

OFFICE MEMORANDUM

DATE: March 8, 2001

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

FROM: Lars Vidaeus, GEF Executive Coordinator



EXTENSION: 3-4188

SUBJECT: **Cambodia: Renewable Energy Promotion
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 March 15, 2001.

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

- Country Driven-ness: The Royal Government of Cambodia (RGC) has expressed a strong commitment to promoting the use of renewable energy resources to achieve economically and environmentally-sustainable rural energy development. This GEF Renewable Energy Promotion project is its first major initiative in that regard. It is an integral part of the Cambodia Rural Electrification and Transmission (RE&T) project that the RGC, together with the World Bank, is preparing (Section 1.3). The RGC, again in collaboration with the World Bank, is also preparing a comprehensive rural electrification strategy, with which the implementation plans for this project and its parent will be consistent (Section 1.2). The indicators of country commitment and ownership are summarized in Section 3.3.4 while the country sector context is addressed in Section 1.1.
- Endorsement: The proposed project was endorsed by Cambodia's GEF Operational Focal Point, H.E. Dr. Mok Mareth, Minister of Environment, on July 27, 2000.
- Program Designation & Conformity: The proposed project is fully consistent with GEF Operational Program # 6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. The technologies it will promote: mini & micro-hydro and solar PV, are consistent with the OP's technical scope. Its objective, as the OP requires, is full barrier removal. The barriers to be addressed are outlined in Section 2.3 and the measures to address them in Section 2.4.
- Project Design: The project's objectives and design are summarized in Section 2.4.
- Sustainability: The project's context, strategic approach and proposed activities are highly conducive to achieving sustainability. There is a large untapped market for rural energy

services and competing energy sources are expensive (Section 1). The target RE technologies are appropriate to Cambodian conditions. There is a vigorous independent power supply system onto which expanded delivery capacity will be built (Section 1). All the key barriers to RE deployment will be addressed (Sections 2.3 and 2.4). Incentive-based financial systems will be used to build market size and reduce costs (Section 2.4). Lessons learned from other WB/GEF RE projects have been fully applied (Section 3.3).

- Replicability: The project's emphasis on building sustainable private delivery capacity is specifically tailored to promote replicability. This market delivery capacity will be complemented by strengthened central government policy and technical capacity and by an aggressive consumer awareness and promotion effort.
- Stakeholder Involvement: All key stakeholders in RE promotion have been consulted and involved in designing the project (Section 4.7), including private energy suppliers and developers, NGOs, government, other donors and financial institutions. Rural communities who will benefit from the RE service opportunities will be consulted and involved in designing the systems to be marketed or installed in their locality.
- Monitoring & Evaluation: Responsibilities and mechanisms for M&E are outlined in Section 2.4.7. The principal performance indicators are summarized in the logframe.
- Financing Plan: This is summarized on the cover page and in Section 2.4.4.
- Cost-effectiveness: The project's abatement cost to the GEF is estimated to be about \$10/tonne of carbon.
- Core Commitments and Linkages: The renewable energy promotion project is an integral part of a larger World Bank Rural Electrification and Transmission Project, and is specifically designed to complement its parent operation. It is fully consistent with the Bank's Country Assistance Strategy for Cambodia. The prospect of GEF support for renewable energy development has leveraged \$5 million in Bank co-financing, and is expected to mobilize at least another \$2 million of other donor support and \$3 million of private investment over its six year life.
- Consultation, Coordination and Collaboration between IAs: This project is the first GEF initiative in Cambodia's renewable energy sector. The ADB has been briefed on its design and UNDP informed about it.
- Response to Reviews: The project's composition and design is basically unchanged from the concept that the GEF Secretariat approved for pipeline entry. As requested, this project proposal clearly identifies and characterizes the key barriers to renewable energy development, establishes the baseline, assesses the potential of each technology and proposes a comprehensive set of activities to remove the barriers to realizing their potential. While no specific expectations for Work Program inclusion were defined by the Secretariat, the project is fully responsive to the GEF's criteria for Work Program entry. It also fully reflects the Secretariat's subsequent guidance on support to RE development. Specifically: (a) capital cost subsidies for grid-connected small hydro projects are not proposed; (b) capital cost subsidies for village mini-grids will be commensurate with demonstrating the potential of this option; (c) subsidies for SHS will be based on their incremental cost and

will decline over the project life of as their supply costs fall; and (d) the GEF support has leveraged substantial co-financing from other sources.

Please let me know if you require any additional information to complete your review prior to the project's inclusion in the Work Program. Many thanks.

Distribution:

Messrs.: R. Asenjo, UNDP
A. Djoghlaif, UNEP (Nairobi)
K. Elliott, UNEP (Washington, DC)
M. Gadgil, STAP
M. Griffith, STAP (Nairobi)
C. Parker/M. Perdomo, FCCC Secretariat

cc: Messrs./Mmes. Sumi, Exel (EASEG); Crousillat (EACLF); Broadfield (EASES); Mathur, Johnson, Khanna, Aryal (ENV); ENVGC ISC, EASEG Files.

PROJECT BRIEF

1. IDENTIFIERS:

PROJECT NUMBER:	GEF-PO71591
PROJECT NAME:	Cambodia: Renewable Energy Promotion
DURATION:	6 years
IMPLEMENTING AGENCY:	World Bank
EXECUTING AGENCY:	Ministry of Industry, Mines and Energy (MIME), Royal Government of Cambodia
REQUESTING COUNTRY OR COUNTRIES	Kingdom of Cambodia
ELIGIBILITY:	Cambodia ratified UNFCCC on 12/18/1995
GEF FOCAL AREA:	Climate Change
GEF PROGRAMMING FRAMEWORK:	OP6: Barrier Removal

2. SUMMARY:

The overall project objectives are to:

- Eliminate the policy, institutional, financing and information barriers that impede the market development for renewable energy in Cambodia so that rural people can have increased access to electricity services; and
- Accelerate rural transformation by expanding electricity access by offering: (i) technical assistance and capacity building for key stakeholders, and (ii) investments in renewable energy systems for isolated mini-grids using hydro sources and in off-grid solar and village hydro.

The goals of the project are to: (i) achieve Cambodia's overall rural electrification goal of 70% of rural households by 2030 and (ii) build a sustainable power generation mix in the country.

Its specific targets are:

- 5% of generation capacity by renewable energy systems (6MW);
- 3 strong renewable energy businesses;
- 3 mini hydro projects supplying to grids on a commercial basis;
- 5,000 to 10,000 solar home systems installed;
- 50 to 100 educated renewable energy employees.

The project will have two main components: technical assistance and investments.

- The technical assistance component will support: i) barrier removal, including the policy and legal framework; access to financing; market information; institutional capacity; awareness raising; and up-front investment cost; ii) capacity building of various stakeholders including: MIME- staff, private sector technicians and managers, consumers, loan-officers, etc. The resources to support the technical assistance will be managed and disbursed through the Rural/Renewable Energy Fund anchored within MIME and guided by a trust-board. The GEF-TA will cost US\$ 5.75 million.
- The investment component would have two parts: (i) investments in grid connected small renewable power stations (hydro), and (ii) investment in off-grid systems (solar and village hydro). A US\$ 5 million IFC or IDA credit line would support these commercial investments.

Overall project investment costs to be covered by a combination of the credit line, private sector contributions, GEF-funding and other donors would be around US\$17 million.

3. COSTS AND FINANCING (MILLION US\$):

GEF	-Project	5.75
	-PDF-B	0.33
	Sub total	6.08
CO-FINANCING	-Other International	5.00 (IFC or IDA)
	-Other Donors	2.00 (estimated)
	-Government/IA:	0.50
	-Private:	3.00
	Sub total	10.50
Total cost of Renewables (GEF)-component :		16.58
Total cost of other Rural and Transmission components :		79.90
TOTAL PROJECT COST:		96.48

4. ASSOCIATED FINANCING (MILLION US\$): N/A

5. OPERATIONAL FOCAL POINT ENDORSEMENT:

Name: Dr. Mok Mareth

Title: Minister

Organization: Ministry of Environment

Date: July 27, 2000

6. IA CONTACT:

Robin Broadfield, GEF Coordinator

East Asia & Pacific Region

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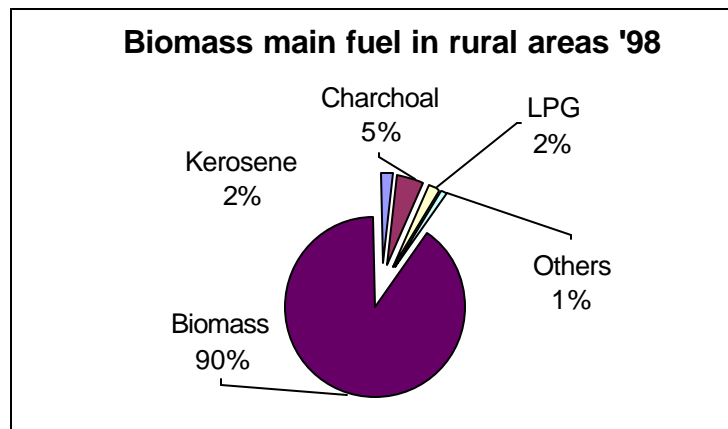
1. Background

1.1 Sector Context

After decades of civil war, which devastated the economy and society during much of 1970s and 80s, Cambodia is making a valiant attempt to rebuild the nation and economy. Since 1994, elected governments have been ruling the country, with a coalition government currently in place. Annual GDP growth was uneven in the 1990s, reaching a high 7.6% in 1995 before slipping to 1% in 1996-97 and recovering to around 4% in 1999. There is widespread poverty and the country suffers from poor industrial base and lack of technical manpower. Over 85% of the labor force is engaged in agriculture in the rural areas. A strong legal framework is yet to be put in place to aid economic development. Cambodia depends heavily on donor assistance.

