
1. Limited Government capacity or disagreements between various donors impede project implementation	M	Minimize government intervention required; careful and sustained coordination with all donors
2. Private sector and financial institutions are not interested in participating.	S	"Smart" subsidies package will be developed to attract them.
Overall Risk Rating:	**M**	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

G: Project Preparation and Processing

1. Has a project preparation plan been agreed with the borrower: (see Annex 2 to this form)

[ ] Yes, date submitted: MM/DD/YY [x] No, date expected: MM/DD/YY

Note: Portions of the attached preparation plan were agreed to in October/November, 1999. Correspondingly, the Bank submitted grant requests to Government of Japan (PHRD) and the Global Environmental Facility (GEF) incorporating specific project preparation activities (see Annex 2).

2. Advice/consultation outside country department:

[x] Within the Bank: The project is being prepared by AFTEG, leveraging in part assistance from the Africa Rural and Renewable Energy Initiative (AFRREI). These staff and consultants have extensive experience with rural energy projects, and are preparing/implementing projects in other African countries. An effort has been made to draw upon Bank-wide experience and expertise in designing the project. The peer reviewer will be Nelson de Franco.

[x] Other development agencies: Bilateral and other multilateral donors (e.g., NDF) have been and will continue to be widely consulted.

[x] External Review: GEF STAP Review by Prof. Daniel Kammen (planned).

3. Composition of Task Team: (see Annex 2)

4. Quality Assurance Arrangements: (see Annex 2)

TBD

5. Management Decisions:

Issue	Action/Decision	Responsibility

Total Preparation Budget: US$ 2,236,000 **Bank Budget:** US $ 400,000 GEF**:** US$ 275,000 PHRD: US$550,000; GoM $91,000; other trust funds - $100,000, PPF: US$ 820,000.

Cost to Date: (US$000)

[ ] GO [ ] NO GO Further Review [Expected Date]

(signature)
Team Leader: Reynold Duncan

(signature)
Sector Manager/Director: M. Ananda Covindassamy

(signature)
Country Manager/Director: Darius Mans

Annex 1: Project Design Summary

Mozambique: Energy Reform and Access

Hierarchy of Objectives	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
a. Sector-related CAS Goal: · Developing infrastructure · Promoting rural development and agriculture **b. GEF Operational Program:** - Promote the adoption of renewable energy technologies by removing barriers and mitigate CO2 emissions	**Sector Indicators:** · Investments in domestic energy infrastructure and export-oriented energy projects. · Increase in rural access to, and consumption of, modern energy Increase output from productive use of modern energy · Size renewable electricity (excluding large hydro) sector	**Sector / Country Reports:** ▪ Utility/GoM annual reports ▪ Household income or expenditure surveys ▪ Enterprise surveys	**(from Goal to Bank Mission)** · Infrastructure investments expand economic growth opportunities and contribute to poverty alleviation. · Broad-based rural development, and sharing of aid benefits reduce rural poverty. · Greater use of renewable energy helps mitigate global warming
Program Purpose: Improvement in the quality of life of peri-urban and rural communities is facilitated through the provision of modern energy **GEF Purpose:** Barriers are removed and implementation costs of renewable energy are reduced	**Number of households with access to modern forms of energy**	• Household survey reports • Impact evaluation reports	

Project Development Objective:	**Outcome / Impact Indicators:**	**Project Reports:**	**(from Objective to Goal)**
· The use of electricity for economic growth and improved quality of life in underserved areas is accelerated in a commercially viable mannes improved; - Mozambican capacity to expand the energy sector is strengthened	· Project areas demonstrate more rapid economic growth and customer willingness to pay for improved energy services. · Project experience is viewed favorably by key stakeholders and the policy/regulatory framework is seen adequate for a rapid "scale-up", as demonstrated by EdM and private sector business plans; · EdM's operational performance improves;	Project supervision reports, plus · Impact Evaluation Reports · EdM operational reports · EdM financial and performance audits · Regulatory reports · Performance audit of MIREME · Reports by participating financial intermediaries,	· Private sector can bring in additional capital and uses it more efficiently. - Low rate of inflation
Global objective: · The elimination of barriers that impede renewable energy development is initiated	· Increase in the numbers of viable solar distributors and other renewable energy businesses, including micro hydro. · GoM adoption of a renewable energy development plan	· Impact evaluation report.	The progress achieved will be sustained

Output from each component:	Output Indicators:	Project Reports:	(from output to objective)
A. Grid Electrification and Power Sector Reforms · Expanded customer base on the main grid in **xx** peri-urban areas and **yy** rural communities in the Northern and Central parts of the country. · **xx** new independent grids are established. · Better management of power flows in the main grid. · EdM is reorganized along distribution profit centers. · A regulatory/financing framework for third party access, tariff-setting, and subsidy transfer mechanism is established. · Private investors and private financial intermediaries participate in electrification schemes.	· Number of household, commercial, institutional and industrial connections · Loads and demand densities in the project areas. · Extent of cost reductions · Capacity utilization rates in rural/peri-urban enterprises.	· EdM project reports · Independent grid operators' annual reports · Customer satisfaction surveys · GoM decrees	· Government and the donors remain committed to sector reforms and the policy/regulatory changes. · Low-cost options are mainstreamed. · Affordability can be enhanced by promoting income-generating uses of electricity. · Acceptability of commercial approach can be increased by promoting indirect benefits of electricity access.
B. Renewable Energy Promotion · Remote rural public institutions utilize PV systems. · Smaller PV systems or lanterns are sold in the market. · Retail distributors of PV systems increase and spread geographically. · Prices of PV systems come down. · A renewable energy development plan is prepared, along with market development and outreach program. · There is greater awareness of renewable technologies and supply chains · A program for micro-hydro development exists	· Number and total size (kWp) of PV systems installed in rural public institutions · Number and total size (kWp) of smaller PV systems sold retail. · Number and geographic dispersion of retail PV distributorships. · Preparation and adoption of future plans acceptable to the Bank and other donors.	· Implementation and supervision reports for the institutional market program. · Market surveys for solar PV system prices in Mozambique and comparisons with price trends in other countries. · Distributor/customer satisfaction and preference surveys.	· High prices, lack of awareness, and absence of efficient supply chains are the key barriers to solar PV market development.

C. Institutional Strengthening and Capacity Building · MIREME staff are better trained, and prepare and timely execute properly formulated workplans. · There are successful negotiations on private concessions for grid distribution. · A business development and support unit is established to assist energy SMEs and financial intermediaries.	· Export contracts · Number of SMEs trained and applying for finance · Number of commercial credit lines extended · Links between domestic and foreign investors and financiers	· Training attendance and reports · Workplans · External performance reviews · Supply chain assessments	· Institutional strengthening of MIREME would accelerate agreements on energy exports and domestic private distribution concessions. · Private sector capacity facilitates financial intermediation and efficient risk mitigation.

