



**Programme of activities design document form  
(Version 09.0)**

BASIC INFORMATION	
<b>Title of the PoA</b>	Installation of Solar Home Systems in Bangladesh
<b>Version number of the PoA-DD</b>	11
<b>Completion date of the PoA-DD</b>	29/06/2020
<b>Coordinating/managing entity</b>	Infrastructure Development Company Limited (IDCOL)
<b>Host Parties</b>	Bangladesh
<b>Applied methodologies and standardized baselines</b>	AMS-I.A. ver. 17- Electricity generation by the user
<b>Sectoral scopes</b>	1 : Energy industries (renewable - / non-renewable sources)

## PART I. Programme of activities (PoA)

### SECTION A. Description of PoA

#### A.1. Purpose and general description of PoA

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##### 1. Policy/measure or stated goal of the PoA

The key goal of Infrastructure Development Company Limited (IDCOL) is to advance rural electrification in Bangladesh. With the support of additional CDM finance, IDCOL hopes to achieve this goal by substantially increasing the number of solar home systems (SHSs) in Bangladesh.

##### 2. General operating and implementing framework of PoA

The small scale programme of activities aims to provide households<sup>1</sup> and other users in Bangladesh with electricity that have no access to the power grid by implementing SHSs<sup>2</sup> with typical capacities ranging from 20 to 200<sup>3</sup>Wp, depending upon the amount of electricity planned to be used<sup>4</sup>. Electricity is generated by the SHS on site by the end user for own use. The Program households currently use kerosene lamps for lighting and batteries to run television sets and other small appliances. The small appliances are charged from time to time at local stores, using small domestic diesel generators.

The Program Coordinating/Managing Entity is IDCOL<sup>5</sup>. IDCOL provides financing to the CPA Implementers and approves new CPA Implementers into the Program. It is also a CPA Implementer and implements the program through Participating Organisations (POs) which, have given up their ownership of emission reductions to IDCOL. Grameen Shakti is a second CPA Implementer and owns the emission reductions generated by its SHS activities. Therefore, there are 2 CPA Implementers (IDCOL and Grameen Shakti). The number of POs is expected to be increased by IDCOL over time. POs select project areas and potential customers, extend loans, install the SHS and provide maintenance support.

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<sup>1</sup> As households are the predominant SHS consumers, the term household is used in the PoA and CPA. Reference to households in this PoA and the CPAs does not preclude other users from partaking in the program.

<sup>2</sup> Whilst the term "Solar Home System" (SHS) is used to describe the technology listed in section A.3, participation in the program is open to any user of solar home system meeting the eligibility requirements i.e., the term solar home system does not imply only allowing households or homes to participate in the program.

<sup>3</sup> Estimated capacity range. The capacity of individual SHS which are installed will vary according to the consumer's choice and demand. Larger systems may be installed to meet the consumer demand. Whatever may be the size, the CER estimation will be based only on the Table 2 in section A.3 of this document.

<sup>4</sup> An overall description of the SHS Program including the sector setting, description of the technology, location of the program, implementation arrangements, overall financing, environment issues and World Bank due diligence/assessment of the program is contained in the publicly available World Bank Project Information Documents for both the IDCOL and the Grameen Shakti executed components of the program: See IDCOL PID at <http://documents.worldbank.org/curated/en/551791468013244483/pdf/42106.pdf> and see Grameen Shakti PID at <http://documents.worldbank.org/curated/en/731621468006273597/pdf/42103.pdf>

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

The SHS program is not required by law; it is a purely voluntary initiative. IDCOL is a public organization but is not required by law or mandatory policy to implement nor to develop a SHS program.

The project is expected to contribute to sustainable development in rural Bangladesh as follows:

- Dependency on imported fossil fuels such as kerosene and diesel will be reduced as SHS directly replaces the usage of kerosene for lighting purposes and diesel for electricity generation.
- Project activities in the rural areas will create new business and job opportunities related to the operation and maintenance of SHS. For example, local technicians will provide maintenance and repair services to SHS users and may start independent enterprises<sup>6</sup>.
- Reliable electricity supply will give impetus to the development of micro-enterprises. The improved lighting from SHS will enable longer working hours and support higher income-generation. Tailoring businesses, convenience stores, cafés and restaurants can serve more clients by continuing to run their businesses after dusk. New income opportunities, such as mobile phone-charging services and longer renting time on mobile phones, are generated.
- SHS users will have healthier home and work environments. SHS will replace the conventional soot-producing lamps, thereby reducing indoor air pollution and health risks such as respiratory disease and eye-related diseases.

## A.2. Physical/geographical boundary of PoA

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The PoA will be implemented in the Peoples Republic of Bangladesh (Bangladesh). CPAs under this PoA will have a national focus rather than a sub-national focus, since the CPAs are to be organised around SHS installation date rather than specific geographical areas. Peoples Republic of Bangladesh is bound by the following coordinates:

Latitude : +20.40° and +27.00° N  
Longitude : +87.50° and +92.55° E

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<sup>6</sup>Grameen Shakti aims to create 100,000 new green jobs partly through SHS.

The project also generated a positive impact on the local manufacturing industry. Initially, batteries were the only component produced in Bangladesh and sold as part of an SHS. However, gradually all components (including solar panels) began to be produced locally. This contributed to the growth of the renewable energy market in Bangladesh as a whole, which employed 114,000 people in 2013 alone. [https://beamexchange.org/uploads/filer\\_public/8e/e1/8ee18db2-99b6-46ae-a5ee-70764fb70b67/scalingup\\_electricity\\_bangladesh.pdf](https://beamexchange.org/uploads/filer_public/8e/e1/8ee18db2-99b6-46ae-a5ee-70764fb70b67/scalingup_electricity_bangladesh.pdf) (last accessed on 18/06/2020)

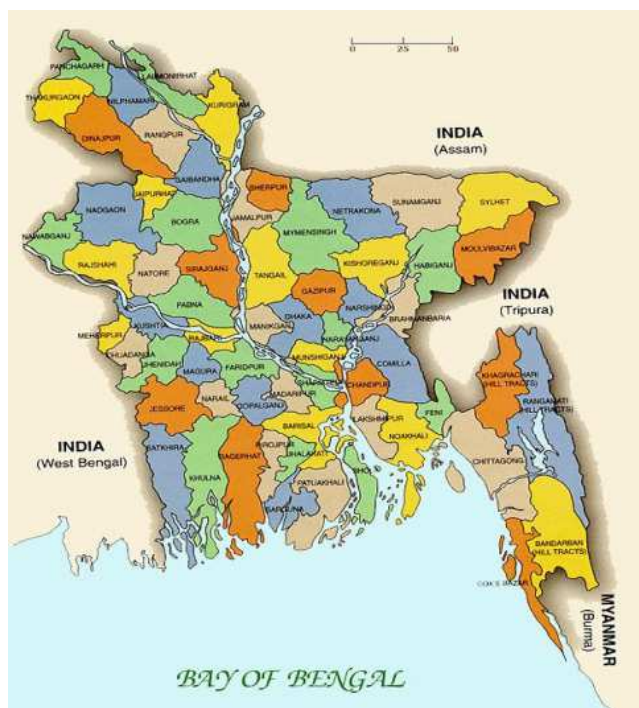


Figure 1: Bangladesh Country Map

### A.3. Technologies/measures

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The technical elements required for a SHS is presented in the diagram below. The photo voltaic (PV) module directly converts solar energy into electrical energy. This electrical energy is stored in a battery. The battery is charged during daytime and the stored energy is supplied to the loads (i.e., lights, television set, etc.) during day and night times. A charge controller is used in-between the PV module and the battery to protect the system from attaining an overcharged or undercharged condition. All SHS to be installed in this project comprise of the same technical elements illustrated in the diagram, namely:

