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Report No: 71700-BD

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ONA

PROPOSED CREDIT

IN THE AMOUNT OF SDR 102.8 MILLION
(US$155 MILLION EQUIVALENT)

TO THE

PEOPLE'S REPUBLIC OF BANGLADESH

FORA

RURAL ELECTRIFICATION AND RENEWABLE ENERGY DEVELOPMENT II (RERED II) PROJECT

August 16,2012

Sustainable Development Department
Energy Unit
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective July 31, 2012)

Currency Unit	Bangladeshi taka (BDT)
BDT 81.92	US$ 1
US$ 1.50833	SDR 1

FISCAL YEAR

July 1 June 30

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank	LED	Light-Emitting Diode
BCCRF	Bangladesh Climate Change Resilient Fund	MPEMR	Ministry of Power, Energy and Mineral Resources
BDT	Bangladesh Taka	MW	Mega Watt
BERC	Bangladesh Energy Regulatory Commission	MPEMR	Ministry of Power, Energy and Mineral Resources
CAS	Country Assistance Strategy	NGO	Non-Government Organization
CDM	Clean Development Mechanism	PBS	Palli Biddyut Samities (rural electricity cooperatives)
CFL	Compact Fluorescent Lamp	PO	Participating Organizations
ESMF	Environment and Social Management Framework	PSDTA	Power Sector Development Technical Assistance
ELIB	Efficient Lighting Initiatives of Bangladesh	RAPSS	Remote Area Power Supply Systems
FMR	Financial Monitoring Report	REB	Rural Electrification Board
FY	Fiscal Year	RERED	Rural Electrification and Renewable Energy Development
GIZ	Gesellschaft für Internationale Zusammenarbeit	SGA	Subsidiary Grant Agreement
GDP	Gross Domestic Product	SHS	Solar Home Systems
GOB	Government of Bangladesh	SLA	Subsidiary Loan Agreement
ICS	Improved Cook Stoves	SREDA	Sustainable and Renewable Energy Development Authority
IDA	International Development Association	TA	Technical Assistance
IDB	Islamic Development Bank	USAID	US Agency for International Development
IDCOL	Infrastructure Development Company Limited	Wp	Watt Peak
KfW	Kreditanstalt für Wiederaufbau	WHO	Wodd Health Organization
kWh	Kilo-Watt hour		

Regional Vice President:	Isabel M. Guerrero
Country Director:	Ellen A. Goldstein
Sector Director:	John Henry Stein
Sector Manager:	Jyoti Shukla
Task Team Leader:	Zubair K. M. Sadeque

BANGLADESH
Rural Electrification and Renewable Energy Development II (RERED II) Project

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Bangladesh

Rural Electrification and Renewable Energy Development II (RERED II) Project (P131263)

PROJECT APPRAISAL DOCUMENT

SOUTH ASIA

SASDE

Basic Information

Date:	11-Jul-2012	Sectors:	Other Renewable Energy (78%), General energy sector (12%), Energy efficiency in power sector (10%)
Country Director:	Ellen A. Goldstein	Themes:	Rural services and infrastructure (78%), Other public sector governance (12%), Climate change (10%)
Sector Manager/Director:	Jyoti Shukla/John Henry Stein		
Project ID:	P131263	EA Category:	B - Partial Assessment
Lending Instrument:	Specific Investment Loan		
Team Leader(s):	Zubair K.M. Sadeque		

Joint IFC: No

Borrower: People's Republic of Bangladesh

Responsible Agency: Infrastructure Development Company Limited (IDCOL)

Contact:	Mr. S. M. Formanul Islam	Title:	Director
Telephone No.:	9103881	Email:	fislam@idcol.org

Responsible Agency: Power Cell

Contact:	Mr. Mahboob Sarwar-E-Kainat	Title:	Director General
Telephone No.:	955-6040	Email:	dg@powercell.gov.bd

Responsible Agency: Rural Electrification Board

Contact:	Brig. General Moin Uddin	Title:	Chainnan
Telephone No.:	791 1334	Email:	chainnan@reb.gov.bd

Project Implementation Period: Start Date: 01-Jan-2013 End Date: 31-Dec-2018

Expected Effectiveness Date: 01-Jan-2013

Expected Closing Date: 31-Dec-2018

Project Financing Data(US$M)

[ ] Loan	[ ] Grant	[ ] Other
[X] Credit	[ ] Guarantee	

For Loans/Credits/Others

Total Project Cost (US$M): 386.0

Total Bank Financing (US$M): 155.0

Financing Source	Amount(US$M)
BORROWER/RECIPIENT	3.5
International Development Association (IDA)	155.0
US Agency for International Development (USAID)	7.6

Bangladesh Climate Change Resilience Fund (BCCRF)	24.5
GERMANY KREDITANSTALT FUR WIEDERAUFBAU (KFW)	12.9
LOCAL BENEFICIARIES	53.4
Non-Government Organization (NGO) of Borrowing Country	90.2
IDCOL Own Financing	38.8
Total	386.0

Expected Disbursements (in USD Million)

Fiscal Year	2013	2014	2015	2016	2017	2018	2019		
Annual	7.9	25.9	51.5	33.1	13.1	10.0	13.5		
Cumulative	7.9	33.8	85.3	118.4	131.5	141.5	155.0		

Project Development Objective(s)

The proposed project development objectives are to increase access to clean energy in rural areas through renewable energy and promote more efficient energy consumption.

Components

Component Name	Cost (USD Millions)
Access to Electricity	309.2
Household Energy	46.3
Energy Efficient Lighting	19.0
Sector Technical Assistance	6.5
Un-allocated	5.00

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [X]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment *OP/BP 4.01*	X	
Natural Habitats *OPIBP 4.04*		X
Forests *OP/BP 4.36*		X
Pest Management OP 4.09		X
Physical Cultural Resources *OP/BP 4.11*		X
Indigenous Peoples *OPIBP 4.10*		X
Involuntary Resettlement *OPIBP 4.12*		X
Safety of Dams *OPIBP 4.37*		X
Projects on International Waterways *OP/BP 7.50*		X

Projects in Disputed Areas *OP/BP 7.60*			X

Legal Covenants			
Name	Recurrent	Due Date	Frequency
National guidelines on disposal and recycling of CFLs		Prior to distribution of CFLs under Part C.1 of the Project	
Description of Covenant The Recipient shall undertake all measures to ensure that national guidelines for the safe disposal and/or recycling of CFLs are adopted prior to the distribution of CFLs procured under Part C.1 of the Project			
Name	Recurrent	Due Date	Frequency
Project Management Unit for Part B of the Project		By three months after the Effective Date	
Description of Covenant IDCOL shall establish and maintain, throughout the period of Project Implementation, a Project Management Unit responsible for the implementation of Part B of the Project			
Name	Recurrent	Due Date	Frequency
Operating Guidelines, ESMF and GAAP	X		
Description of Covenant IDCOL shall ensure that Parts A, B and C.2 of the Project are carried out in accordance with the provisions of the Operating Guidelines, Environment and Social Management Framework (ESMF) and the Governance and Accountability Action Plan (GAAP) REB shall ensure that Part C.1 of the Project is carried out in accordance with the provisions of the Environment and Social Management Framework (ESMF) and the Governance and Accountability Action Plan (GAAP)			

Conditions	
Name	Type
Subsidiary loan agreement with IDCOL	Effectiveness
Description of Condition To facilitate the carrying out of Part A of the Project, the Recipient shall make part of the proceeds of the Credit available to IDCOL under a subsidiary loan agreement.	
Name	Type
Subsidiary grant agreement with IDCOL	Effectiveness
Description of Condition To facilitate the carrying out of Part B of the Project, the Recipient shall make part of the proceeds of the Credit available to IDCOL under a subsidiary grant agreement.	
Name	Type
Subsidiary grant agreement with REB	Effectiveness
Description of Condition To facilitate the carrying out of Part C.1 of the Project, the Recipient shall make part of the proceeds of the Credit available to REB under a subsidiary grant agreement.	
Name	Type
Settlement of outstanding audit observations of REB	Disbursement

Description of Condition	
No withdrawal shall be made under Category (4) until and unless REB has carried out measures, satisfactory to the Association, to remedy all of the outstanding material audit observations with respect to REB's fmancial statements for the RERED project.	
Name	Type
Appointment of Assistant Director (Accounts)	Disbursement
Description of Condition	
No withdrawal shall be made under Category (5) until and unless an Assistant Director (Accounts) with qualification and terms of reference satisfactory to the Association has been appointed by Power Cell	

Team Composition

Bank Staff

Name	Title	Specialization	Unit
Shakil Ahmed Ferdausi	Senior Environmental Specialist	Environmental Safeguards	SASDI
Junxue Chu	Senior Finance Officer	Disbursement	CTRLN
Koffi Ekouevi	Senior Economist	Technical Specialist	SEGEN
Md. Iqbal	Senior Energy Specialist	Technical Specialist	SASDE
Md. Abul Fayez Khan	Program Assistant	Program Assistant	SASDO
Zubair K.M. Sadeque	Financial Analyst	Team Lead	SASDE
Luis Alejandro Lara Lopez	Program Assistant	Program Assistant	SASDO
Burhanuddin Ahmed	Sr Financial Management Specialist	Financial Management	SARFM
Tanvir Hossain	Senior Procurement Specialist	Procurement	SARPS
Ashok Sarkar	Senior Energy Specialist	Technical Specialist	SEGEN
Jose Ramon R. Pascual	Counsel	Lawyer	LEGES
Sabah Moyeen	Social Development Specialist	Social Safeguards	SASDS
Mohammad Anis	Energy Specialist	Energy Specialist	SASDE
Ishtiak Siddique	Procurement Specialist	Procurement	SARPS

Non Bank Staff

Name	Title	Office Phone	City
Anil Cabraal	Renewable Energy Consultant	94-11-230-7665	Colombo
Shirin Jahangeer	Consultant, Gender Specialist	8159001	Dhaka
M. Khaliquzzaman	Consultant, Household Energy	8159001	Dhaka
Iqbal Ahmed	Consultant, Environment	8159001	Dhaka

Institutional Data

Sector Board

Energy and Mining

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation	Mitigation Co-benefits

			Co-benefits %	%
Energy and mining	Other Renewable Energy	78		100%
Energy and mining	General energy sector	12		
Energy and mining	Energy efficiency in Heat and Power	10		
Total		100		

Themes

Major theme	Theme	%
Rural development	Rural services and infrastructure	78
Public sector governance	Other public sector governance	12
Environment and natural resources management	Climate change	10
Total		100

Public Private Partnership

Private Capital Mobilization
Yes

Gender Flag

[X] Analysis and/or consultation on gender related issues	[X] Specific actions to address the distinct needs of women and girls, or men and boys, or positive impacts on gender gaps	[X] Mechanisms to monitor gender impact to facilitate gender-disaggregated analysis

1. STRATEGIC CONTEXT

A. Country Context

1. Bangladesh, with a population of about 150 million and a land area of 147,570 square kilometers, is amongst the most densely-populated countries in the world. The country is vulnerable to natural disasters and extremely sensitive to climate change impacts. Despite the challenges, Bangladesh has managed to graduate to a higher growth trajectory and maintain an average GDP growth rate above 6 percent in recent years. Poverty has also decreased in recent years, keeping Bangladesh on track to meet the Millennium Development Goal of halving extreme poverty by 2015. Total export of the country increased at a rate of about 14 percent since 2005. However, the infrastructure deficits in a number of areas but especially in energy are emerging as the main threats to maintain its growth in exports and GDP. **In** the latest Investment Climate Assessment (lCA), the highest number of firms (78%) expressed their concern about the lack of adequate power.

2. A large segment of the population of Bangladesh has little or no access to electricity or to clean energy sources. Access to electricity in Bangladesh is about 55% and in the rural areas, the access rate is only 43% with about 13 million rural households yet to be electrified.[1] The per capita electricity consumption of about 236 kWh per year is one of the lowest in the world.

3. Out of the total 30 million households in Bangladesh, about 90% use traditional biomass fuels such as fuelwood, dung, and agricultural residues for cooking in low-efficiency stoves (5 to 15 percent fuel efficiency). The incomplete combustions of these fuels in inefficient stoves produce smoke composed of large amount of particulate matter and gaseous pollutants. Indoor air pollution resulting from this smoke is linked with many illnesses including childhood pneumonia and chronic obstructive pulmonary disease representing a significant health hazard. Daily exposure to particulate matter for most Bangladeshis exceeds $200\mu g/m^3$, well above the daily standard of $25\mu g/m^3$ established by the World Health Organization (WHO). The health impact is particularly acute for women and children who are the most exposed groups to indoor air pollution. According to WHO estimates, about 32,000 children below the age of 5 years and 14,000 adults die every year from pulmonary diseases caused by indoor air pollution in Bangladesh.

B. Sector and Institutional Context

4. The energy sector of Bangladesh is facing many challenges, which include, among others: acute shortage of electricity supply to meet demand; heavy reliance on natural gas for power generation, which itself is in short supply; inadequate investments in power generation and natural gas exploration and production; inadequate tariff to cover costs; weak governance and inadequate autonomy of the corporatized public sector entities; limited human resources capability; and inadequate capacity of the regulator. The peak electricity demand in the country is about 7,000 MW and the available generation capacity is about 5,300 to 6,400 MW, resulting in supply disruptions to those having access to electricity. The rural areas connected to the grid face a disproportionate share of load-shedding. The average system losses of the distribution

1 Source: Household Income Expenditure Survey 2010.

utilities are below 13%. Natural gas is the primary fuel for more than 80% of power generation, which itself is in short supply. Renewable energy currently constitutes less than 1% of total power generation in the country.

5. Recognizing the challenges, the Government of Bangladesh (GOB) has adopted a multi-pronged strategy in the power sector that includes energy conservation, load management, adopting grid and off-grid electrification approaches to extend electricity services, promoting private sector investment in short and longer-term power supply measures, exploiting alternative energy resources to diversify the fuel mix, looking actively for power import from neighboring countries, and improving sector governance and efficiency. The GOB articulated a Vision 2021, which includes the objectives of: i) universal access by the year 2021 with improved reliability and quality; ii) stabilizing the sector's financial status and increasing its efficiency; and iii) operating the sector on commercial principles and increasing private sector participation.

6. The Renewable Energy Policy (2008) of GOB laid out the target of meeting 5% of total power demand from renewable energy sources by 2015 and 10% by 2020. The Remote Area Power Supply Systems (RAPSS) guideline of 2007 allows for private sector participation in development, operation, and maintenance of electricity generation system and distribution networks in remote rural areas including isolated islands to supplement GOB efforts at achieving universal access by 2020. However, there has not been much progress in implementing the RAPSS schemes. GOB has prepared the legislation to establish a Sustainable and Renewable Energy Development Authority (SREDA) as an autonomous body to lead its efforts in promoting renewable energy and energy efficiency in the country. The Cabinet has approved the legislation and this will be placed in the Parliament for approval.

