



GEF

Mohamed T. El-Ashry

Chief Executive Officer
and Chairman

Global Environment Facility

1818 H Street, NW
Washington, DC 20433 USA
Tel: 202.473.3202
Fax: 202.522.3240/3245
Email: melashry@worldbank.org

May 29, 2002

Dear Council Member,

The World Bank, as the Implementing Agency for the project, *Bangladesh: Rural Electrification and Renewable Energy Development*, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with the World Bank procedures.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by the Council in December 2001 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the World Bank satisfactorily details how Council's comments and those of the STAP have been addressed. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.gefweb.org. If you do not have access to the Web, you may request the local field office of the World Bank or UNDP to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

cc: Alternate, Implementing Agencies, STAP

OFFICE MEMORANDUM

DATE: May 17, 2002

TO: Mr. Mohamed El-Ashry, CEO/Chairman, GEF

FROM: Lars Vidaeus, GEF Executive Coordinator 

EXTENSION: 34188

SUBJECT: **BANGLADESH: Rural Electrification and Renewable Energy Development Project: Submission for Final CEO Endorsement**

1. Please find attached the electronic file of the Project Appraisal Document (PAD) for the above-mentioned project for your final review and endorsement. This project was approved for Work Program entry at the December 2001 Council meeting, under streamlined CEO endorsement procedures. The scheduled IDA Board date for this project is **June 25, 2002**. We would appreciate receiving your response, so that we may finalize the Bank Board submission, by **May 31, 2002**.
2. The PAD is fully consistent with the objectives, scope, and overall cost of the proposal approved at the December 2001 Council meeting. GEFSEC, STAP, and Council comments have also been addressed. Modifications to the PAD and how comments have been addressed are detailed below.

GEF Council Member Comments (Switzerland)

General

The project is consistent with the operational strategy of GEF. It is consistent with operational program No 6, promotion and adoption of renewable energy by removing barriers and reducing costs.

It has benefited from lessons learnt in previous projects of the same kind, and seems very logically built. Reputable and experienced stakeholders in the SPV marketing and services are among the partners.

Conclusions and Recommendations

SPV allows an entry to be made into a state of pre-electrification, resulting in a considerable increase in quality of life. However, it does not provide for additional income generation by power-driven productive means.

This project does however consider wind and hydro on a pilot basis. But in a clustered area where biomass is available, it would be of interest to consider on a pilot scale biomass gasification as an option for rural electrification.

This project should be supported as one of the next generation SPV projects.

We agree that biomass gasification has substantial potential to meet rural energy needs and to promote income generation activities. This Project would assess the feasibility of this option. Other donors such as DfID and UNDP are pursuing biomass projects in Bangladesh, and the project will interface with them to see whether biomass technologies can be disseminated and replicated through the models developed by those projects. For this purpose, flexibility has been built into the TA component to assess commercialization of biomass technologies, as well as wind and hydro technologies.

GEF Secretariat Comments

Project Design

- 1. More progress desirable through continued efforts to add focus on income generation and social benefits by time of CEO endorsement (through PDF-B activities).*

The preparatory work indicates a wide diversity of income-generating opportunities that can be addressed by the project. The specific opportunity depends on the geographic area, current economic activities, personal skills, communication infrastructure, etc. The project will, on an ongoing basis, identify support and facilitate adequate and appropriate technology supply, credit and technical assistance to exploit these specific opportunities. This identification, support and facilitation (in specific areas) would be carried out by the Socioeconomic Evaluation and Monitoring Cell (SEMC) of Rural Electrification Board (REB).

This unit will also serve as the focal point for evaluating socioeconomic impacts of electrification and direct productive consumption of electricity. To this end the cell will conduct market research surveys, design programs, and evaluate economic and social impact and benefits of rural households. The activities of the cell will cover both grid and off-grid. This institutional arrangement will enable feedback from the evaluation to influence the design of the support mechanisms to promote income generation applications. It would also provide flexibility to design location-specific support mechanisms.

Good progress has been made since work program entry in establishing SEMC within REB. The proposed staffing of the cell and functions have been detailed in Annex 2 of the PAD.

Sustainability

- 2. Details on subsidy regime of project (use of GEF resources) awaits further definition through PDF B “pilot” activities. As a consequence, the following condition has been moved from work program to CEO endorsement: “Project should justify why market will be sustainable without continued GEF equipment subsidies, if used in the project, and how costs will decline over the life of the project.”*

The subsidy design of the Project is based on extensive consultations with Bangladesh MFIs/ NGOs, including some, like Grameen Shakti that are experienced in the solar business. These consultations were carried out during the Project preparation process.

Cost reductions during the project lifetime will occur due to reduced transaction costs in delivering solar systems as well as due to fall of equipment prices. Currently, the Bangladesh solar market has limited players but potential new entrants are showing keen interest. For e.g. Kyocera, a Japanese manufacturer of solar panels and products as well as Free Energy, a European company manufacturing solar products have recently appointed authorized distributors in Bangladesh. Siemens and BP Solar products are already available in the market in Bangladesh. With such increased competition, solar equipment prices are expected to go down in an expanding market over the project duration. However, perhaps more significant impact on market sustainability of the program may occur due to the reduction in operational costs. Cost reductions are expected in the financing and delivery channels for solar home systems as dealer networks expand and NGO transaction costs are reduced in financing such systems.

Though subsidies can be substantially brought down, they may not be fully phased out in the proposed time frame of 5 years of project life. Experiences from other South Asian countries show that the initial build-up of the solar market is slow and starts to ramp up in 2nd or 3rd years of the project. The realistic estimate for complete phase out of subsidies would in the 8-10 years time frame. However, sufficient reductions in costs will be achieved by the end of the project to meet the incremental requirements more easily. In the absence of continued support from the GEF, alternative sources of financing such as carbon financing opportunities, bilateral funds, government subsidies etc. will be pursued by the government to bring the SHS capital costs down (refer PAD pp 5,14).

Replicability

- 3. Greater specification of project activities and active strategies for replication, to be undertaken during the project implementation period, are expected for CEO endorsement, based on outcomes of the PDF-B. The expectations for replication at work program entry given in the review sheet will continue to apply as conditions for CEO endorsement.*

Preparatory studies indicate that the long-term market for Solar Home System's is about 2 million households and the short-term market is about 500,000. As against these assessments, the current project targets only about 64,000 households. Within this market, the scope of replicability is quite large. On the REB fee-for-service program, the current project only targets 6 of the 45 Palli Bidyut Samities (PBSs) and a similar program can be scaled-up based on the results of the existing project.

Similarly, only a few select NGOs are participating in the program and the capacity to replicate and expand is significant considering the large number of rural community-based organizations in Bangladesh.

The key to such expansion is the dealer-MFI alliance. The project will focus on forging such alliances from the beginning. A project launch workshop, planned for August 2002 in Dhaka, will bring together international solar manufacturers, local dealers and Micro Finance Institutions (MFIs) (refer PAD page 21). These alliances would be supported through the TA component in the project to initiate replication in the other PBSs and NGOs

Financing Plan

4. Project document should justify how subsidy arrangements meet the " pipeline entry subsidy principles"

The grant regime proposed under the project is fully consistent with subsidy principles of the GEF.

- Based on the consultant studies that were completed during project preparation, incremental lifecycle costs were calculated as US\$ 97 for 40 W systems and US\$ 85 for 20 W systems. In order to give more incentives for smaller system sizes, a uniform grant of US\$ 90 is proposed irrespective of system size for the first 20,000 systems sold.
- A declining grant regime is followed as per GEF guidance. Based on extensive consultation with the industry, NGOS/MFIS and other stakeholders, an acceptable declining grant regime has been developed. For the first 20,000 systems, a grant of US\$ 90 is proposed, the next 20,000 systems will receive US\$ 70 and the last batch of about 24,000 systems will receive grant support up to US\$ 50 per system.
- As discussed earlier in the note, the 5 year time frame under consideration is not adequate to fully phase out solar subsidies. Experience from other Bank projects have demonstrated that the market build-up is slow during the first/second years of

the project and a realistic time frame for completely phasing out subsidies is 8-10 years. In Bangladesh, the government has shown a commitment by removing the import duties on solar panels. They may continue with this incentive or provide additional small incentives to poor households to cover limited incremental costs, existing after the five year project life. Other sources of funding such as bilateral and carbon finance sources may also be available to help sustain the market after project life (refer PAD pp 5,14).

3. Please let me know if you require any additional information to complete your review of the project document. We look forward to receiving your endorsement of the project for Bank Board approval

Many thanks.

Attachments

cc: Messrs./Mmes. King, GEF PROGRAM COORDINATION (GEFSEC); Iyer, Brook, Goodman, Kochar (SASEI); Govindarajalu (EASEG); Jansen, Panneer Selvam, Pilapitiya (SASES); Temple, Zhao (SACBD) ; Mathur, Sharma, Khanna, Wedderburn, Aryal (ENV); ENVGC ISC, Regional Files

Francine Stephens

N:\ENVGC\GEFCOUNCIL\2002 Submissions\SAR\05-May\Cover Memo - Bangladesh CEO Endorsement.doc

May 17, 2002 2:25 PM

BANGLADESH

Rural Electrification and Renewable Energy Development

Project Appraisal Document

South Asia Regional Office
SASEI

Date: May 8, 2002

Team Leader: Subramaniam V. Iyer

Country Manager/Director: Frederick T. Temple
Project ID: P071794

Sector Manager/Director: Vincent Gouarne
Sector(s): DI - Private Infrastructure, PD - Distribution & Transmission, PY - Other Power & Energy Conversion
Theme(s): Rural Development; Energy; Private Sector
Poverty Targeted Intervention: N

Lending Instrument: Specific Investment Loan (SIL)

Project Financing Data

Loan Credit Grant Guarantee Other: GEF, bilaterals

For Loans/Credits/Others:
Amount (US\$m): 190.98

Proposed Terms (IDA): Standard Credit

Financing Plan (US\$m):	Source	Local	Foreign	Total
BORROWER		92.34	0.00	92.34
IDA		12.61	178.37	190.98
LOCAL COMMUNITIES		6.78	0.00	6.78
GLOBAL ENVIRONMENT FACILITY		1.20	7.00	8.20
Total:		112.93	185.37	298.30

Borrower: PEOPLE'S REPUBLIC OF BANGLADESH

Responsible agency: RURAL ELECTRIFICATION BOARD AND INFRASTRUCTURE DEV. CO. LTD.
Rural Electrification Board
Address: Head Office, 3rd Floor, Nikunja -2, Khilkhet, Dhaka-1229, Bangladesh
Contact Person: Syed Abu Adullah
Tel: 891-6420 **Fax:** 891-6400 **Email:** Rebpp@Citechco.Net

Other Agency(ies):

Infrastructure Development Company Limited

Address: IDB Bhaban, 6th Floor, Agargaon, Dhaka, Bangladesh

Contact Person: Dr. M. Fouzul Kabir Khan

Tel: 8111-235

Fax: 8116-663

Email: Idcol@Dhaka.Agni.Com

Estimated Disbursements (Bank FY/US\$m):

FY	2003	2004	2005	2006	2007	2008
Annual	43.33	57.40	54.60	21.50	9.55	4.60
Cumulative	43.33	100.73	155.33	176.83	186.38	190.98

Project implementation period: FY2003-2008

Expected effectiveness date: 09/30/2002 **Expected closing date:** 06/30/2008

A. Project Development Objective

1. Project development objective: (see Annex 1)

The project aims to support Bangladesh's vision of attaining a higher level of social development and economic growth by increasing access to electricity in rural areas.

The detailed project objectives include:

- (i) assisting the Rural Electrification Board to expand the reach, capacity and reliability of rural grids and to improve the operational and financial performance of the rural electricity cooperatives (Palli Bidyut Samities or PBSs);
- (ii) promoting use of solar home systems in rural areas unsuited for grid expansion;
- (iii) facilitating development of small power projects, using renewable energy sources where feasible, to be owned and operated by the private sector or by NGOs/community-based organizations; and
- (iv) supporting initiatives in rural areas for productive use of electricity to increase household incomes and improve the delivery of services, such as health and education .

The **global objective** of the project is to reduce atmospheric carbon emissions by overcoming market barriers for renewable energy development, including high implementation costs.

2. Key performance indicators: (see Annex 1)

The monitoring indicators for the proposed project fall into two categories:

Output: (i) grid-based systems to serve about 700,000 additional households, rural small and medium enterprises and public institutions; (ii) off-grid systems to provide electricity to about 64,000 rural households or installations; (iii) develop a framework for pilot projects to implement hydro, wind and other types of small power projects; and (iv) establish an institutional system for measuring and documenting the impacts of electricity on poverty and quality of life.

Impact: (i) measurable increases in incomes of households gaining access to electricity (to be assessed through periodic monitoring and evaluation); and (ii) strategies to use electricity productively and improve delivery of rural services.

B. Strategic Context

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

Document number: 21326-BD **Date of latest CAS discussion:** December 12, 2000

The 2000 CAS acknowledges the success of rural, community-based institutions in providing electricity and micro-credit. It encourages building on the success that rural energy cooperatives have had in addressing Bangladesh's poverty and development challenges. The strategy emphasizes the central importance of accelerating access, increasing efficiency and undertaking reforms in the electricity sector. Consistent with these strategies, the proposed project design would:

Enable the country to expand rural electricity access rapidly by supplementing grid with renewable technologies provided by both government and nongovernment agencies;

Promote stronger partnerships with NGOs and community-based organizations to identify, finance and implement community-driven, decentralized means of supplying energy;

In rural areas, support sector reforms by re-demarcation of boundaries between the PBSs and the Bangladesh Power Development Board, through the transfer of distribution areas, especially 'pocket areas', that are generally small towns or settlements inside PBS jurisdictions but are served by the Bangladesh Power Development Board; and

Strengthen PBSs by helping them improve their financial viability and enabling them, through institutionalized mechanisms to define and measure poverty impacts, and introducing a socioeconomic dimension to electricity development.

Global Operational Strategy/Program Objective Addressed by the Project

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

2. Main sector issues and Government strategy:

Main Power Sector Issues

The Bangladesh power sector is dominated by two parastatals, the vertically integrated Bangladesh Power Development Board, (BPDB), and the Dhaka Electricity Supply Authority (DESA), which serves the Dhaka metropolitan area. Although these two parastatals together account for nearly 75 percent of power sales, their operational and financial performance has been historically poor, and a program of institutional reform is under consideration to address their shortcomings. In contrast to the main power sector utilities, rural electricity cooperatives have been more successful in delivering reliable services to their consumers at much higher levels of operational performance. This superior performance encompasses lower system losses, better billing and collection performance, higher tariffs and greater financial discipline. The higher reliability, as well as the continued growth of the rural system depends on increasing the areas covered by each PBS and the transfer of rural and small town load centers from the BPDB to the PBSs.

The key sector issue in Bangladesh is implementing broad sector reforms to establish an efficient and competitive power sector. While Bangladesh has successfully opened its power generation segment to private sector investments, reform measures to establish independent and effective sector regulation and create a competitive industry through BPDB unbundling and privatization of electricity distribution are to be implemented. The Government has recently requested IDA support for implementing the unfinished power sector reform agenda. This project would directly contribute to the ongoing reform efforts by playing an important role in distribution reforms. The project will support rationalization of distribution systems in the country and enable the transfer of a significant portion of the rural service areas from BPDB to REB system.

Rural Electricity Sector Issues

The rural electricity program is based on the ownership and management of power distribution networks by independent consumer owned cooperatives (PBSs) functioning under the umbrella of an apex organization, the Rural Electrification Board (REB). The latter functions as a quasi-regulator and a financial manager of the program and provides a wide range of technical and institutional services to the PBSs. Both REB and the PBSs have maintained a good track record in terms of operational and financial management. The last IDA project (the Third Rural Electrification Project; Cr.2129-BD, which closed December 31, 1999) was rated as "highly satisfactory" in both achievement of objectives and implementation performance by the REB/PBSs. In fact, consumer connections reached 270 percent of appraisal expectations, thanks mainly to the high degree of rationalization of rural distribution network boundaries and substantial hand over of 'pocket' areas to the PBSs.

Notwithstanding the commendable progress in the twenty-year history of the RE program and the fact that the PBSs are connecting about 350 to 400 thousand households a year to the grid, over 75 percent of nearly 15 million rural households lack access to electricity. At the current rate of expansion, it would take Bangladesh nearly 30 years to achieve universal electricity access, without accounting for population growth. Furthermore, given the dispersed nature of rural settlements

and the difficulty of physical access stemming from numerous rivers and watercourses that crisscross the country, grid electrification is often constrained and high-cost. Even in areas with grid electrification, a large number of households use less than 30 kWh a month, mainly for lighting purposes. Therefore, the Government of Bangladesh is now looking to supplement the grid-based electrification program with off-grid options, both to increase rates of electrification and reduce the cost of providing access and supply.

Against this background key rural electrification issues are as follows:

- (i) Balancing the increasing costs of grid expansion with the need to expand rural access by rationalization of existing distribution systems;
- (ii) Improving revenue generation, operational efficiency and the sustainability of less viable PBSs; and
- (iii) Finding viable off-grid alternatives, in addition to the grid based supply, so as to increase electricity penetration in rural areas.

Government Strategy

The Government of Bangladesh and the Rural Electrification Board are pursuing a two-pronged strategy to address the above issues.

The first prong addresses the grid-related issues. The main thrusts are: (i) prudent selection of new areas for grid electrification based on revised and more rigorous revenue assumptions to make the area coverage program economically sustainable; (ii) rationalization of distribution networks by hand over of power systems in secondary towns together with rural systems from BPDB, thereby avoiding investment duplication and enabling more efficient operation of the PBSs; and (iii) emphasis on enhancing the PBSs' financial sustainability through selective financial restructuring measures, targeted loss reduction initiatives and efforts to promote productive electricity consumption.

The second prong focuses on developing alternatives to grid electrification. The Government is actively promoting off-grid options, both through PBSs and through nongovernment organizations (NGOs) and micro-finance institutions (MFIs). Import duty on solar home systems was eliminated in April 2000. Off-grid technologies are being introduced in areas that are uneconomic for grid expansion. Interventions include promotion of solar systems for household and institutional uses and facilitating small private sector power projects in unserved or poorly served areas, using renewable resources such as wind and hydro where feasible. The provision of solar home systems (SHS) will be promoted by the private, NGO and cooperative sectors, coordinated by the Infrastructure Development Company Limited (IDCOL), a government-owned development finance institution. The small power projects of up to 10 MW size, referred to as 'Remote Area Power Supply Systems' or RAPSS, are proposed to be established by the private sector under suitable concession arrangements with the BPDB or REB. A Government investment promotion agency – Infrastructure Investment Facilitation Center (IIFC) – has the mandate to develop RAPSS for private sector participation.