- a) Solar Module (PV panel),
- b) Battery,
- c) Charge controller,
- d) Fluorescent tube lights with special electronic ballasts/LED Lamps<sup>7</sup>,
- e) Mounting structure,
- f) Installation kits, and
- g) Cables and connecting devices

The capacity of individual SHS which are installed will vary according to the consumer's choice and demand. The schematic diagram of connected loads to a typical 40Wp system is shown below:

<sup>7</sup> These are tentative electronic devices only. Households may connect any type of electric/electronic devices as per individual needs with the installed SHS system. However, the emission reduction calculation is done conservatively, only for the kerosene lamp replacements against SHS panel size

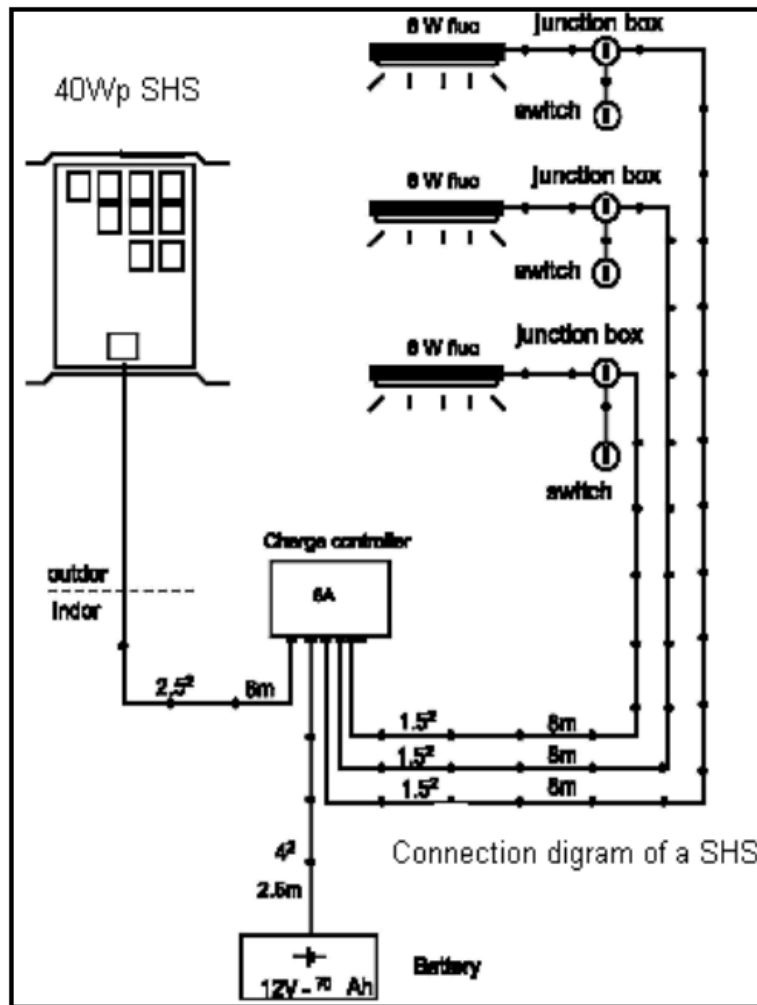


Figure 2. SHS System Circuit Diagram

The typical connected loads to individual SHS of few capacities are as given below:

Table 1. Connected load of SHS systems

Connected Load		SHS Rating, Wp													
		20	21	25	30	35	36	40	42	45	50	52	55	60	63
CFL Lights	Nos.	2	2	2	2	3	3	3	3	3	4	4	4	5	5
	Wattage/light	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Hours/day	4	4	4	4	4	4	4	4	4	4	4	4	4	4
TV - Black & White	Nos.	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Wattage	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Hours/day	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Mobile Charger	Wattage	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Hours/day	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Connected Load		SHS Rating, Wp													
		65	70	74	75	80	83	85	90	100	110	120	125	130	135
CFL Lights	Nos.	5	6	6	6	8	8	8	8	10	10	10	11	11	11
	Wattage/light	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Hours/day	4	4	4	4	4	4	4	4	4	4	4	4	4	4
TV - Black & White	Nos.	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Wattage	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Hours/day	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Mobile Charger	Wattage	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Hours/day	4	4	4	4	4	4	4	4	4	4	4	4	4	4

The technical specifications of few of the SHSs proposed to be installed under the programme are as follows:

Table 2. Technical specifications of the SHSs<sup>8</sup>

Parameter	SHS Rating, Wp											
	20	21	25	30	35	36	40	42	45	50	52	55
Rated peak power, Wp	20	21	25	30	35	36	40	40	45	50	52	55
Type (a-Si, Crystalline Si, etc.)	Cryst Si	Cryst Si	Cryst. Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si
Useful energy (Ah/day)	5.8	5.85	7.065	8.28	12.33	10.8	11.6	13.0	12.01	14.13	13	14.8
Open circuit voltage (V)	21.9	21.7	21.2	21.5	21.7	21.7	21.9	19.7	22.3	22.1	22	21.6
Short circuit current (A)	1.29	1.3	1.57	1.99	2.74	2.4	2.58	2.89	2.67	3.14	2.89	3.29
V <sub>max</sub>	17.6	17.4	17.6	17.56	15.4	17	17.6	16.5	18	17.8	18.7	17.3
I <sub>max</sub>	1.14	1.21	1.42	1.71	2.27	2.1	2.28	2.55	2.5	2.82	2.78	2.94
Number of cells in series	36	36	36	36	36	36	36	36	36	36	36	36

Parameter	SHS Rating, Wp											
	60	63	65	70	74	75	80	83	85	90	100	110
Rated peak power, Wp	60	60	65	70	74	75	80	80	85	90	100	110
Type (a-Si, Crystalline Si, etc.)	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst Si	Cryst. Si
Useful energy (Ah/day)	17.28	19.53	18.85	18.94	20.47	21.1	22.1	26.01	23.04	24.3	27.4	31.995
Open circuit voltage (V)	21.7	19.7	21.9	22.1	21.5	22.3	22.1	19.7	22.1	22	21.56	21.3
Short circuit current (A)	3.84	4.34	4.19	4.21	4.55	4.43	5.03	5.78	5.12	5.4	6.09	7.11
V <sub>max</sub>	17.3	16.5	17.6	17.8	18	18.1	17.8	16.5	17.8	17.6	17.79	17.3
I <sub>max</sub>	3.47	3.82	3.7	3.93	4.25	4.15	4.67	5.07	4.78	5.12	5.63	6.36
Number of cells in series	36	36	36	36	36	36	36	36	36	36	36	36

<sup>8</sup> Actual installed ratings and their specifications will vary from supplier to supplier, within the accepted limits of SHS technical standards set by the Technical Standards Committee.