Project Components/Sub components:	**Inputs: (budget for each component)**	**Project Reports:**	**(from components to outputs)**
A. Grid Electrification and Power Sector Reforms	**34.0**	Project supervision reports, plus	· In peri-urban areas, small towns, and unelectrified district capitals, there are enough "pockets of potentials" to use electricity for productive uses at commercially attractive prices. · Lower-cost standards and procedures can be adapted to Mozambique; · Private investors and financial institutions are interested in participation; cost-based tariffs are acceptable and affordable in private sector concession areas. · Coordination leads to synergistic benefits without taxing government capacity. · Continued commitment of Government and other donors
Main grid sub-component			
- commercial infrastructure	5.0	EdM feasibility study	
- distribution investments	15.0	EdM reports; "bankable" business plans by private distributor(s)	
Independent grids sub-component	10.0	"Bankable" business plans by private grid developers	
	2.0		
Technical assistance sub-component	1.0	"Separation of accounts" study	
- Main grid unbundling		Study on rules for	
- Rules (technical, tariff) for third party access and independent grids	1.0	wheeling and distribution tariffs	
- Design and rules for subsidy transfer		Study on subsidy transfer mechanism	

Renewable Energy Promotion - Solar PV investments - Grid renewables investments - Renewables TA/capacity building	**$9.9 m** $4.4m $1.7m $3.8 m	Project supervision reports, plus - Business plans of solar PV dealers - Budgets of participating GoM agencies - Completed studies	· Large institutional users are able to pay for the PV systems and their maintenance; · Lower cost and/or smaller systems can be adapted for Mozambique; · Retail distributors are interested and can import, stock and sell PV systems without grant financing of working capital. · Successful awareness programs can be launched; pockets of affordability exist.
Institutional Strengthening and Capacity Building	**7.0**	Project supervision reports, plus - training reports - strategy study - consultant reports - design study and reports from a "business support unit"	· MIREME employees can take advantage of training opportunities and continue to work for MIREME; · Private businesses need and can take advantage of the support offered.

ANNEX 2
INCREMENTAL COSTS AND GLOBAL ENVIRONMENTAL BENEFITS

INTRODUCTION AND GEF PROGRAM RATIONALE[3]:

Mozambique is a low-income country struggling to rebuild after years of war and severe debt service burdens. Impressive economic growth of the last several years has been concentrated in or near urban areas, especially the south, in part because of limited or poor-quality infrastructure. The government is gradually expanding the network of public services – especially in health and education

[3] **NOTE**: The Project Concept Document approved by Bank management in January 2001 was for a Sectoral Investment Loan (SIL). Subsequently, agreement was reached with the GoM to recast the project as an Adjustable Lending Program (APL) in view of the long-term partnership needed to be able to lay the foundations required for accelerated electricity access. The program will incorporate unbundling of the main grid, restructuring of EdM, and private participation in EdM distribution. (Reynold Duncan Back-to-Office Report, April 26, 2001, to Darius Mans and Ananda Covindassamy).

sectors – and its recent Poverty Reduction Strategy Paper (PRSP, draft[4]) plans broad-based public investments in both social infrastructure (education, health) as well as physical (roads, water, energy). .

Access to electricity is low, and commercial expansion of the main grid is not feasible in the foreseeable future for much of the large expanse of the country. Given its current and prospective claims on Cahora Bassa hydroelectric power, the opportunities to generate global environmental benefits via grid-connected renewable electricity (RE) technologies are also limited. The potential "workable entry point" for such technologies to generate greenhouse gas (GHG) reductions are therefore potential users in areas remote from the main grid. There is some experience with RE technologies – wind, PV, and micro-hydro – and the GoM has established a goal of electrifying all administrative centers, isolated health centers, and 'other social and economic important targets' with off-grid options over the coming ten years. (National Rural Electrification Strategy Plan November 2000).

Given the significant absorptive and human resource constraints in developing, implementing, and scaling up renewable energy projects, the key challenge is to begin small, and provide steady support, gradually building partnerships with donors and local stakeholders, implementing agencies, and learning by doing, sustaining enthusiasm without over-promising.

The proposed two-phase program (APL) provides an opportunity to meet this key challenge via (a) gradually removing information and awareness barriers, and gaining end-user confidence; (b) reducing the costs of RE - in particular solar photovoltaic (PV) - technologies via rapidly expanding the market size and establishing more efficient supply chains for products and services, both with the rest of the world and within the country; and (c) building the human resource and institutional capacity in public as well as private sectors to develop viable RE businesses. The proposed program's sector reform and access expansion objectives are centered on the "minimum policy platform" (see Annex .. of the PCD), each of whose key provisions – de-monopolization of electricity service, creation of a level playing field, unbundling of tariffs, cost-reflective price regulation, and use of "smart subsidies" – are conducive to creating and supporting viable RE businesses under the program – which concentrates at first on remote PV applications, and then on independent mini-grids based on micro-hydro and wind.

The proposed program's RE component in part draws its inspiration from, and aims to learn from, the Uganda Energy for Rural Transformation APL – supported by the Africa Rural and Renewable Energy Initiative (AFRREI) – with two distinctions, considering Mozambican conditions: a relatively greater focus on capacity building, and exclusion of GEF support for RE supplies into the main grid[5].

Compared to other GEF/Bank 'climate change' projects, the proposed program has several distinctive features:

- RE promotion is linked with sector reforms within the same project;
- initial GEF and other donor support is directed mostly toward PV investments and technical assistance (TA)/capacity building (CB) activities (with the effect that the calculated incremental costs for Phase I of the APL are high); and,
- its PV component, in turn, is based on a philosophy of 'cross-sectoral' collaborations and donor partnerships leading first to investments in "large" or "institutional size" PV systems (which

[4] Republic of Mozambique, Action Plan for the Reduction of Absolute Poverty (2001-2005) (PARPA), 4th draft March 19, 2001, unofficial translation to English by UK DfID Central Africa-Mozambique.

[5] This only reflects the fact that such supplies do not generate significant GHG reductions, and that the marginal cost of bulk power from Cahora Bassa is likely to be much lower than those of RE technologies. It is possible that wind or bagasse-based generation may competitively supply bulk power to the main grid over the longer term, without GEF support.

allow markets for retail PV systems – such as fixed solar home systems or mobile solar "lanterns" – to piggy back).

These features also entail a more rigorous and innovative approach to workable monitoring and evaluation (M&E) arrangements.

BROAD DEVELOPMENT GOALS

As mentioned in the main text, the proposed program's development objectives are to: (a) accelerate, in a commercially viable manner, the use of electricity for economic growth and improved quality of life in underserved areas; and, (b) strengthen Mozambican capacity to expand the energy sector. It seeks to achieve this objectives via supporting the design and implementation of the Government of Mozambique (GoM) National Energy Strategy that, inter alia, aims at reforming the Mozambican energy sector and implementing an enabling environment for greater private sector participation in the sector. The RE component of the proposed program supports these goals in two ways: (a) introducing competitive off-main grid approaches to provision of electricity services via (b) primarily private sector investors in the supply and service chains.

The proposed program's global objective is to initiate the process of eliminating the barriers that impede the development of renewable energy. Promotion of these RE technologies would provide rural institutional and household customers the direct benefits of increased access to electricity, in the form of direct current (DC) power produced by stand-alone solar PV systems or that of alternating current (AC) by independent RE-based grids. The provision of electricity to rural public institutional customers such as health and educational facilities and administrative posts will result in indirect benefits to the poorer households in the form of higher-quality public services, even when they themselves cannot afford electricity access in their homes.

BARRIERS TO RENEWABLE ENERGY DEVELOPMENT AND BARRIER REMOVAL STRATEGY

In the Mozambican context, the main rationale for supporting the development of RE industry is that RE technologies --

- have a geographic and demographic market niche, now and for the foreseeable future;
- offer opportunities for specific indirect benefits of electricity provision to public social infrastructure institutions; and,
- when mature, can compete with grid supplies based on conventional large hydro or coal-fired electricity.