While implementing various initiatives aimed at economic recovery, the Royal Government of Cambodia (RGC) is fully committed to environmental sustainability, as indicated by their ratification of UNFCCC in 1995. As part of this, RGC initiated an exercise for building a national inventory of greenhouse gas (GHG) emissions, the draft report of which is close to finalization. There are several other projects related to environmental capacity building, resource management, etc., which are financed by UN and bilateral organizations. GEF has also funded a biodiversity conservation project, which is presently being implemented. In climate change area, a comprehensive strategy is yet to emerge.

In the energy sector, biomass is the principal fuel in Cambodia, contributing 84% of the primary energy in 1995. Nearly 90% of the rural energy is contributed by fuelwood used for cooking and heating (see Figure).



Cambodia has no known fossil fuel sources, and imports all its petroleum requirements. About 550,000 tonnes of petroleum products were imported in 1995. A small deposit of 7 million tonnes of coal was discovered, but are yet to be exploited. No known gas reserves exist.

The total installed electricity generating capacity in Cambodia is 122 MW, of which 75 MW is for the capital city Phnom Penh and the rest for provincial and district towns. The demand is expected to be 175 MW in 2000, 380 MW in 2010 and 780 MW in 2020.

Just 15% of the total population and 8.6% of the rural population have access to electricity. The per capita consumption of electricity is an extremely low 20 kWh. Most of the electricity in

Cambodia is supplied by diesel power generators. Around 133,000 rural customers receive electricity (out of 1.9 million). Another 76,000 households use car batteries.

Nearly 600 independent power producers operate in Cambodia, running diesel power stations, which range from 350 kW to 5 MW in capacity. Some of them, who also supply in provincial and district centers, operate under license from the government. The others are in an informal market. In absence of any law or regulatory framework, these IPPs charge variable tariffs ranging from \$0.30 to \$0.90 per kWh, the highest tariff rates in South and South-east Asia.

Apart from diesel power, rechargeable batteries are the other main source of lighting for rural people, with an estimated 76,000 families using them. These batteries are charged twice a week on average, and the monthly bill comes to almost US\$ 3.5 per unit. There are about 150 battery-charging stations in the country. Batteries are all imported from China, Singapore and Malaysia. Cambodia has no modern energy resources with the exception of hydropower, which is completely unexploited. Domestic markets for electricity are extremely small and mainly concentrated in Phnom Penh and a few other provincial towns. Expanding the domestic markets for electricity in a sustainable manner and exploiting the considerable hydro resources are two major challenges before the RGC in the rural energy sector. The strategy is to:

- **Increase the access of rural households, enterprises and community institutions to electricity services.** Per capita electricity consumption is among the lowest in Asia. Only about 7-10% of the rural population have access to lighting services through diesel generators and imported batteries. Kerosene is extensively used for lighting in rural areas. Though there is some interest at the policy level, and also a fledgling solar energy market, major market barriers exist to large large-scale promotion of electricity service. The current extremely low access to electricity services notwithstanding, a comprehensive rural electrification strategy is yet to emerge.
- **Exploit renewable energy resources with near-term emphasize on hydro and solar.** Though Cambodia is known to have huge potential to generate power from hydro resources, no systematic measurement of potential or program planning has been done to exploit it so far. A few desk studies, based on data provided by the Ministry of Meteorology and Water Resources, indicate an overall potential of about 10,000 MW. In addition, potential is indicated for a number of micro- (up to 500 kW) and mini- (up to 5 MW) hydro projects in different parts of the country, which are capable of catering to rural electrification needs in a significant way through mini grids and isolated systems. Solar resources are rich in Cambodia with an average radiation of about 5kWh/m². The high prices of competitive products like small diesel grid electricity, battery electricity and/or kerosene show the relatively high willingness to pay electricity, indicating a considerable potential commercial solar home system market. An initial wind assessment for the Indo-China region shows some pockets of good (7 to 8 m/s) and very good (8 to 8.5 m/s) wind regimes near the coast. In these areas follow-on resource assessment needs to be done.

Recently, the RGC, with assistance from the World Bank and other donors (ADB, JICA, etc.), has undertaken to bring about reform to improve electricity services. An Electricity Law has passed the National Assembly and is expected to be signed by the King soon. An Electricity Authority of Cambodia (EAC) is proposed to be set up to deal with sector development and regulation. Donors are also working with *Electricite du Combodge* (EDC), the public utility under the aegis of the Ministry of Industry, Mines and Energy (MIME), to develop a transmission and distribution network in the provincial towns.

In early 2000, the RGC and the World Bank reached an agreement on the broad scope of a Rural Electrification and Transmission Project. This proposed renewable energy sub-component will be part of that project.

1.2 Government Rural Electrification Strategy

Currently there is no comprehensive government strategy for rural electrification in Cambodia. However, the RGC, in discussions with the Bank, has agreed that its approach is to encourage private enterprise to provide electricity service through private-public institutional mechanisms. The RGC has also expressed interest in exploiting renewable energy sources (hydro, solar, wind and biomass) for rural energy services. A comprehensive rural electrification strategy will be one of the key outputs of the present Bank project, the work on which is in progress. The strategy will address the issues of sector organization and private sector involvement in supplying electricity to rural users either by grid extensions, mini grids or individual household solutions. Rural electrification processes will be technology-neutral, based on least cost principles.

The strong base provided by the 600-odd private IPPs in different parts of the country is an important contributing factor in this strategy. In a recent survey commissioned by the World Bank, most of the IPPs expressed a high level of confidence in the prospects of Cambodian economy, and their willingness to sustain and expand the electricity business. The study also showed that with access to financing, most IPPs would be willing to improve and expand their businesses. Thus, the involvement of private sector will be the cornerstone for the government's rural electrification strategy.

1.3 Link to CAS Priorities/Bank Program

The World Bank Country Assistance Strategy (CAS) for Cambodia envisages assistance “to build the foundations for sustainable development and poverty reduction for the medium to long term”, an objective wholly consistent with the priorities of the GoC. This would entail: supporting good governance; building physical infrastructure, particularly roads, water supply, and **electricity** in rural and provincial areas to increase access to services and productive activities; rebuilding human capital; and facilitating private sector development in traditional and non-traditional sectors. The proposed project would contribute directly to all these themes, in varying degrees. Importantly, the project would aim at improving the social welfare of the poorest people in rural areas, by providing access to basic electricity services. Involvement of private sector will enable reliable and cost-effective energy services to be provided. This decentralized approach, complemented by technical assistance for capacity building among various stakeholders, will contribute towards improving governance, and to institutional strengthening of central and provincial agencies involved in implementing new mechanisms for rural electrification.

Finally, the project is consistent with the World Bank Group's priorities in the energy sector, which are to support reform, improve access for unserved populations to modern energy, and promote environmental responsibility.

This GEF – Renewable Energy Promotion project is an integral part of the Cambodia Rural Electrification and Transmission (RE&T) project the Government, together with the World Bank, is currently preparing. The overall objective of the project is to support the Royal Government of Cambodia (RGC) goal of building the foundations for sustainable development in the long term and reducing poverty. It will do so by:

- Promoting rural development by providing the economic benefits of electricity;

- Improving power sector efficiency through: (a) consolidating current initiatives which seek to foster an environment favorable to private participation and an overall commercialization of the power sector; and (b) reducing electricity costs and removing infrastructure bottlenecks.

To achieve these objectives the project will include three principal components: (a) rural electrification; (b) transmission interconnection with Vietnam; and (c) technical assistance.

The project is expected to go to the World Bank Board in July 2001, with a six-year timeframe and an estimated total project cost of around US\$97 million.

1.4 Global Environment Objectives and Consistency with the GEF's Operational Strategy and Renewable Energy Operational Program

The project's global environment objective is to reduce the risk of climate change by mitigating Cambodia's greenhouse gas emissions. This will be achieved by promoting renewable energy technologies as alternatives to and substitutes for GHG-emitting diesel, kerosene and wood fuels.

The project is fully consistent with the GEF's Operational Strategy and with its Operational Program # 6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Costs. The major barriers it will address are: lack of government, private and financial sector capacity to plan, provide and finance renewable energy systems; the absence of a supportive policy and regulatory framework for renewable energy development; the high initial costs of renewable energy equipment in the currently small Cambodian market; and lack of awareness of and confidence in renewable energy systems among potential suppliers and consumers.

2. Promoting Renewable Energy for Rural Electrification

2.1 Problem statement

Rural electrification is a critical necessity for economic development of and improvement in quality of life for the Cambodian people. The present level of access to electricity services in the rural areas is extremely low, and what is available is environmentally unsustainable in the long run. On the other hand, Cambodia has considerable renewable energy resources that offer a sustainable alternative for rural electrification by expanding the generation base and rendering it environmentally more balanced and friendly. Moreover, the private rural energy entrepreneurs have the ability to act as drivers for rural energy supply and sustainable rural development. However, there are serious barriers at the policy, institutional, technical and financial levels that act as impediments to the progress of renewable energy sector development and private sector involvement in Cambodia. Elimination of these barriers is critical for enhancement of rural access to electricity services and to improve environmental sustainability.