Parameter	SHS Rating, Wp			
	120	125	130	135
Rated peak power, Wp	120	125	130	135
Type (a-Si, Crystalline Si,	Cryst Si	Cryst Si	Cryst Si	Cryst. Si

Parameter	SHS Rating, Wp			
	120	125	130	135
etc.)				
Useful energy (Ah/day)	34.87	34.11	35.23	36.45
Open circuit voltage (V)	21.8	21.6	21.6	21.85
Short circuit current (A)	7.75	7.58	7.83	8.1
V <sub>max</sub>	17.2	17.8	17.96	17.98
I <sub>max</sub>	6.98	7.02	7.26	7.51
Number of cells in series	36	36	36	36

#### A.4. Coordinating/managing entity

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- Coordinating or managing entity of the PoA, as the entity which communicates with the Board. The Coordinating/Managing Entity for this PoA is IDCOL.
- Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA.

#### A.5. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Bangladesh (host Party)	Infrastructure Development Company Limited (IDCOL)	No

#### A.6. Public funding of PoA

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The SHS program in Bangladesh is financed through a combination of loans and grants administered by IDCOL. IDCOL is a state entity. It receives funding from the Government of Bangladesh to support the SHS program as follows:

- KfW and GTZ provide funding to the Government of Bangladesh which provides this to IDCOL for the SHS program. IDCOL in turn provides this to POs to support a buy down of (30 Euros<sup>9</sup>) about \$40 per SHS; and
- The World Bank Group (International Development Association - IDA) provides loan finance to the Government of Bangladesh which in turn lends this to IDCOL. IDCOL further lends this finance to POs for extending credit to the buyers of SHS.

<sup>9</sup> This amount of money is provided as listed under section 3.02 of the Participation Agreement. The GTZ/KfW grant decreases over time as the PO reaches certain milestones in terms of the number of SHS installed. Currently, €30 is given by IDCOL to the PO upon installation of the SHS as a buy down on the cost of each SHS.



This financing does not constitute a diversion of public resources or of ODA. The financing assists to support lighting, which is regarded as a basic need irrespective of the greenhouse gas (GHG) mitigation benefits, which the program may have. None of this constitutes a diversion of ODA resources.

## SECTION B. Management system

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### (i) A record keeping system for each CPA under the PoA

An extensive electronic data base is maintained by both Grameen Shakti (PO) and IDCOL as overall program coordinator and chief financier, due to the commercial characteristics of the program, which demands a sound customer billing / data base. This database has been extended<sup>10</sup> to CDM purposes and also makes provision for each SHS to be identified with a particular CPA under the POA.

Each PO installs, maintains, monitors and receives reports on SHS installation through its unit offices. One unit office will typically have between two to ten staff, including managers, engineers, assistants and technicians.

When SHS users purchase a SHS, an agreement is signed with the PO. This agreement contains all the relevant information for the purchase, including system capacity, price, mode of payment, location /address of customer and so on. Every month, the Grameen Shakti and IDCOL head offices collect copies of the sales agreement from the unit offices. Based on the sale agreements, the 2 Head Offices enter the particulars of the sales agreements into their data bases with all information consolidated into the overall IDCOL data base for the program.

More specifically, the CPA and program monitoring system will be as follows:

#### 1. Follow up on the installation of SHSs

- A monthly installation plan / program is prepared by each PO
- The number of new installations is reported and logged daily including the location, size of SHS technology, etc.
- A monthly report is compiled on the completed installations
- IDCOL Inspectors randomly inspect the installed SHS to confirm technical standards and that the SHS has been installed in a rural area to a non-grid connected household. An Inspection Report is produced. The results of the Inspection Report are fed into the IDCOL data base. If the Inspection Report indicates that a SHS has been installed in conflict with the program eligibility criteria, for e.g., in an urban area or to a grid connected household, a Discrepancy Report is generated. The SHS then becomes ineligible under the program and is accordingly not eligible to receive any IDCOL financing. A clear system exists for excluding ineligible SHSs under the program.

#### 2. Follow up of the number of operational SHSs

- The number of installed SHSs is reported to the Operations and Monitoring Team in the unit offices and is stored in the central database at the IDCOL head office
- Loan repayment details and status of recovery of loan is maintained for all SHS customers in the respective PO records / data base

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<sup>10</sup> SHS are identified through the solar PV panel serial number installed by each PO. The PV panel serial number is then inserted into the overall IDCOL data base, which generates a unique agreement code. Once the agreement code is accessed, it provides all relevant SHS data including, for instance, the serial number, size (Wp), installation date, address, owner name, payment details, etc. If the same solar PV serial number is entered more than once, then, the program identifies the duplicate entries and both the SHS units become ineligible for CDM until the issue is resolved. Also, the agreement code can be used to identify which SHS fall into which CPA.

- Information records on training and technical services provided to SHS customers are maintained at the IDCOL/PO offices.

IDCOL inspection team will monitor and follow up with the SHS units installed in different regions by different POs every month. An inspection summary report is generated, and results are shared with the POs for further corrective actions or follow up with the households.

CPA specifies monitoring responsibilities and management structure for the implementation of the monitoring plan in each CDM-CPA-DD.

For CDM purposes, the number and size of operational SHS will be determined annually from the IDCOL data base. The survey will be undertaken at 95% confidence level and  $\pm 10\%$  error margin as per the latest CDM guidelines.

(ii) A system/procedure to avoid double accounting, e.g., avoiding the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA

IDCOL will ensure no double counting as follows:

- Prior to seeking an entry of a new SSC-CPA under the proposed PoA, IDCOL will check the UNFCCC and database to confirm that no stand-alone CDM project activity or CPA of another SHS PoA (if registered) has already been registered or entered under another SHS PoA.
- As it is proposed to uniquely identify each SHS installed under the Program, IDCOL will also check the database of already registered CPAs to check any inclusion of SHSs registered as part of any other CPA and exclude any such cases from the said CPA. It will also check to ensure that no SHS is included in 2 CPAs. Each installation entry in the data base will show under which CPA it falls.
- The DOE requested to enter new CPAs will also verify the above.

No other PoA or CPAs other than those under this SHS program are currently under development in Bangladesh. Accordingly, IDCOL is currently able to ensure that double counting does not take place.

According to the EB approved “Guidance for Determining the Occurrence of De-Bundling under a Program of Activities”, EB 47, Annex 32, a proposed CPA or a PoA shall be deemed to be a de-bundled component of a large scale activity, if there is already a CDM activity, which:

1. Has the same activity implementer as the proposed small scale CPA or has a CME, which also manages a large scale PoA of the same sectoral scope; and
2. Whose boundary is within 1 km of the project boundary of the proposed small scale CPA, at the closest point.