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

The project will address all the key rural electrification issues through: (i) promoting greater access through distribution systems rationalization, expansion and intensification of the grid, with due regard to economic and financial viability; (ii) ensuring financial sustainability of PBSs; and (iii) introducing viable off-grid supply alternatives.

An economic choice has been made in supporting grid expansion where feasible. The area coverage concept pursued by REB is generally well-implemented and proven to yield predictable outcomes and benefits. The project will not support grid investments in areas where these are unviable - as determined by a cost-benefit analysis of projected loads and consumer growth along new lines. The strategic alternative for such areas is to support off-grid options, such as SHS and RAPSS.

An important institutional choice has also been made for off-grid project implementation. The PBSs, private sector and community-based stakeholders (NGOs, MFIs) will receive project support to implement off-grid options as opposed to a utility based approach. This choice has been made to utilize the strengths of the vibrant NGO/MFI sectors in Bangladesh and make off-grid alternatives socially acceptable and commercially sustainable. The cited institutions have demonstrated strengths and advantages in operating at the community and household levels. The utilities, on the other hand, are not organized for social mobilization, have limited access at the village level and are not generally interested in off-grid options, since these constitute a small part of their overall business. Relying on state-sector implementation would also make it difficult to commercialize these options and benefit the consumer through competitive pricing and service provisions.

A financial choice has been made with respect to the grants to be extended for removing barriers to market development for solar home systems. Consistent with the notion that barriers will be gradually reduced with market expansion and in order to facilitate provision of SHS to poor rural households, the grant system has been designed on the following basis: (i) grants are not linked to system size but are a fixed amount, so that smaller systems receive a larger share of costs as grant; and (ii) grants decline over the life of the project from US\$ 90 per system to US\$ 50 per system, as the market expands. The reduced level of grant requirement at the end of the project can then be more easily supported through other sources such as carbon financing mechanisms, bilateral assistance or government programs.

C. Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

Component	Sector	Indicative Costs (US\$M)	% of Total	Bank-financing (US\$M)	% of Bank-financing
A1 Rural Electrification System Expansion, Intensification and Rehabilitation		261.65	87.7	171.68	89.9
A2 REB Technical Assistance		2.98	1.0	2.86	1.5
B1 REB Solar Program		8.16	2.7	4.63	2.4
B2 REB Solar Technical Assistance		0.62	0.2	0.37	0.2
C1 IDCOL Renewable Energy Subloans		21.29	7.1	11.44	6.0
C2 IDCOL Technical Assistance		3.60	1.2	0.00	0.0
Total Project Costs		298.30	100.0	190.98	100.0
Total Financing Required		298.30	100.0	190.98	100.0

The key elements of the project components are:

A1. Rural Electrification System Expansion, Intensification and Rehabilitation: This component will extend support for expansion of distribution facilities in 45 PBSs, including construction of 10,000 kms of new lines, rehabilitation of 2,500 kms of previously taken over lines, and construction and augmentation of distribution substations and associated facilities. It will also facilitate and finance the takeover, rehabilitation and loss reduction of approximately 9,400 kms of lines from BPDB under an agreed transfer and loss reduction program. The agreed transfer program is divided into 3 packages, the first of which covers 4,000 kms of lines over 17 PBSs. The second package of lines cover about 3,000 km in 17 PBSs and the third package covers the remaining 2,400 km of distribution lines in 6 PBSs.

A2. REB Technical Assistance: The project will extend support for institutional development of REB and 45 PBSs, including financial restructuring, socioeconomic program, socioeconomic monitoring and evaluation, environmental safeguards compliance, and poverty reduction aspects of electricity provision.

B1. REB Solar Program: This component provides support for implementing a fee-for-service SHS program to reach an estimated 14,000 households spread over 6 PBSs. Based on the results of this program, it can be extended to other PBSs. In addition to IDA credit, the component will be supported by a GEF grant program for capital cost buy-down.

B2. REB Solar Technical Assistance: REB will receive technical assistance to develop the program, build awareness among recipient communities and PBS staff, establish solar service units, and train and deploy staff to implement the project.

C1. IDCOL Renewable Energy Subloans: A microfinance based direct sales program will be implemented by IDCOL through MFIs and NGOs in cooperation with private sector suppliers to provide 50,000 households with SHS. IDCOL will make sub-loans under a credit program to participating organizations (POs) for refinancing up to 80 percent of loans made to households for purchase of SHS. A GEF grant program will also operate in tandem with sub-loans to overcome solar market development barriers. The credit and grant components would also support development and financing of wind energy, small hydro and biomass sub-projects by private sector, NGOs and communities. These are

envisaged on a pilot basis to introduce and promote renewable energy technologies which are already commercially established in other countries, but not yet reached at commercial operation in Bangladesh.

C2. IDCOL Technical Assistance: Technical assistance is proposed for overcoming barriers to renewable energy market development, project development and administration, capacity building and project monitoring and evaluation. In addition, developing appropriate interventions for ensuring renewable energy market sustainability will be a focus of the technical assistance.

2. Key policy and institutional reforms supported by the project:

An existing policy framework for rural electrification underpins the project. Sixty-seven PBSs now cover nearly 80 percent of the country's rural areas. The Government also pursues an open policy on off-grid options, and three-four companies and NGOs are currently involved in providing renewable energy systems, mainly solar, in Bangladesh. There is no import duty on solar panels and solar system accessories. Key accessories like batteries and fluorescent lamps are manufactured locally, albeit in small numbers. This project would provide an impetus to this nascent industry.

The key policy and institutional reforms that the project has advocated and helped crystallize include the following:

- (i) ***Distribution Rationalization.*** In accordance to the 1993 decision, BPDB retains networks within municipal boundaries and certain 'exempt' institutions (e.g. universities) while handing over the remaining parts of the network to REB/PBSs. The application of the 'municipal boundary' rule leaves many small geographic areas of low load with BPDB, and forces uneconomic supply to such areas from the BPDB network. Furthermore, to supply the adjoining rural areas, PBSs are compelled to establish sub-stations thereby duplicating investments. As a result of project advocacy, the Government has now revised the 1993 decision and established a more rational policy, whereby all pockets areas, including municipalities up to 3 MW loads, can be transferred to the PBSs. In addition, transfers are to take place on an economic basis, allowing entire lines and associated facilities in a pocket area to be transferred in one package as opposed to fragmented handovers. Based on these policy decisions, a transfer program of about 9,400 kms of lines, substations and associated facilities has been finalized and agreed to by the Government, REB and BPDB. The agreed transfer program includes about 30 towns of over 3 MW load which are being transferred on economic grounds, as exceptions to the new policy. These areas will be transferred in three packages - the first package of 4,000 kms of line and facilities spread over 17 PBSs transferred as a condition of Credit Effectiveness; the second package of 3,000 kms of distribution lines and associated facilities spread over another 17 PBSs transferred prior to June 2003; and the third package of remaining 2,400 kms of distribution lines and facilities in 6 PBSs to be transferred by June 2004. Of the 4,000 km of lines to be handed over prior to project effectiveness, nearly 500 km of lines had been transferred by end of April 2002. Transfer of pocket areas in this rational manner to PBSs would increase the overall efficiency and quality of supply, and help several of the PBSs reach commercial viability with concentrated loads and better consumer mix becoming available.
- (ii) ***Loss Reduction Initiatives:*** The REB will establish a special Loss Reduction Team for the newly taken over areas, especially towns with medium to high loads, to assist the General Managers of the concerned PBS to achieve rapid loss reductions and distribution quality improvements. The team will be led by seasoned and experienced former REB/PBS staff who have a demonstrated record of success in loss reduction programs and public relations and will receive outcome-based remuneration under a clearly defined Performance Target Agreement that specifies measurable and time-bound targets. This initiative is expected to bring about rapid improvements in supply quality, efficiency and PBS profitability.
- (iii) ***PBS Financial Facilitations:*** The financial arrangements between REB and PBSs have been based on the principle of 'uniform on-lending terms' to all PBSs. While some PBSs that have good consumer mix have thrived, the uniform on-lending terms have constrained the REB from providing special terms to PBSs that are not so well-placed and require longer time frame to reach viability. The project's intervention has enabled REB to

obtain from the Ministry of Finance a significant policy ruling that it has no objection for REB to offer differentiated lending terms to different PBSs on a case by case basis. A financial restructuring program for a third of the 45 project PBSs that are struggling to achieve financial viability will be implemented under the project once this financial restructuring program is approved by the National Energy Council. In parallel, REB would start scaling down subsidies to PBSs that have crossed the commercial viability threshold and are operating profitably.

REB has recently revised its tariffs for all categories, including the 0-100 kWh per month block of domestic category and irrigation category, to reflect the recent increase in the bulk supply power purchase tariff. REB was also informed by the Ministry of Power that in future, REB should independently determine PBS tariffs as per the provisions of the REB ordinance.

3. Benefits and target population:

The project's primary beneficiaries are Bangladesh's rural population in the project areas. The project will provide electricity access to rural households through grid based and off-grid supply alternatives. Introduction of renewable energy will also engender global benefits in terms of greenhouse gas reductions.

Specific benefits of the project would include::

Rural Households: Significant direct and indirect benefits will accrue from increased access to adequate and reliable supplies of electricity. Direct benefits include improved convenience, safety, and quality of lighting, enhanced ability to operate small appliances, and improvements in indoor air quality resulting from elimination of kerosene smoke. Access to electricity would also lead to improved delivery of basic health and education services in the project areas, thus generating indirect benefits..

Rural Enterprises: These will benefit from increased productivity and income arising from electricity access and use. In particular, availability of electricity will enable irrigation, and thereby promote higher agricultural growth and productivity.

PBS Owner/Customers: All PBS members will benefit from supply quality and operation efficiency improvements as result of project investments.

Social Capital Formation: The project would foster the collaboration and partnerships among PBSs, CBOs, NGOs, MFIs, and private suppliers, thus contributing significantly the social mobilization process and social capital formation.

Global Benefits: The project will displace about 257,664 tons of carbon dioxide (CO₂) over a 15-year life based on avoided kerosene use, yielding a cost effectiveness of US\$ 33.1 per ton.

4. Institutional and implementation arrangements:

Implementation period: The project will be implemented over a five and a one-half year period (FY2003 - FY2008).

Executing Agencies: (i) Rural Electrification Board (REB); and (ii) Infrastructure Development Company Limited (IDCOL). Detailed implementation and operating guidelines for IDCOL are summarized in Annex 12.

IDA Credit: The Government of Bangladesh will onlend a portion of the proceeds of the IDA Credit under standard arrangements to REB for implementing the rural electrification system expansion, intensification and rehabilitation component and PBS administered solar home system program. The balance part of the Credit will be administered by IDCOL under an Agency and Administration Agreement with Government to operate a credit program for renewable energy and RAPSS. The credit program will enable micro-finance institutions and private solar companies to access sub-

loans to refinance loans made by them to households for solar home systems. IDCOL will also be able to make direct sub-loans to developers of pilot renewable energy projects and RAPSS.

GEF Grant: A portion of the grant will be given to selected PBS as installation grants to finance the fee-for-service SHS provision for rural consumers. REB will be eligible to draw the grant on an output basis and pass it through to the concerned PBS. The grant draw is due when the PBS provides documentation to REB evidencing the installation of a SHS and consumer's acceptance. IDCOL will administer a portion of the GEF grant and provide capital buydown to households who purchase SHS. The grant would be drawn and disbursed by IDCOL against claims made by MFIs and suppliers on prescribed documentation and evidence of installation of solar systems and customer's acceptance of it. The grant is designed to contribute to the development of the market and to benefit low-income households. GEF grant will also be available to IDCOL for specified TA with respect to renewable energy promotion, project development and barrier removal activities.

Project coordination: REB will coordinate all implementation activities with respect to the grid component and the off-grid solar component. IDCOL will coordinate the solar and renewable energy program to be implemented through the private sector and MFIs. IDCOL and REB have jointly established a technical committee to coordinate common initiatives such as publicity, solar promotion and quality assurance programs.

Project oversight: Policy guidance for rural electrification and renewable energy will be provided through the Ministry of Energy and Mineral Resources, Power Division. The RAPSS, when developed, are proposed to be regulated under concession arrangements with the sole responsibility of regulation vesting with the concession agency (BPDB or REB). The regulation will be embodied in specific concession agreements.

Accounting, Financial Reporting and Auditing arrangements: The standards and arrangements established under prior rural electrification projects for REB have been effective, and will be continued under the proposed project. These are being further strengthened where necessary and formats for financial reporting and arrangements for audits of new activities such as fee-for-service solar program are being established. Similarly, IDCOL is an established financial intermediary, who is administering the IDA-funded Private Sector Infrastructure Development Project. IDCOL has professional staff, and adequate financial management controls and safeguards are in place. IDCOL will provide quarterly progress reports and in particular provide evidence of continued compliance with the eligibility criteria for institutions participating in the solar home system program. Both REB and IDCOL will submit annual audit reports for the entity and for the project components.

Financial Management: No separate Project Implementation Units (PIUs) will be established to implement this project. Existing departments of REB and IDCOL will carry out project financial management functions under the oversight of their respective Boards.

Funds Flow: IDA credit and GEF Grant funds will be provided to: (i) REB under a Subsidiary Loan Agreement and a Subsidiary Financing Agreement respectively; and (ii) IDCOL under an Agency and Administration Agreement, all on terms and conditions acceptable to IDA. To this end, four Special Accounts, two each for IDA Credit and GEF Grant, will be established in a commercial bank and operated by REB and IDCOL. The Government will allocate counterpart funds for the project on the basis of Annual Development Plan (ADP). Director, Finance of REB and the Chief Executive Officer of IDCOL will be the authorized persons to withdraw IDA Credit proceeds and GEF Grant.

Procurement: IDA financed procurement of goods and works will follow the Bank's Procurement Guidelines. Consulting services and training will be procured in accordance with the Bank's Consultants' Guidelines. GEF financed goods and services will follow the Bank's procedures.

About 90 percent of IDA financing is for purchase of goods, with the balance for small civil works contracts and consultancy assignments. Goods include: line materials, insulators, conductors, distribution transformers, poles, meters

and accessories, solar panels and solar system accessories, vehicles, computers, and office equipment. Contracts for works involve mainly construction and installation of electrical lines, substations and solar home systems.

Most of the procurement under the project will be handled by REB, with an insignificant amount by IDCOL. Both REB and IDCOL have prepared Procurement Plans that are included in the PIP. About 98 percent of the goods will be procured in bulk through international competitive bidding (ICB). Some goods of small quantities will be procured through national competitive bidding (NCB) or shopping as these are unlikely to attract foreign bidders. Goods estimated to cost per contract: (a) US\$ 300,000 or more will be procured using ICB; (b) less than US\$ 300,000 following NCB; and (c) less than US\$ 30,000 using shopping, with the exception of vehicles which will be procured through shopping with contracts value less than US\$ 60,000. Works will be procured following NCB. Depending on the nature of assignments, selection of consultants will be made following quality- and cost-based selection, fixed-budget selection, least-cost selection, single-source selection, and individual consultants methods.

For goods and works, IDA will carry out prior review of the following contracts: all contracts estimated to cost US\$ 300,000 equivalent or more irrespective of procedures and the first two contracts for procurement under NCB regardless of value. All other contracts will be subject to post review by IDA. For consultants' services, IDA's prior review will be required for consultants' services contracts estimated to cost US\$ 100,000 equivalent or more for firms and US\$ 50,000 equivalent or more for individual consultants. All single-source contracts will be subject to prior agreement by IDA.

Annex 6 provides more details in this regard.

D. Project Rationale

1. Project alternatives considered and reasons for rejection:

In continuing REB's 'area coverage concept', one alternative considered and rejected was 'business as usual' that would allow BPDB to supply higher load pocket areas within PBS jurisdictions, limiting the latter only to villages. This alternative was rejected on the following grounds: (i) BPDB's poor commercial and technical performance; (ii) economics of investments – the business as usual approach implies significant duplication of distribution investments; (iii) PBSs cannot provide good supply and customer service with fragmented jurisdictions; and (iv) PBSs cannot achieve financial viability based on rural supply alone.

The Project has considered alternatives to grid based rural electrification to address provision of electricity in areas where the grid is uneconomic. Such areas have been identified for promotion of solar home systems.

With respect to the off-grid component, one alternative was to leave the market for solar to be developed by commercial vendors. However, experience in many countries indicates that commercial vendors alone cannot reach adequate numbers of lower income households and provide credit to consumers. Microfinance institutions have played an important role in solar program successes by enabling suitable rural credit mechanisms. Bangladesh already has a wide network of successful NGOs and MFIs which can potentially expand into credit activities for rural energy. Therefore, the project seeks to ensure participation of these institutions in developing a large scale SHS program for middle and lower income families. Another alternative considered and rejected was leaving out PBSs from the SHS program. Such exclusion was not determined to be feasible as the PBSs currently lack alternatives for consumers situated in areas to which grid supply is uneconomic and have the core institutional infrastructure available to install and service SHS. Consequently the SHS component design involves a variety of alternative suppliers, private dealers, NGO/MFIs and PBSs to enable the most widespread promotion of this technology that is well suited to the low consumption patterns of rural communities in Bangladesh.