2.2 Baseline

84% of the energy requirements in rural Cambodia are met by biomass fuels, mainly for cooking. Only around 10-12% households have access to electricity, which is generated by isolated diesel power generators (300 kW to 5 MW capacity) or rechargeable batteries (imported from China, Singapore and Malaysia), the energy cost of which is among the highest in the region (30-90 US dollar cents/kWh). Huge energy losses (30-40%), non-standardized operations, and absence of laws and regulations to protect the consumers characterize this informal electricity market. Most other households use kerosene for lighting purposes, paying on an average, 30 US dollar cents per liter. Kerosene, like all other petroleum products, is imported. In spite of this low access, there is no policy on rural electrification as yet. Without the implementation of the proposed project (to devise and implement a rural electrification strategy), the situation is likely to remain as it is in the foreseeable future, leading to the following consequences:

- The access to electricity services will continue to be low, and the demand suppressed;
- Process of economic development in the rural areas will continue to be hampered due to lack of electricity;
- Increased use of fossil fuels will lead to increasing environmental unsustainability; and
- Continued dependence on fossil fuels is likely to put pressure on foreign exchange reserves.

However, several features of this situation create opportunities to promote sustainable renewable energy alternatives rural Cambodia. Among them are:

- Electricity tariffs being paid by rural consumers at present are very high on average. This indicates that consumers would be willing to pay relatively high prices if reliable services were provided by solar or hydro sources.
- Around 75,000 rural households are estimated to be using batteries, thus paying about US\$ 3.50 per kWh of energy.
- Over 600 independent rural power producers are operating diesel power stations and another 150 are involved in battery charging, which indicates a good small entrepreneurial base in rural areas for small power businesses.
- Government is committed to promoting private enterprise to increase access to electricity services in rural areas.

- Local micro-financing institutions have already supported some of these IPPs, and are interested in promoting renewable energy.

However, promotion of renewable energy is still in the initial stages. Resource assessments of small hydropower potential are only available in the form of desk studies, and no systematic measurements have been done so far to establish the potential. No scientific assessments of wind speeds, solar insolation or PV potential have been undertaken.

A limited solar energy program is being implemented by the Ministry of Industry, Mines and Energy (MIME), with the support of donors like SIDA for institutional purposes, targeting health centers and educational institutions. About 78 kWp of solar PV systems are estimated to be in place. However, no information is available on their functionality and performance in absence of any monitoring system.

2.3 Barriers

Major barriers exist in Cambodia impeding the development of renewable energy for rural electrification. These barriers¹ can be summed up as follows

- **Lack of policy and legal framework**

The legal environment in Cambodia is generally weak, with an elected government being in power only in the last 3 years. Many of the laws are still being drafted. There is no regulation of the electricity sector at present, and tariff setting by private IPPs is arbitrary, placing the consumers at a disadvantage.

There is no renewable energy policy in Cambodia as yet, though the government has expressed its commitment to promote renewables for remote applications. For instance, there is high import duty on imported solar equipment, which, in absence of any policy, acts as a serious barrier for solar energy. A supportive legal and policy framework needs to be put in place, including a regulatory mechanism, to encourage small power producing entities to promote renewables.

- **Access to financing of renewable energy devices with high front-end costs**

The Cambodian banking system is relatively fragile, and operates mostly on short-term capital with high interest rates. Several micro-finance institutions operate in the rural areas providing credit for short duration with interest rates ranging from 40-60% per annum. Few energy businesses access financing from these MFIs at present for longer term financing. The high cost of renewable energy equipment, especially the front-end cost, acts as a deterrent for MFIs to finance them. Other factors acting as barriers to financing are:

- Low and moderate incomes in rural areas and consequently low creditworthiness
- General shortage of capital, mostly accessed for promoting direct income generating activities, and renewable energy is not a top priority
- Lack of long term funds for IPPs, which prevents them from investing in downstream activities (distribution, alternative technologies, etc.)
- High administrative costs for servicing micro finance in rural areas, and
- No legal framework to deal with collateral, bankruptcy, etc.

¹The barriers are partly derived from a one-day consultative renewable energy workshop organized by MIME and the World Bank in which 18 main stakeholders were represented. One of the three sessions of the workshop discussed the question “what are the main barriers and solutions for faster renewable energy development?”.

- **Lack of information on market characteristics, resource potential**

Little documented information is available on the characteristics of rural energy markets, including their scope, potential, segments and consumer characteristics. No systematic studies have been done to assess the potential for exploiting renewable energy resources in the country. For instance, potential of small hydro power was estimated based on desk-based analysis. A first initial field-based pre-feasibility is currently being conducted.

There is a need to conduct detailed resource assessment studies for solar, wind, sustainable biomass and hydro. A detailed market assessment is needed to evaluate the prospects of solar energy as an alternative to diesel stations or batteries in the different provinces. Though wind potential is reported on the coast and the island systems, and biomass resources (e.g. rice husk) are available in the north-east and northern Cambodia, systematic studies will be required to determine their feasibility as energy sources.

- **Institutional capacity for planning, implementation and maintenance**

Cambodia, relatively inexperienced in democratic governance, is still in the process of building its institutions and the infrastructure is still very poor. Management systems are weak in rural areas. Technical know-how and maintenance skills are in short supply. Lack of experience in operation and maintenance; limited training possibilities; low volume of renewable energy installations so far; no network for service outlets and supply of spare parts are some of the factors leading to institutional barriers.

Lack of coordination among concerned stakeholders (government, donors, NGOs, private sector, financial sector) also acts as an institutional barrier in the absence of a comprehensive policy on renewable energy development and the capacity to implement it.

- **General lack of awareness and political support**

Lack of information on different renewable energy options and their costs and benefits is a big barrier in creating awareness, which is presently very low among the consumers and grass-root level organizations. Efforts at information dissemination are feeble, and marketing of renewable energy products non-existent. Low literacy levels in rural areas, and non-availability of local language (Khmer) literature on renewable energy also contribute to the general lack of awareness.

Presently, active support for renewables is not forthcoming from all the political powers, and there are few 'champions' promoting the cause of renewable energy. Mobilizing this kind of political support in the beginning of the program is critical for sector development.

It is clear that, without addressing these barriers, it is difficult to promote sustainable energy alternatives to increase rural access. At the same time, government and other institutions in Cambodia have little capacity – financial or institutional – to address these barriers. Hence, the request for GEF assistance to progressively lower and finally remove them.

2.4 GEF Alternative

2.4.1 Overall Project Objectives

The overall objectives of the GEF alternative project are to:

- Eliminate the policy, institutional, financing and information barriers that impede the market development for renewable energy in Cambodia so that rural people can have increased access to electricity services; and
- Realize the contribution that electricity access expansion can make towards rural transformation by offering: (i) technical assistance and capacity building for various stakeholders; and (ii) investments in renewable energy systems for isolated mini-grids using hydro sources and in off-grid systems for households, small businesses and community organizations in rural areas.

Further, the proposed renewable energy project will complement the rural electrification and transmission project of the Bank in capacity building and technical assistance.

These objectives are linked to the Country Assistance Strategy's (CAS 2000) strategic priorities of good governance, physical infrastructure, human capital and private sector development.

The global objective, consistent with GEF Operational Program 6 in Climate Change, is to achieve GHG reductions through the removal of the policy, information, technical, cost and financing barriers that currently hinder renewable energy technology dissemination and market development in Cambodia. The proposed project will actively engage the private sector in commercially sustainable activities in order to reduce long-term implementation costs, and offer strong potential for learning and replication.

2.4.2 Summary of Project Outputs

(i) Establishment of a renewable energy credit line

A renewable energy line of credit of US\$ 5 million will be set up with IDA/IFC resources to be operated through commercial banks on commercial terms. The credit institutions will on-lend to Rural Electricity Enterprises, solar businesses and small independent hydro power producers on long term conditions to facilitate the promotion of small hydro plants, village hydro systems and solar home systems.

(ii) Establishment of a \$5 million GEF-financed Rural Energy Fund to support barrier removal

A transparent and clear guided RE-Fund will be set up with GEF grant resources to provide technical assistance for renewable energy development. The fund will support renewable energy investments on the basis of performance and provide technical assistance support to key-players to overcome barriers that are sub-sector wide. When fully established, additional donors willing to support rural and renewable energy development in Cambodia can contribute to the fund.

The key performance indicators of the project are:

- 5% of generation capacity by renewable energy systems (6MW);
- 3 strong renewable energy businesses;
- 3 mini hydro projects supplying to grids on a commercial basis;
- 5,000 to 10,000 solar home systems installed;
- 50 to 100 educated renewable energy employees.

2.4.3 Project components

The project being proposed will have two components: technical assistance and investment

Technical Assistance component

Technical assistance in the renewable energy project will focus on capacity building of various stakeholders to facilitate market development, and assisting the government in formulating a renewable energy policy that would contribute to enhancement of rural access to sustainable energy services.