However, the “Guidelines on assessment of de-bundling for SSC project activities”, version 04, EB 83, Annex 13 stipulates the following: *“If each of the independent subsystems/measures (e.g., biogas digesters, residential solar energy systems, kerosene or incandescent lighting replacements) included in one or more CDM project activities is no greater than 1% of the small scale thresholds defined by the applied methodology and the subsystems/measures are indicated in the PDDs to be each implemented at or in multiple locations (e.g., installed at or in multiple homes) then these CDM project activities are exempted from performing a de-bundling check, i.e., considered as being not a de-bundled component of a large scale activity.”*

As each capacity of SHS installed under the program (max 200W<sup>11</sup>) will be no greater than 1% of the small scale threshold (i.e., 15 MW), the CPAs of PoA are exempted from performing debundling check.

(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

IDCOL and Grameen Shakti are aware of and supportive of the PoA and do not intend to register other PoAs or stand-alone SHS projects.

The monitoring plan shall be based on either of the below options:

- (i) Description of the proposed statistically sound sampling method / procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of GHGs achieved by CPAs under the PoA.
- (ii) In case the CME opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods), then, a transparent system is to be defined and described that ensures that no double counting occurs and that the status of verification can be determined anytime for each CPA;

The project proponent, IDCOL, will follow option (i) of above and will verify all CPAs included under the PoA using a statistically sound sampling method. Sampling shall be carried out for SHS across the CPAs under the PoA.

Step 1: Verification with Designated National Authority (DNA) to avoid double counting.

The purpose of this step is to confirm with the DNA of the host country about the validity of the boundary of the PoA and the CPA. This will be checked by IDCOL with other PoAs or CDM project activities undertaken by other project entities in the host country to avoid double counting.

Step 2: Interview with IDCOL

IDCOL will make available monitoring reports of all the CPAs to the DOEs (please refer to section I.7.1, Generic component project activity, of this document, for details on parameters recorded). The interview and availability of data will ensure that the DOE can confirm the validity of the monitoring data.

The monitoring reports shall meet the requirement of the monitoring methodology of AMS.I-A. This methodology consists of an annual check of all systems or a sample thereof to ensure that they are still operating.

Each installation in every CPA will be given a unique identification number (agreement code) which will provide access to all relevant information for that particular SHS including, for example, SHS size, date of installation, serial number of SHS, owner of the installation, etc.

Step 3: Sampling of households installed with SHS as per the IDCOL data base  
For the purpose of verifying the following,

- the number of SHS in working condition
- the relevant SHS information including the serial number of the SHS associated with the relevant agreement code in the IDCOL data base
- the SHS has generated a Discrepancy Report and should be excluded from the program

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<sup>11</sup>Estimated maximum capacity. Actual installations may vary.

The project proponent will use the Simple Random Sampling method to determine the number of operating SHSs out of the total installed SHSs. The representative sample will be chosen so as to achieve 95% confidence interval with +/- 10% error margin.

The monitoring survey shall be carried out by grouping of SHSs across the PoA into a single group or number of sub groups. From IDCOL technical specifications<sup>12</sup> and third party literature<sup>13</sup>, it is clear the SHS performance reduces only very marginally across the years and there is no major difference among SHS of different CPAs and also with respect to the date of installation. SHS performance characteristic remains more or less uniform over the entire period of interest.

SHS of different CPAs and also with respect to the date of installation. SHS performance characteristic remains more or less uniform over the entire period of interest.

Taking the performance of SHS as a grouping criteria, all the SHSs under the PoA can be considered as a single group or number of sub groups (regrouping the SHSs under the PoA), depending upon the requirement during each verification.

The survey approaches is given in below table:

No.	Survey Approach	Sampling Method	Reliability Requirement Confidence/Precision
1	Single survey for all the SHSs belonging to entire PoA (Option A)	Simple Random Sampling	95% confidence level with +/- 10% error margin
2	Sub-grouping of SHSs across the PoA and one survey for each sub-group (Option B)		

Situations may arise where it will be necessary to create two or more sub-groups of SHSs over the entire PoA for the monitoring survey. For example, as of now, IDCOL and Grameen Shakti, the two major CPA implementers, may want to have separate monitoring surveys for their installations. In such cases, all the installations of IDCOL shall be grouped under one sub-group and all of the installations of Grameen Shakti to be under another sub-group.

As the SHSs in each CPA are installed over the entire Bangladesh, the CME cannot, for instance, easily create geographical/regional criteria for sub-grouping.

Ultimately, the grouping of SHSs for monitoring surveys will depend upon the convenience and management requirement. Typical examples of SHS sub-grouping are given in the table below. It shows how the SHSs could be flexibly grouped. These examples are not intended to restrict future subgroupings of SHSs.

Sub-grouping – Example 1 (Option A):

Sub-Group	CPA Title	Total SHS installations
I	Single monitoring survey for all SHSs under the PoA	2,806,125

Sub-grouping – Example 2 (Option B):

Sub-Group	CPA Title	Total SHS installations
I	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2009) by Grameen Shakti	1,108,775
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by IDCOL	
	Installation of Solar Home Systems in Bangladesh	

<sup>12</sup> SHS of different CPAs and also with respect to the date of installation. SHS performance characteristic remains more or less uniform over the entire period of interest.

<sup>13</sup> Performance of Solar Power Plants In India, Central Electricity Regulatory Commission, February 2011

	(01/01/2012 to 31/12/2012) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by IDCOL	
II	Installation of Solar Home Systems in Bangladesh (01/01/2010 to 31/12/2010) by Grameen Shakti	846,264
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 30/06/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by Grameen Shakti	
III	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2010) by IDCOL	851,086
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/07/2012 to 31/12/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/05/2014 to 31/12/2014) by Grameen Shakti	

Sub-grouping – Example 3 (Option B):

Sub-Group	CPA Title	Total SHS installations
I	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2010) by IDCOL	1,342,858
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 30/06/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/07/2012 to 31/12/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by IDCOL	
II	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2009) by Grameen Shakti	1,463,267
	Installation of Solar Home Systems in Bangladesh (01/01/2010 to 31/12/2010) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 31/12/2012) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/05/2013 to 31/12/2014) by Grameen Shakti	

The above mentioned grouping criteria will also apply to all future CPAs to be included. In selection of any of the options, the sample survey will meet the requirement of “Standard for Sampling and

surveys for CDM project activities and programme of activities”, version 08, EB 105 and “Guidelines for sampling and surveys for CDM project activities and programmes of activities”, version 04, EB 86. Data pertaining to the survey results will be recorded and maintained by IDCOL.

The DOE shall verify the reported number of SHS in working condition and the agreement code and serial number of each SHS in the sampled households.

In the event of a discrepancy, corrective actions and/or the discounting of final emission reductions should be defined by the DOE, in light of significant discrepancies during the survey, to ensure conservative emission reductions are calculated.