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

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)
---------------------	----------------	---

Bank-financed		Implementation Progress (IP)	Development Objective (DO)
Institution Building	Power Distribution (16 Towns) Project (Cr.2016-BD)	S	U
Expand Rural Electrification	Third Rural Electrification Project (Cr.2129-BD)	S	HS
Power Sector Reform Technical Assistance Project	Planned, under preparation		
Ongoing Projects			
Private Sector Delivery of Energy Services	Sri Lanka Energy Services Delivery Project (P010498)	HS	HS
Commercialization of Renewable Energy	India Renewable Resources Development Project (P02449)	S	S
Rural Access Through Renewable Energy	Laos Southern Province Rural Energy (P044973)	S	U
Renewable Energy - Dealer Model	Indonesia Solar Home Systems (P035544)	S	S
Rural Transformation	Uganda Energy for Rural Transformation (P069996)		
Renewable Energy - Off-grid Concessions	Argentina Renewable Energy for Rural Markets (P045048)	S	S
Renewable Energy	China Renewable Energy Development Project	S	S
Planned Projects			
Renewable Energy and Economic Development - Micro-credit and Socio-economic Development	Sri Lanka Renewable Energy for Rural Economic Development		
Renewable Energy Community-based Hydro	Nepal Power Sector Development		
Other development agencies			
Transmission Expansion and Power Sector Reform	Ninth Power (ADB)		

System Development and Power
Sector Reform

Dhaka Power System Upgrade
Project (ADB, under
Preparation)
West Zone Power
Development Project (ADB)

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

3. Lessons learned and reflected in the project design:

 Sector & Themes  KM

First, the project takes into account the recommendations of a Bank review *Rural Electrification: A Hard Look at Costs and Benefits; OED Précis, May 1995*. Grid extension will only be selected for areas where it is the demonstrated economically viable option under conservative assumptions of economic costs and benefits. Additional lessons that have influenced the project design are from *Rural Energy and Development, September, 1996* which recommends five main principles for better access to electricity: consumer choice, cost reflective pricing, overcoming first cost barriers, local participation, and good sector policies.

Second, knowledge acquired from similar projects and studies including; *India Renewable Resources Development, Sri Lanka Energy Services Delivery, Indonesia Solar Home Systems, Indonesia Renewable Energy Small Power, Poverty and Gender in Indonesia and Sri Lanka, May 2001* have been considered.

Third, the Energy Services Delivery Project in Sri Lanka has offered valuable lessons for the proposed project. The design is flexible, with each supervision mission being viewed as an opportunity to adjust project design to address emerging problems and issues. The grant design and delivery models are simple and easy to implement, credit lines and

grant administration are commercially managed and industry associations and advocacy groups are promoted for guiding industry growth and directions.

4. Indications of borrower commitment and ownership:

The Government is strongly committed to increasing electricity access in rural areas. The constitution of Bangladesh requires the state to adopt effective measures to bring about rural transformation *inter alia* through electrification (Article 16). After a long history of reliance on REB/PBS led grid based development, the Government has recently adopted a policy of supporting renewable energy and private sector involvement. A number of enabling and facilitating policy decisions have been made to create the right conditions for greater and more rapid access to electricity in rural areas. (see section C 2 above).

5. Value added of Bank support in this project:

The success of the rural electricity supply system in Bangladesh has prompted widespread support from donors, including USAID, ADB and JBIC. This is a welcome development since the investment requirements of this sub-sector are very large. The Bank's comparative advantage lies largely in playing a catalytic role by assisting the Government to establish an appropriate policy framework to guide the rural electrification program. The Bank's involvement will enable the establishment of appropriate standards for selection of grid and off-grid options, thereby contributing to the sustainability of the rural electrification program.

The Bank's and GEF's world-wide knowledge with regard to practical experience in the field of renewable energy, based on related projects being undertaken in Asia, Africa and Latin America, will enable transfer of established international best practice as well as valuable emerging concepts for adaptation in Bangladesh. The project team brings together professionals with a range of country and sector expertise – with experience of rural electrification and renewable energy projects in Philippines, Zimbabwe, Vietnam, South Africa, Thailand, Laos, Cambodia, Indonesia, Pakistan, India and Sri Lanka.

E. Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (see Annex 4):

Other (specify) NPV=US\$ million; ERR = 16 % (see Annex 4)

(a) Grid Electrification: The cost benefit analysis undervalues benefits since certain benefits are difficult to quantify. These are often excluded from the benefit valuation. Examples of the benefits not usually accounted for include improved safety, better health, improved education, and better opportunities for leisure. Recent studies also conclude that past methodologies used for benefit assessment of rural electrification are often inadequate, resulting in substantially underestimated benefits. Conventional methods can possibly miss as much as 60 percent of total benefits. One reason for the incompleteness of previous estimations of electrification benefits is a failure to define “benefits” in a way that permits valid monetary interpretation. For example, many previous estimates defined benefits as net revenues received by the electricity provider. While relevant for the assessment of the financial viability of the provider, this measure fails to capture the full economic benefits. To overcome such benefits undervaluation, this project will define net benefits as the difference between what a rational user (household or business) would be willing to pay for electricity supply less the actual cost of supply.

Based on this approach the average willingness-to-pay is estimated to be Tk 4.80/kWh. This is still an underestimation as it doesn't reflect other benefits like safety, better lighting, better indoor air quality, convenience, etc. Using the above estimate the economic evaluation of the grid component would have a robust EIRR of 16 percent over a period of 20 years. The detailed assessment and sensitivity analysis are provided in Annex 4.

(b) SHS: The cost of off-grid SHS compares favorably with the costs of grid expansion. The solar component under this project would provide electricity to nearly 64,000 households at a total investment cost of about US\$ 27.6 million, i.e.

US\$ 430 per household. Extending the grid to marginal service areas in Bangladesh would cost about US\$ 400 per connection as per REB's estimates, not counting the cost of generation investment of US\$ 500 per KW. It needs to be pointed out that the grid electricity provides a different and higher level of service to the consumer and has a much higher impact on economic development and social well-being than the electricity made available from SHS, which meets basic needs, mainly lighting. However, as a large majority of rural households are low-intensity consumers using less than 40 kWh per month, therefore the level of service from SHS when used in conjunction with fluorescent lamps is a reasonable alternative.

2. Financial (see Annex 4 and Annex 5):

NPV=US\$ million; FRR = 5 % (see Annex 4)

The financial rate of return is low because of the high costs associated with rural electrification and an assumption that the current regime of less than cost-reflective, administered tariffs shall continue. Financial returns for PBSs are also low because of slow load growth, which results from the electricity use in rural areas being mainly focused on consumptive use. In order to mitigate the risks of low consumer and load growth, the project is supporting a REB initiative to establish a socioeconomic monitoring cell which would work with the PBSs in promoting productive consumption of electricity in rural areas. This initiative is likely to produce positive results both in motivating rural households to gain access and using electricity for income generation and life-quality improvements.

Fiscal Impact:

The REB/PBS system receives capital subsidies in the form of grants for Government funds and concessionary on-lending terms for donor funds. Under this project about US\$ 90 million equivalent, spread over five years, would be provided by the Government as grant to REB for investments.

Impact on the Poor: As 90 percent country's poor are concentrated in the rural areas, the project has a very strong pro-poor focus. The REB and PBS system has a good record of integrating poor households into the distribution system through low initial connection cost. This focus has also been maintained in designing the solar program to promote smaller systems that poor households can afford.

Credit Availability: Debt finance for renewable energy developers and consumers is constrained. Part of this problem arises from the general limited level of development of Bangladesh's financial sector, and part of it arises from the lenders' perspective that the risks associated with these activities are too high or provision of SHS does not lead to income generation. Furthermore, the availability of liquidity with MFIs is constrained and unless this is enhanced, the MFIs can reach only a small proportion of households. Through the project interventions, both the risk perception and credit availability are being addressed. Technical assistance will enable banks as well as micro-finance institutions to address constraints in providing debt finance on commercial terms that meet the needs of households and the renewable energy industry. The credit line will provide up to 80 percent refinancing to MFIs for the solar program.

Solar Program Grants: The project proposes a flexible grant regime that will decline in step with increasing solar market development. Over a five year period, the household grants for the micro-finance program are expected to decline from US\$ 90 per system to about US\$ 50 per system. It is assumed that by the end of the project period, affordability will have improved as system prices will have come down and commercial financing would be available and feasible. The reduced grant requirements could also be easily met through other sources such bilateral assistance, carbon financing mechanisms or government programs.

3. Technical:

There are no significant technical issues. The project design incorporates two safeguards as follows:

- (i) The transfer of distribution areas from BPDB to REB/PBSs is based economic and technical considerations. All pocket areas to the extent of 3 MW have been identified and included in the agreed transfer program. REB has prepared the network intensification and rehabilitation works on this basis. This approach will enable cost-

effective development of the rural electricity supply system. The existing REB guidelines for extension of lateral feeders to serve new areas have also been revised to improve financial profitability. The revenue criteria has been raised to 36,000 takas per km per annum for selection of new lines; and

- (ii) A SHS quality assurance program has been developed by the implementing agencies in collaboration with the Bangladesh University of Engineering Technology and the Bangladesh Standards and Testing Institute. The Technical Committee would accept certifications from recognized labs worldwide for qualifying solar photovoltaic systems, while developing local capacity in REB to test domestically manufactured components like batteries, bulbs and wiring etc.

4. Institutional:

4.1 Executing agencies:

The grid components would be executed by REB. The non-PBS off-grid components will be executed through IDCOL. Both are well established entities with successful track record in program/project implementation.

4.2 Project management:

No separate Project Implementation Units (PIUs) will be established to implement this project. Existing departments of REB and IDCOL will manage the project management under the oversight of their respective Boards.

4.3 Procurement issues:

The Country Procurement Assessment Report (CPAR), broadly accepted by the Government in February 2001, stated poor procurement as a generic problem in Bangladesh. The CPAR recommended for procurement reform with a series of actions. The Government has embarked upon public procurement reform with IDA technical assistance (*Public Procurement Reform Project -PPRP*). The project has adequate provision for providing procurement training to public sector staff.

For the proposed project, most of the procurement totaling about US\$ 315 million will be handled by REB. It has experience of implementing IDA supported projects and has adequate capacity to manage project procurement. It has a Procurement Department, headed by a Director, who is assisted by three Deputy Directors. The Director and one Deputy Director are conversant with the Bank's procurement procedures. Considering the volume of procurement one additional procurement specialist is needed to manage project procurement with specific experience in Bank-related procurement. Given the track record of REB and the institutional capacity, the project related procurement risk is average.

To mitigate the procurement risks associated with REB and to strengthen procurement management capacity, the following arrangements have been made:

REB has agreed to make available qualified additional personnel for procurement.

REB will actively participate in the procurement management capacity improvement activities under the PPRP.

IDCOL's procurement will be limited to small equipment and consultancy assignments of about US\$ 5 million. IDCOL has some experience in using the Bank's Procurement Guidelines. This will help them to carry out the procurement in accordance with the Bank's procedure.

4.4 Financial management issues:

Adequacy of financial Management: The project has a good financial management system which is adequate to account for project resources and expenditure. The two implementing agencies, REB and IDCOL have maintained a good track record in terms of operational and financial management and have been exposed to the Bank's disbursement procedures and financial reporting requirements;

REB has demonstrated good financial discipline in the closed IDA project Cr. 2129 and all audit reports including those of PBS were submitted in a timely manner; IDCOL, being an implementing agency of the on-going IDA credit Cr. 2995 has computerized financial management system and has been complying with all financial covenants. Both the agencies have Financial Management Manuals which outline the project financial management system, which is adequate to meet Bank's FM requirements;

REB and IDCOL maintain computerized accounting system using double entry bookkeeping principles and accrual basis of accounting, which generate timely Financial Statements; and
In order to ensure that the financial management system functions effectively, REB need to strengthen Financial Controller's office with an additional specialist having experience of working on IDA projects. REB has agreed to do so before the Credit becomes effective.

Audit: The annual financial statements of REB would be audited by the Comptroller and Auditor General (C&AG). Private sector auditors will be engaged to carry out annual audits of: (i) REB's financial statements with respect to the projects and (ii) financial statements of IDCOL and its financial statements with respect to the project; according to TORs acceptable to IDA.

Funding Arrangements: IDA funds will be channeled to two special accounts in a commercial Bank and will be operated by REB and IDCOL on terms and conditions acceptable to IDA.

REB and IDCOL will receive Global Environment Facility (GEF) Grant for which two separate Special Accounts will be maintained by the recipients.

The GOB will allocate counterpart funds for the project on the basis of annual development plan (ADP). The Finance Division of the Ministry of Finance would provide IDA and GEF funds to REB under the REB Subsidiary Loan Agreement and REB Subsidiary Financing Agreement respectively. The Finance Division will release funds in local currency on a quarterly basis upon request of REB.

IDCOL's requirement of counterpart funds would be met through its own resources and cost-sharing from beneficiary POs. IDCOL will manage the credit line and GEF grant funding on the basis of an Agency and Administration Agreement to be entered into with the Government. IDA and GEF funds will be used by IDCOL to refinance subloans and provide subgrants to NGOs and MFIs.

5. Environmental: Environmental Category: B (Partial Assessment)

5.1 Summarize the steps undertaken for environmental assessment and EMP preparation (including consultation and disclosure) and the significant issues and their treatment emerging from this analysis.

Environmental Benefits: The project is expected to have positive environment benefits. The global objective is to reduce atmospheric carbon emissions through removing barriers and reducing costs for renewable energy. Locally, the replacement of kerosene and other fuels used for lighting by SHSs would enable corresponding reductions in indoor air pollution. Expansion of renewable energy sources like wind and mini hydros would likewise reduce the need to burn natural gas or oil for power generation. The technical assistance and financial support which would be provided to improve existing diesel based small generation systems in remote rural areas would result in efficiency improvements and better housekeeping, leading to overall reduction of emissions. Also, institutions responsible for project implementation – REB, the associated PBSs and IDCOL - have demonstrated a high degree of social and environmental sensitivity and accountability in prior operations.

Environmental Safeguards: Activities to be financed under the Grid Component of the Project that have a potential to trigger environmental safeguard policies are, expansion, intensification and rehabilitation of electricity distribution

systems in rural areas and the small power generation sub-component. While direct IDA investments will be made in the distribution system rehabilitation and expansion sub-component, the small power generation component will involve only the provision of technical assistance (TA) and possibly investments in associated basic infrastructure development such as the provision of gas supply facilities to plant locations (in accordance with REB's program of support for private sector financed small power generation). Regardless of IDA finances not being directly involved in the small power generation plants, REB is required to ensure that World Bank's environmental safeguards are complied with by the private sector generators, since the project will be involved in provision of TA and possibly investments for supporting infrastructure. Under the off-grid component, the sub-components that may trigger World Bank's environmental safeguard policies are community or private sector initiatives involving mini-grids (distributed supply options), which would include small diesel or gas based generation systems (in the range of 1MW to 10 MW systems), micro-hydro and wind energy projects which may be operated either by the private sector or cooperatives.

Adverse Environmental Impacts: It is anticipated that the negative environmental impacts arising out of this project are not significant: (i) minor and temporary land disturbances arising out of laying of new distribution lines and only in cases where such lines do not follow existing way-leave along roads, streams, etc.; (ii) construction of substations, to be undertaken on unproductive, government or community donated lands; (iii) few pilot mini hydro and wind energy plants; and (iv) small scale gas or diesel based power generation and distribution systems in remote rural areas for which existing environmental standards (both Government and World Bank) will apply. The General Environmental Guidelines in the World Bank's Pollution Prevention Handbook will form the basis for identifying the mitigatory measures for grid and off grid sub-projects except for the RAPSS where the guidelines for thermal power plants will be used.

New Distribution Lines and Substations: The REB will be the main agency responsible for overseeing the design and implementation of new distribution lines executed by the respective PBS. The current practice is to limit land requirements by using existing way-leave, such as following roads and pathways or paddy fields. In respect of new substations, the practice is to use government lands or those made available by the community. Once the traces for the distribution lines have been identified, the extent of environmental impacts will be known. Distribution routes will not go through forest or wildlife reserves as well as other natural habitats. Potential impacts from construction and extension of distribution lines could result from clearing of vegetation from sites. Substations will be the primary source of construction related impacts under the project.

Pilot mini-hydro plants, wind energy and SHS systems: It is envisaged that the project would support at best less than five mini-hydro and wind energy pilot projects of less than 5 MW capacity each. These sub-projects may result in some minor environmental impacts, particularly with regard to the partial dewatering of a section of the river bed from the intake until the water is returned to the river downstream of the powerhouse and consequent impacts on aquatic life in the dewatered section, potential soil erosion caused by flushing flows discharged from sedimentation basins and by overflows at the forebays, potential ground instability caused by canal/pipe construction, cutting of trees for use as power poles in micro hydro projects and potential interference with bird migration patterns in wind energy projects. There is virtually no adverse environmental impacts from SHS of the size financed under this project. However, disposal of batteries used in conjunction with SHS pose an environmental hazard that needs to be addressed.

Small-scale Power Generation Projects: Environmental impacts from both the grid connected small power generators as well as RAPSS have the potential for adverse environmental impacts such as air pollution due to combustion emissions and noise pollution, which would need mitigatory measures incorporated into the sub-project designs. The Guidelines for Thermal Power Plants in the World Bank's Pollution Prevention Handbook will form the basis for integrating mitigatory measures into the sub-project designs.

5.2 What are the main features of the EMP and are they adequate?

Environment and Social Assessment Framework: Since sub-projects, particularly with regard to grid connected small power plants, micro and mini hydro plant locations and developers as well as wind energy sites and associated distribution line traces have not been identified and/or finalized, site specific EAs are not possible at this stage. In view of this, an

Environmental and Social Assessment Framework (the Framework) which will serve as a template and form the basis of undertaking site and sub-project specific EAs has been prepared jointly by REB and IDCOL. The Framework is based on Bangladesh's Environmental Protection Act 1 of 1995 and Environmental Protection Rules of 1997, as well as the World Bank's applicable Safeguard Policies. In accordance with the Framework, all sub-projects financed under the Project need to be subject to an Environmental Assessment (an Initial Environmental Examination or a full Environmental Impact Assessment, as determined by the Department of Environment (DOE) based on the significance of environmental impacts). Project specific EAs would include alternatives analysis of sub-project designs and locations, adequate mitigation, fair compensation, as well as plans and rules of operations for environmental management, which will be incorporated in a sub-project specific Environmental Management Plan (EMP).

Adequacy of Government of Bangladesh's Environmental Clearance: The Government's environmental clearance process is mandatory under the Environmental Conservation Act 1 of 1995 and Environmental Conservation Rules of 1997, therefore, all sub-projects and components financed under the Project would require environmental clearance. While the EIA process is largely similar to the World Bank's OD 4.01, there is a significant deviation in that the Government's environmental guidelines and legislation do not require mandatory public consultation and disclosure, although it is encouraged. Regardless, REB and IDCOL have agreed with IDA that public consultation will take place on all sub-projects and components financed under this project. REB has placed the Environmental and Social Assessment Framework for public review and comment, prior to its finalization.

5.3 For Category A and B projects, timeline and status of EA:

Date of receipt of final draft: February 5, 2002

5.4 How have stakeholders been consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed environment management plan? Describe mechanisms of consultation that were used and which groups were consulted?