Such decentralized, RE technologies are an economically and environmentally superior choice for certain end-users, but their market development is constrained by several factors:

1. low levels of awareness of and experience with RE technologies, in both public and private sectors, despite a small but unpredictable market (driven largely by donor grant programs with limited attention to local market development or financial sustainability or scaling up);
2. limited resource assessment[6];
3. financing constraints at various levels – suppliers to end-users – and the inability of financial intermediation mechanisms to provide adequate risk management options;

[6] There is no solar atlas yet, though efforts are under way to produce one. There are also limited data on wind speeds at 10 m heights. Some limited site studies have been made for micro-hydro development. Various biomass-based electricity options are also potentially attractive, but no resource assessment has been carried out yet.

4. limited institutional capacity to mount and monitor a sizeable program of public investments and/or assistance to private business development in the form of a supportive regulatory environment and financial intermediation alternatives (debt or grant); and,
5. significantly higher domestic prices compared to other countries in Africa or other parts of the world, reflecting a lack of efficient supply and service chains, and limited human resource capacity (on technical, business or policy fronts).

The general misperception – in part a result of the GoM policy to apply "uniform national tariff" for EdM customers – that Cahora Bassa provides "very cheap" hydro-electricity also contributes to the potential for RE technologies and a neglect of niche service needs that can be – and often is – met by intermittent, non-grid electricity service (by batteries or gensets, which can be replaced by solar PV);

At the same time, there have been some investments in wind water pumping and solar PV systems for health clinics and water pumping, both financed by donor grants. There are also some private investments in solar home systems, water-pumping, wind-diesel hybrids, micro-hydro mostly providing shaft power and some electric power, and one also finds solar PV panels being used in small, informal commercial establishments by the roadsides. A number of local private companies have established themselves as suppliers/installers of solar PV systems or have shown interest in doing so[7]. Mozambican migrant workers who work in South Africa (especially mines) have been a source of "cash sales" market for solar PV systems that can be expanded with greater attention to the maintenance and servicing aspects. And the existing market for car batteries for household lighting purposes – about 20,000 to 30,000 a year, at a cost of $35-65 each – suggests that solar PV systems, or at least solar battery-charging, could find a viable market with sufficient potential for scaling up as the awareness expands and as local costs are brought closer to the international levels.

It is recognized that even with more efficient supply chains and support of competitive distribution agents in the Mozambican market, renewable energy options will face a significant financing constraint, and that initially these technologies will have to be provided direct subsidies and other types of business support (e.g., marketing campaigns). The precise modalities of financing support will be developed during the course of additional project preparation.

There are three broad elements of the barrier removal strategy of the proposed program: (a) significant market expansion, led initially by PV systems for large public institutional customers, which would both lower costs and expand experience; (b) associated assistance in establishing a domestic commercial supply and service chain, led initially by PV markets and followed by micro-hydro and wind markets; and (c) technical assistance and capacity building for RE resource and market assessments, development of appropriate policy and regulatory environment, and institutional/business support. The last element of this strategy fits well with three separate elements of the rest of the program: (i) establishment of regionally differentiated grid distribution tariffs and 'light regulation' of independent grids (which reduce the market barriers against off-grid RE technologies); (ii) provision of 'smart subsidies' for all types of providers (grid distributors, independent grid operators, and off-grid RE businesses); and (iii) development of a comprehensive approach to policy and regulatory developments.

PHASE I CHOICES:

The details of specific Phase I and Phase II activities in line with this strategic vision are provided below, and will be further articulated during the course of project preparation and appraisal. The tactical choices for Phase I are:

- Rather than initiate a broad, national program, to limit Phase I solar PV investments to a select number of provinces – most likely, Cabo Delgado, Nampula, and Zambezia – in order to generate a 'critical mass' of investment and service market for the large institutional PV systems and to correspond to investments in the main-grid and independent grids in Phase I;
- Rather than just 'open the window and wait to serve whoever that comes', to limit the choice of strategic 'partner' sectors in public investments to rural health, education, and local government (with a possibility for including rural water, and rural telecom – in combination with promotion of information and communication technologies (ICTs) for the main 'partner sectors' if and as appropriate) in order to work toward complementary, synergistic investments and build a framework for sustainable, expanding program of use of , rather than just 'open the window and wait to serve whoever that comes';
- To work with other donors and leverage their grant resources to apply a "head start" approach to capacity building and technical assistance – i.e., linked to preparation for future investments – in both public and private sectors, rather than risk dissipation of such efforts in the absence of follow-up investment finance; and,
- To utilize existing institutions and other development projects to build partnerships and leverage both funds as well as local human resource capacity. .

PREPAREDNESS TRIGGERS FOR PHASE II

Broadly, implementation progress of Phase I investments and technical assistance/capacity building (TA/CB) activities, and identification of Phase II investment and capacity needs, will be used as 'preparedness triggers' for Phase II. It is conceivable that different sub-components of the GEF-supported project component could be advanced into Phase II at different times. For example, if the independent grid operators in Phase I investments show an interest in providing solar home systems or 'lanterns" – or service and maintenance contracts for large PV systems – as a part of their operating strategies, the solar PV sub-component may well be ready to transition into Phase II. On the other hand, if developments in 'sector reform' portion of the program – e.g., establishment of unbundled tariffs and third-party access, corresponding regulatory structures, and/or financial intermediation mechanisms for private service providers – so might main grid-connected RE investments.

A mix of the following specific indicators will be used to assess readiness for Phase II:

- Progress in 'cross-sectoral' activities for large institutional PV systems – namely, the preparedness of relevant ministries (of health, education, public administration) to (a) incorporate 'electricity service' as a part of their routine capital and operating budgeting process; and, (b) to routinely design their requirements and conduct procurement of RE equipment and services;
- Level of other donors' interest in expanding the 'public institutions' market for solar PV;
- Adequate output from the TA activities – resource assessment, market assessments, assistance with supply chain improvements;
- Identification of sites for grid-connected and independent grid RE investments, with potential private sector interest in equity and debt finance;
- Capacity and interest in the central and provincial ministries and directorates to implement and expand public sector investments;
- Capacity in the private suppliers businesses to expand competitively;
- Level of customer satisfaction (with direct benefits – of improved lighting – or indirect benefits – improvement in the quality of public service deliveries); and,
- Development of indigenous M&E capability – in accordance with indigenously articulated objectives, criteria and methods – aimed at sustaining and expanding the RE market.

THE BASELINE

Without GEF participation, the Energy Reform and Access Program could still proceed, but (a) the focus on renewable energy promotion would be diffuse; (b) RE investments will not reach a 'critical mass' to mobilize local private sector capacity for competitive supplies; and (c) the justification to invest human and institutional resources into technical assistance and capacity building – in particular, aimed at a wider, systematic program of renewable energy industry development in Phase II – will be much weaker.

A. Increased reliance on petroleum-based fuels – with associated carbon emissions – for small electricity markets:
   - Rural public health and educational facilities will continue to rely on gasoline generators for the provision of electricity, and there will be no 'demonstration effects' on private customers – 'larger' commercial customers or individual households;
   - Peri-urban and rural households that cannot be effectively served by the main grid or independent grid supplies will continue to rely mostly on kerosene lighting (with some use of automobile batteries or dry cells for small electrical appliances such as radios or flashlights).
   - Private investors in independent grids (or for large private customers such as for farming estates) will for the most part neglect the potential for micro-hydro or wind technologies because of lack of awareness, absence of routine supply chains, and lack of financing;

B. Limited capacity development in private and public sectors:
   - Domestic solar PV industry will remain small, serving an unpredictable and geographically spotty market, and its incentives to establish reliable supply chains externally or internally, or invest in human resource capacity, will be sharply lower;
   - There will be virtually no capacity in the public sector to help identify, design, and implement RE projects. In turn, the scale and experience base of technology adaptation and 'localization' will remain very low, and the pace of RE development will remain largely subject to small, uncoordinated projects of individual external grant donors.
   - The potential benefits of 'sector reforms' – demonopolization of the grid electricity supply industry, establishment of third party access and unbundled tariffs, and transparent 'smart subsidy' mechanism – will not accrue to the RE industry (or will be sharply limited, and go to support unnecessarily higher costs).
   - The volume of overall cost-effective investments over the longer term will be lower. This is because, to the extent that RE technologies provide an opportunity to serve small, disperse markets more cost-effectively over the long term, continued reliance on higher-cost options such as main grid extension or kerosene would necessarily imply an economic loss. Also, to the extent that continued reliance on low-quality lighting sources such as kerosene lamps involve higher costs (in the long term), there is a corresponding loss in economic welfare, and the transition to modern lighting services would proceed slower.