7. To address the generation shortages, GOB has embarked upon an ambitious generation expansion plan that envisages adding more than 11,500 MW to the national grid by the year 2015. As part of that plan, a number of large power plants have recently been awarded to the private sector. As an interim measure, GOB has contracted about 2,300 MW of plants run on liquid fuel for 3-5 year terms. These short-term plants running on expensive liquid fuel, however, are aggravating the deteriorating financial position of the power sector. To cope with the increased costs of the short-term plants, the Bangladesh Energy Regulatory Commission (BERC) increased the bulk supply tariff by 70% and the retail tariff by about 35% in phases since February 2011 in response to the tariff adjustment requests by the utilities. Even with these adjustments, tariff remains below full cost-recovery. GOB subsidy to the sector stood at BDT63 billion (US$800 million) in FY12 up from BDT40 billion (US$550 million) in FYI 1. This was in addition to the subsidy to the petroleum sector to the tune of BDT90 billion (US$1.15 billion) in FY12, up from BDT40 billion (US$550 Million) in FYI 1.[2] These are clearly unsustainable.[3] In the long run, GOB expects the cost of power generation to come down gradually once the large power plants start to come into operation replacing the costly liquid fuel plants. GOB plans to reduce the budget support requirements to a more sustainable level by FY15 with gradual adjustments in tariff.

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[2] GOB subsidy in petroleum increased by more than double due to a combination of high fuel prices in the international market as well as a sharp increase in petroleum imports due to increased demand from short-term power plants.

[3] In its efforts to reduce the need for subsidy, during the last quarter of FY12, GOB had to resort to restricting generation from the short term plants to the evening hours only when demand is at its peak.

8. Despite all the short and long-term efforts at increasing power generation and demand side management, it will take years to fully close the demand-supply gap. Consequently, it will not be possible to achieve the government vision of universal access by 2021 relying only on the grid. Furthermore, the dispersed nature of rural settlements and the numerous rivers that crisscross the country make grid electrification in many areas difficult and expensive. Off-grid renewable energy is the only near-to-medium-term option left for millions of people in the remote areas of the country.

9. The Solar Home Systems (SHS) program of Bangladesh, supported principally by the Bank with other development partners, has emerged as a viable electrification option for lighting and other basic services in areas without grid access. The SHS program started in 2003 with a target to install 50,000 SHS over the 5-year project period under the on-going Rural Electrification and Renewable Energy Development (RERED) project. The program has far exceeded its goals. It is currently installing over 50,000 systems per month making it one of the fastest growing SHS programs in the world. The SHS program is implemented by the Infrastructure Development Company Limited (IDCOL), a government owned infrastructure finance company. The program is a successful public-private partnership model where the Partner Organizations (POs) (mostly Non-government Organizations) procure and install the systems as per technical standards set by IDCOL. Consumers sign SHS purchase contracts under a micro-finance scheme with the POs. After the systems are installed, the POs apply for re-financing from IDCOL for a portion of the microfinance they extended to the households. After technical and other verifications, IDCOL releases the credit and a fixed subsidy (currently $28 per system) to the POs. This refinancing provides the POs with funds to install more systems and reach even more remote areas.

10. Together with support from the Bank and other development partners, the program is expected to reach about 2 million SHS by end 2012 in rural off-grid areas, contributing to increasing access to electricity by 6%. Thanks to the SHS, women are spending productive time after dark (sewing, knitting etc) and students including girls are spending more time studying. The TVs run by SHS contribute to women education and empowerment[4]. Grameen Shakti and a number of other POs are providing training to village women for assembling some SHS components who are then becoming entrepreneurs running their own technology centers, assembling and providing maintenance services. Continuing with the successful installation of the SHS, IDCOL has set a target to reach another 4 million SHS by the year 2016, requiring support from the Bank and other development partners[5].

11. **In** addition to the SHS, GOB is also exploring other renewable energy options for providing access to electricity in rural areas. There are pockets of off-grid areas and remote islands in Bangladesh where population concentrations are such that renewable energy based

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4 A 2009 survey by the German International Cooperation (GIZ) that included 260 SHS related interviews in northwest Bangladesh found improved lighting and study conditions, improved access to information and communications, increased savings, and improved safety as the main benefits of SHS. It also noted a high degree of satisfaction among the SHS consumers (more than two-third of the respondents were satisfied with the services) while 80% of non-users stated they would like to buy an SHS. A more rigorous impact evaluation study is currently on-going under the RERED project.

5 The target of 4 million households is based on SHS being affordable to top 40% of income earning households. With smaller lower cost SHS available, the program is reaching poorer households, which was not possible earlier.

mini-grid is the least-cost option for providing access to electricity. Providing grid-quality electricity from renewable energy sources in these areas will serve the commercial needs of the rural markets and small enterprises, where the potential consumption of electricity is much higher than the basic lighting and electricity needs of a typical rural household that could otherwise be met by SHS. The on-going Bank support has piloted three renewable energy-based mini-grid schemes for providing access to electricity in selected off-grid remote areas. Taking lessons learned from these pilots, GOB plans to scale-up these types of schemes under the scope of the RAPSS guidelines. Private operators, selected by IDCOL, would be investing in and generating power from the least-cost technology options (solar photovoltaic, biomass gasifier etc) for providing grid quality electricity in the selected locations on a fee-for-service basis. IDCOL will be managing a RAPSS fund to provide for a mix of credit and grant financing to keep the tariff affordable to the consumers, in addition to equity contribution by the private operators. **In** September 2011, the Government issued a concept note for supporting private sector investment in 1,000 mini-grid schemes by 2015, requiring 25 MW of renewable energy capacity.

12. Cooking by rural households is predominantly done in traditional stoves using traditional biomass fuels, the smoke of which is particularly harmful to women and children. The transition to modem, clean cooking fuels like natural gas, liquefied petroleum gas (LPG), and to some extent electricity, will take a long time, as access to these fuels are limited, and the appliances to use them are not affordable to the poor. Transitory clean cooking options for households include improved cook stoves (ICS), advanced combustion stoves, and biogas. An ICS with a well maintained chimney could (i) help save up to 50 percent of the traditional biomass fuels used by improving fuel combustion, and (ii) provide moderate reduction in health damaging pollutants by directing smoke through the chimney out of the kitchen. An advanced combustion stove can provide significantly higher fuel efficiency and reduce emissions. Similarly, biogas can provide clean cooking benefits in addition to household lighting and produce a valuable byproduct in the form of biogas-slurry for fertilizer. For both advanced combustion stoves and biogas, affordability is an important issue preventing a large scale introduction. The large scale dissemination of clean cooking solutions has the potential to yield co-benefits in terms of reduced fuel collection time, improved household health, local environmental quality, and regional climate.

13. Despite efforts by various organizations to introduce clean cooking solutions since the 1980s, in terms of coverage, only about 2 percent of households relying on traditional biomass fuels have access to ICS today. The main barriers for a scaling up of clean cooking solutions in the country are: (i) absence of wide-spread awareness campaigns; (ii) limited funding to support scale-up activities; (iii) absence of a sustainable funding mechanism; and (iv) cost-revenue shortfall preventing the development of commercial enterprises to promote clean cooking solutions. There is an overall lack of leadership, oversight, coordination, and monitoring of household energy access activities in the country. This is preventing cross-fertilization of best practices. A recent USAID report identified the following seven areas for potential interventions on clean cooking solutions in Bangladesh: (i) market intelligence to remove market barriers; (ii) consumer education; (iii) technical standards, testing and certification; (iv) product development; (v) policy and regulation; (vi) business development support; and (vii) access to finance. The recent mobilization on clean stoves and fuels through the Global Alliance for Clean Cookstoves

(GACC) and the United Nations Sustainable Energy for All Initiative offers a unique opportunity that Bangladesh should explore to scale up the provision of clean cooking solutions to households.

14. As part of its efforts to reduce the existing demand-supply gap, GOB has embarked upon the Efficient Lighting Initiatives of Bangladesh (ELIB) program with Bank support to replace incandescent lamps with energy-efficient Compact Fluorescent Lamps (CFLs). The first-phase distribution of 10 million CFLs has been completed, though there have been quality issues with high levels of early lamp failure rates. The Rural Electrification Board (REB)[6] procured the CFLs while the distribution utilities and the rural cooperatives (Palli Biddyut Samities or PBSs)[7] distributed the CFLs to the households in exchange for incandescent lamps. The second-phase distribution of about 7 million CFLs is being planned, including actions to overcome the quality issues. The ELIB program is registered under the Clean Development Mechanism (CDM) for claiming carbon credits with IDCOL as the Coordination and Managing Entity (CME).

15. To implement the power sector reform activities, Power Cell was established in 1996 as a technical arm of the Power Division of the Ministry of Power, Energy and Mineral Resources (MPEMR). It provides technical assistance for policy formulation, design and implementation of power sector reform activities, implementation support to sector agencies, and capacity building activities of the sector. **In** support of this service, the Power Cell has been receiving technical assistance funding through the ongoing Bank-supported Power Sector Development Technical Assistance (PSDTA) project, which is scheduled to close in December 2012. Implementation of the power sector reform activities need continued financial support beyond PSDTA closing.

C. Higher Level Objectives to which the Project Contributes

16. The RERED II project is an important contributor to the GOB's vision of universal access to electricity by the year 2021. Recognizing that the vision cannot be achieved relying on grid electricity alone, GOB has been putting emphasis on renewable energy based off-grid options for providing access to electricity. The Project would also support the Renewable Energy Policy of the GOB by increasing the share of renewable energy in power generation.

17. The Project builds on the achievements of the RERED project, which has delivered gender responsive results by supporting the provision of energy services to facilitate social and productive activities undertaken by men and women in rural areas of Bangladesh. The RERED II Project would support the provision of renewable energy based electricity services and clean cooking solutions using social mobilization approaches of the NGOs and marketing techniques of the private sector. By leveraging the capacities of NGOs and the private sector, the Project would contribute to strengthening the on-going development of a commercial market for SHS, other renewable energy technologies, and clean cooking solutions, thus contributing to job creation in green technologies.

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6 REB is the apex body responsible for planning, financing, and installation of the rural grid electrification network of the country.

7 After constructing the rural distribution lines, REB transfers them to the rural cooperatives (PBSs), which are then responsible for retail service provision as well as the operation and maintenance of the rural grid network.

18. The Project is consistent with the Country Assistance Strategy (CAS) for FYll-I4; it would make a positive contribution to human services through increased access to electricity in hard-to-reach areas and to Bangladesh's climate change agenda through the expanded use of renewable energy. Specifically, the proposed Project would contribute to achievement of outcome 1.3 under CAS Pillar 1 (increased infrastructure provision, access and efficiency) and outcome 2.3 under CAS Pillar 2 (reduced environmental degradation and strengthened natural resources management). **In** keeping with increased vigilance against fraud and corruption risks, the Project incorporates social accountability tools including third party monitoring, and aims at increased transparency through access-to-information and information technology based solutions.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

19. The project development objectives are to increase access to clean energy in rural areas through renewable energy and promote more efficient energy consumption.

B. Project Beneficiaries

20. The Project is expected to reach electricity to 2.5 million people (half of which is women) living in the rural areas of Bangladesh where grid electricity has not reached or is not expected in years to come. Access to electricity has numerous economic and welfare benefits especially to women and children who spend greater proportion of time at home. The Project is expected to provide clean cooking solutions for over 1 million households. Access to clean cooking options especially benefits women and children by improving conditions under which meals are prepared, reducing respiratory diseases, reducing time spent on cooking, and saving money. Finally, by supporting a more effective energy-efficient CFL dissemination, the Project would, to some extent, help to make more electricity available for people in the rural areas who bear a disproportionate share of load-shedding.

C. PDO Level Results Indicators

21. The following outcome indicators are proposed. The indicators marked (*) are core sector indicators. The results framework is in Annex 1.

- Number of households, farmers, and businesses having access to clean energy services
- Generation capacity of renewable energy (other than hydropower) constructed (MW) (*)
- Efficient energy consumption through introduction of energy efficient lighting (MW saved per year)
- Number of direct beneficiaries including female beneficiaries. (*)

III. PROJECT DESCRIPTION

A. Project Components

22. In support of GOB's vision of providing universal access to electricity by the year 2021, the Project would support the provision of renewable energy based electricity services using the capabilities of NGOs and the private sector. The Project would also provide support for increasing access to clean fuels and modem cooking methods. It will help reduce peak electricity demand by supporting an energy-efficient lighting program through dissemination of CFLs. Finally, the Project would provide technical assistance support for policy development and capacity building in the power sector in general, and renewable energy in particular. The components to be supported under the Project are described below. A more detailed description is in Annex 2.

Component A: Access to Electricity (total US$309.2 million, IDA US$116 million)

23. The component would support the Solar Home Systems (SHS) and other renewable energy options for increasing access to electricity. The component would also include technical assistance support to IDCOL for capacity building, inspection and monitoring, impact evaluation, training, and other related activities for ensuring effective implementation.

24. SUb-Component A.I Solar Home Systems (SHS) (total US$199.8 million, IDA US$99.45 million): The Project would further scale up support to the successful SHS program of Bangladesh for providing access to electricity to households and shops in rural areas where grid electricity will not reach in the short to medium term. The target is to support 550,000 systems following the same implementation arrangement of the RERED project. Customers are expected to provide 10%-15% of the SHS prices as down payment. IDA funds (and IDCOL own funds) will refinance 60%-70% of the micro-finance extended by the POs to the households.

25. The funding requirement is based on the current market prices and a grant support of US$20 for each of the smaller systems installed. The prices for solar panels and batteries (the two major cost components of SHS) are quite dynamic. While the prices for solar panels have fallen significantly in the international market in recent times, battery prices have risen sharply. Consequently, prices of SHS in the local market have remained relatively stable since 2006 (in current BDT per Watt peak). In the event that prices of batteries go down, resulting in a reduction in the end-user price for the SHS, this would allow IDCOL to support more systems with the available funding. The estimated costs are also based on the demand patterns of 2010-11 where about a quarter of the systems sold were of small size of 20Wp and less, about half of the systems in 40-50Wp range and the rest above 50 Wp. The funding requirements will change depending on the demand pattern - smaller systems will require less credit draw-down while larger systems will require more funds.

26. A grant of US$20 per SHS is available only for 30 Wp and smaller SHS to increase their affordability as these are purchased by the poorest households.[8] USAID has expressed interest

[8] The program started in 2003 with US$90 per system of grant support, which was the difference in life-cycle costs of SHS and the kerosene lanterns that the SHS replaced. The grant support has since been gradually declined to US$ 28 per system in 2012

to contribute US$2.5 million for meeting the grant and technical assistance needs for the SHS program. The SHS program is at final stage of registration as a CDM project, and once registered, an existing Bank carbon fund (and a proposed new fund) is expected to purchase emission reductions from the program.

27. ***SUb-Component A.2 Remote Area Power Supply Systems (RAPSS) (total US$109.4 million, IDA US$16.55 million):*** The Project would support mini-grid schemes under the RAPSS guidelines to meet the electricity needs of rural household, enterprises, and businesses that could not otherwise be met with SHS. The implementation activities, including selecting the sponsors for establishing, operating, and maintaining the mini-grids, would be undertaken by IDCaL. Sponsor equity will be a minimum of 20% with IDCaL providing the balance (including credit and a capital buy-down grant to keep the end-user tariff affordable) for the mini-grid schemes. The least cost technology options (solar PV, biomass gasification etc.) will be used depending on the resource availability in the specific locations of the mini-grids, building on the lessons learned from the pilots under the on-going RERED project. The component would also support biogas based captive plants to supply electricity in rural areas. Depending on the demand and viability of the sub-projects, the component can support financing other applications such as solar cooling and drying or advanced hybrid brick kilns.