## **SECTION C. Demonstration of additionality of PoA**

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- (i) The proposed PoA is a voluntary coordinated action

IDCOL has voluntarily decided to introduce this coordinated action as part of a strategy for supporting rural electrification. There is no mandatory policy/regulation or law in Bangladesh that requires IDCOL to do this.

The proposed PoA is a voluntary coordinated action currently supported by POs.

- (ii) If the PoA is implementing a voluntary coordinated action, then, it would not be implemented in the absence of the PoA.

The above criterion is confirmed through the below explanation:

### **Background to SHS Program**

Grameen Shakti initiated a soft credit facility to support the sales of SHS in rural areas in Bangladesh in 1997. However, Grameen Shakti was not able to access many areas and customers due to the following barriers: (i) it lacked the financial resources to scale up investment to SHS users; (ii) it lacked the capital to cover risks associated with possible customer default; (iii) the high implementation and operational cost to the organization; (iv) lack of technical service centres and skilled technicians; and (v) lack of enabling regulatory environment to set SHS standards.

The main barriers faced by the customers are: (i) the high upfront cost of the SHS/lack of access to credit; (ii) lack of knowledge on how to install and maintain the SHS as it is not a common practice. With these barriers, clearly the program, under business as usual scenario was not in a position to develop into a nationally significant program.

Recognizing above barriers to expanding the SHS program, a plan was prepared in 2002 and approved to partially address some of the identified barriers at both the program and the SHS consumer levels. IDCOL and its then <sup>14</sup> POs were identified to implement the Rural Electrification and Renewable Energy Development Project (REREDP) <sup>15</sup> to increase the installation and technical service support required for SHS<sup>16</sup>.

<sup>14</sup> Refer to the World Bank website for the RERED project documents, including Project Appraisal Documents, Integrated Safeguards Data Sheet and the Environment Assessment: <http://documents.worldbank.org/curated/en/699721468003918010/pdf/88702-REPF-BRI-PUBLIC-Box385194B-ADD-SERIES-Live-wire-knowledge-note-series-LW21-New-a-OKR.pdf>

<sup>15</sup> Refer to the World Bank website for the RERED project documents, including Project Appraisal Documents, Integrated Safeguards Data Sheet and the Environment Assessment: <http://documents.worldbank.org/curated/en/699721468003918010/pdf/88702-REPF-BRI-PUBLIC-Box385194B-ADD-SERIES-Live-wire-knowledge-note-series-LW21-New-a-OKR.pdf>

<sup>16</sup> REREDP is planned to be jointly financed by the IDA, Global Environment Facility (GEF), KfW/GTZ from 2002 to 2009. Additional World Bank/IDA support is currently under discussion.

A key element in the overall program level design of REREDP was that the subsidy element of the program was planned to decrease over time under the assumption that the support of REREDP to the SHS program would help gain the required traction among rural people that would lead to commercialisation of SHS implementation through reducing SHS and related costs. The two subsidy components which were planned to reduce over a period of time are: (i) a Block A grant, to reduce the cost of the SHS to the customer; and (ii) a Block B grant, provided as an institutional subsidy/payment.

However, IDCOL soon recognized that the programme would need consistent high levels of financing and subsidy for a longer time period than originally envisaged, considering both the overall program level demands and the income levels of the target population, including the high upfront costs of SHS to households. As the program was designed to reduce the overall program level cost of the subsidy element over time, while at same time needing to scale up SHS installations, additional sources of financing needed to be found. Carbon finance was identified as a possible financing source.

### **Description of the program level steps taken to seek carbon benefits**

On 14/06/2005, the Minutes of the 27<sup>th</sup> REREDP Operations Committee recognised that additional financial support would be needed for the implementation of the SHS program. At this meeting a decision was taken by IDCOL to seek carbon finance to assist the implementation of the next stage of the SHS program. Grameen Shakti reported at the meeting that it had already taken a decision to seek carbon finance in order to implement the next stage of the REREDP SHS program and had received national approval for such a program.

In 2007, two further important milestone changes took place in REREDP: (i) it was decided to reduce the approximate US\$ 90 subsidy per SHS to approximately US\$ 40 per SHS (€30)<sup>17</sup>; and (ii) a Project Idea Note for the CDM program, which was under discussion, was approved by the World Bank Carbon Finance Unit on 15/05/2007<sup>18</sup>.

Grameen Shakti and IDCOL intend to use the carbon revenues to effectively enable the SHS program to be implemented with a reduced element of subsidy. Grameen Shakti will retain the revenues which it earns from its emission reductions purchase agreements (ERPA). IDCOL agreed in the minutes of the 49<sup>th</sup> meeting of the Operations Committee that it would provide the income derived from the sale of emission reductions to the other POs, thereby offsetting the loss of a reduced subsidy to the POs.

### **Barriers analysis**

The following section describes the barriers the program faces as defined in Attachment A to Appendix B of the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*.

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<sup>17</sup> In the less than 0.5% of cases where a customer purchases a second SHS for same premises, they are not eligible to receive the buy down subsidy and the SHS will not be considered additional and ERs will not be claimed.

<sup>18</sup> The GTZ/KfW grant decreases over time as the PO reaches certain milestones in terms of the number of SHS installed. Currently, €30 is given by IDCOL to the PO upon installation of the SHS as a buy down on the cost of each SHS. This is called Type A Grant. A type B Grant, equivalent to from €8 down to €4, which serves as an institutional grant, is also provided to the PO for each SHS installation. These amounts are spelt out in sections 3.04 and 3.05 of the Participation Agreement which gets signed between IDCOL and each PO..

The IDCOL website also highlights the approach taken to reducing subsidy. See the article titled "Overview of Renewable Energy Program" at: <http://www.idcol.org/energyProject.php>. It indicates how the subsidy decreases over time.



Guideline 7 of “Guidelines For Objective Demonstration And Assessment of Barriers”, version 01, EB 50, Annex 13 states that “For projects in Least Developed Countries<sup>19</sup>, it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries. Projects in Least Developed Countries are not bound by the provisions in this guideline and may use other approaches that are more adapted to the local circumstances.”

The Rationale under Guideline 7 suggests that Projects in Least Developed Countries can be assumed in general to face significant barriers to their implementation. At the same time, data availability in these countries is considerably limited, which, complicates the demonstration of additionality and therefore, further causes increased transaction costs. Bangladesh falls under the category of Least Developed Countries as listed by the United Nations General Assembly<sup>20</sup>. Accordingly, the barriers to this program are transparently described below based on available information, thereby, satisfying Executive Board requirements.

The barrier analysis demonstrates that a large number of barriers have so far inhibited the adoption of SHS and that without the CDM program, business as usual will continue to prevail. Under business as usual, the CO<sub>2</sub> emissions will be higher than that under the project. The programme activity therefore meets the first additionality test.