Consultation mechanisms with stakeholders established by REB are in place through the PBSs (which are consumer-owned cooperatives) and will be continued. REB will ensure that consultations on sub-project EAs are conducted at the PBS level. Existing consultation and community relations framework of REB and IDCOL will be documented and improved upon to meet the disclosure and consultation requirements of the project. IDCOL has adequate consultation and external monitoring provisions in its Environmental and Social Appraisal Manual; and these would be followed in respect of sub-projects under the components being implemented by it.

5.5 What mechanisms have been established to monitor and evaluate the impact of the project on the environment? Do the indicators reflect the objectives and results of the EMP?

Since the project proponent in the Grid Connected component will be the PBSs, the EA preparation will be the responsibility of the respective PBSs. The actual preparation of the EA will be undertaken initially by a national consultant who will be assisted by PBS staff, until such time that the PBSs will develop adequate capacity to undertake the EA themselves. Training would be provided under the project for PBS staff to strengthen their capacity in this regard. The Environmental and Social Assessment Framework will be used by the PBSs as the basis for preparation of the EAs and will be submitted to REB for review and approval. The REB has recently established an Environmental Compliance Cell, headed by the Chief Engineer (Planning) and consisting of two officials with post graduate degrees in Natural Resources. Capacity building of the Environmental Compliance Cell will be provided under the proposed project in the form of a national consultant for a limited period and training in environmental impact assessment and monitoring for the permanent staff of the Cell. REB's Environmental Compliance Cell will review the EAs submitted by the PBSs to ensure that the EAs conform to the agreed Environmental and Social Framework as well as to the technical quality of the assessment. The Chairman of REB has identified a Board Member who will be finally responsible to signing off on the

adequacy of the EA, which will then be submitted to DOE as required under the Environmental Conservation Act of 1995 and the Environmental Conservation Rules of 1997.

The off grid component would be implemented by the private sector where the project would provide technical assistance and possibly the provision of associated basic infrastructure development costs for RAPSS. The 1 MW to 10 MW power generation plants that would be established under RAPSS would be undertaken by the private sector with possible funding from IDCOL. Excluding SHSs, the potential for adverse environmental issues is greater in the off-grid component than in the grid component. However, IDCOL has a proven track record of ensuring environmental compliance under its current activities of financing large scale infrastructure projects in Bangladesh. IDCOL has developed a detailed Environmental and Social Appraisal Manual which outlines the environmental and social appraisal procedures and guidelines necessary to ensure that IDCOL loans are made in accordance with the environmental, social and resettlement policies established by Government and the World Bank. The detailed Environmental and Social Appraisal Manual was reviewed and approved by the World Bank during establishment of IDCOL under the IDA financed, Private Sector Infrastructure Development Project (PSIDP) in 1997. Therefore, all off-grid components under this project will follow the environmental and social appraisal procedure laid out in the Manual. The responsibility of preparation of the EA is with the project developer and not IDCOL. Once the EA is prepared, IDCOL reviews the document to ensure compliance with Bangladesh Acts and Rules mentioned earlier and with World Bank guidelines. In addition, IDCOL's loan approval is contingent upon DOE's environmental clearance. The technical capacity to undertake the review of the environmental and social assessment of sub-projects at IDCOL is addressed adequately under the PSIDP, therefore, will not be addressed under this project.

6. Social:

6.1 Summarize key social issues relevant to the project objectives, and specify the project's social development outcomes.

Positive Social Impacts: The project is expected to yield positive social impacts through improvements in the quality of power supplies and service. Greater access to electricity would mean higher levels of rural growth and poverty reduction, as well as socioeconomic transformation and marked improvement in the quality of life in villages all over the country. Studies indicate that there has been strong positive impacts in terms of improving socioeconomic status of electricity users, particularly women and the poor. The social indicators of users, e.g. health, education, awareness and participation in social activities, are higher than others in the same socioeconomic category. Electricity facilitated households, contribute positively to women's security, income generation and awareness by increasing the rural populations access to modern media e.g. radio and TV. The project's proposed credit lines would enable NGOs to increase their reach and provide electricity services, especially to hard-core poor living on marginal land and remote areas and ethnic minorities. The social development outcomes of this project would include improved quality of life and sustainable poverty reduction; equity and inclusion in the society; strengthening of social capital and cohesion; and promotion of accountable and transparent institutions. Based on the experience of similar projects in South Asia, it is very unlikely that individual sub-projects to be financed under this project will involve any resettlement or large scale land acquisition since the current practice is to limit land requirements by using government lands or those made available by the community.

Social Safeguard Issues: While every effort will be made to limit land acquisition by using unencumbered government land or those made available by the community, negative social impacts/social safeguards may be triggered if there is a need for land acquisition for: (i) laying of new distribution lines and (ii) mini-hydro and wind energy pilots; especially if such acquisition leads to physical relocation, loss of shelter or assets and incomes. In such instances, proper analysis of social impacts and appropriate mitigation measures would be carried out. As pointed out earlier, the policy and practice is to use existing rights of way alongside public paths/roads and paddy field lands in establishing distribution lines. Village settlements and displacement of houses are avoided. However, if there are issues of resettlement in individual sub-projects, these would be evaluated under the agreed Environmental and Social Assessment Framework and suitable mitigatory actions will be taken while compensation will be provided. No land issues are anticipated in the RAPSS projects (small generation) as these will be implemented by private sector on their own land or on land purchased commercially.

The social assessment of sub-projects and mitigation plans will follow the Environment and Social Assessment Framework described earlier (see 5.2). Assessments would be done to examine the potential social impacts, identify and recommend mitigation measures and develop a Resettlement Action Plan (RAP) if needed and/or a Vulnerable Communities Development Plan (VCDP) in accordance with the Bank's Operational Directives 4.30 and 4.20 and Government guidelines. Social assessments will be carried out as an integral part of the feasibility studies for each sub-project to maximize benefits and mitigate adverse impacts of the sub-projects. As detailed in the Framework, these will consist of: (i) early screening and social impact assessment; (ii) public consultations; (iii) census and baseline socioeconomic survey of potentially affected people; and (iv) preparation of a RAP and/or VCDP, if applicable.

The sub-project developer will carry out the social assessment in accordance with the principles and procedures laid out in the Environmental and Social Assessment Framework. The process for REB and IDCOL has been described earlier (see 5.5). However, if a RAP and/or VCDP is necessary for any sub-project, the EA including the RAP and/or VCDP as the case may be, will be reviewed and cleared with IDA prior to sub-project approval and disbursements.

Social Development Outcomes and Monitoring: Based on the socioeconomic development indicators summarized in Annex 1, the project proposes a mechanism and process to systematically monitor and evaluate the impact of rural electrification in Bangladesh. The monitoring program will: (i) develop baseline indicators during the first year of the project implementation; (ii) monitor socioeconomic changes and develop insight into socioeconomic impact of rural electrification through periodic evaluation of the chosen indicators; and (iii) disseminate and use evaluation results to assess the performance of the rural electrification program on socioeconomic outcomes.

6.2 Participatory Approach: How are key stakeholders participating in the project?

The REB/PBS system is characterized by an established participation and consultation process. Social involvement in rural electrification is part of the cooperative system of delivery of electricity services. Member involvement in PBS administration is encouraged through a number of channels. Prior to formation of the PBS, members are involved directly in the organizational process with direct input provided via focus group meetings and membership drives. Member services personnel from REB organize membership committees to encourage community participation in the organization and formation of the PBS. Prior to energization and for all years afterward, members are involved in election of board officers during annual general meetings. Members are kept aware of key issues by providing information in the form of customer information bulletins that are circulated when bills are distributed each month. Information is also distributed in area consumer meetings and through village electrification committees. The village "advisor program" is a relatively new arrangement where community leaders are invited to participate on a periodic basis with PBS member representatives to discuss the means by which customer concerns can be most effectively addressed by PBS management. The village advisors meet every six months and are most often selected from the community of school teachers serving their respective communities.

Another issue that is handled well by the REB/PBS electrification program is the coverage of households in an electrified village. The evidence from other countries indicate that more extensive coverage of rural households leads to greater equitability and higher returns. The "area coverage" concept adopted by REB facilitates access and has proven quite successful in yielding satisfactory returns on investment in distribution assets. The project will build on these positive features and increase emphasis on 'intensification' of network coverage (i.e. more laterals rather than extended 'back bone' lines to new areas) to encourage greater electrification in the villages already supplied.

Furthermore, NGOs and MFIs are playing a lead role in implementing the solar program through grassroots mobilization and micro-finance mechanisms. This adds to the participatory aspect of the project. The project preparation process included extensive consultations with various stakeholders and participants. Two major studies were undertaken by the Bank and implemented through Bangladesh based NGO consultants for project preparation. In both these studies the consultants identified stakeholders from villages, PBSs and NGOs and organized discussions/demonstration visits.

In order to expand the market for solar home systems, the project will encourage participation of NGOs and solar dealers/manufacturers. A launch workshop, planned for fall 2002, will bring together international solar manufacturers, local dealers and Micro Finance Institutions (MFIs)

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

The project would seek to document the consultation and communication process, pointing out what works and where it needs to be supplemented. In addition to the strong participatory nature of the rural electrification program as outlined above, the involvement of community based organizations and micro-finance institutions like BRAC and Grameen would be facilitated in improving the productive use of electricity and promote greater grass-root participation in formulating rural energy solutions. See 6.2 above for more details.

6.4 What institutional arrangements have been provided to ensure the project achieves its social development outcomes?

In order to ensure that the project achieves its social development outcomes, there would be provision for continuous socioeconomic monitoring through a special unit established in REB. The unit will monitor and evaluate socioeconomic indicators on an on-going basis through surveys and measures of physical achievements and socioeconomic benefits. ToRs for the proposed socioeconomic monitoring unit and provision of TA to operate the unit have been included in the project.

6.5 How will the project monitor performance in terms of social development outcomes?

Please see above (6.4).

7. Safeguard Policies:

7.1 Do any of the following safeguard policies apply to the project?

Policy	Applicability
Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	Yes
Natural Habitats (OP 4.04, BP 4.04, GP 4.04)	No
Forestry (OP 4.36, GP 4.36)	No
Pest Management (OP 4.09)	No
Cultural Property (OPN 11.03)	No
Indigenous Peoples (OD 4.20)	No
Involuntary Resettlement (OP/BP 4.12)	Yes
Safety of Dams (OP 4.37, BP 4.37)	No
Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	No
Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)*	No

7.2 Describe provisions made by the project to ensure compliance with applicable safeguard policies.

In addition to the safeguards and monitoring provisions described earlier, the following three conditions have been introduced to ensure compliance with applicable safeguard policies. These are:

- (i) Any sub-projects involving resettlement, land acquisition or power generation of capacity exceeding 5 MW need to be reviewed and cleared by IDA;
- (ii) Once distribution line traces have been identified in each PBS, an EA should be undertaken which will be subject to public consultation prior to DOE clearance, and IDA needs to be notified of the consultation process; and

- (iii) Within two years of credit effectiveness, appropriate standards should be developed for recycling of batteries used for solar home systems.

The first two conditions have been included in the Environmental and Social Framework, along with suitable legal covenants with the Government, the REB and IDCOL for compliance. The third condition has been included as a dated covenant in the legal agreements. Project TA has been provided to facilitate development and implementation of such standards.

F. Sustainability and Risks

1. Sustainability:

The project's sustainability is being ensured through the partner organizations that remain involved in pursuing the development objectives. Institutions like the PBSs, REB and NGOs/MFIs believe in long term planning and commitment to rural development and have a good record of implementing and sustaining development efforts. The strong rural credit culture and willingness to pay-for-services, that manifests in high loan recovery rates by MFIs and electricity bill collections by PBSs, will ensure that the project outcomes are financially sustainable.

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

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
1. Consumer demand for grid services will remain strong, connection rates will improve and new consumers in served areas can be motivated to use electricity.	M	Focus on socio-economic work by PBSs in association with local NGOs and community-based organizations. TA for socioeconomic focus being provided.
2. With improved performance PBSs can invest more in expanding supply and providing better service and PBSs are able to provide reliable supply to enable consumers benefit from electricity use.	M	REB is undertaking loss reduction program; better financial management in PBSs and continued regulatory oversight of REB.
3. Households adopt solar as viable alternative, program is able to supply systems in an affordable manner, microcredit is available to finance Households; and that the supply chain for SHS is rapidly developed.	S	(i) Barrier removal activities undertaken with GEF support; (ii) engaging established micro-credit institutions in solar program; (iii) capacity building for participating partner organizations; (iv) Quality assurance program being established.
4. Sites are located in areas where electricity demand is available or connectivity to grid is possible and are demonstrated as viable options.	M	IDCOL to work closely with potential developers and electricity sector institutions to develop projects. TA support provided to finance high development costs.
5. Households prefer to use electricity for productive uses and have capital to invest in income earning activities.	M	PBSs have to work closely with community based organizations and agencies involved in rural development. TA support provided to enable this coordination and implementation.
From Components to Outputs		
1. Timely hand over of BPDB lines and	H	Government commitment to continue effective

facilities carried out according to economic rationalization principles; economic criteria for new line selection is followed; loss reduction program meets targets and adequate generation is available for supply.		coordination of area rationalization between BPDB and REB; well-defined agreed program developed before project effectiveness and disbursements tied to achievement of annual hand-over targets.
2. Barriers of awareness building information dissemination, marketing and consumer service can be effectively addressed.	M	GEF support for barrier removal activities is included and the program has been developed through participation by NGOs, MFIs and PBSs. A pool of suppliers and service providers is developing and would be facilitated by the project.
3. Rural consumers are able to afford and pay for alternatives.	M	(i) Project relies on successful micro-credit models; (ii) barriers to high capital costs are being addressed by project interventions; and (iii) grants are dollar-denominated to mitigate exchange risk.
4. Participating organizations and partner groups are able to mobilize interest in solar and establish effective business models.	S	(i) Criteria for selection of partner organizations is based on successful track record; (ii) support for capacity building interventions where needed; and (iii) long-term capital requirement has been addressed through IDA credit line and grant financing.
5. Government provides adequate counterpart funding for implementing the project components	S	REB and the Government will enter into a Subsidiary Loan and Financing agreements, and Government and IDCOL will enter into an Agency and Administration Agreement, to ensure adequate funding
Overall Risk Rating	S	Maintaining high supervision standards, close liaison with counterparts and stakeholders, and relying on the ability of the implementing institutions to address issues and problems as they arise.

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

3. Possible Controversial Aspects:

Historically the transfer of lines and areas from BPDB to REB has been controversial. A comprehensive transfer program has been agreed to between the BPDB, REB and the Government and communicated to the Bank. This minimizes the risk of future disagreement. However, timely and effective implementation of the transfer program continues to be a risk and would be closely monitored during project supervision. The risk has been further addressed by tying disbursements to actual implementation progress of the transfer program.

G. Main Credit Conditions

1. Effectiveness Conditions

- (a) The Government has cleared at least 25 percent of its arrears to REB, current outstanding at about 400 million takas (equivalent to about US\$ 7.0 million).

- (b) REB has established a special task force for the Loss Reduction Program, in form and substance satisfactory to the Bank.
- (c) REB has: (i) furnished to the Bank for its review and approval the financial restructuring package in respect of the 45 project PBSs; and (ii) completed the take over of the lines, areas and associated facilities from BPDB as detailed in the first package of the agreed Transfer Program.
- (d) IDCOL has entered into at least three Participation Agreements with Participating Organizations (NGOs/MFIs/private companies), and these agreements are legally binding upon the IDCOL and the Participating Organizations concerned respectively, in accordance with their terms.
- (e) The IDCOL Project Agreement and the REB Project Agreement have been duly authorized or ratified by IDCOL and REB respectively, and are legally binding upon IDCOL and REB respectively, in accordance with their terms.
- (f) The IDCOL Agency and Administration Agreement, the REB Subsidiary Loan Agreement and the REB Subsidiary Financing Agreement have been duly executed, and authorized or ratified by Government and IDCOL, and the Government and REB respectively, and are legally binding upon the Government, IDCOL and REB respectively, in accordance with their terms.

2. Other [classify according to covenant types used in the Legal Agreements.]

In addition to the standard financial and legal covenants relating to timely reporting of project progress and use of funds, timely conduct of audits, diligent accounting and reporting, and compliance with environmental and social safeguards and fiduciary requirements, the following implementation covenants are proposed:

Government

- (a) Government is to ensure that the Area Rationalization and Transfer program is implemented in a timely and agreed manner. Disbursements from the Credit are tied to successful implementation of the transfer program. The credit effectiveness condition, among others, is to transfer about 4,000 km of distribution lines from BPDB to REB covering 17 PBSs. Upon effectiveness of the credit, disbursement with respect to Goods Category 2a (i) will be available, up to a maximum of US\$ 75.0 million equivalent. Subject to the satisfactory handover of the second package of lines (amounting to about 3,000 km in 17 PBSs) in the agreed transfer program, the next category of goods 2a (ii) up to a maximum of US\$ 45.0 million will be available. The remaining credit proceeds under category goods 2a (iii) will be available for disbursement on the successful transfer of the third package of remaining 2,400 km of distribution lines in 6 PBSs.
- (b) The Government will ensure that all outstanding electricity dues to REB are paid: (i) 25 percent of outstanding by Credit Effectiveness; (ii) and 50 percent of outstanding electricity billing dues. The date in sub-clause (b) would read June 30, 2004 to pay all remaining outstanding electricity dues to REB 25 percent of outstanding by June 30, 2003; and (iii) balance 50 percent of outstanding electricity billing dues to be paid up by June 30, 2004. Furthermore, the Government will establish an appropriate payment mechanism, satisfactory to IDA, for timely settlement of electricity dues to PBSs for electricity supply to government departments and agencies, and to religious institutions, by December 31, 2002.
- (c) Government shall, in consultation with REB and IDCOL, develop appropriate standards for recycling of batteries used for solar home systems within the first two years of the project implementation.