28. The component will also support solar irrigation pumps that would replace diesel-operated pumps thus contributing to increased access to clean energy by farmers. Similar to the mini-grid schemes, private sponsors would identify locations and reach agreements with groups of farmers on the selling rate for water and on the duration and quantity of water supply. Sponsors will be putting in equity of at least 20%, while the rest of the project cost will be financed through a combination of credit and grant to keep the tariff affordable to farmers. IDCaL will do site specific due diligence before approving the sub-projects. Carbon finance opportunities will be designed to overcome existing barriers, scale up support, and sustainability of these activities.

29. IDCaL market assessments and sponsor inquiries indicate that IDcaL could finance 42 solar mini-grids, 1,500 solar irrigation pumps, 450 biogas-based captive plants, and 28 biomass-based captive plants during the Project period[9]. This would require an estimated US$45 million in credit support, US$41 million in capital buy-down grant, and US$1.9 million in technical assistance, in addition to sponsors' equity ofUS$21.5 million. The credit finance requirements will be met from IDA and IDcaL own funds. The capital buy-down grant and technical assistance requirements will be met from USAID (US$5 million) and the Bangladesh Climate Change Resilience Fund (BCCRF) (US$24.5 million)[10] - both channeled through the Bank - and from KfW (US$12.9 million).

(average USD 0.60/Wp compared to USD 2-5/Wp in other countries). From 2013, grant support will drop to USD 20 per system for smaller systems (30 Wp and less) with no grant for larger systems. An impact evaluation study is currently on-going that would assess, among others, the level of grant support necessary to make the systems affordable to poorer households.

9 IDCOL is currently doing due diligence on a number of mini-grid proposals, and the outcome of these will make clearer the final composition of renewable technologies to be supported under the Project.

10 Funding commitment ofUS$24.5 million has been received from the BCCRF. US$23 million is expected for capital buy-down grant for the irrigation schemes, while US$1.5 million is expected for technical assistance including feasibility studies, site-specific due diligence, inspection and monitoring, and impact assessment etc for the irrigation schemes.

Component B. Household Energy (total US$46.3 million, IDA US$12 million)

30. The proposed household energy component supports the efforts of various NGOs in providing rural households with clean cooking solutions. The activities supported would include: (i) awareness raising through social mobilization to ensure potential users are aware of the fuel saving and health benefits associated with clean cooking; (ii) research and development to enhance product quality, performance, safety and durability; (iii) setting up of performance standards, labeling system and testing facilities; (iv) support to selected POs to generate demand and to facilitate enterprise creation so that households are motivated to buy ICS or advanced combustion stoves; and (v) and capital buy-down grants for biogas plants for cooking. The target is to support commercial dissemination of about 1 million ICS and 20,000 biogas units within the implementation period of the Project. Implemented by IDCOL, the component will build on the success of Bangladeshi NGOs in the areas of community outreach in total sanitation programs. It will also build on the earlier work undertaken by local institutions in the areas of stove design and reduction of emission of toxic pollutants from incomplete combustion of wood fuels. To avoid duplication of efforts, the implementation of this component will be in close collaboration with on-going activities in the sector by NGOs, GIZ, USAID and upcoming activities that will be undertaken through the Global Alliance of Clean Cookstoves. With IDA supported activities creating demand and facilitating supply chain development, households are expected to buy the ICS from the market for cash. The biogas plants are expected to be installed by the POs on cash payments by households (net of capital buy-down grants).

Component C. Energy Efficient Lighting (total US$19 million, IDA US$17 million)

31. This component will support the distribution of 7.25 million CFLs in predominantly rural areas where these energy efficient CFLs are not yet widely used. Under the ELIB program supported by the RERED project, about 10 million CFLs were distributed by various utilities to households in exchange for incandescent lamps in 2010. However, post-installation surveys within a few months of installations have indicated alarming levels (33%) of lamp failures. REB, the implementing agency, has claimed replacement of the poor quality bulbs from the supplier. The second-phase procurement of 17.5 million CFLs was initiated in late 2010 under the RERED project (before the post-installation survey results of the first phase was available), but due to various issues (including issues related to submission of fraudulent performance guarantees by the winning bidder) the procurement could not be completed.

32. GOB has expressed its strong commitment to continue with the second phase and intends to initiate a re-bidding, taking into account lessons learned from the poor quality in the first phase and the aborted second-phase procurement. REB will revise the bidding documents with the help of an international technical consultant to strengthen the clauses for quality assurances. Recognizing that many in the urban households have already switched to CFLs, the second phase distribution will be restricted mostly to rural areas where people cannot afford to pay for the high costs of CFLs. IDA funding of US$17 million would cover the costs of CFL procurement including pre-award inspections, pre-shipment inspections and testing, post-shipment testing; costs of distribution including training for proper distribution and documentation to comply with

CDM requirements; customer awareness; impact evaluation etc. Funds from GOB and the utilities are expected to cover the costs of sockets [11] as well as the costs of PMU within REB.

Component D. Sector Technical Assistance (total US$6.5 million, IDA US$5 million)

33. The Project would provide continued technical assistance support to Power Cell beyond December 2012 when the on-going PSDTA project will close. This would include, among others, support for implementation of power sector reform, feasibility studies and environment and social impact assessments for various power sector projects in the pipeline, and capacity building of sector institutions. This would also include support for establishment and operationalizing SREDA through the provision of office equipment and furniture, consultant services, and training; and capacity building support for BERC. Finally, this would support developing national guidelines for safe disposal/recycling of CFLs and capacity building for ensuring safe disposal of CFLs financed under the Project.

B. Project Financing

1. Lending Instrument

34. The Project is proposed as a Specific Investment loan (SIL) to the GOB at standard IDA terms. IDA funds for sub-loans for access to electricity component will be made available to the financial intermediary IDCOL under a Subsidiary Loan Agreement (SLA) with the Finance Division of the Ministry of Finance. Funds for the household energy component and technical assistance support for access to electricity component will be made available to IDCOL under a Subsidiary Grant Agreement (SGA) with the Finance Division. Funds for the energy-efficient lighting component will be will be made available to REB under an SGA with the Finance Division. No SLA will be required for Power Cell to receive project funds as it is a part of the Power Division of the MPEMR.

2. Project Cost and Financing

35. The total estimated cost of the project is US$386 million out of which IDA financing proposed is US$155 million (40%). For the SHS sub-component, IDA financing would leverage household down payments (US$19 million), POs' share of the micro-credit (US69 million), and IDCOL own financing (US$10 million). For the RAPSS sub-component, sponsors are expected to provide US$22 million as equity while the rest would be provided by IDA and other donors (USAID, BCCRF, and KfW) in addition to IDCOL's own funds. For the household energy component, IDA financing of US$12 million will support demand creation, supply chain development through the POs, and capital buy-down grants for the biogas plants, while households are expected to purchase the ICS and biogas for cash (net of grants) (US$34 million). The estimated cost of the energy efficient lighting component is US$19 million, of which IDA financing proposed is US$17 million. The TA to Power Cell is estimated to cost US$6.5 million, out of which IDA financing proposed is US$5 million. A detailed cost table is in Annex 2.

[11] The CFLs are planned to be screw-types that are better option than the pin-types that households typically use, requiring replacement of the sockets along with the incandescent lamps.

Project Components	Project cost	IDA	% IDA	USAID	BCCRF	KfW	GOB, Households, POs/ Sponsors	IDCOL Own financing
A. Access to Electricity	309.2	116.0	38%	7.565	24.5	12.9	109.4	38.8
AI. Solar Home Systems (SHS)	199.8	99.45	50%	2.5			87.9	9.9
A2. Remote Area Power Supply Systems (RAPSS)	109.4	16.55	15%	5.065	24.5	12.9	21.5	28.9
B. Household Energy	46.3	12.0	26%				34.3	0.0
C. Energy Efficient Lighting	19.0	17.0	89%				2.0	0.0
D. Sector Technical Assistance	6.5	5.0	77%				1.5	0.0
Total Baseline Costs	381.0	150	39%	7.565	24.5	12.9	147.2	38.8
Contingencies	5.0	5.0						
Total	386.0	155.0	40%	7.565	24.5	12.9	147.2	38.8

C. Lessons Learned and Reflected in the Project Design

36. The single largest activity of the Project is the SHS sub-component. It builds on the success of the SHS component of the RERED project, which is considered the best practice. Success of the SHS program could be attributed to a number of factors: (i) a sense of ownership by consumers resulting in proper system care; (ii) access to financing and availability of grant assistance to increase affordability and to ensure that pas have adequate capital for investing in and operating the service infrastructure; (iii) customer training imparted by the pas enabling the customers to carry out regular, simple maintenance work themselves; (iv) social acceptability of the pas at the community level and the existence of a micro-credit culture in rural Bangladesh resulting in customer readiness to try the systems; (v) institutional set-up of the pas enabling them to reach remote customers in a cost-effective and efficient manner; (vi) setting technical standards and enforcing the standards through strong supervision and monitoring by IDCaL; (vii) risk sharing between IDcaL and the pas, proper customer selection, and attention by both IDcaL and the pas to collection efficiencies (the pas achieved an average collection efficiency of94% and are servicing their debts owed to IDcaL on a timely basis); (viii) ability to achieve low costs - SHS costs including a five year warranty for batteries and three years of maintenance is US$6-7/Wp (net of subsidy of US$28 per system); and (ix) large customer base in relatively densely populated areas.

37. The Project also builds on the following key lessons from other Bank-financed SHS projects[12]:

- Product quality at entry must be complemented with quality assurance and enforcement. Technical standards established under the RERED project must be upgraded to reflect latest technological developments, including use of efficient light-emitting diode (LED) lamps. A testing lab is being established with support from the

12 With Bank-financed SHS projects in about 30 countries, the Bank is the largest financier of SHS among the multilaterals and has considerable experience in this sector.

ongoing RERED project that will be used to monitor quality at entry and to undertake random testing to assure quality is maintained.

- Keeping the end-goal of fully commercial SHS sales; retain flexibility by how much and how fast grant support is reduced and when reduction takes place. Too quick and too deep a cut in grant assistance could compromise the ability of the POs to provide effective services and may reduce quality. It can also lead to consumer dissatisfaction as they may purchase smaller systems than desired, and the consumers may become unhappy with the level of service provided.
- Presently, the principal SHS customers are the less poor with only about a fifth below the poverty line[13]. As the market in a particular area becomes saturated, more dispersed and poorer consumers would need to be reached. While making lower cost SHS affordable to poorer households is inherently valuable, it also makes business sense. Deepening markets enables service centers to have sufficient critical mass of business. Market deepening to reach poorer consumers requires offering smaller and lower-cost systems, including solar LED lamps that poorer consumers can purchase without compromising quality. The proposed project will make such products eligible to receive assistance.
- An alternate approach to increasing affordability is to use a fee-for-service approach. **In** Peru, the distribution utilities receive a full cost-recovery tariff, comprised of a retail tariff paid by the customer and a subsidy from the national cross-subsidy fund. Prior experience in Bangladesh in a fee-for-service approach was not successful. REB was tasked with the fee-for-service approach under the RERED project, which was later discontinued. The fee-for-service approach will be used in the RAPSS component but not in the SHS.
- As customers become more dispersed, more efficient installation methods, such as using plug-and-play units, and lower cost fees/loan collection methods, such as using mobile phone payments, should be adopted. Otherwise, higher overhead costs will make products too expensive for consumers. The options for introducing IT-based solutions for increasing cost effectiveness in service delivery will be explored in the Project.
- Monitoring and evaluation and obtaining user feedback is essential. Currently, minimal monitoring and evaluation (M&E) is undertaken, only to confirm that product and installation meet standards and that the customers are trained. A third-party monitoring is being introduced under the RERED project that would be continued under the proposed project. The on-going impact evaluation study will provide recommendations for baseline M&E indicators, which will be incorporated in the Project.
- Donor funds for either grants or credit is insufficient to meet the government goals for off-grid electrification. Commercial sources of financing must be mobilized. A study is being initiated under the RERED project to find ways to leverage additional financing from commercial sources.

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[13] The 2009 survey of GTZ found that while there were considerable number of poorer people who purchased an SHS, only 23% could be classified as "poor" when applying the regional poverty line. SHS-owning households had a higher per capita incomes (BDT 2,400 per month) than the national average of BDT 1,485. In the northwest Rajashahi division, 48% live below the upper poverty line and 31% below the lower poverty line, compared to 23% of the SHS users in the sample who are living below the upper poverty line and 16% below the lower poverty line.

38. Lessons from RAPSS program. Some of the above lessons, in principle, also apply to the RAPSS investments with respect to meeting customers' expectations in quality and reliability of service, providing affordable service, responding to customer concerns, judicious and targeted use of grants to increase affordability, and working with credible partners who have effective management and financial discipline. Several additional lessons apply. As a mini-grid has constrained electricity supply (limited by renewable energy generator capacity, if expensive diesel back up is not used), ensuring fair allocation of electricity among users and using electricity efficiently are essential. Careful assessment of willingness to pay is important for the project to be financially viable. Irrespective of what customers were paying for electricity in the past, they will compare their service and cost of service to that available in the nearby grid customers. There must be reasonable certainty that in the near to medium term the grid will not reach the community or that the sponsor will be compensated for the stranded assets. If the grid does arrive, many customers will opt for grid service as the tariff would be much lower (even if reliability would be low), with a drastic reduction in revenue for the mini-grid sponsors.

39. Lessons learned in the household energy program: Bank experience of implementing household energy programs worldwide provides for the following lessons learned: i) a holistic approach to household energy issues is necessary; ii) public awareness campaigns are prerequisites for successful interventions; iii) local participation is fundamental; iv) consumer fuel subsidies often times do not to reach those who deserve it most; v) both a market-based approach and public support are essential for commercialization of ICS; vi) the needs and preferences of stove users should be given priority; vii) durability of ICS is important to successfully expand their distribution; and viii) the poorest segment of the population might need microfinance to afford an ICS.

40. In the particular case of Bangladesh, lessons learned include: (i) engaging the local government, community leaders and health volunteers is beneficial for effective awareness raising, increased coordination and successful implementation; (ii) locally appropriate awareness-raising approaches for programs are crucial for uptake of household energy products; (iii) user training on maintenance and use of cookstoves should be extended to women, who are the main users; (iv) performance monitoring of cookstoves should be an important element of program design to ensure adequate feedback for enhancing stove designs; (v) reliable after-sales support and services produce great confidence among users and facilitate the adoption and use of technology; and (vi) the cookstove business must be sufficiently profitable to encourage credible firms and entrepreneurs to enter the business. These have been incorporated in the design of the Household Energy component of the Project.