#### **CME, CPA implementer/PO and household level Investment barrier<sup>21</sup>:**

*SHS is not financially attractive / affordable to SHS households and program implementers<sup>22</sup>:* SHS is financially unattractive to potential SHS consumers and to the potential SHS installers because of: (i) the high upfront investment cost<sup>23</sup> of a SHS (household level barrier); and (ii) the costs to POs of installing and maintaining a SHS (CPA implementer/PO barrier). The success of the REREDP project shows that how important the additional finance is in supporting the buy down of SHS to the buyers and to the POs to install and maintain SHS. In addition, even with the present level of financing and grants raised by IDCOL as CME, the program falls short of funding required to meet its implementation targets (CME barrier to financing the program). The following table provides IDCOL's calculation of the short fall in SHS, which need to be installed each year, to meet the 1 million SHS target by 2012, due to the shortage of available investment.

Year	2009	2010	2011	2012
Target Nos.	132,000	162,000	198,000	240,000

<sup>19</sup>As defined by the United Nations General Assembly in its resolutions (59/209, 59/210 and 60/33) and its updates

<sup>20</sup>[http://unfccc.int/files/cooperation\\_and\\_support/ldc/application/pdf/ldc-list-31jan08.pdf](http://unfccc.int/files/cooperation_and_support/ldc/application/pdf/ldc-list-31jan08.pdf)

<sup>22</sup> New customers: The project team discussed whether the program should be segregated into SHS customers which could enter the program and receive the SHS subsidy but who would not be eligible to benefit from the CDM because they were not considered to be poor enough or were considered to be too rich. This idea is not practical and was dropped for the following reasons. Firstly, a program which is trying to become commercially viable cannot afford to load its customer base with an ever increasing numbers of customers who are marginally credit worthy and have a precarious financial position. Therefore, any customers who are credit worthy and meet the eligibility criteria need to be accepted into the program especially because the more credit worthy customers make up for those who are less credit worthy (a principle found in all credit programs). Secondly, CDM revenues partly benefit the expansion and the extension of the overall SHS program as well as providing some benefit to each SHS customer. Thirdly, Bangladesh is one of the poorest countries in the World. It therefore makes little sense to try distinguishing shades of “poorness” especially in a rural context.

**Financing Details:**

Until 2008, 280,000 SHSs have been installed in Bangladesh. To meet the target of 1 million SHSs by 2012, an additional funding for 720,000 systems is required through various grants and sources. The following table shows the financing available from various sources and the number of systems that can be installed using these funds and the short fall to meet the targets.

<b>Source<sup>24</sup></b>	<b>Grant A &amp; B</b>		<b>IDCOL Fee</b>		<b>Re-finance</b>	
	<b>SHS Nos.</b>	<b>Amount (EUR)</b>	<b>SHS Nos.</b>	<b>Amount (EUR)</b>	<b>SHS Nos.</b>	<b>Amount (USD)</b>
GTZ - Small SHS (Remaining Portion)	24,500	931,000	24,500	318,500	-	-
GTZ - 3 <sup>rd</sup> Phase (Remaining Portion)	35,275	1,199,350	35,275	246,925	-	-
KfW reallocation	271,724	7,777,928	271,724	1,902,068	-	-
GTZ - 4 <sup>th</sup> Phase (Proposed)	50,000	1,760,000	50,000	560,000	-	-
Asian Development Bank loan	-	-	-	-	100,000	28,500,000
Islamic Development Bank loan	-	-	-	-	56,350	16,059,750
The World Bank loan	-	-	-	-	326,000	92,910,000
GPOBA*	172,360	3,791,920	172,360	1,206,520		
Total	553,859	15,460,198	553,859	4,234,013	482,350	137,469,750
Fund required to meet the target	732,000	19,379,300	732,000	5,481,000	732,000	208,620,000
Shortfall	<b>178,141</b>	<b>3,919,102</b>	<b>178,141</b>	<b>1,246,987</b>	<b>249,650</b>	<b>71,150,250</b>
Equivalent USD		<b>5,168,671</b>		<b>1,644,577</b>		<b>71,150,250</b>

\* Global Partnership on Output-Based Aid

<sup>24</sup>All sources of funds are channelled either to Government and then to IDCOL or to IDCOL and then to the POs.

Though one can argue that IDCOL as CME should fill the program level financing gap by raising additional funds from other sources, the program continues to face a financing shortfall/barrier and carbon finance is one way of reducing the need for loan finance and concessional finance which is clearly necessary due to the lack of liquidity in global financial markets. The availability and utilisation of CDM funds will help to overcome the barriers mentioned below at CME, CPA Implementer/PO and household level.

High upfront SHS costs (Household level barrier): At this stage, it is not envisaged how far the CDM revenues would contribute to subsidize the upfront investment cost of each SHS as the income derived is not guaranteed and insufficient for that<sup>25</sup>. The income can also be used to reduce the investment cost of important item like batteries, O&M contract costs after warranty period and the short fall in the investments required to expand the program to reach to at least one million households. This will support the continued sustainability of the program.

The table below shows, how the cost (loan portion) of a new 50 Wp SHS, to the customer, decreased from the year 2002 onwards. But then, it increased in the year 2006 due to the increase in the cost of SHS and the decreasing grant for each SHS. This increase in loan portion to the SHS customer in the year 2006 took place at the time that a decision was being taken on the future of the program<sup>26</sup>.

Year	Avg. System Price (Taka)	Grant (Taka)	Loan Portion (Taka)
2002	24,000	5,274	20,400
2003	23,700	5,274	20,145
2004	22,600	5,274	19,210
2005	22,200	4,159	18,870
2006	24,000	3,125	20,400

Costs to POs of installing and of maintaining SHS (CPA Implementer/PO): The SHS program suffers from lack of funds to provide technical support centres and from lack of technicians to install and maintain the SHS. This in turn, creates a technical barrier. Whilst Grameen Shakti will use the income which it derives from carbon finance to expand its network of technology centres, the IDCOL POs will be able to use the revenues to sustain their programs and to expand into new areas.

Risks of default by SHS customers need to be covered (CPA Implementer/ PO and CME barrier): All the programs which provide credit need to cover the costs of default since they pose a potential threat to the survival of the program. Moreover, initially IDCOL's financing facility to the POs under REREDP was an off balance sheet item. But recently, the mechanism of accounting has been changed and all loans to the POs under REREDP are now part of IDCOL's own balance sheet. For this reason, Bangladesh Bank in their last audit report instructed IDCOL to take collaterals from the

<sup>25</sup> The contribution of CER income to a SHS will vary significantly depending on when a SHS is purchased, the energy baseline which is approved, when the program is finally registered and the demand for ERs in the post 2012 Kyoto market. Using a 65Wp SHS as example: assuming the SHS customer needs to repay \$300 after down payment; a 65Wp SHS saves 233 kg of CO<sub>2</sub> per annum. Over 10 years at \$10/tonne this is \$20 per SHS.

<sup>26</sup> Program start date is 22/06//2007. Increasing SHS cost was therefore a major concern in 2006 during program design.

POs to mitigate the credit risk under REREDP. This change in financial structure has required POs to become more risk averse in assessing the credit worthiness of new customers.