THE ALTERNATIVE (THE PROJECT)

The proposed alternative consists of investments and technical assistance/capacity building (TA/CB) for a two classes of RE technologies:

- solar PV systems, initially focused on large institutional users in the public sector (rural health and educational facilities, and local administrative posts), but gradually building up larger market share for household-size systems; and

- micro-hydro and wind power technologies, primarily for independent grids to serve local customers, but may also be used for large industrial or commercial users or to supply bulk power into the main grid.

In Phase I, solar PV investments and TA/CB activities dominate; micro-hydro and wind investments (or "grid renewables") are expected to be quite limited due to (i) limited resource data, (ii) high transaction costs, and (iii) slow development of regulatory institutions for independent grids. In Phase II, the "grid renewables" market is expected to expand rapidly, and the use of GEF funds is increasingly shifted from direct subsidies to indirect 'business support' and non-grant financing.

The project approach will:

- establish a 'critical mass' of initial solar PV market and subject it to international competitive bidding in order to exploit the economies of scale and rapidly bring the domestic equipment prices in line with the world market levels as well as reduce the unit costs of local service and maintenance;
- support and accelerate entry of private suppliers of RE equipment and services, and private entrepreneurs in RE-based 'independent grids', with technical and financial assistance; and,
- establish the regulatory and policy framework for a national RE program, and provide for institutional and human resource development to support such a program.

The overall program of costs and financing is as below:

Summary Table: Cost and Financing of Renewables Promotion Program ($m)					
	Cost	GEF	IDA/other donors	GoM	private
Phase I					
Solar PV investments	4.4	1.5	1.9	0.5	0.5
Grid renewables investments	1.7	0.5	1.0	-	0.2
subtotal	6.1	2.0	2.9	0.5	0.8
CB/TA/Business support	3.6	0.7	2.5	0.3	0.1
Monitoring & evaluation	0.2	0.2			
Total	9.9	2.9	5.4	0.7	0.9
Phase II					
Investments capital costs					
Solar PV investments	8.6	1.4	4.9	0.8	1.5
Grid renewables investments	7.9	1.8	4.9	-	1.2
subtotal	16.5	3.2	9.8	0.8	2.7
CB/TA/Business support	5.0	3.0	2.0	0.5	0.5
Monitoring & evaluation	0.4	0.2		0.2	
Total	21.9	6.4	11.8	1.5	3.2
Program summary					
Solar PV investments	13.0	2.8	6.8	1.3	2.0
Grid renewables investments	9.6	2.3	5.9	0.0	1.5
subtotal	22.6	5.1	12.7	1.3	3.5
CB/TA/Business support	8.6	3.7	4.5	1.3	0.6
Monitoring & evaluation	0.6	0.4	-	0.2	-
Total	31.8	9.2	17.2	2.8	4.1

INCREMENTAL COST SUMMARY

The calculated incremental costs are based on the following scenarios for (a) investments, and (b) technical assistance and capacity building.

INVESTMENTS

Investments in institutional/household solar PV systems:

The goal of the GEF alternative is to open up the institutional (health clinics, schools, NGO posts, and private businesses) market for solar PV systems to local competitive procurement, to establish the financial, technical, and business development intermediation mechanisms for local suppliers, and to 'piggy back' the marketing and market development of solar home systems and small/mobile solar systems. GEF grants would be used for direct subsidies – either as fixed unit price ($/Wp or $/unit) or competitively – via a National Rural Electrification Fund (possibly a window within FUNAE, for channeling GEF/bilateral grants). In particular, two distinct markets would be targeted (other markets may emerge as a result of "demonstration effects"):

- Rural public institutions: The first program would be directed at meeting efficiently all the modern energy needs of rural institutional consumers - such as health clinics, schools, and administrative posts, and possibly for water supplies (for general access or dedicated to the use of clinics or schools, say) in two or three provinces in Phase I and for additional three or four provinces in Phase II. Phase I would initiate the process by providing about 300 'large systems' for lighting, cooling for vaccines and electricity for other appliances (radio, telecom, TV). The typical system size would be about 700 Wp, and would cover basic electricity services for staff housing as well. This would be a "cash market" for private suppliers, with the bulk of financing coming from donor-supported investment programs in the education and health sectors[8] (as well as GoM budgets for these sectors under the PRSP), and the remainder from GEF grant support under this project;

- Households: The second program would aim to provide "fixed" solar home systems (of about 40 Wp each) for lighting and TV, or small/mobile solar systems (or "lanterns", of about 12 Wp each)) to rural households and small commercial users, also by private PV dealers on a commercial basis with some subsidies. (These could include cash purchases by Mozambican miners in South Africa.) Phase I targets installation of about 1,600 SHS and 900 mobile systems. This is a conservative estimate, and excludes at this time any potential interest of a private distribution concessionaire (from the main grid or via independent grids) in incorporating SHS or lanterns in his/her electrification scheme for a given area[9]. Phase I price reductions, service improvements, and increased awareness of (and confidence in) solar PV technologies are tentatively projected to lead to Phase II investments of about 6,000 SHS

[8] Denmark and Norway are preparing project interventions in the rural health and education sectors, which are to include provision of electricity via solar PV systems in schools and clinics.

[9] It is conceivable that a grid distribution concessionaire sees provision of SHS under a "lease" or an "energy service company" model as an economically attractive complement to grid extension when the prospective household is too far (more than 1 km, say) from the grid distribution lines. This option is neglected from the incremental cost calculations here because it is difficult to specify a priori what the avoided emissions would be – from avoided kerosene use in the households or from avoided generation fuel for grid supplies (which may well be hydro or another renewable rather than diesel).

and 7,000 mobile systems[10]. It is expected that during Phase I, a few reliable, competitive solar PV dealers emerge, who would be able to extend consumer credit (or 'hire-purchase' schemes) in Phase II and refinance it via commercial banks; if so, Phase II of the program would provide for an on-lending scheme for IDA/other credit sources.

Assuming that the relevant ministries – of, say, health, education, state administration, and perhaps water – have the relevant funds to procure electricity services for their facilities[11] – the **'baseline'** for the large institutional customers – some of whom exist, and some expected to emerge as a result of rehabilitation and expansion of rural health and education networks – would be the use of gasoline gensets according to the types of service they are expected to provide. Some institutional systems would be installed with external grant funds, but with widely varying technical standards, and uncertain or inadequate attention to after-market services or to scaling up the market over time.

The **baseline** for the household customers is that some cash purchases from South Africa (via the miners' supplies companies) and Zimbabwe would continue, and local retail sales of modules and systems will grow somewhat. The prices will remain high, the quality unreliable, service unavailable or high-cost. The awareness of PV technology will remain low, and it would continue to be seen as 'risky' or 'inadequate'.