41. Lessons learned in the ELIB program: The critical elements for the success of large scale CFL deployment programs include: i) strong ownership and commitment of the Government; ii) simple program design that makes free distribution of CFLs the preferred option to cost recovery; iii) strong planning and record keeping; iv) effective coordination amongst the key stakeholders; v) advance consumer awareness; and vi) high quality technical specifications and qualify enforcement. Besides, for long-term continued use of CFLs, availability of high-quality CFLs at affordable costs must be ensured. This may require providing support for domestic sources of production, with adequate testing laboratories for quality assurance. Parallel

regulatory and policy efforts of removal of duties and taxes, phasing out of incandescent lamps, and effective recycling or end-of-life management programs, would be needed. The ELIB program has been designed to incorporate all these elements. The first-phase CFLs under the ELIB program were distributed in two single days across hundreds of distribution centers, which proved to be cumbersome in complying with the stringent CDM documentation requirements across the centers. Considering this, a door-to-door distribution is planned for the second phase of the program that would ensure better control over distribution and documentation. To ensure quality of CFLs procured, several modifications to the bidding procedure are envisaged that include, among others, stricter qualifications criteria to attract only genuine bidders and enhanced product testing before shipment.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

42. The main components of the Project (access to electricity and household energy) would be implemented by IDCOL, a government owned infrastructure finance company. IDCOL is run by professional management under effective oversight by a competent Board. As a company, IDCOL is able to offer market based incentive package to its management and staff. IDCOL has proven its capacity in managing the growing renewable energy program of GOB under the on-going RERED project. The growing renewable energy portfolio however is going to put a strain on the capacity of IDCOL. Recognizing this, an institutional development consultant has been engaged by IDCOL to review the current organization structure and to proposed modifications for enhancing its capacity. It is expected that during the implementation of the Project, capacity of IDCOL will be enhanced with separate unit established to manage the renewable energy program. **In** addition, for the household energy component, a separate Project Management Unit (PMU) will be established for day-to-day management of the component.

43. IDCOL will implement the components with the help ofPOs who are mostly NGOs (for SHS and household energy) and NGOs/private sponsors (for RAPSS). The PO selection committee of IDCOL would select the POs as per the eligibility criteria outlined in the Operations Manual of the Project. Starting with 5 POs, the SHS program now has 29 POs, and IDCOL expects to engage more POs as part of its goal of achieving a commercially sustainable competitive market for SHS in Bangladesh. IDCOL has an independent Technical Standards Committee, which approves the standards for the SHS and RAPSS. For the household energy component, a separate technical committee comprising stove experts, technologists and relevant government officials will be set up to advise on design and certification standards and other relevant technological issues. IDCOL has a team of inspectors who would inspect and verify that the systems are installed as per approved technical standards before financing is released from the Project fund. For the RAPSS sub-component, the sub-project specific due diligence would be done by IDCOL based on project proposals from the POs. The Bank will review the appraisal reports of the first *five* sub-projects in each technology.

44. The energy-efficient lighting component will be implemented by REB suing the same implementation arrangement of the RERED project. REB will procure the CFLs and distribute them to the relevant PBSs and other distribution utilities. PBSs and the distribution utilities will

be responsible for distributing the CFLs in exchange for incandescent lamps in the respective service territories, and destruction of the collected incandescent lamps. REB will be responsible for overall management of the component. IDCOL will be responsible for maintaining database and conducting post-installation surveys as part of CDM requirements.

45. Power Cell will be implementing the technical assistance to the sector following the same implementation arrangement of the PSDTA project.

46. A coordination committee has been set up at Power Division of the Ministry of Power, Energy and Mineral Resources (MPEMR) with representation of the relevant agencies and other ministries (Ministry of Environment, Ministry of Agriculture etc) for effective coordination during implementation of the Project.

B. Results Monitoring and Evaluation

47. Monitoring and evaluation are fundamental to assess implementation progress and to provide necessary corrective measures during implementation. IDCOL has a well-established monitoring system in place for its SHS program that will be further strengthened for the growing SHS program and replicated for use in the other activities (RAPSS and household energy). Data for measuring the outcome and results indicators outlined in Annex 1 will be collected by the POs and reported in the refinancing applications to IDCOL.

48. A robust impact evaluation (IE) on the SHS program is currently on-going that will measure the impact of SHS on household income and socio-economic welfare. This evaluation will suggest M&E indicators that will be incorporated in the PO reporting under the Project. A similar impact evaluation study will be conducted for the access to electricity and household energy components of the Project during implementation. The study will be designed to attribute causality to project interventions. The proposed impact evaluation aims to determine whether the project has had a significant impact on income, employment, access to social services and socio-economic welfare of the beneficiaries. Results will be disaggregated by gender to measure the impact on female beneficiaries. A baseline survey for the IE will be carried out at project start and the follow-up survey at the project completion. The study will implement a difference-in-difference approach for comparison between treatment (beneficiaries of the project) and control (non-beneficiaries) groups. Annex 7 details out the methodology to be used.

49. To better assess customer feedback from electricity connections (through SHS and RAPSS) and from clean cooking solutions (ICS and biogas plants under the household energy component), several IT based options for enhanced reporting and feedback are being explored. Some of the POs in the SHS program already have a mobile text messaging system in place to track daily installation data of various field offices of the POs. The option of introducing this system for the whole SHS program and the other activities (RAPSS and household energy) would be explored which would allow for automatic update of the installation data in the database maintained at IDCOL. Customer satisfaction feedback via text messaging would be introduced that would allow for an easy and cost-effective method for collecting customer feedback, thus ensuring enhanced accountability of the POs for proper service delivery. As part of CDM validation, independent third party audits will be carried out annually for the SHS program.

50. For the energy-efficient lighting component, REB will collect data on the number of CFLs distributed by the PBSs/utilities and report through a progress report on a quarterly basis. Data on loads before and after the distribution in selected feeders will be collated to measure the impact of distribution of CFLs in terms of MW saved. Funding for this impact assessment is provisioned for in the sector technical assistance component implemented by Power Cell. As part of CDM validation, independent third party audits will be carried out annually to verify that the CFLs are working at households.

51. Power Cell will report on a semi-annual basis on the activities undertaken and track progress in creating an enabling policy for renewable energy development.

C. Sustainability

52. The Project is aimed at making the SHS fully commercial with the pas eventually borrowing funds at market terms from commercial sources by the end of the implementation of the Project. With this goal in mind, IDcaL has been gradually reducing the refinancing rate from 80% initially to 70% currently. During the implementation of the Project, IDCaL will extend refinancing of only 60% of the micro-finance of the larger pas having a credit outstanding amount of more than BDT 250 million. A commercialization study is currently on-going exploring options for full commercialization of the program while ensuring that poorer households are not left out of the program due to increased costs of commercialization.

53. The RAPSS sub-component will require investors to have equity contribution in the sub-projects and the tariff will be set to ensure a reasonable return to the investors to compensate for the commercial risks that the investors would take. Financial analyses of RAPSS sub-projects have identified that grants of 20 to 50 percent of capital costs would be needed today to make these projects viable at a tariff that is within the customers' ability to pay. IDCaL will closely monitor performance of ongoing and proposed sub-projects and adjust grant levels of future projects to the minimum required. IDcaL is also considering competitive award of grant funds to RAPSS projects based on minimum subsidy requirements.

54. By opting to support micro-enterprise development through trammg and capacity building through well established pas, the household energy component will pave the way for commercial dissemination of clean cooking solutions. By supporting large-scale dissemination of CFLs in exchange for incandescent lamps, the Project would have demonstrated the benefits of CFLs (savings in customer bills), which would motivate households to continue to use CFLs after expiration of the program CFLs. The Project would also provide support for relevant policy and regulations (e.g. gradual phase-out of incandescent lamps and reduction of taxes and duties on CFLs), which would help promote CFLs in the long-run.

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

Stakeholder Risk	Rating
Implementing Agency Risk	
- Capacity	Substantial
- Governance	Moderate
Project Risk	
- Design	Moderate
- Social and Environmental	Moderate
- Program and Donor	Low
- Delivery Monitoring and Sustainability	Moderate
Overall Implementation Risk	Moderate

B. Overall Risk Rating Explanation

55. The Project is a repeater operation prepared by implementing agencies which are familiar with Bank procedures, and the main agency (IDCaL) has a proven track record. Therefore, the preparation risk has been rated as Moderate. With respect to implementation, key risks are related to capacity issues for IDcaL (due to scaling up of activities), project complexity (number of components), and sustainability of min-grids under RAPSS sub-component (related to willingness to pay). To address IDcaL's capacity constraints, an institutional assessment is underway to recommend capacity enhancements to meet the needs of the growing renewable energy portfolio. A separate PMU with adequate staff will be established for implementing the household energy component. With respect to project complexity, the components proposed under the Project are independent of each other, such that delays in one component will not impact on the implementation of the other components. With respect to tariff affordability and sustainability of the RAPSS mini-grids, a gradual approach will be undertaken with market testing with a few mini-grids first. In an event the anticipated demand for the mini-grids do not materialize as planned, the funding available will be utilized in the irrigation schemes or in the SHS program in support of achieving the objective of providing access to electricity.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analyses

56. Economic and financial analyses were conducted for representative system configurations:

- SHS of varying sizes, displacing kerosene lighting and use of rechargeable batteries for operating small appliances such as TV. Weighted average size was 50 Wp supplying 6 kWh/month. SHS are used to provide electricity to dispersed customers

where a grid extension and establishment of the distribution network is either not feasible or not cost effective due to dispersed nature of customers, difficult terrain, or low load densities.

- RAPSS:
  - Solar mini-grid comprises of a solar photovoltaic array, batteries, inverter, back-up diesel (to increase reliability), and a distribution network. The representative system is 103 kWp supplying 23 kWh/month per customer to 500 customers. The alternative is a diesel mini-grid providing the identical level of service to the same set of customers. The tariff charged is based on the willingness to pay of the consumers as obtained from survey data.[14] A mini-grid is used where load density is high (larger number of customers densely located and/or meeting higher electricity demand beyond basic lighting and other services that could be met by a SHS).
  - Solar irrigation water pump with 6.5 kWp solar array, variable frequency inverter, submersible pump, and water distribution network irrigating about 30 acres for three seasons. It would displace a diesel pump and with the same water distribution network.
  - 200 kW biomass gasifier/generator comprising of a fuel handling system, biomass gasifier, gas cleaning equipment and a gas-powered generator will supply power to the sponsor's own facilities in place of a diesel generator of similar capacity supplying the same quantity of electricity.
- CFLs of 13 and 23W replacing incandescent lamps of 40/60W and lOOW respectively. The national benefits are due to the avoided electricity consumption, reduction of peak load as well as the global benefits of avoided C02 emissions. The benefit to the consumer will be the reduction of electricity expenses and also avoiding more frequent replacement of incandescent lamps, had the consumer continued to use incandescent lamps.
- Household Energy comprises Improved Cookstoves (ICS) and biogas units replacing traditional biomass stoves. A biogas unit produces 2.8 m3 of gas per day for cooking. The quantity of gas is sufficient to prepare three meals a day.

57. The results of the economic and financial analyses are summarized below and detailed in Annex 9.[15] All evaluated representative sub-projects are economically and financially viable. The exact number and combination of technologies to be supported under the Project is not known with certainty as it depends on market demand. Consequently the fund allocations across various investment categories may be different from that envisaged at appraisal. IDCOL will

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14 Survey conducted at the 100 kWp solar mini-grid in Sandwip Island, the first project financed by IDCOL. The project is operating and customers are paying 32 *BDT/kWh*.

15 Key assumptions used in the analyses were: solar PV module price of US$ l/Wp for large modules with positive tolerances; domestic installed cost of SHS of US$7.25 on average including five year system-wide warranty and three years maintenance; other hardware costs are from IDCOL records; domestic retail price of diesel and kerosene of 61 *BDT/liter;* economic cost of diesel and kerosene (including domestic storage and distribution) of 82.5 and 69 *BDT/liter* respectively; real fuel cost escalation of 2 percent; marginal duty and tax rate on equipment of 24.4 percent, with PV modules duty and tax exempt; an exchange rate of 82 BDT/US$; and a discount rate of 10 percent. Assumptions and details are in the economic and financial analysis report in the Project Files. In CFL analysis the standard tariff of 4.97 *BDT/kWh* was used in the financial analysis and an avoided cost of 3.6 *BDT/kWh* was used in the economic analysis. CFL failure rates were taken into account, using values recommended in UNFCCC CFL CDM Methodology.

conduct economic/financial assessments of each sub-project loan application prior to approving investments as part of its due diligence.

Components	Stand-alone	RAPSS			Efficient **Lighting**	Household Energy	
Technology	SHS	Solar **Mini-grid**	Solar **Irrigation**	Gasifier Power	CFL	ICS	**Biogas**
Number of Units	550,000	42	1500	28	7.25 Min	1 Min	20,000
Project EIRR (%)	43				211	36.3	27.3
Economic Cost Effectiveness							
- Renewable Energy		38BDT/kWh	*1.7 BDT/m3*	11 BDT/kWh			
- Diesel alternative		48 BDT/kWh	*2.4 BDT/m3*	34BDTlkWh			
Project FIRR (%)	26	13.7	10-13	28	45	91	15.1
Financial Cost Effectiveness							
- Renewable Energy		31 BDT/kWh	*1.2 BDT/m3*	12 BDT/kWh			
- Diesel alternative		43 BDT/kWh	*1.9 BDT/m3*	25 BDT/kWh			
Sensitivities	Kerosene use must drop to one liter per month per household for EIRR to drop to 10%.	Breakeven levelized ost of electricity when diesel fuel cost s 30% less or if PV system cost 33% greater. FIRR is 10% when ariffis 20 *BDTI* kWh. f REB grid takes over 8 years to reach the area, the FIRR xceeds 12 percent.	Breakeven levelized cost of water when diesel economic cost is 64% of current cost. Financially, solar irrigation is lower cost till diesel fuel drops to half its current cost of 61 BDT/liter	Breakeven 1evelized economic cost of electricity when diesel fuel cost is 32% of current cost; or when biomass fuel cost is 3.8 times greater.	EIRR without carbon credits is 182%. FIRR without carbon credits is 43%	If biomass fuel cost is 80% of current cost, EIRR drops to 10%	If biomass fuel cost is 60% of current cost, EIRR drops to 10%.

58. SHS. Economic Internal Rate of Return (EIRR) and Financial Internal Rate of Return (FIRR) were used to assess the viability of SHS where it displaced kerosene lighting and rechargeable batteries. Sensitivity analyses were conducted to assess the robustness of the results. The SHS economic analysis took into account the economic value of avoided kerosene use as well as the avoided battery charging that a SHS customer would have been incurring prior to getting a SHS. C02 emissions reduction value was taken into account, but it is low compared to economic cost savings.

59. RAPPS. Economic cost effectiveness analysis was conducted for RAPSS applications - solar mini-grid, solar irrigation pumping and for biomass gasification captive power supply - against diesel generation as the alternative providing the same levels of service. Grid extension was not considered as an alternative as these RAPSS applications will be installed in areas unlikely to be served by the REB grid in the near to medium term. Cost effectiveness analysis, rather than EIRR computation, was undertaken as the type of service (electricity or water delivery), and the service levels (kWh or cubic meters of water supplied) from the renewable energy options and the diesel alternative are identical - thus the benefits are identical.