The TA component would be implemented through a Rural Energy Fund to be set up and managed by MIME (condition for effectiveness of World Bank supported RE&T project) and supported by a Project Management Unit. The Fund will be guided by a trust board with representatives of the main stakeholders including MIME, EDC, Ministry of Finance, Ministry of Rural Development, Rural Electricity Enterprises Association, donor agencies, and a legal and financial expert. The activities to be supported by the TA component are:

(i) Capacity building and training (estimated GEF input US\$ 1.0 million)

The targeted stakeholders to be covered under the capacity building activity would include: a) *Government*: Officials of MIME, EDC and other relevant departments at national and provincial level will be provided with training to plan and promote efficient development of the rural renewable energy sector including the aspects of decentralized rural energy planning, techno-economic feasibility assessment of various renewable energy options, project monitoring and evaluation, institutional coordination, etc.; b) *Private sector*: The domestic rural electricity entrepreneurs, solar project developers, and small independent hydro power producers will be trained to implement rural renewable energy projects including mini-grid and off-grid projects. The various aspects to be covered will include energy demand estimation, financial management, providing post-installation services, marketing and advertisement, etc. c) *Financing institutions*: Commercial banks and Micro finance organizations will be targeted to build their capacities in evaluating and financing renewable energy projects, and in designing and implementing financial models to manage and recover the investments made. d) *Trainers' training*: Specific resource persons will be targeted to act as trainers who can replicate the capacity building activities across the sector, so that they become sustainable in the long run. e) *Consumer orientation*: Rural consumers and community groups will be targeted for creating awareness and capacity building among them so that they could make informed choices regarding clean and reliable electricity service options available from hydro, solar, and other renewable energy technologies. Grass-roots NGOs and community institutions will be made use of reaching the target groups in areas where project feasibility is established.

(ii) Policy & regulation development (estimated GEF input US\$ 0.75 million)

This activity would support: (a) Development of a *policy* that would create a level playing field for renewable energy private sector investors. Broad elements of the Renewable Energy Policy will be drawn from an action plan that would include: renewable energy resource assessment; overall demand estimation over a period of 10 years; proposed technology mix; financial and economic analysis; resource mobilization plan; program implementation plan; institutional arrangements. (b) Establishment of a *regulatory framework* (in conjunction with the Electricity Law of Cambodia) to provide renewable energy public-private partnerships with well-defined framework, including decentralization for promotion of small renewable energy systems; (c) Development of a *standardized small power purchase agreement* (SPPA) that would be consistent with the Electricity Law, and would cover the specific requirements of small, off-grid energy projects. (d) Determination of energy *tariffs*, based on full cost recovery principles, that would take into account regional differentiation in willingness to pay, resource endowments and institutional capabilities; (e) Development of *technical standards* to ensure safety to the consumers and a minimal quality of services, and (f) Establishment of *financing and subsidy mechanisms* for renewable energy based on logical, explicit rules and regulations so as to ensure good governance.

(iii) Increasing affordability for initial market penetration (estimated budget US\$ 1.5 million)

In order to address the barrier of high front-end costs of stand alone and village based renewable energy technologies, a part of the TA will be used to provide subsidies to meet part of the initial system costs. The financial models for administering these subsidies will be developed according to location-specific conditions but will be strictly performance-based, and will be provided only after the systems are installed in the field. A maximum of one-third of the system cost (33%) will be paid as subsidy initially, which will reduce progressively over six years depending on the progress of the implementation program. Initially, the subsidies will be offered for solar home systems and village hydro systems.

(iv) Operational TA (estimated budget US\$ 1 million)

This activity would support the drivers of market penetration for renewable energy systems. This will include: (a) nationwide and targeted promotional campaigns, test marketing and awareness creation of renewable energy options; (b) support productive uses campaigns; (c) quality improvement of renewable energy systems by providing information of systems offered to customers; (d) market surveys for solar and small hydro systems; (e) development of business, marketing and financing plans; (f) cross-sectoral programs (renewable energy use in health, education, telecom, etc.), (g) resource assessment, and (h) co-financing for operational barriers identified by the stakeholders during the course of project implementation.

(iv) Project Management, Monitoring and Evaluation Unit (estimated budget: US\$ 1.5 million)

A Project Management Unit would be establishment to support the Renewable Energy Department in MIME and the Secretariat of Rural Energy Fund in managing the grant-funds. The unit would also be responsible for monitoring and evaluating the income-generation and other social benefits of the off-grid renewable energy projects. Support to the PMU will reduce over the six year project duration to guarantee transfer of knowledge and capacity to the Fund and MIME.

Investment component

The investment component of the project will promote specific renewable energy projects that would demonstrate the efficacy of different technology and implementation models, based on market principles. These projects will be selected by the private sector. Pre-feasibility studies are being finalized for solar and mini hydro investments, with support from the GEF PDF B. The investments would be technology neutral and would cover all types of renewable energy technologies, including small hydro, solar, sustainable biomass and wind, depending on their specific feasibility. It is expected that initial investments will be made in small hydro, village/community level hydro systems and solar home system projects, which appear to have short term potential.

To ensure private sector participation and contribution common commercial practices would be supported and build on. This would indicate that commercial financing institutions will require at least 25% of down-payment from the developers to serve as a risk guarantee for the fully commercial loan. It is on this private sector contribution that performance based subsidies and additional technical assistance could be leveraged.

The investment component would have three parts:

(i) Investments in grid connected small hydropower stations

These projects to be set up in relatively high concentration of demand to: demonstrate electricity use for productive, income generating activities; introduce cost-effective designs, standards and management procedures, leading to low unit cost for consumers; and illustrate models of private sector agreements. At least 3 hydro projects with a total capacity of 6 MW will be installed as part of the Credit Program.

(ii) Investments in solar PV systems.

These will cover the following sectors: enhance the quality of life of domestic households by providing solar PV systems, on commercial terms (with smart capital investment subsidies where required), to meet requirements of lighting and power for small appliances; provide lighting and power for running small businesses, leading to income generation and rural employment (using micro finance options to ensure full cost recovery); and meet energy requirements of community institutions like rural health centers, pagodas with religious and social functions, and residential primary and middle schools. Institutional clients will have to receive significant subsidies for the systems, which would be supplied by the private sector. The project will provide guidance to involved line ministries on standards and competitive bidding procedures. A target of up to 10,000 solar home systems would be disseminated using funds from the Credit Program, and incremental cost subsidies from GEF TA Rural Energy Fund.

(iii) Investments in village/community level hydro systems.

These projects will be set up in remote rural areas, where least-cost. The projects will be in kilowatt scale (about 50 – 200 kW), depending on the specific demand estimation. Community level institutions will be supported and trained to manage these projects. Alternatively, local entrepreneurs, where feasible, can also take up running of the systems on commercial basis. These systems will targets the uses, as described above for solar home systems. A total of 10

village/community hydro systems would be installed under the project with loans under the Credit Program, and incremental subsidies from GEF TA Rural Energy Fund.

2.4.4 Estimated project cost

The total renewable energy financing package is expected to be about US\$16 million. The approximate break-down will be as follows:

IDA/IFC funding	\$5.0 million
GEF funding	\$5.75 million
Private sector	\$3.0 million
Other donors	\$2.0 million
Government	\$0.5 million

The GEF will finance the technical assistance activities, and support initial investment in solar market development (including the incremental costs of initial systems to drive their costs down).

2.4.5 Project stakeholders and benefits

The stakeholders involved in the project will be consumers (rural households, small businesses, community institutions); private companies in Cambodia and their external partners who participate in investment, installation and equipment supply; micro finance institutions and commercial banks; NGOs; the national government (Renewable Energy Directorate, Ministry of Industry, Mines and Energy); provincial and district governments; and communes.

The primary direct benefits are:

- The addition of at least three small hydro projects (up to 6 MW capacity), and electricity services for up to 5,000 – 10,000 rural customers through solar home systems and village hydro schemes. This proposal comes at a stage when few rural households have access to electricity in Cambodia.
- Development of markets for off-grid renewable energy technologies.
- For the GEF eligible technologies (solar home systems and village/community hydro schemes), mitigation of emissions through avoidance of conventional fossil fuel technologies.

The primary programmatic benefits are:

- Incorporation of environmentally sustainable renewable energy technologies within the planning framework for pre-grid rural electrification (solar home systems and village hydro schemes);
- Acceptance by consumers, project developers and financial institutions of the viability of off-grid systems for electricity production and delivery;
- Built capacities among various stakeholders in planning and implementing off-grid renewable energy projects.

Global environment benefits:

The project is projected to avoid 0.55 million tonnes of carbon emissions over 25 years at a cost to the GEF of just under \$10 per tonne of carbon emissions avoided.

Target population:

The principal target and beneficiaries of this project are the rural customers (5,000 to 10,000 direct), who will be able to have improved access to clean and reliable electricity services. In addition, several other stakeholders will also be targeted under various components:

Small hydro for mini grids – Private project developers will be benefited as they would have access to long term finance to set up the projects. Commercial banks, acting as PCIs will also benefit, as they will have access to capital from IDA/IFC, and will be able to deploy some of their own funds in this sector.

Solar home systems and village/community systems – Rural households, rural energy entrepreneurs, village level cooperatives, community institutions, NGOs will be targeted to act as project developers and managers.

Capacity building – This activity under the technical assistance component will target a range of stakeholders including MIME, EDC, Banks, MFIs, project developers, REEs, NGOs, grass-roots organizations and households who will receive training in various aspects related to project design, implementation, financing, technical issues and institutional issues.

2.4.6 Project execution

Implementation period: Six years (2001-2007)
Executing agencies: Ministry of Finance, Ministry of Industry, Mines and Energy

The overall responsibility for project implementation will be with the Renewable Energy Directorate in the Ministry of Industry, Mines and Energy (MIME) with support from a PMU, which will be set up as an independent unit affiliated and overseen by MIME.