Under the GEF **alternative**, the annual PV market be expanded to roughly $1.3 million per year during Phase I and to $2.2 million per year during Phase II, PV businesses would be assisted in finding best-price sourcing opportunities from around the world (including possibly local production of some components), and would be provided a per Wp subsidy to reduce first costs and enable expansion of sales and service networks. The businesses will also be given other direct assistance, as necessary, in strengthening their capacity to access commercial and quasi-commercial short- or long-term finance (including from SME development projects such as Bank-financed PODE program, or from foreign equipment suppliers and private grant donors).

This package of interventions to rapidly expand the market in a predictable manner and supporting the entire delivery chain as well as pioneering institutional customers is expected to lead to significant cost and price reductions (via international competitive bidding) as well as greater awareness and acceptance – first for the larger institutional systems and gradually for the smaller systems.[12] The GEF-financed up-front subsidy to the PV investment component is expected to be in the order of about $5/Wp during Phase I and $1/Wp during Phase II, and overall $2/Wp for the entire program. These correspond to about $30 per ton gross CO_2 abated in Phase I, $10/t in Phase II and $15/t overall (or about $110/t, $36/t and $57/t respectively for gross carbon abated.)

[10] Affordability for PV systems does exist, as evidenced by the reliance on higher-cost, inconvenient alternatives such as car batteries, especially in recent years of economic stability and prosperity. Industry estimates suggest that about 25,000 to 30,000 car batteries are sold annually for home electrification use, and that the market keeps growing because many people have no other means of electric lighting. Based on this, it is estimated that there is a short term market of 20,000 solar systems. Recognizing, further, that a large portion of Mozambican population lives in areas that will be difficult to serve via main grid electrification, the technical potential for solar PV systems is over two million households over the next 10 to 20 years.

[11] This assumption is realistic in that investments to be financed here are to be a part of the corresponding ministries' infrastructure capital and operating budget plans. That is, the solar PV systems are not to be `provided' to them whether or not they want them and have arrangements to service them (as has often happened with purely grant-driven programs). Rather, as the relevant ministries are cultivated as customers of PV systems, they go out and procure what they find to be the right fit for their needs, and local PV businesses participate in the bids for capital equipment as well as services.

[12] A larger and growing market also helps reduce the costs of training for service and maintenance.

PV Investments				GEF 'buy down'		
	Avg.size Wp	# of systems	Capital cost $/Wp	per Wp	per ton CO2	per ton C
Phase I						
Institutional systems	750	300	$ 15.2	$ 5.1	$ 31.2	$114
Home systems	40	1,600	$ 14.4	$ 5.4	$ 27.5	$101
"Small"/mobile systems	12	900	$ 11.6	$ 5.7	$ 26.1	$96
Total/weighted average			$ 14.9	$ 5.2	$ 30.0	$110
Phase II						
Institutional systems		550	$ 12.2	$ 1.7	$ 10.3	$38
Home systems		6,000	$ 12.1	$ 1.8	$ 9.4	$35
"Small"/mobile systems		7,000	$ 8.8	$ 1.8	$ 8.1	$30
Total/weighted average			$ 11.7	$ 1.8	$ 9.7	$36
Program						
Institutional systems		850	$ 13.2	$ 2.9	$ 17.7	$65
Home systems		7,600	$ 12.6	$ 2.6	$ 13.2	$49
"Small"/mobile systems		7,900	$ 9.1	$ 2.2	$ 10.2	$37
Total/weighted average			$ 12.7	$ 2.8	$ 15.4	$57

Investments in 'grid renewables' (micro-hydro/wind):

This component would consist of investments in small micro-hydro or wind electricity generating facilities, either for independent grids for local distribution or for self-generation by large industrial/agricultural users, including the rehabilitation and expansion of old micro-hydro plant.

There has been some – albeit limited – assessment of micro-hydro potential in Mozambique[13], and significant efforts have been made over the years by NGOs working with various local stakeholders to demonstrate the viability of micro-hydro options. (Some micro-hydro generation sets owned by local governmental authorities date back to pre-independence period, and some private investors have also been using such systems.)

On the wind technology option, no comprehensive resource assessment has been conducted but the general view has been that (a) Mozambique's wind regime is probably not conducive to large-scale windfarm development for competitive supplies into the main grid, BUT that (b) pockets of appropriate wind regimes do exist, for small-scale generating options as proposed here, possibly also as 'hybrids' in combination with existing diesel generators in remote areas. (That is, it may be economically attractive to expand capacity via adding a wind turbine rather than replace with a new, larger diesel generator.)

Unlike the PV investments, investments in micro-hydro and wind options are dependent on (a) appropriate advances in power sector regulations for independent grid operators and (b) detailed, site-specific resource assessment. However, it also appears – from current vantage point – that once a 'level playing field' is established (during Phase I, as part of the sector reforms process) for grid-based supplies of RE and non-RE technologies, the 'incremental costs' for grid-based RE technologies at resource-favored sites will increasingly consist of only the initial high 'transactions costs' which can be better addressed via use of non-grant financing rather than direct subsidies. (See below).

[13] See Smail Khennas and Andrew Barnett, 2000. *Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries*. Final synthesis report. ESMAP Technical Paper 006. Washington, DC.

	Grid Renewables Investments			GEF 'buy down'		
	Avg.size kWp	Avg. # of systems	Capital cost $/kWp	per Wp	per ton CO2	per ton C
Phase I						
Wind	200	3	$1,650	$0.5	$20.8	$76
Micro-hydro	100	3	$2,530	$0.8	$17.3	$63
Total/weighted average		6		$0.6	$19.1	$70
Phase II						
Wind		15	$1,490	$0.3	$13.8	$51
Micro-hydro		15	$2,285	$0.5	$11.9	$44
Total/weighted average		30		$0.3	$12.9	$47
Program						
Wind		18	$1,517	$0.3	$15.0	$55
Micro-hydro		18	$2,326	$0.6	$12.8	$47
Total/weighted average		36		$0.4	$13.9	$51

Technical Assistance and Capacity Building

Technical Assistance in Phase I will support the preparation of Phase II design for (a) up-scaling of the cross-sectoral energy/education/health solar PV initiatives started during the project, and (b) building a broader renewable energy sector development plan.

Together with local and international support the necessary background information will be collected, institutional arrangements and responsibilities discussed, pipelines for investments identified, energy need assessment models defined, suggestions for policy enhancements and a program for follow up activities described. The design of the subsidy release criteria, organizational responsibilities in relation to the subsidies and other related issues will be part of the activity but will receive separate attention.

Market Development activity will support the businesses in their market research, controlled test marketing[14], and outreach. The focus of the market research and the controlled test marketing is towards the more affordable smaller solar systems for households and optimal design for the larger scale institutional systems. The market research will clarify the profile of the potential buyers therewith establishing stronger focussed marketing strategies, product design and pricing policies. This activity will be developed and undertaken in close collaboration with the existing companies, and build on the experiences of some of the larger commercial companies (e.g., beverage makers) who use similar market development process. In the later stage of the project, specific marketing tactics like road shows, district demonstration centers and national awareness campaigns might be considered. To make sure that these activities are undertaken as part of the individual business strategies the activity will be designed on a cost-shared basis.

Capacity Building activity will focus on three main target groups: (i) the local renewable energy businesses, (ii) rural development organizations, commercial banks and government officials from energy as well as non energy sector ministries, and (iii) cross-sectoral working groups.

[14] Controlled test marketing is a defined activity in the marketing area, it can provide test results that reliably simulate real-market conditions and buyers. These methods can reduce risk and test-market costs as well as save time.