*Project Solution:* The SHS credit mechanism works as follows:

Grameen Shakti and IDCOL aim to reduce the initial investment costs (down payment) of SHS to each household/consumer. Firstly, as discussed above, the cost of each SHS is subsidized in the order of \$40 (Block A Grant) apart from the institutional subsidy (Block B Grant) provided to POs. SHS users then pay 10% - 25% of the total SHS price as an initial down payment. The remaining 75% - 90% of the loan amount has to be repaid in up to 42 equal monthly instalments<sup>27</sup>. With an increasing price and loan component to each SHS customer, provision needs to be made for a greater number of users to default on their loans. CER revenue generated from the project will be used to provide a buffer and covers the risk of non-repayment of loans by approximately an estimated 3,840 households<sup>28</sup> per year on an average.

### **Barrier: SHS penetration rate and lack of awareness of SHS**

Lack of familiarity by potential customers about SHS (household level barrier): As per World Bankrecords<sup>29</sup>, only about 40% of Bangladesh's total population has access to grid-connected electricity. In rural areas, the only available and affordable technologies are the kerosene lamps for lighting and batteries for running small appliances like black and white TV.

At the time of writing this PoA Design Document for registration, the main organizations which support the off grid rural electrification activities and the installation of SHS in Bangladesh are Grameen Shakti and IDCOL, including its POs. Up to 01/01/2007, no more than 105,000 SHS have been installed nationally<sup>30</sup> against a roll out target of 1 million by 2012. Therefore, 105,000 SHS consumers out of 15 million potentially eligible households<sup>31</sup>, apart from other potential SHS users, imply a penetration of a mere 0.6% only. This low penetration rate of SHS in Bangladesh indicates the massive need for additional resources, technical support and awareness to achieve the target of 1 million SHS by 2012 and to support the noble cause of the government to electrify the entire country by 2020.

*Project Solution:* The program has designed an extensive education and awareness program which is described in more detail in section F.1.

### **Institutional & Regulatory Barriers:**

Lack of supporting regulations and standards (household level, CPA implementer/PO and CME barrier): In Bangladesh, there is a lack of supporting regulations and standards to encourage

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<sup>27</sup> the Draft Participation Agreement, Section 3 also spells out the financing arrangements which IDCOL will assist POs to extend to SHS owners including ensuring that the terms are affordable to the SHS owners. The IDCOL presentation titled IDCOL's Solar Energy Program.

<sup>28</sup> This figure of 2% of SHS installed is used by Grameen Shakti as a safety net for the upper end number of potential defaulters. The original planned volume of emission reductions was expected to be about 25% larger but has been reduced by the conservativeness of the current methodology.

<sup>29</sup>

<sup>30</sup> See also World Bank PID, Bangladesh: IDCOL Solar Home Systems Project <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/551791468013244483/bangladesh-idcol-solar-home-systems-project>

<sup>31</sup> With 25.5 million households across the country of which 70% are rural, that provides 17.85 million rural households. With 85% of rural households not electrified, that makes approximately 15 million rural households eligible to participate in the SHS program.

renewable energy (RE) practices and technologies<sup>32</sup>. SHS providers and households therefore need to bear the risks of equipment failure and/or the costs of developing standards. Prior to the program, a Standards Committee did not exist to set standards for the provision of SHS.

*Project Solution:* Under the program, SHS standards are set and maintained through a Standards Committee. Carbon revenues, therefore, assist IDCOL to manage the process of setting up the standards.

#### Timeline to demonstrate serious consideration of the CDM

Date	Activity
14/06/2005	Item 5 of Operations Committee minutes. It is reported that Grameen Shakti and IDCOL are making preparations to seek carbon finance for SHS program and that the Prime Minister's Office had granted Grameen Shakti approval to develop a carbon finance program
20/03/2006	Draft LOI prepared for SHS project at that time with Grameen Shakti
26/07/2006	PIN summary of draft PIN prepared by the Bank
31/01/2007	Final PIN approved by the Bank
23/04/2007	Item 6 of the Operations Committee agenda: IDCOL notes that it is likely to sign a CDM agreement with the World Bank
01/01/2007	Initial program and start date which was subsequently invalidated by EB 47 para 73 ruling leading to required adjustment of the start date to no earlier than 22/06/2007
15/05/2007	PIN approved by World Bank
22/06/2007	Program and start date of first CPA
15/07/2007	IDCOL reported that it had received consent letters from all POs except GS that they agreed to IDCOL effectively being their bundling agent.
23/07/2007	DOE hired
07/09/2007	LOI signed with World Bank
19/12/2007	ERPA signed
13/04/2008	Host Country Approval
05/08/2009	Bank Board approves additional financing loan (REREDP) loan to Government/IDCOL due to increasing price of SHS and debt servicing and need to provide additional finance to help reach target of 1 million SHS

(iii) If the PoA is implementing a mandatory policy/regulation, then, this would/is not enforced;

Not Applicable

(iv) If mandatory, a policy/regulation is enforced, the PoA will lead to greater level of enforcement of the existing mandatory policy/regulation

Not Applicable

Following recent EB guidance on additionality demonstration for PoAs ["Standard for demonstration of additionality of GHG emission reductions achieved by a programme of activities" Version 01, EB 63, Annex 2], the following are defined as a key criterion to demonstrate the applicability of barriers as also confirmed per the eligibility criteria no. (1), (4) and (5) defined in section K of this document.

<sup>32</sup> [http://www.isesco.org.ma/ISESCO\\_Technology\\_Vision/NUM01/A.K.M.%20Sadrul%20Islam/A.K.M.%20Sadrul%20Islam.pdf](http://www.isesco.org.ma/ISESCO_Technology_Vision/NUM01/A.K.M.%20Sadrul%20Islam/A.K.M.%20Sadrul%20Islam.pdf)

Key additionality criteria (as also defined in the eligibility criteria in Section K of this document)	(a) Reason for selection of criteria (b) Proof of confirmation?
<p><i>The proposed CPA should have access to financing channels of the IDCOL Solar Energy Program</i></p> <p><i>("Each proposed CPA implementer, other than IDCOL itself, should be an approved participant of the IDCOL Solar Energy program")</i></p>	<p>Reason: Implementing organizations cannot implement the SHS activities in households without financing from the IDCOL Solar Energy Program. This is needed to reduce the financial burden (barrier) on households and to address the investment barrier which program implementation faces.</p> <p>Proof: The IDCOL Participation Agreement will be used to demonstrate that the CPA Implementer is an approved participant of the IDCOL Solar Energy Program. Articles III and IV of the Participation Agreement make it clear that POs are eligible to receive IDCOL financing.</p>
<p><i>The proposed CPA must be within the country of Bangladesh which is an LDC</i></p>	<p>Reason: This implies that CPAs located in LDCs, faces investment, technical and institutional/regulatory barriers.</p> <p>Proof: Bangladesh, as defined by the United Nations General Assembly in its resolutions (59/209, 59/210 and 60/33) and its updates, is one of the Least Developed Countries before 28/05/2010, including today;</p>
<p><i>The proposed SHS customers in the specific CPA must be households / communities / SMEs located in rural areas do not have grid connected electricity at time of SHS installation</i></p>	<p>Reason: The proposed SHS customers in the specific CPA must be households / communities / SMEs located in rural areas and not have grid connected electricity at time of SHS installation.</p> <p>These households face technical and investment related challenges as they are generally poor and lack capacity and support.</p> <p>Proof: Each CPA is only included into the PoA if each household is located in a non-electrified area and is off-grid.</p>

As long as each CPA confirms the above mentioned three criteria, the CPA is considered to be additional.