Subsidies and funds for various technical assistance activities will be disbursed through a Rural Energy Fund anchored within MIME guided by a multi-stakeholder trust-board. The Fund will have clear objectives, implementation guidelines and a transparent decision making structure. The trust-board will consist of representatives from: MIME, Ministry of Economy and Finance, Ministry of Rural Development, donor agencies, Rural Electricity Enterprises Association, and a legal and financial expert. The board of trustees will meet on a regular (bi-monthly) basis. PMU will support a small secretariat (three persons, two part-time) in day-to-day operations to administer the Fund.

See Annex 4 for institutional arrangements and flow of resources.

Project coordination details:

Credit line component

The Ministry of Finance or IFC would on-lend the proceeds of the credit component to eligible participating credit institutions (PCIs), which would, in turn, onlend the proceeds along with complementary financing out of their own resources, to eligible sub-borrowers. For this purpose, a Credit line will be established with an eligible commercial bank(s), which will operate the credit on commercial terms. The RGC and Bank are currently considering a number of Banks such as CANADIA, ACLEDA Bank, Standard Chartered and First Overseas Bank to select the PCI.

The Credit Line program would support sub-projects of up to 3 MW in capacity per project. A certain (20%) proportion of the total credit (to be agreed upon) would be reserved for solar home system and village-hydro schemes until the Mid-Term Review which would consider the need for continued earmarking of funds. The maximum IDA or IFC refinancing amount under the Credit Program would be US\$1.0 million per project or the PCI's single borrower exposure limit, whichever is lower. Operating policy guidelines and proposed on-lending arrangements for the Credit Program would be patterned after those used in the past World Bank/IFC projects in other countries.

The on-lending rate to PCIs would be a variable rate equal to the Average Weighted Deposit Rate (AWDR), or another appropriate rate to be determined during project implementation by RGC in consultation with IDA or IFC. The on-lending rate to PCIs would be adjusted semi-annually to reflect market conditions. PCIs would assume the credit risk and set their own lending rates in agreement with their clients. Sub-loan maturities would vary according to individual subprojects but would not exceed 10 years, including a maximum 2-year grace period. IPPs, Project developers, NGOs and cooperatives operating in Cambodia are potentially eligible sub-borrowers, subject to PCI credit-worthiness assessment.

The final date for submitting subproject applications to PCIs will be five years after Credit Effectiveness. The closing date for disbursement will be five-and-half years after Credit Effectiveness. Each subproject proposal would include a timetable for implementation.

The PMU of MIME will work closely with the PCIs to monitor their lending programs and ensure that they would meet all the rules and regulations that govern IDA/IFC funds.

Technical Assistance and Capacity Building component:

These activities will be funded from the Rural Energy Fund proposed to be set up, and managed by MIME supported by the PMU. The Fund will administer GEF grant funds – and will be responsible for: (i) performance based subsidies to intermediaries; (ii) (co-financing of) technical assistance activities.

GEF Technical Assistance (TA) grants would be available to help project developers prepare feasibility studies, business plans and bank loan documentation for off-grid subprojects . Grants would be disbursed on a reimbursement basis up to 90% of the cost of preparation of a solar home system subproject and 95% of the cost of consulting services for preparation of a village hydro subproject. Reimbursement would be triggered by (i) Fund approval of a subproject on the basis of a bank loan application package supported by a complete feasibility study/business plan; (ii) presentation of eligible expenses; and (iii) submission of sub-loan disbursement request equal to or exceeding the GEF grant amount. Each subproject developer would be eligible for only one grant.

Project oversight (policy guidance, etc.): EDC will submit to IDA at the beginning of each calendar year, evidence of public announcement of the annual Standardized Small Power Purchase Agreement (SPPA) non-negotiable Tariff update.

Accounting, Financial Reporting and Auditing arrangements:

The Credit Program Component

The PMU will maintain the Credit Program-related statistical records, incorporating, among other things, (i) approval of subprojects and disbursement made in respect thereof; (ii) classification of subprojects by off-grid village hydros, (or solar home systems and village hydros, as the case may be); (iii) classification of subprojects by size and geographical distribution; and (iv) classification of subloans and grants approved by size, maturity pattern and geographical distribution.

- The PMU will maintain separate disbursement records and accounts with respect to each PCI under the Credit Program; keep on file supporting disbursement documents as well as bank accounts relating to disbursements; and maintain a Project Account. All records, documents and accounts are to be maintained in accordance with sound accounting practices for independent audits and for review by IDA and GEF missions.
- The PMU will prepare/submit quarterly statistical reports on the Credit Program and other periodic reports (including semi-annual PCIs' loan collection performance reports) as required by RGC and IDA.
- An annual external audit is required of the Project Account and Special Account, and a separate opinion on Statement of Expenditures (SOEs), not later than four months after the close of each fiscal year
- An annual external audit is required of each PCIs' financial statements, within four months of the end of the fiscal year, to confirm their continued compliance with the PCI eligibility criteria.

Technical Assistance and Capacity Building Component

- The MIME will submit to IDA audited project expenditures (Statement of Expenditures and Special Account) within six months of fiscal year end as well as unaudited financial accounts within 4 months, and audited accounts within 6 months of fiscal year end.
- The MIME will provide RGC and IDA semi-annual reports on the TA and capacity building components presenting the progress achieved during the semester against the implementation plan agreed with IDA from time to time.

2.4.7 Monitoring and Evaluation (see also 2.4.6)

Monitoring and evaluation will be coordinated by the PMU in the Renewable Energy Directorate of the Ministry of Industry, Mines and Energy (MIME). The key performance indicators that will be gathered and assessed are summarized in logframe (Annex 1). The MIME will prepare semi-annual progress reports for review by the IDA. The IDA will comprehensively review progress in project implementation (including the performance indicators) twice per year. In addition to its regular supervision, IDA and the RGC will jointly conduct a Mid-Term Review about three years after project effectiveness. This Review will identify and disseminate best practices and constraints, if any, to project implementation, and find ways to address them.

The PMU would also be responsible for monitoring and evaluating the income-generation and other social benefits of the off-grid renewable energy projects. Support to the PMU will reduce over the six year project duration to guarantee transfer of knowledge and capacity to the Fund and MIME.

The Credit Line Component

The World Bank Group (IDA or IFC) will examine and approve the eligibility of potential PCIs and monitor the eligibility status of approved PCIs on the basis of periodic reports submitted by each PCI through the PMU.

The World Bank Group (IDA or IFC) will also review: (i) the first two subloan proposals, irrespective of size, presented by each PCI, (ii) all subproject proposals (including the related environmental assessment) above the “free limit” established for each PC; (iii) each PCI’s first solar home system subloan proposal, and (iv) each subproject developer’s first solar home system subloan proposal. The World Bank Group (IDA or IFC) will provide comments on subloan proposals promptly, and approve them as appropriate, assuring itself that they are consistent with the developmental objectives of the Project and Operating Policy Guidelines for the Credit Program and GEF Grant funds.

2.4.8 Timing

Six years, with the initial two years for laying the institutional, regulatory, capacity foundation in which investments take place on a small level, after this the investments will gradually increase in volume.

2.4.9 Other Donor Involvement.

Considerable donor involvement has been seen in Cambodia in power sector reforms and investments as well as capacity building (ADB, JICA, SIDA). Japan and Finland are supporting the preparation of a rural electrification strategy and 10 year program. SIDA has been funding some institutional solar systems through NGOs. The Japanese Government has shown interest in renewable energy development including small hydro. Funding from ESMAP has been secured to finance the preparation of the proposed Renewable Energy Action Plan. Further, ADAF funds have been mobilized to study the feasibility of village/community level small hydro projects. The World Bank, with GEF support, would take a leading role in assisting aid partners to promote renewable energy in Cambodia.

3. Justification and rationale for GEF support

3.1 Country Eligibility.

Cambodia ratified the UNFCCC on 12/18/1995.

3.2 Relevant GEF Operational Program.

The proposed project falls in GEF Operational Program 6 on Climate Change - promoting the adoption of renewable energy by removing barriers and reducing implementation costs. The project envisages a long-term programmatic approach to strategically develop its renewable energy sources, especially small hydro and solar, on a sustainable basis, providing these resources with a key role in Cambodia’s rural electrification and development strategy.

3.3 Rationale for GEF Project

The GEF project would directly contribute to the themes outlined in the CAS for Cambodia: supporting good governance; building physical infrastructure including electricity in rural and provincial areas to increase access to services and productive activities; rebuilding human capital; and, facilitating private sector development in traditional and non-traditional sectors. The project is also consistent with the World Bank objectives of support to reform, improving access for unserved populations to modern energy, and promote environmental responsibility.

In the face of high tariffs for fossil fuel power, and lack of wide coverage of rural population (only 15-20% have access to any electricity), renewable energy based on small hydro and solar is almost the only alternative in the rural areas of Cambodia. However, a number of barriers (section 2.3) impede the development of renewable energy. Therefore, it is necessary to clearly identify and characterize barriers for renewable energy development in Cambodia, and also to establish a baseline for the current status and prospects of each applicable renewable energy resource. Further, the project would assist in putting together the necessary elements of an institutional framework and a long-term action plan to eliminate the barriers and demonstrate a sustainable strategy to create and expand the markets for various renewable energy technologies. The project would aim at removing barriers to commercial operations, and reducing transaction costs that arise out of inexperience, initial low size of the market, and/or the diffused nature of rural energy applications.