REB

- (a) REB's internally generated funds are not less than 1.5 times its debt service requirements.
- (b) REB's annual operating expenses and the amounts paid by REB as interest and other charges on its debt do not exceed 66 percent of the aggregate amounts received by REB as interest on its loans and investments and as other revenues.
- (c) REB shall furnish its draft annual performance targets of 45 PBSs to the Bank for its review and comments by August 10 of each year. Upon receiving Bank's comments, REB shall enter into agreements with the 45 PBSs on their performance targets and shall share the Performance Target Agreements (PTA) with the Bank for its information and record.
- (d) REB shall ensure that it takes all necessary measures to be in compliance with the environmental and social impact assessment, mitigation, disclosure, and consultation provisions under the Environment and Social Assessment Framework. Furthermore, REB will provide for IDA's review and approval, environmental assessments including resettlement action plans, in respect of all distribution lines and associated construction activities involving land acquisition or resettlement; and arrange to carry out timely and adequate public consultations at the PBS level in respect of the environmental assessments prepared by it, prior to seeking DOE's clearance.

IDCOL

- (a) IDCOL will carry out an annual review of the eligibility of Participating Organizations and report the results of such review to the Bank.
- (b) No disbursements against subloans (or subgrants), will be made until IDA is satisfied that the subloan (or subgrants) has been made in accordance with the eligibility criteria and procedures and on the terms and conditions set forth or referred to in the Operating Guidelines.
- (c) IDCOL shall ensure that it takes all necessary measures to be in compliance with the environmental and social impact assessment, mitigation, disclosure, and consultation provisions under the Environment and Social Assessment Framework. Furthermore, it will furnish for IDA's review and approval appraisal reports, including resettlement action plans, in respect of those sub-projects that involve resettlement, land acquisition or power generation of capacity exceeding 5 MW.

H. Readiness for Implementation

1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.
 2. The procurement documents for the first year's activities are complete and ready for the start of project implementation.
 3. The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.
- The following items are lacking and are discussed under loan conditions (Section G):

I. Compliance with Bank Policies

1. This project complies with all applicable Bank policies.
The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.

Subramaniam V. Iyer
Team Leader

Vincent Gouarne
Sector Manager/Director

Frederick T. Temple
Country Manager/Director

Annex 1: Project Design Summary

BANGLADESH: Rural Electrification and Renewable Energy Development

Hierarchy of Objectives Sector-related CAS Goal:	Key Performance Indicators Sector Indicators:	Data Collection Strategy Sector/ country reports:	Critical Assumptions (from Goal to Bank Mission)
<p>1. Support power sector reform and restructuring in the rural sector by: (a) rationalization of rural distribution areas and expansion of the Rural Electrification System; and (b) greater private sector and community participation in electricity supply.</p>	<p>1. Rural distribution areas transferred to electricity cooperatives (PBSs) in an economically efficient way. Targets are nearly 4,000 kms of lines and associated facilities transferred to PBSs from BPDB by effectiveness; 3,000 kms of lines and associated facilities by June 2003 and the remaining 2,400 kms of lines to be transferred by June 2004.</p> <p>2. Private sector and NGOs involved in supply, financing and services of off-grid electricity through solar and other options. Targets are (i) 50,000 solar systems by private and NGO sources over five years; 20,000 at mid-term (ii) 14,000 systems to be installed by PBSs on fee-for-service over five years; 4,000 at mid-term. At least two wind and hydro projects developed and implemented by private sector by the close of the project.</p>	<p>1. Project Supervision Reports.</p> <p>2. Project Supervision Reports</p>	<p>1. Rationalization of rural distribution has significant impact on sector reforms.</p> <p>2. Off-grid electricity markets grow and gain commercial viability and have a measurable share of the electricity industry.</p>

Project Development Objective:

1. Increase access to electricity in rural areas by grid and off-grid options.

2. Enhance socioeconomic impact of electricity provision in rural areas.

3. Education – enhanced through improved lighting

Outcome / Impact Indicators:

1. Number of rural consumers provided access from grid.

At midterm: 400,000

At Close: 700,000

2. Number of rural consumers serviced from renewable energy sources

At midterm: 24,000

At Close: 64,000

3. Increase number of hours school aged children in the household study at night.

Project reports:

1. Project progress reports and supervision

3. Would use the following methods for monitoring and evaluation: (i) Households in the project areas will be randomly selected for interviews to collect baseline data and then resurveyed to determine changes after electrification (on an annual basis for five years.); and (ii) Annual M&E report will be prepared and reviewed

(from Objective to Goal)

3. SHS will be accepted by rural populations as appropriate alternatives to grid electrification

<p>4. Quality of Life – improved from higher safety, comfort and convenience; such as improved lighting inside and outside, replacing kerosene and use of appliances (TV, radio, fan, refrigerator)</p>	<p>4. Higher percentage of households in the electrified areas feel secure and more comfortable; increase number of lumen-hour for lighting inside home; and number of households use space cooling (fan) cold food storage (refrigerator), and TV/radio (for information and leisure).</p>	<p>4. Safety and comfort can be measured through household surveys and households can afford to buy appliances.</p>
<p>5. Women Empowerment: Improved education among girls and easier access to news and information specifically on women developmental issues through TV and radio.</p>	<p>5. Number of hours school aged girls in the household study at night; percentage of women getting access to news and information; and number of women knowledgeable about reproductive health, HIV/AIDS and other women issues.</p>	<p>5. Children have easy access to school (school is located within reach of children); girls are allowed to go to school, information about reproductive health and HIV/AIDS prevention are disseminated through radio and TV, and households can afford radio and TV at home.</p>
<p>6. Direct impact on income: reduced cost for access to: (i) lighting; (ii) news, information and entertainment; and (iii) electricity for those using electricity from other sources prior to formal access such as batteries</p>	<p>6. Decrease cost of lighting for households (measured in terms of lighting per lumen hour); reduced cost of electricity for listening to radio and watching TV (measured in terms of cost of electricity to operate radio and TV per hour); reduced cost of electricity per kWh for household that were using car batteries, or diesel gen-set prior to switching to grid electrification</p>	<p>6. Prior to electrification households used dry cell batteries for radio and car batteries for TV; after electrification households use plugged in (electricity from the grid or solar panel) for radio and TV; households can afford audio and video equipment or video services operator available in the electrified area.</p>
<p>7. Enhance rural productivity, development opportunities and reduce poverty through increased access to electricity.</p>	<p>7. Measures of rural productivity, development and poverty such as households using electricity for income generation like water pump, motor, electric fan, refrigerator and other electric appliances or tools; and farmers using electric water pump and motor for agricultural production and processing.</p>	<p>7. Rural enterprises can afford to buy electric appliances for business; price of agricultural products allow reasonable profits; no major flood or other natural disasters that may destroy crops; and costs of inputs remain stable or decline to allow reasonable profits.</p>
<p>8. Safe drinking water: clean water for drinking, especially in areas where ground water contains arsenic.</p>	<p>8. Number of deep wells that supply drinking and clean water that use electric pumps; especially in areas where</p>	<p>8. There are deep wells that supply drinking and clean water to the public in the electrified area; ground water contains arsenic and deep</p>

ground water contains
arsenic.

wells were dug to solve the
problem; and area covered by
the project has arsenic
problem in the ground water.

Output from each Component:	Output Indicators:	Project reports:	(from Outputs to Objective)
1. Grid expansion and intensification	<p>1a. Length of lines transferred and rehabilitated. At midterm: 4,000 kms At Close: 9,400 kms</p> <p>1b. Length of new lines. At midterm: 4,000 kms At Close: 10,000 kms</p>	<p>1. Project reports, REB MIS, quarterly progress reports, supervision missions, sub-project completion reports, performance target agreements</p>	<p>1. Consumer demand for grid services will remain strong, connection rates will improve and new consumers in served areas can be motivated to use electricity.</p>
2. Improving operational performance and financial position of PBSs	<p>2a. Better consumer mix and higher loads through area rationalization, measured by share of domestic 0-100 kWh per month consumers in project PBSs</p> <p>2b. Reduction in system losses of handed over areas – measured based on Performance Target Agreements for each PBS</p> <p>2c. Improved collection performance of project PBSs – measured based on Performance Target Agreements.</p> <p>2d. Enhanced financial viability of PBSs measured by debt service coverage ratios of PBSs.</p>	<p>2. REB MIS, quarterly progress reports, performance target agreements; supervision mission reports and audit reports.</p>	<p>2. With improved performance PBSs can invest more in expanding supply and providing better service and PBSs are able to provide reliable supply to enable consumers benefit from electricity use.</p>
3. Providing rural access by Solar Home Systems in areas inappropriate for grid extensions.	<p>3. Number of solar home systems (SHS): 50,000 SHS installed by private and NGO sources over five years; 20,000 at mid-term; and 14,000 systems to be installed by PBSs on fee-for-service over 5 years; 4,000 at mid-term.</p>	<p>3. Project progress reports from IDCOL and REB.</p>	<p>3. Households adopt solar as viable alternative, program is able to supply systems in an affordable manner, microcredit is available to finance households; and that the supply chain for SHS is rapidly developed.</p>
4. Improving rural access by mini-grids and other renewable energy options – wind and hydro.	<p>4. Three pilot projects developed and implemented. At least one completed by mid-term and three by project close.</p>	<p>4. Project reports from IDCOL.</p>	<p>4. Sites are located in areas where electricity demand is available, connectivity to grid is not possible and are demonstrated as viable options.</p>
5. Promoting productive use of electricity to increase rural	<p>5. Number of Households enjoying improved indicators</p>	<p>5. Baseline data and annual updates provided by REB's</p>	<p>5. Households prefer to use electricity for productive uses</p>

household incomes and improve delivery of services

of economic and social well-being.

Socioeconomic Monitoring Cell. (see 2.2 above)

and have capital to invest in income earning activities.

Project Components / Sub-components:

1. 1 Rural grid extension: distribution lines, substations, transformers, service connections, meters etc.

Inputs: (budget for each component)

1. US\$ 261.65 million

Project reports:

1. Progress reports and disbursement reports; supervision mission reports

(from Components to Outputs)

1. Timely hand over of BPDB lines and facilities carried out according to economic rationalization principles; economic criteria for new line selection is followed; loss reduction program meets targets and adequate generation is available for supply.

2. Renewable Energy and off-grid (including solar).

2. REB: US\$ 8.78 million
IDCOL 24.89
million
Total US\$ 33.67 million

2. Progress reports and disbursement reports; supervision mission reports.

2a. Barriers of awareness building information dissemination, marketing and consumer service can be effectively addressed.

2b. Rural consumers are able to afford and pay for alternatives.

2c. Participating organizations and partner groups are able to mobilize interest in solar and establish effective business models.

Annex 2: Detailed Project Description

BANGLADESH: Rural Electrification and Renewable Energy Development

Bangladesh aims to expand electricity access for accelerated economic growth and improved quality of life. This project supports the Government's access expansion strategy by providing assistance to extend electricity through both grid and off-grid options. It also aims to improve the productive use of electricity and the efficiency of rural supply through several institutional development and financial restructuring measures directed at the Rural Electrification Board (REB) and the Palli Bidyut Samities (PBSs). This objective is sought to be achieved through the following interventions:

- Assisting REB to expand and intensify rural grids and improve the operational and financial performance of the PBSs;
- Promoting use of solar home systems in rural areas inappropriate for grid expansion;
- Facilitating development of isolated mini-grids, based on natural gas, diesel, wind and hydro sources where feasible;
- and
- Increasing productive use of electricity and enhancing poverty impacts.

The RERED Project will be implemented through two implementing agencies: The Rural Electrification Board (REB) and the Infrastructure Development Company Limited (IDCOL). REB will implement grid based rural electrification system expansion, intensification and rehabilitation, solar home system on fee-for-service basis and technical assistance for environment assessment of the project, socioeconomic impact monitoring and evaluation, institutional development, and barrier removal of solar program through awareness campaign and market promotion. IDCOL will intervene through financial intermediation for making available longer term refinance and grants for NGOs and MFIs, as well as to SHS suppliers, to finance households to buy solar home systems and technical assistance for removing barriers in the development of a solar market. IDCOL will also make available a credit line for investment and grant financing for project development to promote other renewable energy options like wind, hydro and biomass energy in Bangladesh.

The project is divided into three parts – a grid investment and technical assistance component implemented by REB (part A); a Solar component and technical assistance to promote solar program to be implemented by REB (Part B) and a Renewable Energy component of investments, financial intermediation and technical assistance implemented by IDCOL (part C). The following table summarizes the different components, their costs and financing sources.

By Component:

Project Component 1 - US\$261.65 million

A1: Rural Electrification System Expansion, Intensification and Rehabilitation

The rural electricity program is operated by independent consumer owned cooperatives or PBSs functioning under the umbrella of an apex organization, the REB. The latter functions both as a quasi-regulator and a financial manager of the program and provides a wide range of technical and institutional support to the PBSs. The Rural Electrification Board has successfully registered a high rate of electrification providing access to nearly 400,000 new rural consumers each year. However, given the low coverage (under 25% of rural households have access), electrification rates have to increase dramatically. The constraints to this are: (i) high cost of grid extension; (ii) shortage of power supply from BPDB to the rural grid; and (iii) financial sustainability of PBSs.

To address these constraints the Government is promoting rationalization of distribution networks by handing over BPDB-operated power systems in secondary towns to REB to increase efficiency of supply and reduce overall costs of electrification. Furthermore, REB is introducing greater prudence in selection of lines and revisiting revenue and cost assumptions that have governed the area coverage program thus far. Off-grid options are being promoted for uneconomic areas. To address the shortage of adequate bulk power supply, REB and the Government have introduced a policy to promote localized power generation through small privately operated plants, supplying directly to PBSs. Finally, the

financial viability of PBSs is being tackled through a package of measures. These include, (i) revenue enhancing measures such as actions to transfer of pocket areas and critical load centers from BPDB; (ii) debt restructuring in the form of increased grace periods or adjustment of debt against grants; (iii) selective investments that could enhance revenue and performance profiles; and (v) expanding productive uses of electricity to increase consumption patterns.

Table 1: Project Costs and Financing by Components

	US\$ Million					
	<i>Government</i>	<i>MEI</i>	<i>HH equity</i>	<i>IDA</i>	<i>GEE</i>	<i>Total</i>
<u>PART A - Grid Component</u>						
A1 - Rural Electrification System Expansion, Intensification and Rehabilitation	89.97	-	-	171.68	-	261.65
A2 - REB Technical Assistance	0.12	-	-	2.86	-	2.98
Sub Total PART A	90.09	-	-	174.54	-	264.63
<u>PART B - Renewable Energy Component (REB)</u>						
B1 - REB Solar Program	2.00	-	-	4.63	1.53	8.16
B2 - REB Solar Technical Assistance	0.25	-	-	0.37	-	0.62
Sub Total PART B	2.25	-	-	5.00	1.53	8.78
Sub Total REB	92.34	-	-	179.54	1.53	273.41
<u>PART C - Renewable Energy Component (IDCOL)</u>						
C1 - IDCOL Renewable Energy Subloans	-	2.85	3.20	11.44	3.80	21.29
C2 - IDCOL Technical Assistance	-	0.73	-	-	2.87	3.60
Sub Total PART C	-	3.58	3.20	11.44	6.67	24.89
Sub Total Renewable Energy	2.25	3.58	3.20	16.44	8.20	33.67
Total	92.34	3.58	3.20	190.98	8.20	298.30

This component will extend support for expansion of distribution facilities in 45 PBSs, including construction of 10,000 kms of new lines, rehabilitation of 2,500 kms of previously taken over lines, and construction and augmentation of distribution substations and associated facilities. It will also facilitate and finance the takeover, rehabilitation and loss reduction of approximately 9,400 kms of lines from BPDB under an agreed transfer and loss reduction program. The investments will enable the intensification and expansion of the distribution network to cover about 36,000 villages covering 400,000 new consumer households. The loss reduction component will enable an additional 300,000 consumers to be provided with access, bringing the total number of households provided electricity access under the project to 700,000 households over five and a half year period.

REB's Role: REB functions as an autonomous, quasi-regulator and financial intermediary for the rural electrification sector. In relation to the 67 PBSs under its jurisdiction, it is responsible for the following activities: (i) approve PBS system design and construction of sub-station and electric distribution lines; (ii) staffing and training of REB/PBS personnel; (iii) financing development activities, including re-lending program; (iv) monitoring PBS operations and management activities; (v) providing liaison with other utility organizations under the Power Sector with regard to purchase of Power and other related issues; (vi) coordination with other governmental agencies; (vii) conducting Board of Director's election of the PBSs; (viii) conducting management audit to oversee and coordinate the activities of the PBSs for smooth operation of the system; (ix) procurement, erection and installation of distribution lines and substations; and (x) approve tariffs proposed by PBSs for all consumer categories. The REB/ PBS operations are regarded as a center of excellence among the poorly performing public sector institutions in Bangladesh. The REB/PBSs have been showing good performance and delivering results, since inception about 20 years back. They are also capable of assuming

additional role and responsibility with minimum training and assistance and can produce results. Bank's last credit to REB concluded with a highly satisfactory note in achieving its development objectives, physical works and institution building targets.

Area Rationalization Program: The objective of the area rationalization program is to integrate rural networks into the PBS networks, avoiding duplication of investment, in order to achieve reliable and efficient distribution services at least cost to consumers. This requires the transfer of distribution areas (including sub-stations, lines and associated facilities) currently under the control of BPDB to PBSs. Though several thousand kms of lines have been transferred in the past, these have not been carried out in an economic manner. Fragmented transfers of portions of areas, leaving stranded pockets served by BPDB or REB have detracted from creating contiguous service areas. In the current situation, a particular rural distribution network in the geographical supply territory of PBS is owned both by REB and BPDB but in a scattered fashion. Here the PBS supplies rural loads outside concentrated BPDB load centers (towns, municipalities, industries etc.). This results in poor integration and expensive duplication of assets.

Under this project, the area rationalization program has been re-formulated along the following economic principles: (a) contiguous areas to be transferred including towns, municipalities etc., thus avoiding fragmented transfers and perpetuation of 'pockets'; (b) full assets to be transferred starting from outgoing 33 kv lines, and electric supply units to be closed if these are serving unviable loads; and (c) agreed transfers are to be effected in one instalment avoiding fragmented transfers. These principles would help both BPDB and REB realize economic gains and serve rural consumers more efficiently.

Consistent with these principles the Government has taken a decision to transfer all pocket areas in the 45 project PBSs, including municipal towns up to 3 MW loads from BPDB to REB. A transfer program of 9,400 kms of lines and associated facilities, spread over three years, has been agreed between BPDB and REB. The Government has agreed that the first year program lines and areas will be transferred prior to credit effectiveness as per agreed conditions. Each of the two remaining annual programs would be implemented in 2003 and 2004 respectively. The disbursement for the grid component of the project would be conditional to each package of the handover program.