Local renewable energy businesses will receive support to prepare better business plans and implement them. Initially, SME development experts with the assistance of a PV market expert will develop criteria for a high quality business plan in the Mozambican context. Individual businesses will then be provided guidance and, as necessary, training, to prepare and execute such business plans. The activity will support businesses to build their capacity to improve products to meet the price/quality range expected by rural households and the health and education ministries. It will also support the businesses to improve and expand their current installation and after-sales services. These activities will be undertaken in collaboration with the CPI and may be achieved through established twinning relations with high quality foreign businesses (e.g., promising south-south trade relationships).

Additionally, internationally available renewable energy training programs will be tailored to the Mozambican situation. It will contain teaching modules and extension materials that will strengthen the capacity of distributors as well as financiers and customers to make informed and reliable choices, and to own and operate the solar PV systems. Simple technology descriptions, data collection tools, and screening tools will be provided, as well as information on how to obtain the equipment. Particular attention will be given to a training module on the cross sectoral renewable energy options in the health and education sector, and build on lessons learned by the WHO[15], NREL and other international organizations that have worked with and tested the different options in other developing countries. The training material will also contain a module for government officials from energy and non energy sectors on renewable energy policy aspects, international agreements, and renewable energy program management. The material will be based on participatory training methodology. The activity will train local training institutions after which they will receive small financial support to train the different target groups in the rural and urban areas. The activities will be undertaken in collaboration with UEM, regional renewable energy institutes and the SADC[16].

To implement the institutional systems will require cross sectoral collaboration among different ministries, accompanying experts and businesses. To facilitate this process one or two (health and/or education) working groups will be established. A professional facilitator will support the groups during the process of collaboration. In addition, technical support will be made available to support the groups on specific issues. The group(s) will support the government officers in establishing functional specifications, technology assessment tools, operation and maintenance schedules, fee collection mechanisms, definition of responsibilities, procurement guidelines etc.

Phase II of TA/CB

The needs for technical assistance and capacity building (TA/CB) activities in Phase II will become clearer during Phase I. In line with the proposed 'preparedness triggers' for Phase II, these TA/CB activities would build on experience gathered during Phase I both in the public and private sectors, and would be geared towards meeting specific local needs identified by the stakeholders. As the investment program gradually shifts more in favor of household solar PV systems and grid-connected renewables, the capacity building activities for the private sector would increasingly consist of business development assistance, and strengthening the supply chains for RE technology goods and services. In the public sector, TA/CB assistance to the power sector regulators would be aimed at continuing learning from 'best practices' in other parts of the world.

[15] The WHO recently finalized a four-year research project to determine an integrated approach of solar energy for primary health care.

[16] Training material from ESAMI (Tanzania), EDRC (South Africa), TAU (SADC), ITC (Zimbabwe), NREL and others will be used.

Use of Non-grant Financing

Due primarily to the severe structural and capacity limitations of the commercial financial institutions in Mozambique, the GEF grant in Phase I will be provided directly as a subsidy to the sellers of RE technologies (PV systems, wind and micro-hydro systems) under rules of competitive procurement to be defined during project preparation. In Phase II, however, it is anticipated that direct subsidies to wind and micro-hydro, or other grid-connected RE investments, would be gradually eliminated, and other modalities such as partial guarantees would be applied; direct subsidies to non-PV technologies would thus be limited to technical assistance and capacity building activities. Direct subsidies to solar PV sellers would continue in Phase II but on a declining basis as the domestic market grows, costs and prices are closer to those in the world market (which are also expected to decline). Investors in wind and micro-hydro who distribute electricity to other customers would also qualify for the general rural electrification subsidy in both Phase I and Phase II, under the rules to be developed for the national rural electrification fund.

Global Environmental Benefits

The calculated gross avoided CO_2 emissions for the 300 kWp solar PV investments and 900 kWp grid-connected wind/micro-hydro investments in Phase I are 52,000 and 27,000 tons respectively over a 15-year lifetime. In Phase II investments of about 736 kWp solar PV and 4.5 MWp grid-connected RE technologies (mostly wind/micro-hydro, but may include other), the calculated gross avoided CO_2 emissions are 133,000 and 136,000 tons respectively over a 15-year lifetime.

SUSTAINABILITY

A key strategic reason to choose an APL instrument for a project that also combines sector reforms with RE promotion was to seek to ensure sufficient, gradual nurturing of the local markets and capacities so as to ensure the long-term sustainability of RE investments under the project AND acceleration of these investments beyond the period when GEF grants cease. The overall approach is that, over time, sustainability will come from barrier removal, cost reductions, rising incomes, and declining GEF grants. Also, as the Government plans to finance the electrification fund via, for example, a levy on energy mega-projects and grid-based electricity, the need for external grants to support electrification in general, or that via RE technologies in particular, will decline.

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 lower-cost suppliers abroad, 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. Additionally, the planned TA/CB activities will support 'learning by doing' and incorporating mid-term revisions and corrections along the way; taking care to reduce grant dependencies of individual sub-projects.

As one of the least-developed countries, Mozambique is expected to remain dependent on grant support from donors in social sector investments – e.g., health and education. To that extent, the expansion of the 'public institutional market' will remain indirectly dependent on donor support. The major change this project proposes in this regard is to incorporate 'electricity (and perhaps ICT) provision' as a routine part of budgetary processes of individual line ministries. Initially the PV sellers take the usual commercial risk that this portion of their market depends on the ability of the GoM to fund

public-sector social services. Over time, as their market grows and diversifies, this risk would become relatively smaller.

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 (M&E), which will focus on three broad categories of impacts – direct and indirect benefits of electricity access; market viability of a variety of suppliers and technologies; and, achievement of environmental objectives. GEF-specific indicators will be linked to the second and third of these categories, and are briefly described in the table below. Baseline levels will be established during project preparation and initial implementation, using both quantitative survey techniques as well as participative techniques for qualitative data. It is also anticipated that, over time, some of the M&E will be increasingly 'mainstreamed' and 'localized' – so that the beneficiaries and market players themselves have an interest in providing, collecting, and reporting data. Dissemination of program results will be accomplished through regular reporting as well as contributions to international conferences and other such fora.

Responsibilities for overall M&E and its sub-components will be determined during the course of project preparation

Component	**MARKET DEVELOPMENT INDICATORS**
PV Investments	• Sales not financed or subsidized by the project • Performance and perceptions of market participants at different points in supply and service chains; foreign participants' interest • Percentage cost/price reduction at various levels in the supply chains • Cost/prices compared to regional and world markets • Varieties of systems available outside the project • Varieties of sales and financing terms offered • Codes, standards, and certification • Consumer protection mechanisms developed and accepted
Grid-renewables Investments	Same as for PV investments plus, • Regulations development for independent grids and for bulk sales to the main grid or independent grids
Technical Assistance/Capacity building (TA/CB)	• Number of participants, duration and commitment, cost-sharing • Studies completed and decisions taken by GoM • Academic/training programs mainstreamed • Utilities and distribution concessionnaires adopt off-grid systems in their planning and marketing
	MARKET INTERVENTION INDICATORS
PV Investments	• Direct sales (# of systems, kWp, $, terms of sales) • Geographic spread of customers • Size distribution of household PV systems • Amount of subsidies disbursed • Budgets of participating ministries for electricity services • Amount and sources of supplier financing
Grid-renewables Investments	- same as for PV investments -