The project would also address serious issues of capacity and efficiency in the sector through fostering private provision of energy services in the rural areas, which are not expected to be covered by grid extension or large power plants in the near future. The project would enhance the enabling environment for private investments in renewable energy services delivery through application of a standardized small power purchase agreement and non-negotiable tariff. The project would also enhance consumer awareness of renewable energy services and help the financial community become familiar with privately developed renewable energy projects.

3.3.1 Project alternatives considered and reasons for rejection:

During project preparation, consideration was given to alternative project designs with different institutional arrangements for providing renewable energy services.

- Complete ownership by the government (MIME). Given the general lack of infrastructure in the country, the alternative of the government being the sole implementing of the project, responsible for all the functions (project planning, financing, implementing, monitoring, etc.) was considered. In this model, private sector involvement would have been confined to equipment supply and current existing small enterprises providing electricity services would have been hampered in their existence. In studying the option, it was found that these rural electricity enterprises are the innovators and drivers in their communities for development. If Government would take over one of their main lines of business it would fall dry. In addition, the capacity in the Government is limited and not in the position to address the challenge alone.
- Project implementation through village cooperatives: Given the need to build capacities at the village level, the alternative of using local cooperatives was considered for project implementation. However, the cooperative structure is not universal nor strong in Cambodia, and would have consumed too much time and resources to make it work. Further more, the model created a lot of discussion among the main stakeholders for cultural reasons.

- A full commercial/market approach. Within this model demand and supply without involvement of the Government and other intermediaries would determine the development path of renewable energy in Cambodia. In the current environment in Cambodia with omissions of important laws (e.g. monopoly law, bankruptcy law) and regulations, this approach was chosen to be not preferred. However, it was indicated that with the entrepreneurial spirit in the country, this could be a model for the future after government regulations and laws, and enforcement mechanisms have been put in place.

In view of the above considerations, an institutional model that brings together the respective strengths of the different stakeholders (government, financial institutions, project developers, local communities, equipment suppliers, etc.) so that the project would lead to strong capacity building at various levels. In this approach, there will be built on the existing entrepreneurial dynamics in the rural areas while at the same time the government will act as a “market enabler” which will include transparent policies, setting regulations, safety standards, performance incentives for rural development.

3.3.2 Major related projects financed by the Bank and/or other development agencies

The following World Bank/GEF-supported projects have guided the design of the renewable energy activities proposed within this project:

- Indonesia Second Rural Electrification Project which supported five pilot mini hydro projects; and the Indonesia Solar Home Systems Project which followed private sector approach for solar home system development, involving commercial banks and regular businesses to develop the market.
- India Renewable Resources Development and the India Renewable Energy II Project which supported a range of renewable energy technologies with a heavy involvement of the Government.
- China Renewable Energy Development which will support large scale investment in Wind and Solar systems.
- Vietnam Rural Energy I which supported among other things the piloting of a cooperative owned micro hydro hybrid system.
- Uganda Energy for Rural Transformation Project which will establish a Rural Energy fund.
- Sri Lanka Energy Services Delivery Project which is providing support to renewable energy development through the commercial sector. For mini hydro projects the development of a standardized power purchase agreement was supported to streamline the negotiation process between the small entrepreneurs and the national utility.

3.3.3 Lessons learned and reflected in proposed project design

These lessons learned from these projects that are reflected in the design are:

- The challenge of promoting renewable energy is substantial and should involve as many stakeholders as possible. This means private businesses, commercial banks, micro finance institutions, NGOs, research organizations, government agencies at different levels, donors, etc. Understanding the objectives, roles and responsibilities of the different institutions will accelerate the implementation of the project.
- Participatory approach is essential. Ownership and understanding of the key issues facing the sub-sector is paramount in addressing them effectively. Workshops and consultative meetings

are examples of how this could be achieved. This also results in building on existing infrastructure rather than designing a new one.

- Development of the renewable energy market requires several years of capacity building, institutional set-up and rural infrastructure building before major acceleration can take place. This phase should be recognized and sufficient up-front funds should be available.
- Subsidies should be managed in an absolute transparent way and should be designed according to performance indicators and co-financing principles.
- Financial engineering is often required including providing micro-finance options for technologies with high front-end costs like solar PV.
- Key market characteristics need to be available including willingness and capability of consumers to pay, before implementing an enterprise-driven energy project.
- Need for ensuring a strong policy and legal framework to guide private sector involvement.

3.3.4 Indicators of borrower commitment and ownership

The RGC and the World Bank have, through a recent dialog, reached a common understanding on the need for expansion of electricity access and the role of private sector in such an expansion. The RGC has agreed to the primary involvement of private sector in rural electrification, with the government playing a regulatory role in facilitating this process. RGC has expressed strong commitment to promoting renewable energy resources, which can lead to sustainable rural energy development. A macro level renewable energy policy draft (available only in Khmer so far) prepared by MIME indicates a prominent role for renewable energy technologies – especially hydro and solar – in increasing rural access to electricity services. MIME does have an active Directorate of Renewable Energy with 14 employees, which, with adequate exposure and capacity building, could play a coordinating role at the national level.

There is also a strong opinion among the stakeholders that renewable energy sector should be developed systematically to meet the energy service requirements of the rural poor. This feedback was strongly conveyed in a stakeholder workshop conducted in July 2000 by MIME and the World Bank in Phnom Penh.

There is strong acceptance for renewable energy promotion among the private sector also. In a recent study of the REEs commissioned by the World Bank, over 75% of the REEs, who are presently in diesel power business, indicated that they would expand/switch to renewable energy services business, if renewable energy technologies are shown to be least-cost options.

Several micro finance institutions (MFIs) also expressed interest in solar businesses. The CANADIA Bank has already been talking to small hydro project developers to start lending operations.

Thus, there is all round support and commitment among the relevant stakeholders towards developing the renewable energy sector in Cambodia.

3.3.5 Value added of World Bank and GEF support

The World Bank took the lead in conducting a dialog with RGC and MIME regarding the rural electrification and transmission project. Through GEF PDF B, the Bank and GEF are assisting RGC in designing the renewable energy component, preparing a SPPA and in establishing the market feasibility for solar home systems and small hydro power projects.

Thanks to Bank and GEF support, this project will mark the first time that private sector funds have ever been leveraged to develop the renewable energy market in Cambodia. So far, only 100% donor funded (mainly solar) renewable energy projects have been implemented. Smart subsidies will be provided through the transparent Rural Energy Fund to facilitate this process for consumers and consumer groups for which renewable energy systems are potentially commercial, but not yet commercially feasible.

In addition to GEF funding, WB mobilized support from ESMAP (US\$ 478,000) to prepare a Renewable Energy Action Plan for Cambodia. WB is also talking to other donors such as ADB, JICA, etc. to leverage additional renewable energy promotion resources and to coordinate approaches to renewable energy development.

The World Bank has supported similar renewable energy projects in the region and could provide the RGC with this experience from other countries.

4. Issues requiring special attention

4.1 Economic Assessment

An initial economic assessment for the different technologies was conducted. The analysis, performed in constant dollars, over a lifetime of twenty years, with a discount rate of 12%, and without taxes and duties, shows that all options have a potential positive Net Present Value (after cost reductions), which indicates that all are sound investment opportunities for the country.

The larger mini hydro projects connected to the EDC-grid are already least-cost compared to diesel generation². Their economic energy cost averages around 10cUS\$/kWh. With final cost estimates to be confirmed, conservative figures have used in the calculations. The estimated capital cost for hydro is US\$1800/kW and US\$60/kW/yr of fixed operation and maintenance cost is assumed. Considering that this sector has hardly been developed in Cambodia and costs in other countries are lower, further cost reduction for the hydro plant is likely to take place.

With no rural infrastructure in place, the levelized cost for the mini-grid/village and solar systems³ are slightly higher than their current high GHG-emitting competitors - diesel generators⁴ and kerosene lamps⁵ (cUS\$19 vs. cUS\$17/kWh). However, if an initial capital subsidy of US\$500/kW is introduced for the village hydros and an initial capital subsidy of 33% for solar, both systems become least-cost options. When supported by these initial subsidies, it is estimated that the markets for these options will expand, and their costs will fall to a level that will make them economically competitive with diesel and kerosene by the end of the project.

² Capital cost for diesel system was taken to be US\$490/kW, with specific fuel consumption of 0.27 liter/kWh, fuel price of 0.26US\$/liter, fixed O&M cost of 2% and variable O&M cost of 5%.

³ Capital cost of solar home system US\$350/30 Wp system, batteries are replaced on a yearly basis, as well as the two light bulbs.

⁴ Capital cost for mini grid diesel system was taken to be US\$570/kW, with specific fuel consumption of 0.40 liter/kWh, fuel price of 0.30US\$/liter, fixed O&M cost of 3% and variable O&M cost of 7%.

⁵ Village survey shows about 6 liter per day kerosene consumption per household, kerosene lamps have a life time of two years, there are two kerosene lamps per household and have fixed O&M cost of 20% and variable of 25%.

4.2 Financial Assessment

An initial financial assessment for the three demonstration investments was also conducted. Again, the analysis, performed in constant dollars, over a lifetime of twenty years, with a discount rate of 12%, and with taxes and duties, shows that all options have a positive Net Present Value making all options for businesses requiring a 12% rate of return viable.