Table: Summary of Agreed Line Takeover Program From BPDB to REB

By	Number of PBSs	km of Lines
Project Effectiveness	17	4,000
June 15, 2003	17	3,000
June 15, 2004	6	2,400
Total	40	9,400

Loss Reduction Program: PBSs are forced to bear substantial financial losses when old, poorly planned and structured and dilapidated loss making networks are taken over. Quick performance turn-around is necessary to minimize PBS losses from these taken over networks. A loss-reduction program has been formulated by REB involving the creation of Special Task Forces and performance incentive based compensation (defined under a Performance Target Agreement). The incentives are directly linked to performance targets in loss reduction and increase in collections, while being inversely linked to the time taken to produce such improvements. Such special efforts have the full support and commitment of Government and its political leadership. Additional resources in terms of special magistrates and police assistance are being made available. The program will be operationalized prior to Credit Effectiveness. Under the loss reduction program, the overall target is to bring down the losses in all taken over areas to an average of about 15 percent from the 45-50 percent existing at the time of takeover.

Construction Program: In order to ensure that new line constructions take place in an economically sustainable manner, the revenue cut-off has been kept at Taka 36,000 per km of line per annum. In every PBS program, the proposed new lines are sequenced on the basis of decreasing revenue earning potential. Only lines with the ranking priority higher than

the threshold revenue per km will qualify for the project investments. This criteria of line selection will help REB to prevent construction of uneconomic lines.

Financial Restructuring of PBSs: The REB has formulated and the Government has endorsed a financial restructuring program for PBSs. These measures include: (i) permitting PBS tariff bands to be determined by REB, consistent with established practice of cost recovery i.e. tariff is sufficient to cover operational and financial costs; (ii) confirming autonomy to REB for determining lending terms and conditions to PBSs without affecting the financial terms between Government and REB; and (iii) providing suitable waivers to REB for finalizing budgets without reference to Government in respect of PBSs that are no longer receiving subsidies. The Government has put in place these facilitations and the project will support the REB to undertake the financial restructuring measures as per the agreed program.

Project Implementation: This project represents a quantum jump in the size of investments being managed by REB. It would involve more than US\$ 60 million investments each year over a five year period. REB has established a project team under the leadership of a seasoned Chief Engineer Projects (designated as Project Coordinator). Adequate personnel for Procurement and Financial Management have been inducted into the team. A high-level team under the leadership of Chairman, REB has been established to develop and implement the system loss reduction program. The team will advise and assist the Directorate of System Loss Reduction in designing and implementing loss reduction programs. The team will review these plans and projects and monitor performance of the loss reduction program and make suitable and timely corrections to strategies for achieving loss reduction targets.

Environmental and Social Issues: Since the proposed distribution lines are at the low voltage level with simple structure and low effect on the ambient environment, environment effects are considered negligible. The line routes and substations defined in the project will be mostly drawn or constructed in fields and outside forest areas. The effects on the ecology and natural surface structure of the soil are considered negligible. Electrical lines will be drawn and constructed based on the international standard keeping in view the safety clearance for residential areas. Land requirements are small, and mostly existing rights of way are proposed to be used. Hence land acquisition and resultant displacement of residences or economic activity are not significant. In cases where such land acquisition is needed, the Government has agreed to follow the provisions of the Environmental and Social Framework summarized in the PAD. Institutional arrangements for compliance with safeguards is covered in the section under TA.

Project Component 2 - US\$2.98 million

A2: REB Technical Assistance: To address REB's continuing institutional development needs, this component will support a number of activities. These include:

1. Institutional Development

Installation of Local Area Network (LAN): Networking for internal communications and information systems is critical for improved efficiency and information exchange within various units of REB and PBSs. The technical assistance will support hardware, software and training for REB and PBSs to be fully networked and use state-of-the-art information technology in their operations.

Expansion of GIS Mapping System: REB is carrying out a pilot study on GIS Mapping System under USAID funding. Adoption of the GIS Mapping System as a planning tool will enable better project selection, and make system expansion and/or intensification initiatives more efficient. TA to assess the results of the pilot and scale-up GIS adoption for REB and PBSs is envisaged under the project.

Training: To enhance the capability of REB/PBS personnel with a specific and up-to-date technology and systems, training in the following areas will be supported: Procurement; System Design and Distribution Planning; Operation and Maintenance of RE systems; computerization and information systems and Management.

Development of Additional Customized Software: Customized software for various operational and financial needs will be developed through outsourcing, together with training as needed.

2. **Environment Compliance Unit:** The project TA will support the establishment and initial operation of an environment compliance unit (ECU) in REB and capacity building of PBSs for carrying out EAs and manage environmental mitigation at the project level. grid development and some other off-grid developments to promote electrification in rural areas. This assistance includes training for REB and PBS staff to carry out and review Environment Assessments of sub-projects, development of processes and formats for assessments, public disclosure and consultations and monitoring. REB has already established the ECU headed by a Director and supported by a Deputy Director. The Director, ECU will report to the Member PBS to ensure overall application and compliance with safeguard policies. To help REB properly carry out the assessment work a consultant, experienced in environment impact assessment would be appointed to train REB staff on carrying out Environment Assessment work and would prepare several EAs of initial projects. The first five EAs will be submitted to IDA for review and clearance prior to disbursements for associated investments. Subsequent EAs will be submitted to IDA for review as and when the need arises or requested by IDA, to ensure conformity with World Bank safeguard policies.

3. **Socioeconomic Monitoring and Evaluation Cell:** The Bangladesh rural electrification program does not have a mechanism to systematically monitor and evaluate impacts of electrification. The REB has established a Socioeconomic Evaluation and Monitoring Cell (SEEMC) to monitor and evaluate the impact of rural electrification. The project will provide technical assistance to operationalize the cell and conduct data gathering and analysis. The Cell will engage suitable consultants to: (1) establish monitoring and evaluation mechanism for REB/PBSs; (2) provide training (on-the-job and in-class training) in the field on monitoring and evaluation research methods, surveys, data analysis and report writing; and (3) demonstrate evaluation research design, sampling design, field surveys, data collection, data analysis and reporting methods through field-level work. It is expected that consultants would take a leading role during the first three years of the project, gradually transferring know-how and skills to the REB staff in the Cell and in the PBSs.

4. **Socioeconomic Development:** TA will be provided to REB and PBSs to develop load promotion and productive use initiatives in rural areas, in collaboration with other rural development and service institutions. The focus will be awareness building and education for both consumers and service providers to integrate electricity use into economic development and service delivery projects.

Project Component 3 - US\$ 8.16 million

B1: REB Solar Program

Background: The Government strategy emphasizes promoting off-grid options in areas that are unsuitable for grid expansion. The potential market for off-grid systems, especially solar, is substantial. A recent study has estimated that nearly 2 million households could potentially benefit from solar systems. However, the limited nature of current initiatives and daunting institutional, policy and financial barriers have prevented any significant success. This project, therefore, seeks to develop a sound, commercial and sustainable framework for off-grid energy in Bangladesh by addressing these barriers.

Baseline: The REB undertook the Narsingdi Solar Electrification Pilot Project in 1995 where about 900 households within a 29 sq.km riverine island area, received electrification through three solar charging stations and stand alone systems. The Narsingdi experience has provided REB and PBSs with experience in implementing a fee-for service SHS project. The project has clearly demonstrated the technological suitability of SHS based electricity service for Bangladesh rural populations. Since the program was predominantly grant based, besides indicating the possible success of the fee-for-service approach, it has not provided adequate basis for financial viability or operational sustainability. However, it has demonstrated a high level of customer satisfaction, justifying efforts to extend these experiences to another phase in which financial and commercial feasibility are key objectives.

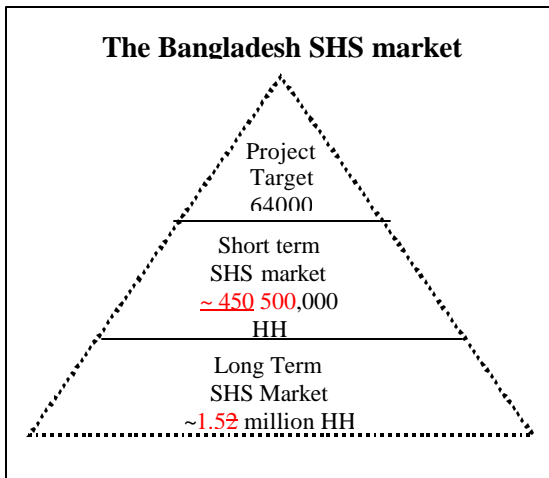
There is evidence that a solar program rooted in private and community based initiatives could also be successful. Grameen Shakti, a subsidiary of the Grameen Bank, has been involved in supplying and financing SHSs for the last two years, during which nearly 5,000 systems have been installed. Bangladesh Rural Advancement Committee (BRAC), the largest national NGO, is also involved in a similar fashion and has supplied nearly 1,200 systems. Besides Grameen

Shakti, only one other local company, Rahimafrooz, has been active so far in supplying SHSs. In these cases the financial viability of the operations is one of the objectives. It is too early yet to see if this is realized, as the operations have not yet reached the maturity after which this can be measured and, due to the pilot character of the operations, financial reporting is not yet in every case providing adequate information for this purpose. However, several private sector dealers, including BP Solar, Shell/Siemens and Kyocera are preparing to enter the market creating an expectation of future competition. With the current solar initiatives, the estimated baseline is 12-15,000 households gaining access in the next 5 years. Such households are also more likely to be in the relatively higher-income bracket, earning incomes around US\$ 1,000 per annum. For poorer families, the cost of a solar system is too high and affordability is an issue. The less developed marketing and supply/service side is also a barrier. Quality standards and consumer assurance mechanisms need to be introduced as well to develop a sustainable and credible market for SHS.

The Baseline scenario is based on no project interventions taking place. The alternative is based on IDA, GEF, GOB participation in barrier removal, credit and grant support. The key baseline elements are summarized in the following table.

Baseline Element	Status as of April 2002	Expected at end of Project
Number of households using solar home systems on ownership basis	Approximately 8000, expected to reach 12-15,000 over the next five years in the absence of assisted development	At least an increase of 50,000 systems over baseline
Number of households using fee for service provision through PBSs	Not more than 2000 systems over the next 5 years	Awareness nationwide, with actual fee for service programs operating in 6 PBSs installing and operating nearly 14000 systems
Number of institutions (public, private, community based) directly involved in promoting, marketing or financing solar home systems	Six; two public (LGED, REB), two private dealers (Rahim Afroz, Grameen Shakti), and two NGOs/MFIs (BRAC and Grameen Shakti)	At least fourteen organizations, including private sector, MFIs, NGOs and PBSs, involved in promotion, finance & sale of SHS.
Other renewables, wind and hydro	Small, isolated projects tried by various agencies with mixed results	Complete at least two pilot projects and evaluate prospects for commercial development of small hydro and wind projects.

Alternative: The alternative is to develop renewable energy access models that are commercially viable and can be scaled-up in a sustained manner, with a lower level of capital support in the future. The specific focus of the solar program is to develop such implementation models for 64,000 SHS on a fee-for-service basis, microfinance or direct purchase basis. This represents more than 10 percent of the short term solar market of 500,000 households. (see figure below) The alternative for wind and hydro energy is to develop pilots to promote learning, overcome barriers and identify interventions needed to establish a commercial and sustainable foundation for these technologies.



Barriers: The achievement of the alternative is constrained by a number of barriers. These have been identified on the basis of past experience in project implementation from Bangladesh and other countries, and studies commissioned during project preparation.

- (a) Policy barriers: The Government has established a nonexclusive regime for provision of rural energy. The REB now has a framework for SHS implementation through the PBSs under fee-for-service mode. However, for hydro and wind, there is no framework under which electricity generated can be sold directly to customers or purchased by the utility. Part of the reason for this policy vacuum is that in Bangladesh (other than in some countries) such technologies have not yet been developed in a commercial manner and it is still unclear whether this could be viable in Bangladesh. Prior studies indicate limited potential for hydro in the hilly areas of Bangladesh, where implementation is difficult due to political-economy reasons. Studies on wind also indicate potential in some coastal areas. It would be premature to address the policy barrier without commercial viability being confirmed. Hence, the project proposes to involve private sector in establishing commercial viability through selected pilot projects. The policy regime could then develop from the evaluation of the pilot projects.
- (b) Institutional barriers: The project aims to take advantage of well functioning rural institutions in energy, microfinance and social mobilization. Limited managerial and implementation capacity in the area of renewable energy is the main barrier for these institutions. This stems from lack of: (i) knowledge about available solutions and products; (ii) trained technicians for installation and operation of SHSs; (iii) ability to identify and mobilize target groups; (iv) presence of well capitalized SHS supply companies who can benefit from successful experiences in similar circumstances in other countries, and (v) mechanisms to finance households to buy/adopt SHS. Similarly, though PBSs have pushed for solar programs, they have done so without developing sustainable provision models, such as fee-for-service provision.
- (c) Financial/Economic barriers: The high initial capital costs of renewable energy options, in particular that for SHS, pose a significant barrier to adoption. This is confirmed from recent studies. High costs of solar modules, batteries and lamps, together with the need for foreign currency for imports are notable barriers. Though there are several well established and financially sound credit providers, availability of sufficient credit to households for SHS remains a problem. MFIs prefer to loan for income-generating activities only, with tenors limited to 24 months. For SHSs, loan tenors of 3-5 years are required. Therefore, MFIs would require credit enhancement support to create 3-5 year liquidity and build capacity to conduct a micro-credit program for SHS.
- (d) Social and Information barriers: The program could suffer from a perception that SHS adoption could delay or preclude grid access. The lack of awareness and information dissemination about: (i) renewable energy technologies including SHS; (ii) socioeconomic characteristics of potential rural consumers, including the

unserved population; (iii) possibility of using solar systems for purposes other than home lighting such as community level/public usage in educational institutions, hospitals, clinics, mosques etc.; and (iv) availability of adequate supply and service, would need to be addressed. Furthermore, there is lack of awareness about selection of the right system taking into account economic condition, load requirement and ability to pay, performance expectations, and proper battery usage.

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

GEF assistance would be essential in evolving multiple off-grid electrification initiatives, implemented through the PBSs and NGOs. The core objective of the GEF supported project is to accelerate solar market development by these organizations in (a) isolated and remote areas without the prospect of grid electrification service, and (b) areas not to be served by the national rural electrification grid within the next 5 to 10 years. The project would need to establish mitigation mechanisms such as buy-back programs, to address consumers inability to use SHS in villages where the grid access becomes available within 10 years of SHS installations.

While the direct impact of the project will be felt only on about 64,000 households, a key contribution of this program would be in developing implementation models which could be replicated and scaled-up in a sustained manner, with lower level of capital support in the future. The specific focus of the program would be to develop implementation (business) models to serve the lower end of the market segment on a fee-for-service basis, hire purchase or direct purchase.

Outputs: The off-grid part of the project has the following three sub-components:

- A fee-for-service SHS program implemented by REB and PBSs, reaching an estimated 14,000 households, over a period of five and a half year (nearly 0.7 megawatt-peak - MWp). The SHSs will be supplied and serviced by PBSs to households and institutions in isolated rural communities without access to electricity, to power lights, small fan radios, televisions, and other small electrical appliances. Initially 6 PBSs have been selected for this purpose and if the program gains in popularity and acceptance, it could be extended to other PBSs. The project is expected to exert positive socioeconomic developmental impact by improving the quality of rural life and augmenting income of households to some extent. The investment will be supported by technical assistance to build awareness among recipient communities and PBS staff, establish solar service units among the selected PBSs, train and deploy staff and develop and implement the project.
- A microfinance based direct sales program implemented by IDCOL to support electricity access for 50,000 households with SHS (nearly 2.5 megawatt-peak-MWp), over a five and a half year period. The SHSs will be supplied and serviced by private companies in partnership with microfinance institutions (MFI) and NGOs. IDCOL will administer a credit program for participating NGOs and MFIs to obtain refinance for loans made to households for purchase of SHS. The program will be led by NGO/MFIs who will identify potential consumers, make consumer loans, form alliances with SHS suppliers for installations and service and receive and pass-through GEF grants to consumers.
- A GEF supported grant program for capital cost buy-down and technical assistance for barrier removal activities. The grant program would operate in tandem with the pay-for-service and microfinance models for solar and assist in developing demonstration projects in wind and small hydro.

Component Description: This component will support the operation of a 'fee-for-service' SHS program leading to 14,000 SHS in rural households. The PBSs are well-placed to establish infrastructure and communication rapidly in

remote & isolated areas to supply and service SHS, extending their core business with similar but adapted equipment. The effectiveness of solar energy technology for domestic and shop lighting, running of small appliances, refrigeration for health centers and clinics, small scale water lifting etc. has been established in Bangladesh. However, a systematic promotion of SHS on commercial lines has not taken place. The project is making a very modest dent in the solar fee-for-service market which is estimated to be nearly 500,000 households as per a recent study. To begin with the REB is launching systematic solar program in the following 6 PBSs – (i) Sirajgonj; (ii) Pabna-2; (iii) Barisal; (iv) Natore-2; (v) Cox's Bazar; and (vi) Sunamgonj. The selected areas for installation of SHS in these PBSs are at the tail-end of the grid electrification and line construction master plan. In the normal course the residents of these areas would have to wait another 10 to 15 years for electricity through the grid. Initial market survey undertaken in these areas show that there is significant demand for SHS and nearly 6000 potential consumers have been identified in these 6 PBSs. Additional areas and consumers will be identified as the project progresses and the target is to install and successfully service 14000 systems over the five year project period. The year-wise and system-size targets are shown in the attached table.