TA/CB	- to be developed -
	MARKET SUSTAINABILITY INDICATORS
PV Investments	• Consumer acceptance of PV systems as well as more generally of the criticality of electricity services in education, health, and local administration performance; • Incorporation of PV option in the business plans for grid electricity distributors (main or independent grids); • Pipeline development for Phase II investments and beyond; • Localization of assembly and service
Grid-renewables Investments	- same as for PV investments -
TA/CB	- to be developed -

Incremental Cost Matrix			
	Baseline	**Alternative**	**Incremental**
Domestic Benefits a. Investments	Rural and off-grid market grows, slowly, and primarily with diesel and kerosene Solar market small, product availability narrow, and near-exclusive dependence on imports for hardware and human capacity Private investors select diesel gensets for electricity provision to independent grids	Phase I: Expansion of large institutional PV market SHS and lanterns become available in several geographic markets Some private investors select wind and micro-hydro options for independent grids for public distribution or for private industrial uses.	Awareness and information barriers removed Greater efficiency in supply and service Acceptance of PV technology by users and financiers Cost reduction in PV and other RE technologies, and narrowing of cost gap with international market
		Phase II: Growth of PV systems market Renewables-based independent grids (wind and micro-hydro, possibly bioenergy)	Successful demonstration of a range of technologies and business approaches Further cost reduction in PV technologies, and narrowing of cost gap with international market
b. Capacity	Reliance on imports	Development of local	Same as in the

Incremental Cost Matrix			
	Baseline	**Alternative**	**Incremental**
	for equipment supplies and services, for a small, unpredictable market Little specific attention to making RE options viable for retail or grid-based applications. Limited private sector development for RE supplies and services.	commercial supply chains Public sector policy and regulatory capacity Private sector business development	"alternative" case
Global environmental benefits	None	Offset of GHG emissions via avoidance of gasoline, kerosene, and diesel.	Phase I: About 79,000 gross tons of CO_2 (14, 150 gross tons of C) avoided over project lifetime Phase II: About 269,000 gross tons of CO_2 (73,470 gross tons of C) avoided over project lifetime.
Cost by components (million US$)			
Phase I: Solar PV Grid renewable Capacity building/technical assistance M&E **Subtotal**	 4.6 2.1 2.9 -- 9.6	 6.2 2.6 3.6 0.2 12.6	 1.6 0.5 0.7 0.2 3.0
Phase II: Solar PV Grid renewable Capacity building/technical assistance M&E **Subtotal**	 11.6 10.5 2.0 0.2 24.3	 13.1 12.2 5.0 0.4 30.7	 1.5 1.8 3.0 0.2 6.4

Incremental Cost Matrix			
	Baseline	**Alternative**	**Incremental**
Total	**34.9**	**43.3**	**9.4**

GEF STAP REVIEW AND COMMENTS

STAP Reviewer's Comments and Project Team's Response

Reviewer: Prof. Daniel M. Kammen, Professor of Energy and Society and Professor of Public Policy; Director, Renewable and Appropriate Energy Laboratory, University of California, Berkeley.

Summary:

This is an ambitious project, and the human capacity to build what are effectively three major new energy markets (solar, wind, and micro-hydro) all simultaneously is still somewhat problematic. It can be done, but an evaluation would be helpful that shows the current and future level of trained – local – trained facilitators and private-sector vendors, and how that resource base maps onto the demands that a project of this size will place on the industry.

Response: Agree. This is being done as a part of the PDF-B consultancy on 'Design of Capacity Building Program for Renewable Energy Industry'.

Extensive funds are allocated for development of the 'markets'. Added emphasis on technology and service evaluation, and even certification would be useful.

Response: Agree. Will be addressed during preparation via the PDF-B consultancy on 'consumer protection mechanisms'.

The scope of this project suggests that an international review board would be of use to not only the work taking place in Mozambique, but in other nations as well where renewable energy and/or rural transformation efforts are in effect, or are planned.

Response: This merits serious consideration and will be explored further during preparation, along with other options. One possibility would be to establish a group outside the individual projects, and help coordinate different donors' activities on renewables in several countries.

The extended project duration is an important innovation.

The project is now sufficiently clear -- particularly the incremental cost analysis -- that it is ready for approval.

Comments on the ICA (9-18-01 version):

Notes Sheet: What is the sensitivity to the price fluctuations noted for the various fuels? In both the Kenyan and South African solar (PV) histories, PV demand was highly inelastic to changes in kerosene costs. This was apparently due to the dominance in importance to consumers of energy reliability over price, at least for the early adopters of PV. Early studies of the improved stove market in Maputo by A.

Ellegard (Stockholm Environment Institute) indicated strong price sensitivity (as expected for low-cost cookstove technologies).

Response: Kerosene, gasoline and diesel price assumptions are critical to the estimated incremental costs. At the current world prices of oil products, estimated unit incremental costs are lower than what they would have been, say, two years ago. Alternatively, the estimated unit incremental costs would have been even lower if a real(i.e., net of inflation) price increase was assumed. (The prices assumed here are at the world market levels, with assumed adjustments for market size premium and domestic distances.) On demand sensitivity to fuel prices, there are three distinct markets here, and the products/fuels competition varies by geography (within and across countries) and end use. It is probably the case that cross-price demand elasticities for the lighting market are low, and that the assumed oil products prices may matter less than the consumers' expectations of such prices and preference for higher quality lighting. (For PV, the consumer preference for electric lighting over kerosene is well-known, and it is understandable that PV system demand is relatively inelastic with respect to kerosene price.) Incremental cost analysis here is not addressed to cooking fuels and technologies.

Summary Sheet: The selection of 'large' (40 Wp) versus small/mobile (12 Wp) solar systems for household users is interesting. In much of East Africa the SHS market has bifurcated (see Duke, Jacobson, Kammen, 2001, available online at: http://socrates.berkeley.edu/~rael/qualityshs.pdf) into sales of systems roughly > 40 Wp (largely to the affluent, and to businesses), and the current solar home system market, of < 40 Wp. The split of 'large' versus 'small/mobile' systems may be fine, but justification should be offered based on the current sales of these system types in Mozambique. Is this effort one that will require multiple training process, or can vendors selling one make a good case for the other as well?

Response: The primary justification for bifurcation is that sales of the 40 Wp fixed systems will be limited due to affordability constraints while the 12 Wp systems haven't yet been introduced and face some market risks. Also, the 40 Wp and 12 Wp sizes selected here are for illustrative purposes and represent a partial range of unit sizes that could be marketed under the project. Implications for training processes are not yet clear; controlled marketing and market tests – as proposed under PDF-B consultancies and Phase I TA - will clarify them.

Recommend using cost/ton carbon, instead of cost/ton carbon dioxide to conform to most international analyses of GHG offsets.

Response: Agree; both units given now in the Project Brief.

The incremental cost and cost/ton carbon is based on key assumptions about solar⇔kerosene substitutions. There are a number of questions about the degree to which this takes place (versus simply adding energy sources to the household mix. The importance of this is apparent in the calculations in **PV Systems and Alternatives** and in the kerosene lamps analysis). The project justification based on carbon offsets is more convincingly made if based around prevented future emissions.

Response: Project justification is indeed based on 'prevented future emissions' from the systems expected to be installed under the project and through removal of barriers to market growth. There is no a priori reason to expect that kerosene lighting use per household would increase over time. So what is assumed here - in line with other solar home systems projects - is that each 40 Wp system or 12 Wp system avoids 0.52 tons and 0.17 tons of carbon dioxide per year, based on estimates of per household kerosene use in the two market segments.