60. Electricity from a solar mini-grid is economically and financially lower cost than from diesels. The FIRR is 13.7 percent for the solar mini-grid when the retail tariff is 32 BDT/kWh. The equity IRR is satisfactory at about 18 percent as 50 percent of the project cost is grant funded. The results are robust - diesel fuel price must drop 30 percent or PV cost increase 33 percent for diesel to be a lower cost alternative. Both are highly unlikely.

61. A key risk to these mini-grid projects is that customers may not want to pay such a high tariff, especially if the national grid gets near to the mini-grid site. This risk would be mitigated if the mini-grid sites are carefully screened to select sites where there is a high willingness to pay and where the national grid will take a long time to reach. Areas where the grid would take over 8 years to reach would be suitable as the FIRR is about 12 percent or more after 8 years. The risk to the developer is also low as the financial cash flow is positive and FIRR is 12 percent by the sixth year. A key decision point is the sixth year where a significant investment has to be made in replacing batteries. If the grid is anticipated in the near future, the battery investment should not be made, rather interconnecting the solar array to the grid to supplement grid power and to offer voltage support can be considered. Early battery failure would hurt the project finances seriously and therefore enforceable battery warranties are required (SHS systems require 5 year warranties and they have been honored by all participating battery suppliers).

62. Solar irrigation is financially and economically viable. As the sponsors charge less for water from a solar irrigation scheme than from a diesel water supply scheme, water demand from farmers is expected to be strong. The financial results are robust - diesel fuel cost must drop to about 30 BDT/liter (or half its current subsidized financial cost) for diesel pumping to be less costly. It is unlikely that diesel fuel cost will drop so much.

63. The biomass gasifier power project has positive economic and financial returns. Economic cost of electricity from a gasifier is one third that from a diesel generator. Financial cost of electricity from the gasifier is about half that of diesel generation as diesel fuel is subsidized. To achieve attractive returns, the plant must operate reliably over the long term. Internationally, small biomass gasifier power plants have had a spotty performance record. Therefore this technical performance risk must be mitigated through careful design, well trained operators, and properly managed fuel supply. For diesel generation to be lower cost, biomass fuel cost would have to quadruple (in India, for example, biomass fuel price increased six-fold over a ten year period in areas with significant biomass power generation).

64. CFL. EIRR and FIRR were computed for CFLs and both are highly positive. Economic and financial cash flows are positive from the second year. Since the quality of lighting between a CFL and the incandescent light is not very different, consumer surplus from improved lighting was not calculated for the CFL component. Economic benefits of C02 emissions reductions were taken into account.

65. **Household** Energy. The Household Energy sub-components - Improved Cookstoves and Biogas Units - have attractive returns, both financially and economically. They have significant co-benefits in terms of improved health, socio-economic status, and reduced workload for women.[16] The benefits accrue principally to women and children who spent time in the home and in the kitchen and have responsibility of collecting fuelwood.[17] These co-benefits, though not explicitly valued in the EIRR will increase the EIRR of the ICS and biogas sub-components.

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16 IDS, "Biogas User Survey", Report to IDCOL, November 2011.

17 Improved cookstoves and biogas stoves result in significant reduction of indoor air pollutants such as small particulates, and toxic pollutants. The WHO estimates that as much as 3.6 percent of the total burden of disease in Bangladesh is attributable to exposure to indoor air pollution; 32,000 children below 5 years of age die annually due to acute lower respiratory infections, and 14,000 adults die due to chronic obstructive pulmonary disease. ESMAP, "Improved Cookstoves and Better Health in Bangladesh: Lessons from Household Energy and Sanitation Programs, The World Bank, Final Report June 2010.

Even without considering the health and other benefits, the economic results are robust - biomass fuel prices have to drop to 60-80 percent of current prices before EIRR reduces to 10 percent. **In** households where fuel is gathered but not explicitly priced financially, there would be less incentive to adopt an ICS or biogas unit. Therefore consumer awareness and education proposed in the project is exceedingly important for adoption of these improved cooking devices.

B. Operational Policy 8.30 Compliance

66. IDCOL, being a financial intermediary, is required to comply with World Bank's Operational Policy 8.30 for Financial Intermediary Lending (OP 8.30). An OP8.30 compliance review was carried out in June 2012 that found IDCOL to be in compliance with the requirements. IDCOL is in good financial position with adequate capitalization, has good loan recovery rate (collection performance of the POs has been over 96%), makes adequate loan loss provisions as per Bangladesh Bank's regulations, keeps its books of accounts in compliance with rules and regulations, and has a satisfactory profit margin and management capacity ensuring its sustainability as a financial intermediary. The cost of funds for the POs under the project is comparable with their other sources of financing - such as PKSF (Pally Karma Shahayak Foundation), the apex institution financing micro-finance organizations in Bangladesh - ensuring that there is no significant market distortion arising from implementation of the Project. The detailed OP 8.30 compliance review for the RERED II Project is provided in **Annex 8.**

C. Technical

67. The project uses well established renewable energy technologies. The SHS sub-component use internationally sourced photovoltaic panels and locally sourced batteries, charge controllers and lights, all of which will be compliant with the standards set by the Technical Standards Committee of IDCOL. Before approving the sub-projects under the RAPSS sub-component, IDCOL due diligence will ensure that the technology used is the least cost option. For the household energy component, a separate Technical Standards Committee will be formed to advise on design and certification standards and other relevant technological issues.

68. Given the size and growth of the SHS program, it has now become imperative to build domestic capacity for testing of key components and systems to verify continued compliance, and to undertake performance testing of PV systems in the laboratory and in the field. The on-going RERED project is supporting establishment of a testing facility in Bangladesh. Once established, the POs and manufacturers can avail the testing services for a fee. IDCOL would use the testing services to monitor quality and performance.

69. Regular inspections will be held by IDCOL to ensure the systems are installed as per the approved technical standards. **In** addition to the inspections, IDCOL will conduct annual technical audits by independent third parties to verify that approved products are used, and are installed as per the technical standards.

70. For the CFLs to be procured under the energy-efficient lighting component of the Project, the technical specifications will be strengthened with support from an international consultant to ensure that the procured CFLs are technically robust to withstand the wide voltage fluctuations

typically experienced in the Bangladesh system and can last the required life-time stipulated in the technical specifications.

D. Financial Management

71. A financial management assessment was carried out to evaluate the overall financial management environment prevailing in the country and within the implementing agencies of the Project in accordance with OP/BP 10.02. IDCOL, the implementing agency for the main investment components (access to electricity and household energy), has been implementing the SHS and other renewable energy programs with support of the eligible POs under the RERED project since 2003. IDCOL has acquired significant experience in IDA financial management procedures and requirements. IDCOL's FM organization and system are found to be adequate to manage its operation and to undertake project financial management activities. IDCOL is in the process of full-computerization of its accounting system that will allow for automatic generation of interim project reports without any scope for manipulation and errors. The Participation Agreement between IDCOL and the POs would include provisions requiring the POs/sponsors to maintain appropriate accounting and financial control as outlined in the Operating Guidelines of the Project.

72. The financial management organization of REB, the implementing agency for the energy-efficient lighting component, is a robust one and its entity financial management systems are also acceptable to IDA. However, there are some outstanding audit issues on the project accounts of REB under the RERED project. An action plan has been developed by REB and substantial progress made in settling the outstanding audit observations. Taking appropriate measures to remedy the outstanding observations has been made a disbursement condition for the efficient lighting component.

73. Power Cell has gained experience in Bank project implementation from their participation in the PSDTA project. There have however been issues with lack of FM staff at the Power Cell. A Deputy Director for Finance and HR has been appointed recently. Appointment of an Assistant Director (Accounts) is made a disbursement condition for the sector TA component implemented by Power Cell. Power Cell resolved all the outstanding audit observations under the PSDTA project that were identified as material to IDA and agreed to follow-up on a priority basis in the case of any audit observations that may arise in the future during implementation of the RERED II Project. A Project Audit Committee with composition and charter of duties acceptable to IDA will be established to monitor the follow-up on audit issues of REB and Power Cell.

E. Procurement

74. Procurement for the Project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated January 2011 (Procurement Guidelines); and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated January 2011 (Consultant Guidelines) and the provisions stipulated in the Financing Agreement. The overall responsibility for implementation of the Project would be with IDCOL, REB and Power Cell. The sub-loans under the access to electricity component implemented by IDCOL would be under financial intermediary loan and the procurement for

these components will be the responsibility of the concerned pas. The pas are expected to follow established commercial practices ensuring economy and efficiency. A procurement audit by independent third parties will be conducted every alternate year to review the procurement practices of the pas to ensure they conform to commercial practices.

75. A procurement capacity assessment was carried out in all the three implementing agencies with the web-based Procurement Risk Assessment Management System (P-RAMS). REB has adequate staff with procurement knowledge in its Procurement Directorate. However, delays in awarding contracts and maintaining confidentiality during the bidding process are the key issues in REB. Power Cell has shortage of staff with procurement knowledge causing delays in procurement process. Being a financial intermediary, IDCaL is not involved in major procurement except for small value procurement of goods and consultant services. REB and Power Cell are not immune to systemic issues affecting procurement efficiency and performance. The Project is rated as "Substantial-Risk" from procurement operation and contract administration viewpoint.

76. As part of the procurement risk mitigation measures, all the three implementing agencies have agreed to identify a Procurement Focal Point to help the respective agencies in day-to-day procurement follow-up and preparation of periodic procurement reporting. For CFL procurement, an individual international consultant having technical knowledge on CFLs will be appointed to help strengthen the technical specifications and testing requirements. **In** addition, an individual international procurement consultant will support REB during bid invitation and evaluation as a member of the bid evaluation committee. A national procurement consultant will be appointed by Power Cell who can also assist IDCaL as and when needed basis. REB and Power Cell will prepare thorough terms of reference and a time bound action plan for the bid evaluation committee to ensure strict confidentially of the bidding process and timely completion of the evaluation. Procurement Plans for the first eighteen months for all the three implementing agencies, acceptable to IDA, have been prepared.

F. Social (including Safeguards)

77. No public land will be used for the Project, and no land acquisition will be financed under the Project. Land required for the RAPSS sub-projects will be private lands made available by the sub-project sponsors via direct purchase or by leasing. IDCaL requires that the land for the sub-projects is free of disputes and encumbrances. All land for Project use, whether made available via direct purchase or leasing, will be screened to ensure that no physical or economic displacement of communities/persons will take place, and lands which are disputed or have encroachments on them (informal settlers, non-titled entities) will not be used for the Project. It may be mentioned that such encumbrances are rare in rural areas.

78. The project may extend facilities in areas where indigenous people (IPs) live. However, availing the facilities/services/products under the access to electricity and household energy components of the Project is purely on a voluntary basis for all paying customers (including IPs). No negative impacts are anticipated towards IPs. **In** cases of project activities in the **IP** areas like Chittagong Hill Tracts, the pas are well-versed in **IP** languages to offer adequate consultation on maintenance of products. awareness raising, and training.

79. A gender responsive social assessment for the Project was carried out to identify opportunities for gender responsive activities in the access to electricity and household energy components. The assessment involved focus group discussions, key informant interviews, and household observations in five different sites. The assessment identified that the SHSs supported under the on-going RERED project has increased women's safety, mobility and entrepreneurial ambitions. It has enabled children to study properly at night and do better in school. Several gender focused activities that would be further explored for implementation under the RERED II Project include consultation with women during installation of the SHS to ensure the locations of the light fixtures are at places that are more beneficial for women in their household chores. Women-centered training and consultations will be adopted to maximize the benefits of SHS for women. To expand the use of biogas plants, POs would explore options for employing both male and female employees who will have access to rural men and women to motivate and advice them for installing and using biogas plants. Consultation with women would be ensured before installation of ICS regarding location and height of the stove placement. More detailed recommendations are in Annex 10.

80. IDCOL will be responsible for monitoring of environmental and social safeguard compliance with support of the POs. An environmental management and social management framework (ESMF) was adopted under the original RERED project, which was updated during the two additional financing of RERED. The ESMF has been further reviewed and revised for the RERED II Project. The updated ESMF includes an assessment of the progress on the compliance of the activities undertaken in the ESMF of the RERED project. The updated ESMF along with its BangIa version has been disclosed in IDCOL website on July 18, 2012 and in World Bank Infoshop on July 20, 2012.

G. Environment (including Safeguards)

81. The Project will promote and scale-up the use of renewable energy technologies and energy efficient bulbs. These interventions yield net positive environmental impacts. The project is designated as environmental Category B (partial assessment) according to OP/BP of the Bank and only one environmental safeguard policy OP/BP 4.01 has been triggered. No significant and/or irreversible adverse environmental and social issues are expected in the sub-projects financed under the project.

82. IDCOL has gained experience in implementing the ESMF under the Bank financed RERED project. It has made progress in establishing the Environment and Social Safeguards Management Unit (ESMMU) to institutionalize the environmental and social management in its operation. IDCOL now has a full-time environment staff member who is working with POs and battery manufacturers/suppliers to raise awareness about the importance of environmental and social safeguards. Visits are made by the staff to all battery recycling plants on half-yearly basis for ensuring environment compliance. To further strengthen the ESMMU, IDCOL is in the process of appointing an additional environmental consultant to guide the client in preparing and reviewing the environmental assessment/screening for subprojects.

83. The major environmental concerns of this project are: (i) risk of lead contamination from improper disposal! recycling of lead-acid storage battery used in SHS; and (ii) risk of mercury contamination from improper disposal of CFL bulbs. Several measures have been undertaken by

IDCOL to strengthen SHS battery recycling including refinancing for battery replacement and enhanced incentives for POs and manufacturers for collection of expired batteries. IDCOL has required the compliance of ISO 14001:2004 and OHSAS 18001:2007 by all battery recyclers and battery suppliers. 12 out of the 13 battery suppliers have become ISO 14001 and OHSAS 18001:2007 compliant, and the remaining one is expected to be compliant soon. Also, out of the three battery recyclers of the country, one is already compliant and the other two are in the process of becoming compliant. It is expected that the remaining battery recyclers will be ISO 14001:2004 and OHSAS 18001:2007 compliant before the implementation of the Project begins. An annual environment audit by independent third parties will be undertaken to assess the adequacy of the current mechanism for ensuring proper recycling of batteries and to monitor implementation of the ESMF.

84. For the energy-efficient lighting component, national guidelines will be developed by a team of international and local consultants for the proper disposal of CFLs. These guidelines are required to be in place before the distribution of the CFLs financed under the Project can commence. The sector TA component of the Project will provide technical assistance support for capacity building for ensuring safe disposal of expired CFLs financed under the Project.

Annex 1: Results Framework and Monitoring

BANGLADESH: Rural Electrification and Renewable Energy Development II (RERED II) Project (P131263)

Results Framework

Project Development Objectives

PDa Statement

The proposed project development objectives are to increase access to clean energy in rural areas through renewable energy and promote more efficient energy consumption.