Annex 2, Table 3: RERED Project – REB/PBS Solar Systems Targets

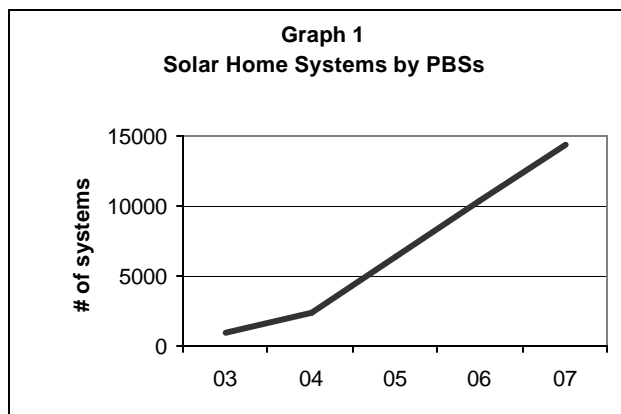
Implementing organization	Year 1	Year 2	Year 3	Year 4	Year 5	Total
REB / PBS (6)						
System-1 (36 Wp)	400	1000	1600	1200	1800	6000
System-2 (50 Wp)	100	200	1200	1400	1100	4000
System-3 (72 Wp)	100	200	1200	1400	1100	4000
Total	600	1400	4000	4000	4000	14000

The targets shown in the first two years are ambitious but can be reached with the envisaged number of 6 PBSs. For the following years an additional number of PBSs may be needed to reach these goals. An evaluation will be made to determine the need to increase the number of PBSs and, if necessary, to change the approach, including a review of terms and conditions. Since the PBSs have an established institutional and financial structure, the incremental costs of marketing fee-for-service solar is limited. The PBSs would need to carry out social mobilization and marketing in the selected areas, engage and train suitable local staff to install, service the systems and collect monthly bills, monitor implementation and evaluate results. Furthermore, solid partnerships with one or more SHS suppliers will be needed to ensure high quality of systems and to learn from experiences in other countries. The various implementation steps are summarized.

- Selection of locations by the PBS with the help of available master plan and socioeconomic data.
- Pre-qualification of SHS-suppliers and determining the scope of supply and the roles of the suppliers and the PBSs.
- Preparation of consumer lists by PBS staff, together with engineering design of SHS.
- Membership drive - motivation, demonstration, customer drive and training.
- Signing contracts with member consumers.
- Consumer house wiring.
- Solar Home System installation and consumer connection.
- Regular billing and collections and periodic training and maintenance visits.

Implementation Responsibilities: REB and PBSs have jointly identified the respective staff and consultants required to implement the project. These are: (i) the Electrical Retainer consultant available at each PBS for identifying the areas, engineering aspects, technical training, contracting and installation/service; (ii) local consultant to be hired for consumer membership drive and awareness building – could be a locally active NGO; and (iii) PBS management to oversee implementation with the REB Solar Cell playing an advisory and oversight role. These activities will be prepared and undertaken in close cooperation with the SHS supplier(s). The construction contractor will perform the activities of SHS installation after completion of a customer training program. On completion of installation by contractor and final inspection by the PBS retainer consultant, the contractor will get final approval from renewable energy cell of REB and

hand over the assets to the concerned PBS. The SHS fee-for-service program will be in operation from the time of handover to PBS. Consumer education for efficient operation of SHS is very important. Battery maintenance/operation and an ability to carry out minor trouble shooting by the consumer will be very helpful for smooth operation of SHS by the consumer. The pool of village electricians being trained for solar house wiring will also be able to provide such assistance and training to consumers from time to time. The maintenance of SHS and billing and collection tasks will be performed by PBS technicians/staff.



Specification and Standards: Since REB is planning to extend continued service to its consumers on the basis of 'fee for service' for 15-20 years (or, if earlier, until the grid connection is established), there have to be quality standards in place to assure customers that the systems will continue to work throughout the anticipated economic life of the system. A technical committee has been established for setting appropriate technical standards and specifications for SHS materials and equipment to be used in this project. This committee will also be responsible for establishing service standards for SHS consumers. The core committee comprises REB and IDCOL personnel as technical committee members, supported by technical experts from the Bangladesh University of Engineering and Technology (BUET) and the Bangladesh Standards and Testing Institute (BSTI) as appropriate. The Committee will qualify specific solar modules and accessories, as well as complete solar home systems, for inclusion under the program based on appropriate testing certificates furnished by suppliers from recognized laboratories. A small testing laboratory is also being established in REB under the project to carry out testing and standardization of locally manufactured components such as batteries, controllers, lights, wiring etc. A more detailed treatment of TA activities is provided later in this annex.

Project Component 4 - US\$0.62 million

B2: REB Solar Technical Assistance: The following sub-components will be supported through TA.

1. Market development and Capacity Building (PBSs and REB): REB will take a program approach to support solar market development in PBS areas. This would involve helping the PBSs to identify target areas for solar promotion, outreach to prospective consumers, and develop marketing and service programs. It would also enable PBSs to establish specific solar program units, with adequately trained staff and systems to implement and monitor the program. The assistance is being provided on the basis of business plans and capacity building proposals for each PBS. Part of this support is already in place through the GEF PDF B grant. The project TA will be available over a five-year period, initially starting with the selected 6 PBSs.

2. Quality Assurance Program (PBSs and REB): REB will operate a quality assurance program for establishing and monitoring technical standards for SHS components and systems, including post installation testing as well as service standards for SHS consumers. A Technical Committee for the Quality Assurance Program has been set-up by REB and IDCOL with participation of Bangladesh University of Engineering and Technology and the Bangladesh Standards Testing Institute. As part of the quality assurance efforts, a small testing laboratory will be established at REB to test the performance of the SHS components and systems and also serve as technical training site for the PBS technicians

involved in the program. The Technical Committee shall be responsible for overseeing the quality assurance program and the setting of quality and output specifications.

3. Monitoring and Evaluation: REB's Renewable Energy Cell will monitor the solar program to ensure that: (a) PBSs are following established technical, after sales service, and consumer education standards; (b) Adequate and effective program outreach is being undertaken, (c) customers are satisfied with their SHSs, and (d) proper follow-up, billing and collections are being undertaken. Monitoring methods would include the following: (i) end-user level audits of 10% of installed systems to ensure satisfactory product quality and service; (ii) customer surveys using simple, short postcards and questionnaires; (iii) small focus group sessions with consumers in different PBS areas conducted as part of the market monitoring; and (iv) complaint based end-user audits and other data gathering in response to complaints or information received from customers or others. Results of the monitoring and devaluation efforts will be incorporated in the quarterly progress reports.

Project Component 5 - US\$21.29 million

C1: IDCOL Renewable Energy Subloans: This component will enable IDCOL to provide project development support and financing through sub-loans and grants for renewable energy development. The primary focus is on expanding electricity access to 50,000 households with SHS (nearly 2.5 megawatt-peak–MWp), over a period of five years, on a micro-finance based, direct sales program. The SHSs will be supplied and serviced by private companies in partnership with microfinance institutions (MFI) and NGOs. IDCOL will administer a credit program for participating NGOs and MFIs to obtain refinance for loans made to households for purchase of SHS. The program will be led by NGO/MFIs who will identify potential consumers, make consumer loans, form alliances with SHS suppliers for installations and service and receive and pass-through GEF grants to consumers. The credit and grant programs are also open to support wind energy and small hydro sub-projects developed by private sector, NGOs and communities.

The credit program established through the IDA credit will be administered by IDCOL on behalf of GOB. The credit program will be open to all NGOs/MFIs that meet the selection criteria detailed in Annex 12. Suppliers and dealers of SHS will be allowed access to the credit program through MFIs or directly through IDCOL, depending on their business approach. Participating MFIs, NGOs and SHS dealers will be free to target any number of SHSs that are commensurate with their organizational capabilities and that they reasonably believe can be promoted over a five-year period. The participating NGOs, MFIs and SHS dealers will identify/motivate potential households that can pay in the range of 10 to 20 percent of the system cost as equity to adopt SHS. The balance of the costs are to be met by a GEF grant of US\$ 90 to buydown the system cost and a microfinance loan for the balance amount. MFIs would be eligible for refinance from the IDCOL credit program upto 80 percent of the amount of loan extended to the households and a reimbursement of GEF grant to a maximum of US\$ 90 per system upon satisfactory evidence of installation and customer satisfaction. The un-refinanced portion of the MFI credit is the equity amount that MFIs shall have at risk under the program.

The credit program will have the following two sub-components:

- *Grant Sub-Component:* A total of US\$ 3.80 million in grants to be administered by IDCOL will be available to buydown the capital cost of SHS and to meet the incremental operating cost of the NGOs/MFIs in promoting SHS. Only one subsidy entitlement per household customer will be provided. Subsidy will follow a declining scale as the market expansion will lead to decline in prices and removal of commercial barriers. An indicative subsidy profile is illustrated in the following table. This is subject to review and change depending on implementation experience and evolution of the market. In cases where suppliers effect sales of SHS directly to consumers without any MFI credit, the suppliers can access the grant in favor of the customer. However, in order to do so, suppliers would have to pre-register with IDCOL and meet specified eligibility conditions. Specific eligibility guidelines for MFIs, NGOs and suppliers are described in the Operating Guidelines (Annex 12).

Item	Amounts in US\$	
	Price Buy-down Subsidy Available to Implementing Agency	Operational Costs Max. Subsidy that can be Retained
First 20,000 systems	90	20
Next 20,000 systems	70	15
Next 20,000 systems	50	12

- Line of Credit Sub-Component:* IDA/Government of Bangladesh ("GOB") would make available US\$ 11.44 million to IDCOL for providing long-term credit refinance to eligible MFIs to finance purchase of SHS by households or individuals and direct sub-loans to developers of small hydro, wind energy and biomass projects, on a case-by-case basis. Suppliers/dealers of SHS will be allowed access to the credit program through MFIs or directly through IDCOL, depending on their business approach.

Project Targets

Period	Year 1	Year 2	Year 3	Year 4	Year 5	Total
No. of Systems to be financed	6,000	8,000	11,000	13,000	12,000	50,000
Equivalent kWp to be financed over the Project Life (kWp)	292	420	582	605	544	2443
GEF Grant (US\$ million)	0.54	0.72	0.88	0.92	0.74	3.80

Implementation: IDCOL and five selected suppliers, NGOs and MFIs are in the process of implementing a Phase I program of nearly 500 systems, using the same program conditions and procedures as established in this project. The Phase I has been funded by a GEF PDF B grant of US\$ 340,000. The implementation program described below is modeled on experience gained from PDF B related work. IDCOL will be responsible for establishing and publicizing: (i) program participation eligibility criteria for NGOs, MFIs, suppliers; and (ii) credit and grant program eligibility criteria, including quality standards and certification requirements for equipment to be eligible for refinance/grants. The other key implementation responsibilities of IDCOL are described in the following paragraphs.

Program Administration: IDCOL will administer the credit program in a output-based fashion. Disbursements of the subloan and grant will take place only after the system installation has been completed and the customer has documented his/her satisfaction with the system. This would be on the basis of an installation certificate issued by the supplier of the system, countersigned by the concerned MFI/NGO, and the submission of a Customer Acceptance Receipt in an agreed format. In order to administer the credit sub component, IDCOL will: (i) enter into separate Participation Agreements with MFIs, specifying the covenants that MFIs have to comply with; (ii) process disbursement requests for loans approved by MFIs based on the evidentiary documents to be formalized in the Participation agreements between the MFI and IDCOL; (iii) maintain separate disbursement records and accounts with respect to each MFI under the Project; (iv) keep on file supporting disbursement documents as well as bank accounts relating to disbursements; and (v) 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. In addition, IDCOL will maintain statistical records, incorporating, among other things, approval of subloans and disbursement made and provide IDA with regular reports.

Project Component 6 - US\$3.60 million

C2: IDCOL Technical Assistance: The TA for renewable energy development will consist of:

1. Technology promotion, capacity building and market development: IDCOL will take a program approach to supporting market development, to introduce new ideas and renewable energy technologies and applications. IDCOL will be responsible for developing and managing the program, through an active process of seeking requests for proposals from consumers, communities and companies, and developing ideas for activities that respond to market conditions. The GEF grants would provide a major share of the funding, including for pilot marketing efforts proposed by the SHS dealers, depending on the type of activity and the availability of co-financing from sponsors (TA co-sharing). The market development program will include initiatives to attain financial and economic sustainability and aims at creating the basis for a market place for off grid rural electrification. The program will be prepared in consultation with representatives of MFIs, consumers, other agencies, and communities that are stakeholders in the Project. This would include support for activities such as public information campaign, developing the commercial capabilities of SHS dealers, developing mechanisms for consumer financing, developing suitable standards and facilitations for environmentally safe disposal of batteries used with SHS, and other activities to be defined during Project implementation.

2. Project Administration IDCOL (1-5th Year): IDCOL will be supported under the project to ensure smooth operation of the grant program, emphasizing simplicity, efficiency, and speed consistent with the need for fiduciary and safeguard compliance. As part of this activity, IDCOL will undertake and support representation and promotion of the RERED Project both domestically and internationally. This will include convening of local meetings, seminars, and workshops, presentations at selected conferences, as well as hosting of international groups seeking to learn from Bangladesh's solar experience or to enter the market here. The Ministry of Finance ERD will enter into a contract with IDCOL to carry out the credit and grant administration. IDCOL will undertake its work in accordance with a set of agreed Operating Guidelines. IDCOL will receive a fee of up to US\$ 600,000 for administering the grant program over the five year project period. The fee will be released against an approved budget satisfactory to IDA and based on actual expenses as per the budget. IDCOL will also receive an appropriate fee from the Government for administering the Credit Program from year 5-15.

3. Monitoring and Evaluation: IDCOL will monitor participating organizations to ensure that: (a) grant funds are being used for the intended purpose; (b) the SHS dealers are complying with established technical, after sales service, and consumer protection standards; and, (c) customers are satisfied with their SHSs. TA supported monitoring methods would include: (i) end-user level audits of 25 systems sold by each company to ensure satisfactory product quality; (ii) random, unannounced, independent end-user level audits of subsequent reported sales, as needed; (iii) customer surveys using simple, short postcards and questionnaires; (iv) small focus group sessions with companies and consumers in different regions conducted as part of the market monitoring; (v) complaint based end-user audits and other data gathering in response to complaints or information received from customers or others; (vi) reviews of documentation and reports provided by SHS companies, local and international suppliers and others; (vii) direct observation and verification during regular field visits; (viii) annual reviews of the audited financial statements submitted by each company, including counter-audits as necessary to verify information; and (ix) performance reviews with individual companies, their accountants, auditors and commercial banks as necessary; and annual meetings with companies to discuss ways to improve the compliance monitoring system. In addition to the end-user audits and other compliance monitoring activities, IDCOL in partnership with REB, will conduct technical performance audits of solar home systems or components.

4. Renewable Energy Development (Wind, Hydro, biomass): The project will support IDCOL to introduce and promote renewable energy technologies which are commercially established in other countries, but not yet commercial in Bangladesh, and integrate new stakeholders into the project. Technology introduction, promotion, and capacity building will be undertaken primarily in the context of wind, hydro and remote area power supply systems (mini-grids). The emphasis will be in the following areas: (i) Mini/grid connected wind, where the aim is to develop and implement a modest wind project transactions that can demonstrate commercial viability of this technology. Support will be provided for resource assessment through wind-mapping to better determine sites that are suitable for economic power generation. Support will also be provided to the electricity utilities for developing an enabling policy framework for commercial project development and study the feasibility of demonstration projects. (ii) Off-grid or grid connected hydro, including support for resource assessment, promotion, project development and handling of technical and commercial issues; (iii) Development support for mini-grids on a generation technology neutral basis. Integration of new stakeholders, such as

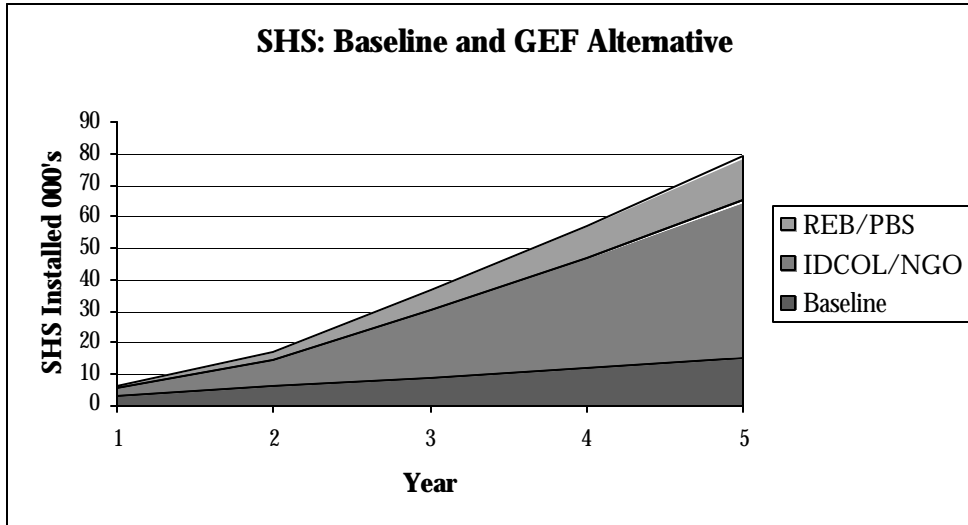
microfinance institutions, private sector companies, rural retail companies, and NGOs will be facilitated by IDCOL on an as-needed basis for developing these technologies. These organizations may or may not wish to access the Credit Program, but may still benefit from technical assistance under the program. (iv) Develop the nascent renewable energy industry in Bangladesh through support for renewable energy awareness building, information dissemination and business awareness workshops to stimulate private sector interest in renewable energy. Such assistance could be channeled through institutions and agencies active in this field, such as Bangladesh Renewable Energy Association (BREAA) and the Renewable Energy Information Network (REIN) of stakeholders established by the UNDP and LGED.

To the maximum extent possible, the activities will be refined and executed by relevant Bangladesh institutions. This activity will be administered by the IDCOL, which will conduct/facilitate the necessary formulation of TA packages, including terms of reference, selection of consultants and supervision of contracts.

Additional Annex 11: Incremental Cost Matrix and STAP Review Comments and Response BANGLADESH: Rural Electrification and Renewable Energy Development

The approach for solar home systems considers the replacement of kerosene lamps by solar lighting. For a detailed project description, see main body of the text as well as Annex 2, where the project components are discussed in detail. Below the incremental cost matrix based on this information.