Summary (Table 3) & SHS Sheet: This table highlights a key issue in market development, particularly for PV systems. In an number of countries the evolution of the SHS PV market has been significantly driven by two factors: (1) the presence of TV as a high-valued application; and (2) quality standards, or at least discernible differences between products based on price/performance characteristics (Duke, et al., 2000). With a market intended to grow to > 15,000 systems during Phase II, greater attention is needed for module testing and education (irrespective if formal or informal standards prevail in the market in Mozambique. Again, Duke et al., 2000 provides a set of test procedures, recommendations on how to provide this information to the market, and approaches to working with vendors.

Response: Agree. TV access is being rapidly expanded in Mozambique, and will be a main driver for PV demand. Activities are planned in the preparation phase for testing as well as defining testing/certification needs during the program.

Small Systems: The comparison of the 'Base' and 'GEF' cases need to be clarified. No capital replacement costs appear to be included.

Response: It is assumed that battery and lamps are covered in the 'annual O&M' of $20 per system.

Investment Calculation: This analysis, which is very clear, is highly conservative with respect to the renewable energy – solar, wind and hydro – options. Over a seven year project life, assuming that the renewable energy programs are even moderately successful, the total carbon savings will be considerably higher than indicated in the spreadsheet. The development of a PV market, for example, that grows to sales of > 3,000 units/year will have significant ancillary benefits in terms of future growth in energy use that is diverted from fossil fuels to renewable energy. An estimated growth coefficient of 3 percent/year would be reasonable, and with 50% of that met with renewables, the $/Carbon avoided values will decrease by over 20%. This calculation, while speculative, is recommended. This applies even more strongly to the Grid RE Summary analysis.

Response: We agree that the estimates are conservative and believe that such conservatism is prudent. The expectation of 50% of the marginal growth in kerosene lighting demand being met by PV is too optimistic at this stage. Besides, some of the electricity for lighting market will be captured by grid supplies. Two, grid-based renewables will incur 'carbon offsets' only insofar as they are used for 'independent' grids (because main grid marginal generation comes from hydro). This 'independent grids' market is also small, and even as it grows, some of it will be captured by the main grid.

Micro-hydro: An estimate of the river resource for micro-hydro systems should be included to be used in an evaluation of the market potential, given the favorable economics indicated in the analysis of both $/ton carbon and in the project NPV. Expansion to the scale indicated suggests the potential to develop a micro-hydro industry, with regional sales. The Zimbabwean micro-hydro turbines produced until recently have left the market due to violence in that country. Mozambique could become a regional supplier, particularly if project funds are use from the 'market development' program to support this initiative.

Response: The estimate of river resource will be done later during preparation. Also, based on current indications, South Africa or Zimbabwe (once the violence ends) are probably better placed for capital goods production and regional distribution. Mozambican capacity for maintenance and repair are to be emphasized first.

Summary: the incremental cost analysis, despite inevitable problems and uncertainties in the assumptions that underlie the value of the GEF option in terms of carbon offsets ($/tC), is well argued and clear. With the NPV calculation already included in the analysis, it would be instructive

to add an evaluation of the future offsets in carbon emission based on a partial conversion of adopters to a renewable energy component of future growth in energy use.

Response: As mentioned above, while there is a potential for significant 'spin-off', at this time we feel the implied conservatism is prudent. Monitoring and evaluation (M&E) during Phase I will provide a better basis for judging whether the potential for 'spin-off' is large enough so as to justify a more aggressive stance in Phase II.

Further Comments on the PCD:

As in the initial review, this project seeks to jump-start several distinct clean energy sectors in Mozambique. This is an excellent goal, but it remains unclear if sufficient human resources exists to develop these programs without over-reliance on a few key individuals. Are there more extensive ways to distribute the burden on building three new energy markets (to say noting of the differences between small and large PV)? A process with a staggered phase-in of the PV, wind , and micro-hydro phases would make sense.

Response: Agree. This is indeed how it is planned --- large institutional PV systems initially, wind and micro-hydro later, household PV systems to build up gradually and escalate.

Why is biomass not a candidate here? There are extensive saw mills and timber plantations that may, like their counterparts in Zimbabwe (e.g. Border Timbers) have extensive biomass waste issues that could become a key fuel.

Response: The use of biomass is under consideration, but it is prudent to start on a small scale in view of the institutional and human resource capacity constraints already mentioned. Furthermore, the issue is electricity generation for own use (where gasoline and diesel compete) versus for sales to the main grid. The latter seems an unviable option while Cahora Bassa marginal cost is less than US 1 cent/kWh. The former might be attempted. For now, the 'grid renewables' analysis covers wind and micro-hydro; biomass gasifiers may be piloted in Phase I.

Annex 4

Minimum Policy Platform
to Facilitate Sustainable Expansion of Electricity Access in Underserved Areas

1. Level playing field for private sector participants. The Government will establish a market/sector structure that will:

- **Permit private sector entry** (already done by the new Electricity Law) for supply of electricity – generation, transmission, distribution/retailing – from the interconnected grid systems as well as stand-alone, independent mini-grid systems.

- **Ensure fair competition for all suppliers with respect to EdM.** In particular, the necessary steps will be taken to ensure EdM does not have an unfair advantage over potential private sector participants in competing for distribution/retailing of electricity purchased in bulk from the EdM-operated grid system. For example, EdM should not have the unfair advantage of being able to offer relatively low retail tariffs for a new distribution area, based on funds from an implicit cross-subsidy from EdM's existing retail operations.

2. Enabling regulatory framework. The Government will establish a suitable regulatory framework that has:

- **Clear separation of responsibilities.** The Government will assign to separate agencies the distinct responsibilities of: (i) planning and policy setting; (ii) establishing and promulgating regulations; (iii) issuance of licenses and necessary permits and ensuring compliance with the regulations ("regulator"); and (iv) conflict resolution, arbitration, and adjudication in cases where an involved party wishes to appeal a finding of the regulator.

- **"Light-handed regulation" procedures and processes for small, stand-alone systems.** The Government will allow for simplified regulatory procedures and decentralized administration for small, stand-alone power systems.

3. Cost recovery and cost-based tariffs. The Government will permit full cost recovery and cost-based tariffs to facilitate private entry and local initiatives, recognizing that this will imply that consumers in different parts of the country will pay different retail tariffs, and that the tariffs for some consumers will be significantly higher than for others, even after some subsidies have been provided for (see also para 4). In particular, the Government will permit/establish:

- **Regionally differentiated retail tariffs** for all suppliers including EdM, which vary according to the cost of service delivery. The benefits of the grid connected low cost hydropower resource will be allocated on a national basis and not restricted to grid-connected consumers only.

- **Bulk-supply tariffs based upon the cost of supply at the delivery point.**

- **Non-discriminatory wheeling tariff (and access)** to facilitate power transactions between distribution concessionaires and third-party generators.

4. Subsidy transfer and financing mechanism. The Government will establish a subsidy transfer and financing mechanism – a National Rural Electrification Fund – to take account of regional equity and

other considerations including efficiency and sustainability under a regime of cost-based regionally-differentiated tariffs and multiple service provider in the future. In particular, the Government will design subsidy schemes and allocation procedures that:

Follow pre-established clear, explicit rules that:

- Are transparent, i.e., avoid implicit (and operating) subsidies that lead to waste and non-accountability.

- Are linked to results, i.e., maintain the focus on expanding access by subsidizing the initial cost of investment rather than the cost of operation.

- Provide strong incentives for cost-minimization i.e., retain the commercial orientation to reduce costs even though subsidies are being provided.

Ensure good governance, i.e., the institutional responsibility for policy and rule setting for the NREF will be clearly separated from administration of the Fund, and an independent entity to be responsible for requisite checks and balances, monitoring performance, and ensuring compliance.