Project Development Objective Indicators

Indicator Name	Core	Unit of Measure	Baseline (Dec 2012)	Cumulative Target Values						Frequency	Data Source/ Methodology	Responsibility for Data Collection
				2013	2014	2015	2016	2017	2018			
Number of households, farmers, and businesses having access to clean energy services	D	Number	0	100,200	321,100	674,200	930,900	1,239,200	1,578,000	Quarterly	Project Progress Report capturing data collected from the POs	IDCaL
Generation Capacity of Renewable Energy (other than hydropower) constructed		MW	0	6	18	35	41	50	61	Quarterly	Data reported by the POs in refinancing applications	IDCaL
More efficient energy consumption through	D	MW saved per year	0	0	50	200	190	170	160	Quarterly	Project Progress Report capturing data collected from the PBSs and	REB

introduction of energy- efficient lighting											other utilities	
Direct project beneficiaries		Million	0	0.5	8.2	9.5	9.7	10.1	IOA	Quarterly	Project Progress reports capturing data reported by the POs in the refinancing applications	IDCOL! REB
Female beneficiaries		Percentage	0	44	50	51	52	54	55	Quarterly	Project Progress reports capturing data reported by the POs in the refinancing applications	IDCOL! REB

Intermediate Results Indicators

Indicator Name	Core	Unit of Measure	Baseline (Dec 2012)	Cumulative Target Values						Frequency	Data Source/ Methodology	Responsibility for Data Collection
				2013	2014	2015	2016	2017	2018			
Number of solar home systems installed	D	Number	0	100,000	300,000	550,000	550,000	550,000	550,000	Monthly	Minutes of the Operations Committee meeting of IDeOL reporting data collected from sales records of the Partner Organizations	IDCOL
Number of connections made	D	Number	0	150	470	990	2,440	4,370	6,750	Quarterly	Mini-grid appraisal reports	IDCOL

through mini-grid systems and captive plants											and sub-project status update	
Number of solar irrigation pumps installed	D	Number	0	30	150	350	600	1,000	1,500	Quarterly	Sub-project status update	IDCOL
Number of improved cook stoves purchased by households	D	Number	0	0	20,000	120,000	370,000	670,000	1,000,000	Monthly	Minutes of the Operations Committee meeting of IDCOL reporting data collected from the POs	IDCOL
Number of biogas plants installed	D	Number	0	100	600	3,000	8,000	14,000	20,000	Monthly	Minutes of the Operations Committee meeting of IDCOL reporting data collected from the POs	IDCOL
Number of energy efficient lamps distributed	D	Number	-	-	0	7,250,000	7,250,000	7,250,000	7,250,000	Quarterly	Quarterly Progress Report	REB
Enabling policy for renewable energy development	D	Text	SREDA not operational	SREDA not operational	SREDA established	SREDA operational with core staff appointed				Semi-Annual	Project Progress Report	Power Cell

Bangladesh: Rural Electrification and Renewable Energy Development II (RERED II) Project (P131263)

Results Framework

Project Development Objective Indicators	
Indicator Name	Description (indicator definition etc.)
Number of households, farmers, and businesses having access to clean energy services	This includes access to electricity through Solar Home Systems (SHS) and other renewable energy options (mini-grids, biogas/biomass based captive plants, solar irrigation etc), and access to clean cooking solutions through improved cook stoves and biogas plants
Generation Capacity of Renewable Energy (other than hydropower) constructed	MW capacity added from the access to electricity component. Technologies include, among others, solar, biomass gasification, biogas etc.
More efficient energy consumption through installation of compact fluorescent lamps	The difference in capacity (Watt) of energy efficient lamps and the incandescent lamps that would be replaced
Direct project beneficiaries	People in the households getting electricity connection through SHS and mini-grids, Farmers getting water from solar irrigation pumps, number of captive plants, Females having access to clean cooking solutions, and people in the households getting energy efficient lamps.
Female beneficiaries	Women and girls in the households getting electricity connection through SHS and mini-grids, female-headed businesses/shops getting connection through mini-grids, females in the households getting access to clean cooking solutions, and females in the households getting energy efficient lamps.

Intermediate Results Indicators	
Indicator Name	Description (indicator definition etc.)
Number of solar home systems installed	Solar home systems of different capacities
Number of connections made through mini-grid systems and captive plants	This includes the number of connections from renewable energy based mini-grids, and captive plants based on biomass gasification, biogas and other technologies
Number of solar irrigation pumps installed	Irrigation pumps of different capacities
Number of improved cook stoves purchased by	Stoves with higher fuel and emission efficiencies compared to the traditional stoves

households	
Number ofbiogas plants installed	Biogas plants of different capacities for cooking
Number of energy efficient lamps distributed	The energy efficient lamps distributed to households in exchange of incandescent lamps
Enabling policy for renewable energy development	Establishment and operationalization ofthe Sustainable and Renewable Energy Development Authority (SREDA)

Annex 2: Detailed Project Description

BANGLADESH: Rural Electrification and Renewable Energy Development II

1. A large segment of the population of Bangladesh has little or no access to electricity or to clean modem energy sources. Access to electricity in Bangladesh is about 55% and the per capita electricity consumption of about 236 kWh per year is one of the lowest in the world. The access rate in the rural areas is about 43% with about 13 million rural households yet to be electrified. Even those with access to electricity experience supply disruptions because the available generation capacity is insufficient to meet demand. The GOB articulated a Vision and Policy Statement on Power Sector Reforms in 2002, which includes the objective of universal access to electricity by the year 2021 with improved reliability and quality. By expanding access to electricity, especially for rural households and communities, Bangladesh aims to accelerate economic growth and improve the quality of life.

Component A: Access to Electricity (total US$309.2 million, IDA US$116 million)

2. The Infrastructure Development Company Limited (IDCOL) has estimated that about 4 million households are likely candidates for Solar Home Systems (SHS) services; this is in addition to the 2 million households who would have already obtained an SHS by the end of 2012.[18] In September 2011, the GOB issued a concept note for supporting private sector investment in 1,000 mini-grid schemes by 2015 requiring 25 MW of renewable energy capacity. This Project supports the Government's strategy of expanding access by providing assistance to extending electricity coverage using renewable energy. The following interventions to be supported by the Project will advance the national electricity access goals:

- Promoting the use of solar home systems in rural areas where grid expansion is un-economic; and
- Facilitating development of renewable energy based applications such as decentralized mini-grids, water pumping etc., where feasible.

3. IDCOL is the implementing agency of the access to electricity component of the Project. IDCOL will continue its successful role in implementing the SHS and the Remote Area Power Supply Systems (RAPSS) sub-components using the same business model and operational plan as in the RERED project. IDCOL will provide financial intermediation to make longer term refinance and grants available to its Partner Organizations (POs), which are private firms, NGOs and Micro-finance Institutions (MFIs). IDCOL will also make available a credit line for investment and grant financing for project development to promote renewable energy mini grids and other renewable energy projects under the RAPSS sub-component. IDCOL will administer TA grant funds to support project supervision and oversight; product quality enhancement; introducing new products including low cost LED lamps; administer battery and CFL light recycling etc.

[18] Based on data from the Household Income and Expenditure Survey (HIES) of201O. The estimate of 4 million assumes that 50% of the un-electrified rural households with a minimum income ofBDT 3,000 per month would be candidates for purchasing SHS based on affordability considerations. With income levels rising and smaller, lower cost SHS becoming available, the number of potential SHS customers is likely to be higher.

4. The access to electricity component comprises of the following:

a. SUb-Component A1 Solar Home Systems (SHS) -USD 99.45 million in IDA credits for SHS Investments comprising of approximately 550,000 SHS (ranging in capacity from 10 Wp and larger) including technical assistance support;

b. SUb-Component A2 Remote Area Power Supply Systems (RAPSS) - About USD 16.55 million in IDA credits for Renewable Energy Investments comprising mainly solar PV, biomass and other renewable energy mini-grids and captive plants, solar irrigation, and technical assistance support. Other applications for which investors are seeking support, such as solar cooling and drying as well as hybrid brick kilns could also be supported.

Co-financing from other Development Partners

5. USAID has committed to provide US$7.565 million in grant financing to provide subsidies for SHS (US$2,4 million), RAPSS (US$4.7 million) and technical assistance (US$0,465 million). This will be channeled through a Bank-administered Trust Fund. An amount of US$24.5 million from the Bangladesh Climate Change Resilience Fund (BCCRF) has been committed for funding the matching grant and technical assistance for the solar irrigation pumps under the RAPSS components. Besides, KfW is expected to provide US$12.9 million in grant financing for the RAPSS components. An estimated 38.8 million is expected from IDCOL own financing (accumulated from repayments from earlier refinancing to the POs for the renewable energy program). Table 1 has the detailed cost estimate for the Project.

6. SUb-Component A1 Solar Home Systems (total cost US$199.8 million, IDA Credit US$ 99.45 million). Majority of the funding under the Project is expected to be channeled to the SHS program to support approximately 550,000 SHS to contribute to the national electrification goal. The SHSs will be supplied and serviced by the partner Organizations (POs) (NGOs and private companies) that provide micro finance loans for purchasing SHS. IDCOL will use the IDA credit to refinance a portion of the loans. A grant of USD 20 is available only for 30 Wp and smaller SHS to increase their affordability as these are purchased by the poorest and this grant will be sourced from the USAID funds (channeled by the Bank under a separate Grant Agreement).19 The POs will identify and qualify customers for obtaining loans and will bear the full commercial risk of lending. The POs will supply SHS products that comply with technical quality standards set by the Technical Standards Committee set up by IDCOL. The indicative number of SHS to be supported under RERED II is given in Table 2.

19 The program started in 2003 with US$90 per system of grant support, which was the difference in life-cycle costs of SHS and the kerosene lanterns that the SHS replaced. The grant support has since been gradually declined in to US$ 28 per system in 2012 (average USD *0.601Wp* compared to USD 2-5/Wp in other countries). From 2013, grant support will drop to USD 20 per system for smaller systems (30 Wp and less) with no grant for larger systems. An impact evaluation study is currently on-going that would assess, among others, the level of grant support necessary to make the systems affordable to poorer households.

Table 1: Estimated Project Costs with Financing Sources (US$ Million)

Project Components	Project cost	IDA Financing	IDA %	USAID		BCCRF		KfW	House-holds	*POsl* Sponsors	*GOBI* Utilities	IDCOL Own Financing
				Capital Buy-down Grant	TA	Capital Buy-down Grant	TA					
A. Access to Electricity	309.2	116.0	38%	7.1	0.465	23.0	1.5	12.9	19.2	90.2	0.0	38.8
AI. Solar Home Systems (SHS)	199.8	99.45	50%	2.4	0.1				19.2	68.7	0.0	9.9
A.2. Remote Area Power Supply Systems (RAPSS)	109.4	16.55	15%	4.7	0.365	23.0	1.5	12.9		21.5	0.0	28.9
B. Household Energy	46.3	12	26%						34.3			0.0
C. Energy Efficient Lighting	19.0	17	89%								2.0	0.0
D. Sector Technical Assistance	6.5	5	77%								1.5	0.0
Total Baseline Costs	381.0	150.0	39%	7.1	0.565	23.0	1.5	12.9	53.5	90.2	3.5	38.8
E. Contingencies	5.0	5.0										
Total	386.0	155.0	40%	7.1	0.565	23.0	1.5	12.9	53.5	90.2	3.5	38.8

Table 2 SUb-Component At: Indicative SHS Investments

Solar Home Systems Investments 2013 and 2014									
Indicative System Type	Projected Market Share	Number ofSHS	Unit Cost		Total Cost (USD Millions)	Sources of Financing (USD Millions)			
			BDT	USD		Down Payment	Grant	PO Loan	IDCOl loan
20Wp	23%	127,024	14,600	174	22.1	2.0	2.5	7.0	10.6
40Wp	19%	105,155	24,800	295	31.0	3.1	-	11.1	16.8
50Wp	31%	171,948	30,500	363	62.4	6.2	-	22.3	33.9
85Wp	27%	145,873	45,500	542	79.0	7.9	-	28.3	42.8
Total		550,000			194.6	19.2	2.5	68.7	104.1

Note: This does not mclude the techmcal assistance support ofUS$5.2 million reqUired for the SHS program

7. Customers are expected to provide 10% of the SHS prices as down payment while the IDCOL loan will refinance 60%-70% of the micro-finance extended by the POs to the households. Out ofUS$104 million credit funds requirements, IDA credit would provide US$94 million while the rest will be met from IDCOL from its own sources accumulated from the repayments from the POs against the earlier credits.

8. The estimated costs are based on current market prices. The prices of solar PV prices in the international market have experienced a rapid decline in recent times. However, the SHS prices in Bangladesh have been relatively stable since 2006. The reduction in PV panel prices in the international market has been offset by increases in locally sourced battery prices and currency depreciation. Still, SHS prices in Bangladesh are among the lowest in the world ranging in price from US$6-8/Wp without a grant, inclusive of installation, five year warranty, and three years of maintenance services. In the event that systems costs do go down in the future reflecting continuing decline in solar PV prices, the IDA funds can support more systems.

9. The estimated costs are based on the demand patterns of 2010-11 where about a quarter of the systems sold were of small size of 20Wp and less, about half of the systems in 40-50Wp range and a quarter were larger sizes of 85Wp. The funding requirements will change depending on the demand pattern - smaller systems will require less credit draw-down while larger systems will require more funds. With the rapid growth of the program, it is expected that the program will be penetrating deeper into the market, thus reaching poorer households demanding smaller systems. With the PV prices falling, it is expected that the smaller systems would be affordable to poorer households.

10. IDCOL has the target to make the program fully commercial with the POs eventually borrowing funds at market terms from commercial sources. With this goal in mind, IDCOL has been gradually reducing the refinancing rate from 80% initially to 70% currently for the large POs. During the implementation of the Project, IDCOL will extend only 60% of the micro-finance of the larger POs having a credit outstanding amount of more than BDT 250 million. A commercialization study is currently being undertaken to explore options for full commercialization of the program during the implementation of the Project period while ensuring that poorer households are not left out of the program due to increased costs of commercialization.

11. Technical assistance (TA) support for SHS: Monitoring of SHS and the POs/sponsors are an important function of IDCOL supported by RERED II Technical Assistance. The monitoring is to insure that: (a) grant funds are being used for the intended purpose; (b) the PO comply with established technical, after-sales service and consumer protection standards; and (c) customers are satisfied with the services. TA-supported monitoring methods would include: (a) end-user level audits of adequate number of systems sold by each PO to insure satisfactory product quality; (b) random, unannounced, independent end-user level audits of subsequent reported sales, as needed; (c) customer surveys using simple, short postcards and questionnaires; (d) small focus group sessions with companies and consumers in different regions conducted as part of the market monitoring; (e) complaint-based end-user audits and other data gathering in response to complaints or information received from customers or others; (f) reviews of documentation and reports provided by PV companies, local and international suppliers and others; (g) direct observation and verification during regular field visits; (h) annual reviews of the audited financial statements submitted by each company, including counter-audits as necessary to verify information; and (i) performance reviews with individual POs, their accountants, auditors and commercial banks as necessary; and (j) annual meetings with the POs to discuss ways to improve the compliance monitoring system.