With duties and taxes in similar ranges for the hydro and diesel equipment, and the grid connected mini-hydro systems having no taxes on fuel, the hydro will remain least-cost compared to diesel or even improve. At this time it is hard to say if the village hydro system on a financial basis is more expensive than the diesel option. Based on the adjusted economic calculations the average financial levelized cost looks to be almost equal.

With the current high import duty on solar (45%), the systems are financially more expensive than the kerosene option. However, if all or part of the ad-hoc duty waivers that are presently given to solar systems supplied by NGOs are extended to the market, as is planned, solar systems will become competitive. The Ministry of Industry, Mines and Energy, and the largest solar PV supply company in Cambodia are in dialogue with the Ministry of Economy and Finance to modify the import duty policy on solar PV modules in this way. Successful conclusion of these negotiations will considerably enhance the systems' competitiveness and market prospects.

4.3 Technical Assessment

The renewable energy technologies supported by the RE project (small hydro and solar home systems) are technically sound and demonstrated worldwide. While Cambodia has limited experience in technology development and dissemination, there is one company, Khmer Solar, which has been sourcing solar equipment from reputed suppliers like Siemens to market in Cambodia. Also, world-reputed companies such as Siemens, Matsushita and Shell Renewables have expressed interest in tapping the Cambodian market, which would ensure availability of quality technologies.

4.4 Institutional Assessment

Executing agencies and Project management

MIME: Renewable energy program is implemented by Technical Energy Department (TED) of MIME, which has 14 employees. They have good technical skills (in the context of Cambodian economy) and have been doing pilot RE projects for 4 years. They have experience in dealing with NGOs and local communities.

Apart from TED, there is a separate Hydro Power Department in MIME, which works closely with TED in small hydro power sector. This department has been responsible for conducting the desk studies on hydro potential.

Overall, however, there is a need to build up the capacity of MIME considerably. The Project Management Unit (PMU) to run the proposed Rural Energy Fund will be set up within MIME, which would not only lead the overall capacity building effort, but would also focus on building the capacities within the MIME itself.

4.5 Social Assessment

Project preparation included extensive consultation with public and private sector stakeholders. The proposed project would have a positive social impact by providing initial electrification services to 5,000-10,000 rural households currently without access.

Women and children are expected to benefit the most from these off-grid services. Small business entrepreneurs, majority of them women, will be benefited greatly; the improved lighting will allow them time to undertake additional income generating activities. Women also note that better lighting enables them to respond more quickly to infant needs at night. Children benefit from the additional time to study, watch television or listen to the radio.

4.6 Environmental Assessment

The proposed project would yield net positive environmental effects. The off-grid electrification sub-projects would reduce use of kerosene and lead-acid automotive batteries. No significant negative impacts are envisaged from the run-of-stream village-hydro projects, because of their small size. No resettlement is envisioned because the project does not involve land acquisition or creation of transmission lines and reservoirs. Power generated from renewable energy sources would correspondingly reduce emissions from fossil fuel burning, with benefits to the local and global environment. PCIs would ensure that project sponsors obtain RCG and IDA-mandated environmental clearances, where necessary. Small hydro subprojects will be reviewed by MIME/EDC.

4.7 Participatory Approach

Project identification/preparation included extensive collaboration with private sector, NGOs, local financial institutions, and donor stakeholders which is expected to continue during project implementation. During the initiation mission of the World Bank in July 2000, a stakeholder workshop was held in collaboration with MIME, which was attended by 18 key stakeholders covering the government, private sector, NGOs, academia and donors. This workshop led to clear identification of different barriers impeding the development of renewable energy in Cambodia. This participatory approach is expected to be adopted throughout the implementation of the proposed project.

Private Sector - The project has been prepared in consultation with the beneficiaries, many of whom are in the private sector. Mini-hydro project developers in particular, have met frequently with the project preparation team to assess progress and offer advice. They have made very clear their interest in accessing the Credit Program.

Local Financial Institutions - Micro finance institutions as well as private banks have provided inputs in project preparation, These financial institutions (e.g. CANADIA Bank) requested that the project include retroactive financing, so they could begin project development immediately.

Donors - Project preparation included discussions with JICA to ensure complementarity between the proposed project and their projects. Collaboration with additional donors, is anticipated during project implementation and operation.

4.8 Sustainability and Replicability

The renewable energy project will target areas in Cambodia where grid extension is not planned in the near future. Thus, the projects will likely compete with diesel generators and batteries, which offer poor services at a very high cost at present. Therefore, renewable energy services will be marketed to provide reliable and quality services at comparable costs, which should ensure their long-term sustainability. Care will be taken to select sites with concentrated demand for mini-grid projects, and promote solar systems in remote areas where they are likely to be the most cost-effective clean energy solutions. The project preparation phase will carefully consider the demand-supply aspects to arrive at cost-effective options.

Apart from the techno-economic considerations, innovative financial engineering will be adopted to match the payments for energy services with the willingness and ability of the consumers to pay. This would mean some market segments may require subsidies, and the challenge will be to design an optimal combination of market size, composition and subsidy so as to attract the private sector. After sales service and maintenance would be a necessary requirement irrespective of the mode of private sector involvement. The project would also strive to ensure that key stakeholders have the requisite capacity to handle various tasks. All these considerations would ensure long-term sustainability of operations.

It should also be mentioned here that in designing the activities for GEF support in Cambodia, lessons learnt from the experience of the World Bank and other donors in supporting renewable energy technologies in countries of this region – Vietnam, Indonesia, India, Sri Lanka, etc. – have been taken into consideration (see above). Learning from other country experiences should contribute towards the sustainability of this project.

4.9 Critical Risks

<u>Project Outputs to Development Objectives</u>	<u>Rating</u>	<u>Risk Minimization Measure</u>
Interest of commercial banks and businesses in renewable energy wanes	Low - Moderate	<ul style="list-style-type: none"> i) Training and capacity building of loan officers; ii) Have a few best practices in place during first year of operation. iii) Development of a standardized power purchase agreement. iv) Mini-hydros can be highly profitable, thus sustaining PCI interest .
Effective operation of EAC and transparent calculation of power purchase tariff	Low - Moderate	Substantial TA to EAC as part of RE&T project to support development of regulations, guidelines and operational manual.
Drought conditions could reduce financial viability of renewable energy subprojects	Low	Subproject technical designs and business plans (especially small hydro projects), appraised by PCIs, must account for abnormal weather conditions
<u>Project Components to Outputs</u>		
Private sector (both PCIs and subproject developers) loses interest or is unable to prepare subprojects	Low	<ul style="list-style-type: none"> i) PCI and subproject developer interest was a major impetus to Project development; ii) The SPPA and Tariff will be adopted by EAC; iii) GEF Grant support is available for off-grid subproject preparation; iv) Market assessments indicate strong potential demand; v) The capacity building component aims at strengthening local alternative energy expertise; and vi) The GEF project supports a broader capacity building effort
MIME Procurement delays	Low	Capacity building in procurement procedures
MIME loses commitment to renewable energy	Low	No sustainable alternatives to renewable energy in rural areas. RGC/Bank dialog continues to stress importance of renewables for rural electricity services.
<u>Overall project risk rating</u>	Low	

4.10 Possible controversial aspects

No major controversial aspects. The only possible issue could be the transparent division of commercial credit facility and subsidy provision, including the establishment of a Rural Energy Fund to administer the subsidies with a multi stakeholder board of trustees. The Government agreed to have the establishment of the Rural Energy Fund as a condition for effectiveness of the Rural Electrification and Transmission project.

ANNEX 1

Project Design Summary

Narrative Summary	Key Performance Indicators	Monitoring and Supervision	Critical Assumption
<p style="text-align: center;">Sector related CAS Objectives</p> <p>1. Encouragement of private investment and entrepreneurship</p> <p style="text-align: center;">Sector related CAS and GEF Objectives</p> <p>2. Build the foundations for sustainable, environmentally sound development</p>	<p>1a. 100% increased electricity sales by private operators by project end (from 72 GWh to 140 GWh)</p> <p>1b. 100% increased private owned rural energy assets (from US\$ 12 million to US\$ 24 million)</p> <p>1c. 3 small power purchase agreements signed</p> <p>2. 5% avoided green house gas emissions by project end</p>	<p>1a. Year reports of Rural Electricity Enterprise Associations</p> <p>1b. Year reports of Rural Electricity Enterprise Associations</p> <p>1c. EDC progress reports</p> <p>2. Progress, supervision and mid-term reports</p>	<p>1. RGC and EDC maintain committed to stronger private sector involvement in the power sector and continue improvement of private sector legislation</p> <p>2. MIME and MOE maintain committed to support introduction of renewable energy</p>
<p style="text-align: center;">Project Development Objectives</p> <p>1. Maximize the economic development impact of rural electrification</p> <p style="text-align: center;">GEF Project Development Objective</p> <p>2. To maximize the use of local natural resources and the use of least-cost supply options in the power sector</p>	<p>1a. 20,000 new electricity services to households, businesses, schools, health centers and others.</p> <p>1b. 5 strong medium scale (500 to 1500 customers) rural electricity enterprises</p> <p>2a. Installation of at least 8 MW of grid and off-grid renewable energy system by end of project</p> <p>2b. Renewable</p>	<p>1a. Progress, supervision and mid-term reports</p> <p>1b. Progress, supervision and mid-term reports</p> <p>2a. Progress, supervision and mid-term reports</p> <p>2b. Progress,</p>	<p style="text-align: center;">Objectives to CAS-objectives</p> <p>1a. Sufficient qualified staff available</p> <p>1b. Continued support for private sector involvement by RGC and EDC</p>