	Baseline	Alternative	Increment
Domestic Benefits	<p>Slow Solar market development. At best SHS installations by NGOs/MFIs without support may reach 15000 in the next 5 years.</p> <p>Limited grid-extension by the PBSs/REB to provide access in rural areas. Demonstration of SHS applications in some areas.</p> <p>Limited development of PV business models; Service delivery through large NGOs such as BRAC only. Pay for service, dealer sales model only available in pilot areas.</p> <p>Slow development of other renewables including micro and hydro and micro wind</p>	<p>Accelerate market development through support to NGOs, MFIs and Dealers. Estimated SHS installations in the next 5 years will be 50,000 systems through this approach.</p> <p>PBSs implement a “fee for service” SHS Program for about 14,000 households in 5 separate PBSs in addition to the 50,000 SHS above. Total SHS 64,000 in 5 years. (see chart below)</p> <p>Project promotes multiple approaches- fee for service through PBSs, sales through several NGOs, and direct sales by dealers.</p> <p>Support for hydro and wind market development and building an enabling policy/regulatory framework</p>	<p>Barriers (Information, first cost etc.) to commercial development removed. Strengthen PV capabilities within businesses and NGOs, increase consumer awareness and confidence, and provide a grant to buy-down first cost.</p> <p>In addition to measures described above, build capacity within PBSs to design, implement and evaluate SHS Programs.</p> <p>Successful demonstration of a range of business approaches and incremental social awareness and acceptance for SHS.</p> <p>Policy barriers to wind, mini hydro removed.</p>
Global Environmental Benefits	Power development and rural energy service provision relies on batteries, diesel and kerosene.	Offset of GHG emissions through application of SHS	Nearly 250,000 tons of carbon dioxide avoided



	<i>Baseline</i>	<i>Alternative</i>	<i>GEF Increment</i>
Cost by Component	(million US\$)	(million US\$)	(million US\$)
1a. Solar home system – investments (including implementation support and credit line management)	5.30	26.40	6.34
1b. Solar home system – technical assistance	0.0	3.90	1.56
2. Other Renewables – Technical Assistance	0.0	0.30	0.30
GEF Incremental Costs			8.20

Notes: (1) The Baseline scenario is a 'no project' scenario, because without GEF participation for barrier removal, IDA credit support and TA alone would not result in any significant change to SHS promotion. Therefore, baseline achievements are those expected from current initiatives by few institutions.

(2) The GEF Alternative scenario is based on IDA, GEF, GOB participation in barrier removal, credit and grant support.

STAP Review

September 27, 2001

(by J. P. Painuly, Senior Energy Planner, UNEP Collaborating Centre on Energy and Environment (UCCEE)
RISØ National Laboratory, Post Bag 26, Roskilde, DK- 4000, Denmark)

Review of the document "Project Brief: Bangladesh Rural Electrification and Renewable Energy Development Project"

Overall Comments: The proposal is well developed and comprehensive in nature. It seeks to accelerate penetration of solar home systems (SHS) in rural areas of Bangladesh building on the strengths of existing institutions and employing innovative measures to remove the barriers. Since the project targets the poor rural households with limited paying capacity, it may need to ensure that calculations of repayment requirements for the SHS and paying capacity are reliable. The project can benefit from the experiences in Africa and Asia where rural consumers have been targeted for solar energy usage. The project also explores potential for mini hydro and wind energy in the Bangladesh.

Project Relevance : Rural electrification is one of the important measure to improve quality of life and most of the target population is not expected to have access to electricity in near future in absence of the project. It is also in line with the Bangladesh Government strategy to promote off-grid options in such areas. The project meets the GEF funding criteria under its operational program and also meets FCCC objectives of mitigating greenhouse gas emissions.

Background Information: It is presented fairly well in the document.

Other Features: The project takes a participatory approach in which various stakeholders are involved. This is very useful for resolving the problems and future extension of the concept. Solar industry is not explicitly mentioned as an active partner. Their participation can be useful for training and confidence building about the product through maintenance contracts. Such maintenance can be done by local technicians trained by them. Capacity building is an important component of the project, which is useful for its large-scale application to realize the potential. Project is replicable and hence can contribute to climate change mitigation in other regions also.

The project should refer to the successful experiences in countries in South Asia and benefit from that.

Scientific and Technical Assessment

- (i) System selection: It is very important that appropriate system is selected. A 20 Wp system appears to be on lower side considering following factors:
 - (a) The peak watt capacity normally refers to a radiation level of 1000 w/m² and 250 C. Performance falls at higher temperatures. Therefore, it is to be derated for available radiation level (which may be low during monsoon) and temperature; and
 - (b) Factors such as energy losses in the system, efficiency of the battery may result system performance upto 75 percent (Alsema, 2000). When you take various other effects also into consideration, actual output of a typical system may be less than half of rated value (Stamenic, 1995).

Therefore, a 20 Wp system may hardly be able to support two bulbs of 7 W. Is it enough for the lower level identified in the project? It is possible if they were using only two kerosene lamps/lanterns. But in that case, they may be consuming four to six litres kerosene per month only. How much they will spend on this? Anywhere between US\$ 1 (if subsidized) to US\$ 2.5 (if no subsidy) per month. If they are spending US\$ 3.11 (as mentioned on page 11), they

have more than 2 light points. In that case, 20 Wp is not adequate. Similarly, 40 Wp may be a poor substitute for those spending monthly US\$ 5.84 on kerosene for lighting.

Also, if the system is designed to meet minimum electricity demand, it may turn out to be insufficient to meet the expanding demand (with income growth) long before end of its working life. Currently, it is quite expensive to upgrade the system. In a recent study Lee (2001) assumes a 50 Wp system suitable for a household consuming kerosene about 10 litres / month. This may be too high but indicates that 20 Wp may be low.

(ii) Financial assessment: It is important that program is financially viable for all the stakeholders; SHS users, suppliers, IDCOL, MFIs etc.

On page 11: Expenditure of US\$ 3.11 per month over a period of 15 years yields US\$ 259 for level 1 and 487 for level 2 (it appears a discount rate of 12 percent was used). Cost of solar home systems is taken as US\$ 344 and 544 for 20 and 40 Wp systems.

Since break-up is not given, it is not clear whether all the costs have been factored in or not. These include system costs, installation costs, maintenance costs and financing costs. Financing costs can be quite high; IDA costs, IDCOL costs and MFI costs. MFIs typically lend at rates 18 percent and above unless special arrangement exists for SHS financing. Some of these are barrier removal costs but need to be accounted for.

Three- to five-year loans from MFIs are planned (page 8). Even if SHS level consumer were to be financed 100 percent (US\$ 259 loan + US\$ 85 subsidy), their monthly outgo to repay the loan will be many times their monthly expenditure on kerosene. This is because, they spend this amount over 15 years, but need to pay over five years. How is this problem sorted out ?

More detailed calculations on financial assessment for each stakeholder may throw light on all these issues.

(iii) Funding requirements for wind and mini hydro assessment, and pilot project have not been included in the proposal; and.

(iv) Data on diesel use for battery charging and how this will be substituted by SHS is not available in the proposal.

Global Benefits:

In the calculations of direct benefit, it is mentioned that 5.76 million litres of kerosene will be avoided. This works out to 8 litre per household per month. (divide by 60000*12). This is not consistent with expenditure on kerosene (US\$ 3.11 and US\$ 5.84). The kerosene saved should be much higher.

Cost of carbon is given as US\$ 32.8/ton CO₂ (or US\$ 120/ t C). No calculations have been provided. Incremental cost and carbon cost calculations should be given.

The calculations on lumen equivalence basis may not be relevant considering the implicit assumption in this about triple kerosene consumption.

Editorial Comments:

1. Add a list of acronyms or expanded form when first used (for example for CAS on page 4 and PRSP on page 27).
2. Page 6, 2.2 Baseline: Baseline is also used for cost calculations. For clarity, please mention that in the baseline, these incremental households not covered by solar home systems will continue to use kerosene (45-48000).

3. Page 10: What happens to SHS if grid comes in 5 years (to 10 years?). What is payment period for consumers? What about buyback of 5-10 year old? What about result of this on GHG savings calculated ? These could be explored, if necessary.
4. Page 10: 2.4.2: Figures and headings on costs on page 10 and 29 are not consistent. Following discrepancy exists.
 - (a) In (i) ; SHS through NGO and MFIs: Figures are 11.16 and 4.5 against 12.16 and 5.5 on page 29. Also "finance 60000 SHS" should be changed to 50000 as on page 11 (2.4.3 (b)).
 - (b) In (ii) SHS through PBS: figures are 3.29 and .7 against 3.43 and 84 on page 29.
 - (c) In (ii) SHS through PBS: TA amount of US\$ 1 million each mentioned is not reflected on page 29 in the component SHS program implemented by PBS. This appears to have been added to the wrong component. See (A) above. Logically, this should have been added to last component on page 29 (technical assistance for capacity building and demo projects).
 - (d) For (iii); Development of framework for other renewable: No funding allocation is shown.
5. Page 12, last para: "The estimated cost of the TA component is a total of 4.2 million". But from page 10, total TA adds upto $1.56+1.56+2= 5.12$ (from i and ii).
6. Page 19 Last Para: "In the case of PBSs, under the current grid program, even households using less than 40 kWh per month are regular in paying bills and the cost of SHS fee-for-service is not likely to be much higher."

MFIs do have excellent record of recovery. But comparison with 40 kWh consuming household is not relevant. This is because this (40 kWh) represents almost 16 times output provided by SHS (of 20 W, 4 hours daily), allowing consumer to use TV and other appliances with the same amount.

7. Page 21, Economic assessment: Calculation details should be included (as Annex).
8. Page 21, Financial assessment: Calculation details should be included (as Annex).
9. Page 25, last para: "market assessments indicate a significant potential of over 1.7 million households for the 20 W systems and over 430,000 households for 40 W systems."

The above data indicates a total of about 2.13 million for 20 and 40 W systems. Total market estimate is given as 4 million elsewhere (page 6). How is it arrived at?

References:

- Alsema, E.A., E. Nieuwlaar, 2000. Energy Viability of Photovoltaic Systems. Energy Policy 28 (14): 999-1010.
- Lee, Robert F., Ian Simm and Bruce Jenkyn-Jones, 2001. "Could carbon financing appreciably accelerate the diffusion of Solar Home Systems?", PCF Plus, Washington DC.
- Staminic L and G. Ingham, 1995: Solar Photovoltaic Revolution. A Canadian Handbook for Electricians, Engineers, Inspectors and Builders. Sunology International Inc. Vancouver B.C. Canada.

Response to the STAP Review

The STAP review generally endorses the project and commends some of its key features, such as participatory approach and replicability.

In response to the comment about referring to South Asia experience on renewables, the Project Brief describes a broad range of lessons learnt from various projects, including those from South Asia. The principal experience in this regard is from India and Sri Lanka. In most projects in India, solar home systems (and small hydro and wind projects) have been developed in the non-government and private sectors, similar to the approach being proposed for Bangladesh. However, the general reluctance of the commercial sector and suppliers in India to take rural credit risk has limited the penetration of solar systems. Hence, the preference in Bangladesh to follow a time-tested rural micro-credit model that has fared well in other areas of community-driven development initiatives. Support for the micro-credit model comes from Sri Lanka, where the sale of solar home systems has risen dramatically since the leading rural micro-finance institution there – SEEDS – took an active role. Several of the project's proposed initiatives on barrier removal and capacity development are directly modeled on lessons learnt from Sri Lanka and India.

Regarding the comment on the positive role of the solar industry, the project intends to engage the solar industry as an active partner in developing and serving the solar market in Bangladesh. The current state of the solar industry in Bangladesh consists of a few dealers, but several major players have shown interest in entering the market through this project window. The project provides for TA to develop private sector partnership and introduce both quality standards and competitive provision of equipment and services. Based on experience in other countries in South Asia, this would help to develop strategic plans for greater coverage, better service, and possibly lower costs.

The following responses broadly follow the ordering of the comments in the review note (Annex 3a)

- (i) System selection: We completely agree with the comments. Intuitively one would believe that low income rural families in Bangladesh would be able to afford only 20 Wp systems. However a growing body of implementation experience and feedback from NGOs and micro-finance institutions (MFIs) is producing a different picture. 36 Wp and 40 Wp systems appear to be preferred over the 20 Wp systems. This is also the experience from Sri Lanka where consumers like to upgrade 20 Wp systems within a few weeks of installation and the market share of 20 Wp systems is declining. This latent preference for higher watt systems explains to some extent the ambiguity reflected in the report. The analysis conducted during preparation is based on 20 and 40 watt peak systems; however the delivery systems and business planning is likely to stress 36-50 Wp sizes and higher, both for fee-for service schemes and MFI credit programs. Eventually, as the implementing agencies finalize their business plans and the PDF B is mobilized to enable NGOs to prepare marketing programs, a more appropriate selection of system sizes would emerge.

From an analytical standpoint, it is to be noted that the US\$ 3.11 value for households stems from costs of both kerosene and battery maintenance and charging costs. Batteries are extensively used in rural Bangladesh. The cost of charging a battery approximately every 15 days, along with associated transport and time costs (often boat journeys involving several hours) is in the range of 250-400 Takas per month (about US\$ 4-6). The US\$ 3.11 and US\$ 5.84 values are average estimates of a range of lighting and battery use options. Clearly, households used to employing batteries would not be satisfied with a 20 Wp system, which is consistent with earlier statements regarding preference for larger systems.

- (ii) Financial assessment: Attachment A illustrates cash flows for a household purchasing a 40 Wp system with 3 year credit from MFI with a grant element of US\$ 90. The calculations take into account all the costs, including taka 800 per year for maintenance, and taka 7000 every five years for battery replacement and other spares. The life of the panel and controller is taken to be conservative 15 years (it can be upto 20 years) and a 20 percent equity contribution by the consumer is factored. The net cash flow for the household is positive,

with an FIRR of 13 percent. In the first three years, besides the equity contribution of 4000 takas, the household has to pay out nearly 165 takas per month over and above the savings realized on kerosene and battery charging. From the fourth year onwards there is a net saving. The pattern of financing is not different from practice being followed by MFIs for other activities, where loans range from one to three years. In order to account for the fact that the solar system does not generate additional incomes, the project will try to encourage MFIs to lend for five years in order to make systems more affordable. Detailed business planning work is currently underway to determine the financial viability of each enterprise (NGO and/or MFI) and PBS in providing systems, credit and services to consumers. The reviewers advice of taking account of all costs to the household are duly noted. The outcomes of the detailed business planning will determine the nature and extent of financing criteria under IDA credit lines to the implementing institutions and the financing terms to consumers.

- (iii) Funding requirements for wind and mini hydro assessment, and pilot projects have been included. These are shown as 'Other TA' in the Project Financing Plan in Annex 2. The GEF provision is US\$ 300,000, and if assessments indicate positive potential, IDA funds would also be available to develop and implement pilots and establish commercial framework.
- (iv) Data on diesel use for battery charging is difficult to ascertain with a reasonable degree of confidence in Bangladesh. The reasons are several, the main ones being: (i) battery charging stations are largely operating in the informal sector; (ii) in many places these are operated through grid connections, and grid power uses a mix of natural gas, diesel and hydro for generation; and (iii) seasonal variations in availability and cost of battery charging facilities is very high, e.g. in the flood season, many centers would be inaccessible and households would also move to flood and cyclone shelters. Hence, the estimates worked out for carbon savings are probably on the low side as savings from diesel use for battery charging has been ignored. The number of battery charges vary from 20-27 per annum, and the levelized monthly costs therefore range from US\$ 2.1 p.m. to US\$ 3.3. The incremental cost calculation takes an average for 23 charges leading to a levelized cost of US\$ 2.85 per month* for the equivalence of a 40 Wp system. Please see details in Attachment B. (* this has resulted in a slight correction in valuing benefits for determining incremental costs – the 40 Wp equivalence is now valued at US\$ 5.51 instead of US\$ 5.84 previously. This results from taking an average view on the number of battery charging by household annually)

Global Benefits

As mentioned earlier, the cost savings of US\$ 3.11 and US\$ 5.51 are worked out on the basis of kerosene usage and actual costs of battery charging. Incremental cost calculations and carbon benefits are shown in Attachment B. The point about calculations on lumen equivalence basis not being relevant is well taken, these are furnished for illustrative purposes only. Text in the project brief has been amended to reflect this.

Editorial Comments

The comments are gratefully acknowledged and the inconsistencies have been addressed in the report. Some specific responses on substantive issues raised follow:

3. Page 10: *What happens to SHS if grid comes in five years (to 10 years?). What is payment period for consumers? What about buyback of 5-10 year old ? What about result of this on GHG savings calculated ? These could be explored, if necessary.*

This is clearly one of the crucial design issues, and the project team discussed this issue in detail with the Rural Electrification Board during the pre-appraisal mission. Selected areas under PBSs are not likely to receive grid connections in the next 10 years. Under the fee-for-service scheme though, the PBSs can recover the systems in an electrified village and move them to other remote villages. The NGOs before targeting households for SHS also

ensure that grid will not be available in the area as per the current PBS program for next 10 years. However, the project will explore the necessity and viability of providing buy-back programs.

6. Page 19 Last Para: The comment is: *"In the case of PBSs, under the current grid program, even households using less than 40 kWh per month are regular in paying bills and the cost of SHS fee-for-service is not likely to be much higher." MFIs do have excellent record of recovery. But comparison with 40 kWh consuming household is not relevant. This is because this (40 kWh) represents almost 16 times output provided by SHS (of 20 W, 4 hours daily), allowing consumer to use TV and other appliances with the same amount.*

The 40 kWh per month example is used for comparison with PBS fee-for-service scheme only. This consumption at current tariffs represents a cost of about 150 taka per month, and the PBS fee for service tariffs per month are in the range of 250 Takas. A willingness to pay in this range in unelectrified villages has been clearly established through surveys. The MFIs on the other hand are using the savings from kerosene as the basis for the viability of financing the SHS and no equivalence with 40 kWh consumption is imputed. The text has been reworded to remove this impression.

7. and 8. Calculation details in respect of economic and financial assessment are not included in the interest of keeping the report to a reasonable length, but are available for review. These are being provided to the STAP reviewer.

9. Estimations of solar market demand: The demand numbers are based on two field studies carried out in Bangladesh over the last three years. The various inconsistencies on assessed demand in the report have been addressed. The overall picture is as follows: Nearly 4.8 million households earn more than US\$ 50 per month. Of these, households that spend more than US\$ 3.11 per month and US\$ 5.51 per month on battery charging and kerosene costs are 36 percent and 9 percent respectively. This provides about 1.70 million household that can potentially purchase a 20 Wp system, and 0.43 million households that can potentially purchase a 40 Wp system, with some grant support. The market for 20 Wp and 40 Wp systems is therefore assessed as 2.13 million. The figure of 4 million systems is an approximation of households earning more than US\$ 50 per month and not connected to the grid, without considering current expenditures on kerosene and battery charging. In order to reduce confusion with different estimates, the report now uses only the 2.13 million households number consistently.

Attachments available in project files :

Attachment 1: Financial Assessment for household adopting SHS

Attachment 2: Incremental Cost Analysis and Global Carbon Benefits