12. In addition to the end-user audits and other compliance monitoring activities, IDCOL in partnership with testing laboratory set up under the RERED support, will conduct technical performance audits of PV systems or components. IDCOL will support the introduction of new and improved solar products, including LED lamps and in further expanding the portfolio of viable renewable energy applications. The TA for the SHS program is summarized in Table 3. Total funding needs for the TA is US$5.2 million, out of which IDA will provide US$5.1 million and USAID US$O.1 million. The TA comprises of the following principal activities:

1.0 Quality Assurance

1.1. PV Systems Testing Consulting Services to achieve ISO 17025 accreditation. The RERED Project is supporting the establishment of a testing laboratory in Bangladesh for testing PV systems and components to assure product quality. This TA will assist the laboratory obtain ISO 17025 quality certification.

1.2. PV Standards support, including stand-alone solar LED lamps. This TA will assist the technical Standards Committee update and improve upon the SHS standards used for quality assurance, including adoption of standards and test procedures for LED lighting. The LED lighting quality standards will build on the standards developed for the WorId Bank/IFC Lighting Africa program.

1.3. Technical SHS Inspection. This TA will support field inspection of SHS to ensure customers have received the products that comply with standards and to verify that users have been trained in SHs use.

1.4. Collection Efficiency Inspection. This TA will support IDCOL oversight to ensure that POs loan collection and loan collection procedures are in compliance.

1.5. Field and Lab SHS Audits & Testing will conduct random laboratory and field testing of SHS in continuing efforts to ensure products are delivering the promised levels of service at the required reliability. The laboratory set up with RERED funding will be used for conducting the testing and audits.

2.0 Training & Outreach

2.1. Customer Training & Awareness. This TA will support IDCOL and PO efforts to train SHS users and to increase their awareness of SHS so that its value is enhanced.

2.2. Staff Training will support capacity building of PO technical, marketing and sales staff so that they will improve the quality and responsiveness of services offered to SHS customers. The scoping out of the training needs and design of the training program is supported under RERED.

2.3. Technician Accreditation Program. This TA will support the development of a SHS technician accreditation program at a national vocation training institution to verify that technicians have the necessary skills and expertise to undertake SHS installation and repmr.

2.4. Technician Accreditation will support the implementation of the technician accreditation program

2.5. Training and Exposure Visits will fund study tours and field visits inside and outside of Bangladesh for IDCOL staff, POs and other renewable energy developers to gain from experiences in Bangladesh and other countries.

2.6. Lighting Bangladesh Program will begin implementation of the World Bank/IFC Lighting Global program in Bangladesh. Lighting Global Program is an expansion of the World Bank/IFC Lighting Africa Program (http://www.lightingafrica.org) that is catalyzing the market for renewable energy-based off-grid lighting that is highly efficient, reliable and low cost. The initial expansion outside of Africa is taking place in India and Bangladesh is expected to be next. Lighting Bangladesh will benefit the poorest consumers who continue to depend on kerosene and other fuel based lighting and who cannot afford SHS. Lighting Bangladesh will offer business and market development support for entrepreneurs interested in offering efficient renewable energy lighting products, build relationships between foreign suppliers and domestic distributors/ retailers and manufacturers, build awareness, help remove policy and regulatory barriers, among others.

3.0 Environment

3.1. Battery Recycling Support to POs. This TA activity will support the POs to continue their battery recycling efforts and will cover the incremental cost of battery recycling.

3.2. CFL recycling program design. CFL bulbs contain a small amount of mercury and if the bulbs break and the mercury is not safely secured it can be a harmful contaminant. This TA will support IDCOL in its efforts to promote careful use and disposal of CFL bulbs until such time a national CFL recycling it program in introduced.

4.0 Studies and Planning

4.1. Impact Evaluation. This TA will undertake an impact evaluation of SHS and other renewable energy technologies to assess user outcomes and benefits and to obtain user perceptions. This is necessary in order to evaluate the development outcomes of the programs and to provide feedback to product suppliers and the POs/sponsors.

5.0 Goods

5.1. SHS Implementation and Supervision Supplies. IDCOL will procure training manuals, customer training leaflets, inspection forms, toolkits, laptop computers required for SHS program implementation and supervision. IDCOL anticipates having to procure, 6,000 Staff Training Manuals, 550,000 each of Customer Training Leaflets and Inspection Forms, 1,200 Toolboxes, and 200 Laptop Computers

5.2. PV Testing Lab Equipment Upgrade. This TA will provide additional testing equipment necessary to upgrade the testing laboratory to be in full compliance with the requirements for testing SHS (and possibly solar PV mini-grids and solar water pumps) to ISO 17025 standard.

Table 3

Technical Assistance for SHS Program

Item	Cost/unit (USD)	Number	Grant (USD mil.)
1.0 Quality Assurance			
1.1 PV Systems Testing Consulting Services to achieve ISO 17025 accreditation, visit to overseas lab	75,000	1	0.08
1.2 PVStandards support, including stand-alone solar LED lamps	25,000	1	0.03
1.3 Technical SHS Inspection	1.00	550,000	0.55
1.4 Collection Efficiency Inspection	0.18	825,000	0.15
1.5 Field and Lab SHS Audits & Testing	for 3 years		0.50
2.0 Training & Outreach			
2.1 Customer Training & Awareness	2.00	550,000	1.10
2.2 StaffTraining	20	6,000	0.12
2.3 Technican Accreditation Program Design	30,000	1	0.03
2.4 Technician Accreditation	300	1,200	0.36
2.5 Training and Exposure Visits	10,000	25	0.25
2.6 Lighting Bangladesh Program	200,000	1	0.20
3.0 Environment			
3.1 Battery Recycling Support to POs	10	100,000	1.00
3.2 CFLrecycling program design	50,000	1	0.05
4.0 Studies and Planning			
4.1 SHS Impacts Evaluation	150,000	1	0.15
5.0 Goods			
5.1 Goods (training manuals, customer training leaflets, inspection forms, toolkits, laptop computers)	Varous	Various	0.32
5.2 PVTesting Lab Equipment Upgrade	300,000	1	0.30
Total			5.20

13. SUb-Component A2 Remote Area Power Supply Systems (RAPSS) (total cost US$109.4 million, IDA Credit US$ 16.55 *million).* IDA funding is made available to private firms and NGOs to finance other renewable energy investments. These are principally expected to be solar

water pumping and mini-grids serving households and small enterprises in areas not served by the grid[20]. The technology to be used will be based the least cost option depending on the resource availability in the specific locations for the sub-projects. Batteries and back up diesel generators may be part of the power supply system to increase reliability and availability. IDCaL will verify the technical, financial and economic viability of the applications and ensures they comply with environmental and social safeguards. IDcaL will consider financing other applications such as solar cooling and drying or advanced hybrid brick kilns, depending on demand and the project's viability. Capital cost buy-down grants of 20 to 50 percent will be given to support these emerging classes of projects. IDCaL will bear the full commercial risk of the loans. The indicative portfolio of renewable energy investments to be supported by RERED II is given in Table 4.

Table 4 Sub-Component A2: Indicative Investments

RAPPS Renewable Energy Investments (2013-2016)							
RAPSS Technology	Average Capacity	Number	Cost per unit (US$)	Total (US$ million)	Equity (US$ million)	Grant (US$ million)	Loan (US$ million)
Solar Mini Grid	150 kWp	42	600,000	25.2	5.0	12.6	7.6
Solar Water Pump - Irrigation	500m3/day	1,500	40,000	60.0	12.0	24.0	24.0
Biogas based Power Plant	20KW	450	32,000	14.4	2.9	2.9	8.6
Biomass Gasification Plant	200KW	28	285,000	8.0	1.6	1.6	4.8
Total		2,020		107.6	21.5	41.1	45.0

Note: This does not mclude the techmcal assistance support ofUS$1.865 mllion requued for the RAPSS program

14. The targets for mini-grids can be more realistically assessed once the initial few mini-grids are implemented. Even after capital buy-down grants up to 50%, the mini-grids will have to charge considerably higher tariff than what the PBSs charge to its consumers. The tariff of the 100kW mini-grid at Sandwip island financed under RERED is BDT32/kWh compared to the maximum tariff for households of BDT 9.38/kWh (for consumption beyond 500 kWh per month). Potential customers surveyed by sponsors and IDcaL have an ability to pay and expressed a willingness to pay a higher tariff than the rate charged by the PBSs. There is nevertheless a risk that customers may start to complain at paying higher rates for an extended period of time.

15. The mini-grid investors also face the risk that the REB grid may reach their customers before the sponsor has recovered his investment. Since the PBS tariff charged would be significantly less than that charged for mini-grid service, their customers may stop purchasing electricity from the mini-grids and the sponsor is left with a stranded asset. As part of its due diligence, IDcaL will seek from MPEMR and BERC assurances that the mini-grid area franchise would not be violated for a minimum number of years and devise a mechanism for compensating the sponsor in case the grid does reach the mini-grid service area and customers do migrate.

[20] The RERED project piloted three renewable energy based mini-grid schemes for providing access to electricity in selected off-grid remote areas and several solar water pumping projects.

16. IDCOL is currently doing due diligence on a number of mini-grid proposals for financing under the Project. Once the initial mini-grid sub-projects are implemented, the willingness to pay by the customers would become clearer. **In** the event the mini-grids do not materialize as planned, the funding available can be utilized in the irrigation schemes (where willingness to pay is less of an issue as the tariff to be charged is expected to be comparable to what the farmers would otherwise be paying for diesel pumps) or in the SHS program in support of achieving the objective of providing access to electricity.

17. For the indicative targets set for the RAPSS sub-component, funding requirement is US$109,4 million (including TA ofUS$1.865 million), out of which POs/sponsors are expected to provide 20% equity amounting to US$21.5 million. The capital buy-down grant and TA requirements will be met from the USAID trust fund (US$5 million), Bangladesh Climate Change Resilience Fund (BCCRF) (US$ 24.5 million), and KfW (US$12.9 million). The credit funding is expected to be met from IDA and from IDCOL own funds.

18. The On-lending terms for SHS and RAPSS are summarized below:

	SHS	RAPSS
Customer/sponsor down payment	10-15 percent	20 percent
Grant	USD 20 for 30 Wp and smaller	20-50 percent of sub-project cost
Loan portion refinanced by IDCOL	60-80 percent depending on PO size	30-60 percent of sub-project cost
IDCOL loan interest	6-9 percent depending on PO size	6 percent
IDCOL loan tenor	5-6 years depending on PO size	6-10 years
IDCOL loan grace period	6 months-l year	9 months - 2 years
IDCOL loan securitization method	Bank guarantees/mortgages for minimum 20% of outstanding liability and one year repayments in reserve account	Bank guarantees/mortgages for minimum 30% of the sub-project cost
PO loan terms to customers	Market rate (typically 12-15 percent)	N/A
PO loan tenor to customers	2-3 years	N/A

19. Disbursements of the SHS sub-loan and grant will take place only after the installation has been completed and the customer has documented his/her satisfaction with submission of a Customer Acceptance Receipt. **In** order to administer the credit sub-component, IDCOL will: (i) enter into separate Participation Agreements with the borrower (i.e., POs and other renewable energy investors), specifying the binding covenants; (ii) process disbursement requests for loans approved by the borrowers based on the evidentiary documents to be formalized in the Participation Agreements; (iii) maintain separate disbursement records and accounts with respect to each borrower 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 missions. **In** addition, IDCOL will maintain statistical records, incorporating, among other things, approval of sub-loans and disbursements made and provide IDA with regular reports.

20. ***Technical assistance (TA) support/or RAPSS:*** The TA for renewable energy investment support is summarized in Table 5. Total funding needs for the TA is US$1.865 million, out of

which USAID will provide US$0.365 million and BCCRF US$1.5 million. The TA comprises of the following principal activities:

1.0 Studies and Planning

1.1. Additional Renewable Energy Projects Development. This TA will support the GOB goal of achieving 10 percent renewable energy use in the power sector by 2020 by identification and development of new renewable energy applications.

1.2. Identification and pre-feasibility of mini-grids and captive plants. This TA supports IDCOL efforts of encouraging the development and investment in solar and biomass power generation, solar cooling and drying, and hybrid Hoffman brick kilns - applications where investors are beginning to seek IDCOL assistance.

1.3. Renewable Energy Projects Awards Support. The renewable energy applications require specialized expertise beyond that currently available at IDCOL to undertake their due diligence. This TA will permit IDCOL to obtain such expertise until such time, IDCOL builds in-house expertise.

2.0 RAPSS Irrigation Support

2.1. Staff and office facilities for 10 regional offices and the head office of IDCOL for the first three years of the program

2.2. Consultancy services for Upazilla level solar irrigation planning and site-specific due diligence support

2.3. Field inspections and monitoring for the irrigation schemes that would cover the costs of transport and travel allowances of the field inspectors and head office staff and establishment of solar irrigation pump testing capabilities in the national PV testing lab

2.4. Training, outreach and communications to farmers and the sponsors

2.5. Impact assessment including consulting services, surveys, and instrumentation

Table 5

Technical Assistance for RAPSS Program

Item	Cost/unit (USD)	Number	Grant (USD mil.)
1.0 Studies and Planning			
1.1 Additional RAPSS Projects Development	20,000	10	0.20
1.2 Identification and prefeasibilty of other RE	10,000	10	0.10
1.3 RAPSS Awards Support	65,000	1	0.065
2.0 **RAPSS Irrigation Schemes**			
2.1 Project implementation and monitoring (staff and office costs for first 3 years)	200,000	3	0.60
2.1 Consultancy services for planning and due diligence	200,000	1	0.20
2.3 Field inspection and monitoring	300,000	1	0.30
2.4 Training, outreach and communciations	100,000	1	0.10
2.5 Impact assessment (baseline, mid-term and final)	100,000	3	0.30
Total			**1.865**

21. **Component B Household Energy (total cost US$46.3 million, IDA credit US$12 million).** The proposed household energy component aims to scale-up the efforts being undertaken by various NGOs in providing rural households with clean cooking solutions. These solutions include improved cook stoves (ICS), advanced combustion stoves, and biogas. Their large scale dissemination has the potential to yield co-benefits in the following areas: (i) household health; (ii) local environmental quality; and (iii) regional climate. The focus on these clean cooking solutions is dictated by the fact that modem cooking fuels like natural gas, liquefied petroleum gas (LPG), and to some extent electricity, and the appliances to use them will take a long time to be accessible and affordable to the majority of the rural population. Traditional biomass fuels such as wood, twigs, leaves, agricultural and plant residues, paddy husk, bagasse, jute sticks and dried animal dung are the dominant fuels used by about 90% of the population of Bangladesh. The incomplete combustion of these fuels in inefficient stoves produces smoke containing large amount of particulate matter and gaseous pollutants. Indoor air pollution resulting from this smoke is linked with many illnesses including childhood pneumonia and chronic obstructive pulmonary disease representing a significant health hazard.