	<p>electricity service to 10,000 new customers</p> <p>2c. 50 Renewable energy staff employed</p>	<p>supervision and mid-term reports</p> <p>2c. Progress, supervision and mid-term reports</p>	
<p>GEF Project Outputs</p> <p>1. Renewable energy systems installed and sustainable operated</p> <p>2. Trained energy staff and increased general awareness in the field of renewable energy</p> <p>3. Strong renewable energy businesses</p>	<p>1a. Standard Small Power Purchase Agreement adopted by EAC and EDC</p> <p>1b. 5% of generation capacity by renewable energy systems (6MW)</p> <p>1c. 3 mini hydro projects supplying to grids on commercial basis</p> <p>1d. 5 to 10,000 solar home systems installed</p> <p>2a. 50 to 100 educated renewable energy employees</p> <p>2b. 2 regional promotion campaigns</p> <p>3a. 3 strong renewable energy businesses</p>	<p>1a. Progress, supervision and mid-term reports</p> <p>1b. Progress, supervision and mid-term reports</p> <p>1c. Progress, supervision and mid-term reports</p> <p>1d. Progress, supervision and mid-term reports</p> <p>2a+b. Progress, supervision and mid-term reports</p> <p>3a. Progress, supervision and mid-term reports</p>	<p>Outputs to objectives</p> <p>1a. Effective operation of EAC and transparent calculation of purchase tariff</p> <p>1b. Continued interest of private sector</p> <p>1d. Interest international solar companies to enter the market</p>
<p>GEF Project Components</p> <p>1. Credit Program for renewable energy investments</p> <p>2. Capacity Building and Technical Assistance through Rural/Renewable Energy Fund</p>	<p><i>Disbursement of IDA/IFC and GEF funds according to schedule:</i></p> <p>1a. IDA/IFC: US\$5 million</p> <p>2a. IDA: US\$ 1 million</p> <p>2b. GEF: US\$ 5 million</p>	<p>1. Progress reports including supervision reports, and mid-term review reports.</p> <p>2. Progress reports including supervision reports, and mid-term review reports.</p>	<p>Components to outputs</p> <p>1.1 Private sector interest and ability to prepare subprojects</p> <p>1.2. Active participation of PCIs</p> <p>2. Effective procurement and processing of Energy Fund</p>

ANNEX II

INCREMENTAL COST ANALYSIS

For the description of the context, development goals, barriers, objectives, baseline, GEF alternative, and sustainability see text in main body. Below the incremental cost matrix based on this information.

	Baseline	Alternative	Increment
Domestic Benefits	<p>Access to electricity services will continue to be low and the demand suppressed;</p> <p>Process of economic development in rural areas will continue to hamper due to lack of electricity</p> <p>Power availability remains constrained, with prices high and reliability low.</p> <p>Very limited development of the commercial market of renewable energy technologies.</p>	<p>Stimulation of rural businesses to expand operations including solar home systems</p> <p>Large scale intervention to support the provision of grid-extension, mini grids and isolated through the private sector.</p> <p>Institutional strengthening in development of regulation, pricing, contracts, etc.</p> <p>Energy costs decline and availability improves, with linkages to productive use applications and development of local small power entrepreneurs.</p> <p>Renewable energy as integral part of rural electrification and power supply development strategies</p>	<p>Barriers (information, first cost, etc.) to commercial development removed.</p> <p>Successful demonstration of a wide range of alternative technologies and business approaches.</p> <p>Technology improvement that benefits renewable energy producers and enhances competition with diesel sources.</p>
Global Environmental Benefits	Power supply development, and rural energy services rely on car batteries, diesel, and kerosene.	Significant offset of GHG emissions through range of renewable technology options displacing 5% what would otherwise be diesel generator sets, and 5 to 10,000 kerosene households.	<p>0.55 million t of carbon avoided</p> <p>Opening market for commercial renewable energy business in Cambodia</p>
Cost by Component	(million US\$)	(million US\$)	(million US\$)
1a. Grid connected mini hydro - investments	5.40	5.40	0.00
1b. Grid connected mini hydro – technical assistance	0.10	0.40	0.30
2a. Village hydro - investments	7.50	8.25	0.75
2b. Village hydro – technical assistance	0.10	0.40	0.30
3a. Solar home system - investments	2.25	3.00	0.75
3b. Solar home system – technical assistance	0.10	0.50	0.40
4. Capacity building and policy development	0.30	3.55	3.25
GEF Incremental Costs	15.75	21.50	5.75

ANNEX 3a
STAP review
(Reviewer: Daniel M. Kammen)

Summary

The Cambodia Renewable Energy Promotion Project has the potential to significantly transform the rural energy sector characterized by a diverse, entrepreneurial, set of clean energy providers and a growing post of well-served customers. The project has the advantage of a suitable, long, time-frame.

Among the issues that the PCD could clarify are:

1. Optimal Use of Market and Public Sector Diverse

The technical assistance component (2.4.3(iv)) includes an innovative array of mechanisms (a-h). To determine which of these mechanisms to employ in each situation, it is recommended that the MIME solicit a set of pre-business plans from the current and potential future renewable energy entrepreneurs. From this set of business models, the MIME can determine what mixture of public-sector assistance, capacity building, or more market-dominated support would best fit a given locality. In this way the MIME can take maximum advantage of the growing private-sector expertise and make maximum use of its resources.

2. Support Expanding Markets Without Excluding New Entrants

A complex feature of the project is that the funds to support market developments could be exhausted without fully stimulating new private sector growth unless careful planning allocates resources (e.g. 2.4.3.iv (a-h)) to a diverse sets of existing and new market entrants, and methods for the public sector to support the private sector.

3. Household Versus Village and Community Markets

The project is intended to support both clean energy services to households and larger community-scale projects. Experiences in Kenya (Duke, et al, 2000) , the Dominican Republic, and elsewhere suggest that it can be difficult for companies to serve this diverse set of clients. MIME could establish a public-private (including NGO groups and entrepreneurs) to advise use of the capacity building, credit line and Rural Energy Fund so that small-scale and large customers are both supported by the fledgling renewable energy REEs.

4. Integration of Other Donors

For the project to succeed, additional donors will be required to support the large number of initiatives envisioned (e.g. 2.4.9.a). The international and in-country project team must remain vigilant that no cases of tied-aid are introduced into Cambodia.

5. Incremental Cost Calculation

At this stage many of the specific financial allocations remain undetermined. A full evaluation of the incremental cost analysis is thus not appropriate. However, analyses of the costs, assuming some additional donor involvement, is reasonable.

Annex 3b

Response to the STAP review

1. Optimal use of market and public sector drivers

Agree with the comment. At this stage it is unclear which of the different delivery mechanisms will be optimal in Cambodia. Therefore, the operational TA is focussed on learning to know the market and indeed building on existing initiatives as well as new ideas by the entrepreneurs. The solicitation for ideas has started during the preparation of the project when a stakeholder workshop was held identifying the main barriers and *solutions* for renewable energy development as perceived by the representatives of 18 organizations. This soliciting process (including pre-business plans) will continue during project implementation. New ideas in principle will be supported on a co-financing basis to ensure ownership by the proponent.

2. Support expanding markets without excluding new entrants

Even though an estimated 600 Rural Electricity Enterprises exist in Cambodia, hardly any have experience with renewable energy systems. In fact, of the 45 REEs interviewed none of them had a renewable energy supply system. Further more, the number of existing renewable energy businesses is very small in Cambodia. Therefore, the support should very much act as a trigger for new companies to come forward to explore the renewable energy business opportunities. To lower the barriers for entrance of new businesses, larger, sub-sector-wide (not company specific), up-front market investments will be supported by GEF. This would include: nation wide market surveys, general awareness campaigns, and capacity building of management, technical and sales staff. Company specific, follow-on, activities can then be taken on by the businesses.

3. Household versus village and community markets

Agree with the comment. Experiences in other countries in the region (Sri Lanka, Indonesia, Vietnam, India) have shown similar conclusions. In many cases the two sub-sectors are serviced by two different types of organizations. In Sri Lanka for example, the village hydro development is very much driven by the NGOs, while the solar home systems market is serviced by commercial companies like Shell Solar and RESCO. Therefore, involvement of public-private participation in design of use of funds is important. This would be included in the design of the Rural Energy Fund with a trust board with representatives of the main stakeholders, as well as the continuation of the participatory consultation process with representation of the different types of organizations.

4. Integration of other donors

Agree with the comment. Part of the on-going preparation by MIME is the development of a 10 year Cambodia Renewable Energy Action Plan, where clear objectives, targets, priorities for implementation, and financing requirements will be outlined. MIME plans to use this Action Plan to coordinate donor interest in supporting renewable energy development.

5. Incremental cost calculation

Based on the information to date, an economic and financial analysis have been conducted and is summarized in the document. However, I agree that with the lessons learned and new information gained during project implementation, economic, financial as well as incremental cost calculation should be up-dated. This should also reflect the additional donor funds that might come available.

ANNEX IV - FLOW OF FUNDS AND SUMMARY OF INSTITUTIONAL SET-UP