22. Despite efforts since the 1980s to introduce clean cooking solutions by many organizations including the Village Education Resource Center (VERC), the Institute of Fuel Research and Development of the Bangladesh Council of Scientific and Industrial Research (BCSIR), Grameen Shakti, Bright Green Energy Foundation, Practical Action, and the GIZ, in terms of coverage, only about 2 percent of households relying on traditional biomass fuels has access to improved cookstoves (ICS). The main barriers for a scaling up of clean cooking solutions in the country are: (i) absence of massive awareness campaigns; (ii) limited funding to support the scale-up activities; (iii) absence of a sustainable funding mechanism; and (iv) cost-revenue shortfall preventing the development of commercial enterprises to promote clean cooking solutions. There is an overall lack of leadership, oversight, coordination, and monitoring of household energy access activities in the country. This is preventing cross-fertilization of best practices. A recent USAID report identified the following seven areas for potential interventions on clean cooking solutions in Bangladesh: (i) market intelligence to remove market barriers; (ii) consumer education; (iii) technical standards, testing and certification, (iv) product development; (v) policy and regulation; (vi) business development support; and (vii) access to finance.

23. ***The strategic approach*** of this component includes: (i) awareness raising through social mobilization to ensure potential users are aware of the fuel saving and health benefits associated with clean cooking; (ii) research and development to enhance product quality, performance, safety and durability; (iii) setting up of performance standards, labels and testing facilities; and (iv) support to selected partner organizations to generate demand and to facilitate enterprise creation. It will build on the success of Bangladeshi NGOs in the areas of community outreach in total sanitation programs. It will also build on earlier work undertaken by local institutions in the areas of stove design and reduction of emission of toxic pollutants from incomplete combustion of woodfuels. The implementation of this component will be in close collaboration with on-going activities in the sector by NGOs, GIZ, USAID and upcoming activities that will be undertaken through the Global Alliance of Clean Cookstoves. It will integrate lessons learned from past and on-going clean energy solutions programs such as : (i) engaging the local government, community leaders and health volunteers in effective awareness raising; (ii)

adopting locally appropriate awareness-rmsmg approaches for uptake of household energy products; (iii) extending user training on maintenance and use of cookstoves to women, who are the main users; (iv) ensure that performance monitoring of clean cooking products is an important activity of the programs to ensure feedback susceptible to enhance stove designs is provided; and (v) ensure reliable after-sales support and services to produce great confidence among users and facilitate the adoption and use of technology.

24. The component is structured around three main sub-components:

- Sub-component 1: Awareness raising and community outreach ($0.8 million). As it stands, the majority of the population in Bangladesh is not aware that the use of traditional biomass fuels is associated with health hazards through indoor air pollution. Massive and well targeted awareness campaigns are needed on the health damaging effects of indoor smoke from incomplete combustion of biomass. Activities will include: (i) massive campaigns to educate households on the health hazards associated with indoor wood smoke; (ii) demonstrations of the benefits of clean cooking solutions as compared to the traditional stove; and (iii) support of a variety of media avenues to promote and market clean cooking products. These activities will capitalize on the successful experiences on social mobilization by the NGOs in the country.

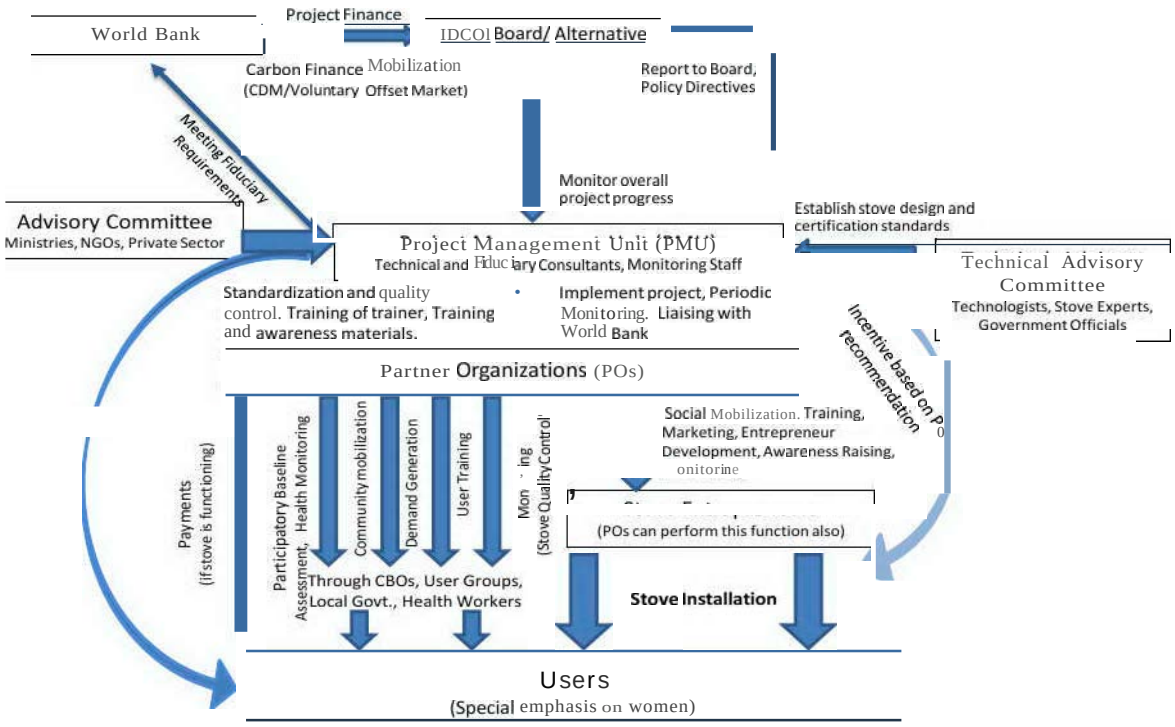
- Sub-component 2: Capacity strengthening of national institutions ($1.9 million). Many sector assessments indicate an overall lack of leadership, oversight, coordination, and monitoring of household energy access activities in the country. Theses assessments also indicate a real need to create performance standards characterization and to conduct systematic testing, certification and monitoring activities to enhance the quality, performance, safety and durability of improved cookstoves and to give thereby confidence to customers and financiers. Activities will include: (i) research and development to enhancement of product quality, performance, safety and durability; (ii) setting up of performance standards, labels and testing facilities; (iii) strengthening of managerial skills of targeted entrepreneurs; (iv) development of sub-projects eligible for carbon finance; (v) build capacity of policy makers; (vi) develop local capacity for monitoring of carbon finance projects. (vii) design output-based disbursement procedures to support POs; and (viii) develop innovative and pragmatic funding procedures to attract new players into the sector capitalizing on carbon finance.

- Sub-component 3: Financing to support Partner Organizations and local entrepreneurs ($8.5). There is a need to scale up household energy access activities using a market based model to develop enterprise development initiatives by attracting new entrepreneurs into the sector while strengthening the capacity of the existing ones. Activities could include: (i) support clean cookstoves subprojects through POs to commercially disseminate one million clean cookstoves by the end of the project; and (ii) support biogas subprojects proposed by the POs to disseminate 20,000 biogas plants by the end of the project. Selection criteria of the POs will include their field presence and institutional capacity in disseminating ICS or similar other rural activities (e.g., Sanitation, SHS, Biogas). The POs are expected to generate saturation demand for ICS in defined areas through social mobilization, and develop and train local entrepreneurs

for the supply chain for ICS and their components. These POs could be NGOs and/or micro-finance institutions, which will be responsible for supporting and overseeing the work of the entrepreneurs, technicians and manufacturers of stove appliances engaged in the supply chain side.

25. Implementation arrangements: Overall advisory oversizhl will be provided by SREDA. SREDA will be responsible for the formulation of a long term national strategy on household energy access and design mechanisms to coordinate its monitoring, evaluation, and impact assessment. An advisory committee comprising of members from SREDA and other relevant Government Agencies, NGOs and private sector stakeholders will be formed to review the activities and provide feedback to improve its implementation.

26. Dav to day implementation will be under the responsibility of IDeOL. IDCOL will establish a specific project management unit (PMU) for the implementation of the component. The IDCOL PMU will be responsible for day to day management of the component following Bank's fiduciary guidelines and procedures. It will also be responsible for the monitoring of the component's activities and results. The Project will finance the PMU's operating costs to implement this component. It will also finance sub-projects to the undertaken by the POs.



*27. **Basic** implementatioll principle." **of sub-projects** 011 the clean **cookstoves:***

I. The project will finance IDCOl's operating costs to implement this component.

2. It will finance sub-projects to be undertaken by pas. Each sub-project will consist of a package of aggregate units of 10,000 households roughly covering 2 to 3 Union Parishads.
3. A rcquest for proposal will be made to select POs based on their past cxpcrienec and current ficld presence.
4. A fixed estimate of staffing costs, tmining, field promotion, and PO overhead per 10,000 dean eookstovcs was developed in consultation with key pa s and will be applied. IDCOl will have the flexibility to review periodically these estimates based on implementation experience.
S. Promotion activities will be organized to makc demonstrations of advanced combustion stoves to segments of the rural population depending on afTordability.
6. Development of standards, testing protocols, and ecrtifieation.

28. Particular cmphasis will be placed in thc dcvelopment of standards, certification of clean cooking products, and testing protocols. These will include technological assessments, updating and certifications of clean cooking products; and adaptation of tcsting protocols to local conditions. A Technical Committee comprising of stove experts, technologists and relcvant government officials under lOCa l 's guidance will be set up to advice on design and certification standards and other relevanttcehnological issues. Table I shows thc improvement in cmission reductions already achieved over the traditional stove. A continuation of this work will be supported by this component to reach optimal levels of fuel efficiency, emission reduction efficiency, durability, and safety. Implementation of these activities will be done in close eollabomtion with the USAID financed Catalyzing Clean Energy in Bangladesh Project.

Table I: Average 48 hour emission data in households using different stove models and **comparison** with I pot traditional model.

	Stove type	**PM (µg/m3)**	**% reduction over** traditional **stove emissions**	CO (ppm)	**% reduction over** traditional **stove emissions**
1.	Be SIR 1 pol portable model	127.51	84.4	0.367821	98
2.	BCSIR 2 pot fixed model *w/* chimney	237.66	71	0.205486	99
3.	VERC Grihalaxmi	503.11	39	2.460658	65.2
4.	VERC 3 ot model	463.85	44	1.062352	85
5.	VERC 1 pOI portable *w/* 2 grates	133.07	36.8%	0.10285	99

Source: Winrock and USAID **(2009).** Commercializalion of **improved cookstoves** for reduced indoor air pollution for urban **slums** of **Northwest Bangladesh.**

29. ***Basic*** *iml'lemefltatiolll'rillcil'les o! slIb-l'roject\· **on biogas:*** Sub-projects on biogas will disseminate 20,000 domestic biogas plants in rural areas with the ultimate goal to establish a sustainable and commercial biogas sector in Bangladesh. Gas produced in these plants will be uscd for cooking purposes and lighting of rural households. In addition, the slurry, by-product of biogas plants, being a very good organic fcrtilizer will be used to maintain soil fertility and increase crop production. The slurry is also used as fish feed.

30. A fixed dome design biogas plant is promoted under this program. The design is basically of two types; i) design for cattle dung and human excreta; and ii) design for poultry droppings. Each design has 6 sizes of plants of different gas production capacities (1.2, 1.6,2.0, 2.4, 3.2 and 4.8 m^3). The bigger sized plants (3.2 and 4.8 m^3) are used for multiple households whereas other sizes are used for single household.

31. IDCOL currently has a biogas program funded by the Netherlands Development Organization (SNV), and the proposed IDA support is geared towards scaling up the program following the same implementation arrangement. IDCOL currently has 38 POs in the biogas program. POs install biogas plants as per the specifications and standard set by IDCOL. Each plant receives BDT 9,000 (US$110) capital buy-down grant on an average that will be financed from the Project. IDCOL will provide the refinancing (covering 80% of the loans to households) from its own sources. IDA funds under the project will be used to cover PMU costs, training, monitoring and evaluation etc in addition to the capital buy down grant.

32. Credit requirement per plant based on 2.4 m3 average size is:

	Item	BDT
1.	Average investment cost per plant	36,000
2.	Average Subsidy	9,000
3.	User down payment (15%)	4,050
4.	MFIs contribution (20%)	4,590
5.	Average IDCOL credit per plant	18,360

33. Distribution of installed plants through the on-going program according to their sizes:

Size	**Installation**	0/0
1.2	122	0.52%
1.6	959	4.06%
2.0	5,265	22.31%
2.4	7,808	33.09%
3.2	5,387	22.83%
4.8	4,058	17.20%
Total	**23,599**	**100.00%**

34. Implementation constraints include:

- Need of working capital requirement for the POs
- Cattle retention - **In** many cases, the customers sell their cattle due to financial difficulties
- Bird Flu - a regular phenomenon every year is causing shut-down of a large number of potential domestic poultry farms. Consequently, these customers are not able to pay the loan installments
- It is not possible to withdraw a biogas plant from the household premise when the household fails to make the installments
- Biogas plant construction is hindered during the 3-4 months of monsoon season

35. Detailed Budget of the Household Energy Component

Sub-component 1: Awareness raising and community outreach	Cost USD
1.1 ICS promotion	610,000
1.2 Biogas Promotion	206,000
Sub Total	816,000
Sub-component 2: Capacity strengthening of national institutions	
2.1 ICS IDCOL PMU Cost including M&E	1,118,000
2.2 Biogas PMU cost	274,000
2.3 Biogas quality control	132,000
2.4 Biogas slurry Management	252,000
2.5 Biogas Training	98,000
2.6 Monitoring and Evaluation	71,000
Sub Total	1,945,000
Sub-component 3: Financing to support local entrepreneurs and to attract new entrants	
3.1 PO Cost forICS	6,330,000
3.2 Biogas subsidy	2,195,000
Sub Total	8,525,000
4. Contingency (Price and Physical)	714,000
Grand Total	12,000,000

36. Component C Energy Efficient Lighting (total cost US$19 million, IDA credit US$17 million). Given the power generation shortages, GOB has embarked upon the Efficient Lighting Initiatives of Bangladesh (ELIB) program in 2009 aimed at reducing the peak demand in the country to minimize the existing supply-demand gap. A GIZ study in 2008 estimated that a total of28 million incandescent lamps were used in households in the country. In order to replace the incandescent lamps at households, the ELIB program targeted to distribute 10.5 million CFLs in the first-phase and another 17.5 million in the second phase, thus replacing the incandescent lamps used in all the households in the country. The first phase of the program financed under the RERED project had distributed about 10 million CFLs to households in exchange for incandescent lamps. The program was implemented by the Rural Electrification Board (REB) with the help of the distribution utilities and the Palli Biddyut Samities (PBSs). REB was responsible for procurement of the CFL and the utilities/PBSs were responsible for distribution of the CFLs in exchange of the incandescent lamps and destruction of the collected incandescent lamps. The first phase distribution was completed in two single days in 2010. Customers came to the hundreds of distribution centers (local schools, utility offices, community centers etc) on the designated days and collected CFLs in exchange of the incandescent lamps. The program was registered as a Clean Development Mechanism (CDM) project with IDCOL as the Coordinating and Managing Entity (CME).