## SECTION D. Start date and duration of PoA

### D.1. Start date of PoA

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22/06/2007<sup>33</sup>

The preparation of CPAs 1- 4 began in parallel with the preparation of the PoA and the installation of SHSs within certain CPAs began as a consequence of the program on 01/01/2007 before the CDM PoA-DD was advertised for Global Stakeholder Consultation on 04/12/2007. It should be noted that the SHSs installed before 22/06/2007 were a result of the programme and benefited from the programme design features, though they are excluded to comply with CDM Glossary of terms version 05 and EB 47 para 72 requirements. Therefore, only SHS installed/implemented on or after 22/06/2007 are eligible for inclusion into the PoA. As a consequence of parallel

<sup>33</sup> This date has been updated to allow only CPAs with start date after 22/06/2007 following EB guidance via EB47 report. As the start date of each CPA under this program is based on date of individual systems (SHS) installed, in order to accommodate these requirements, systems installed prior to 22/06/2007 have been excluded from first CPA.

implementation of CPAs and preparation of the PoA, 22/06/2007 is also considered as the program start date.

## D.2. Duration of PoA

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28 years and 0 months

## SECTION E. Environmental impacts

### E.1. Level at which environmental impacts analysis is undertaken

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1. Environmental Analysis is done at PoA level
2. Environmental Analysis is done at CPA level

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Environmental analysis is done at PoA level as the installation of SHS is a routine predictable activity which is beneficial to the environment and the individual CPAs are small scale activities. The activity, therefore, benefits from environmental analysis at the PoA level.

### E.2. Analysis of environmental impacts

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No analysis of the environmental impacts of the SHS activity is required by Bangladesh. However, IDCOL conducted an environmental analysis for the overall World Bank loan for the REREDP<sup>34</sup>, which included a SHS component, in May 2002. The environmental assessment states on page 10 that mini hydro, wind and solar PV (i.e., SHSs) are among the least environmentally damaging power generation options. The environmental assessment was appraised by the World Bank, found to meet World Bank safeguard requirements and is publicly disclosed in the World Bank internet website. For the preparation of the carbon finance aspects of the program, the World Bank once again reviewed compliance requirements to Bangladesh and to World Bank safeguard policies. The publicly available Integrated Social Assessment Data Sheets (ISDS) for the program make the same findings that there are no significant safeguard or environmental issues.

The only environment issue identified in the environmental assessment documentation is the disposal/recycling of old lead batteries. For economic and environmental reasons, the old lead batteries are immediately collected through the program due to their scrap lead value and replaced with newbatteries. This ensures continuity in the SHS service and prevents lead contamination in the environment<sup>35</sup>.

### E.3. Environmental impact assessment

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According to the National Environmental Policy 1992, Environmental Conservation Act 1995 and Environmental Conservation Rules and Regulation 1997, a project dealing with solar energy does not require any environmental clearance certificate for implementation. Therefore, there are no requirements for carrying out Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). CPAs will thus not be accompanied by environmental analysis.

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<sup>34</sup> Refer to

[http://www.wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187283&siteName=WDS&entityID=000094946\\_02060404024782](http://www.wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187283&siteName=WDS&entityID=000094946_02060404024782)

<sup>35</sup> The process for recycling of batteries is described on the IDCOL website in slide 10 of the following presentation: <http://www.idcol.org/download/IDCOL%20Solar%20Energy%20Program-June%202008.pdf>



## SECTION F. Local stakeholder consultation

### F.1. Level at which local stakeholder consultation is undertaken

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1. Local stakeholder consultation is done at PoA level
2. Local stakeholder consultation is done at CPA level

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The key stakeholders are national in character and include, IDCOL, Grameen Shakti, the POs, World Bank, national equipment suppliers and other nationally important organisations. The program is national in character and does not involve sub-nationally defined CPAs. In light of the above, comments were sought at the PoA level.

### F.2. Modalities for local stakeholder consultation

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CDM Stakeholder consultations were held with the key program stakeholders once in 2005 and twice in 2007. The Program Operations Committee which is chaired by IDCOL was used to conduct the CDM stakeholder consultations. Stakeholders were invited by IDCOL to attend the meeting through the meeting agenda which is circulated in advance of all meetings.

On 14/06/2005, during the start of the CDM program documentation preparation stage, the first meeting was attended by 21 stakeholders including Grameen Shakti, 7 POs, 2 battery suppliers and the World Bank. On 23/04/2007 during the finalisation of the CDM programme documentation, the second meeting was attended by 33 stakeholders including IDCOL, Grameen Shakti and 17 POs and the World Bank. On 15/07/2007, the third meeting was attended by 21 stakeholders including IDCOL, Grameen Shakti, 13 POs and World Bank. All three meetings were held during the CDM program preparation stage and before hosting the documents for validation by DOE. Stakeholders were provided with an opportunity to review and propose amendments to the meeting minutes at each subsequent meeting of the Program Operations Committee. No negative comments were expressed by those present at the meetings or subsequently at the confirmation meetings.

### F.3. Summary of comments received

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As mentioned above, on 14/06/2005, the first meeting to address SHS program CDM was held. The meeting was attended by 21 stakeholders including Grameen Shakti, 7 POs, 2 battery suppliers and the World Bank. The World Bank representative explained the concept of carbon finance to the meeting with reference to the program:

- One of the stakeholders asked if it would be possible to seek both GEF finance and carbon finance; and
- Grameen Shakti said that it had sought approval from the Designated National Authority (DNA) under the Prime Minister's Office for its proposed SHS activities.
- BRAC, one of the larger POs' said that it was also considering seeking carbon finance

On 23/04/2007, the meeting was attended by 33 stakeholders including IDCOL, Grameen Shakti, 17 POs, technical suppliers to the program and the World Bank:

- The meeting heard that the World Bank would assist IDCOL and POs to seek carbon finance; and
- IDCOL requested POs to provide letters indicating that IDCOL could seek carbon revenues on their behalf.

On 15/07/2007, the meeting was attended by 21 stakeholders including IDCOL, Grameen Shakti, 15 POs and World Bank:

- IDCOL reported that it had received letters from all of the POs authorising IDCOL to seek carbon finance on their behalf, except for Grameen Shakti; and
- IDCOL reported that it intended signing a Letter of Intent with World Bank.

#### **F.4. Consideration of comments received**

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The 3 meetings held at PoA level showed a high level of support for undertaking a carbon finance operation. Few issues were raised:

- It was agreed that it would be possible to seek both GEF and carbon finance;
- IDCOL reported that it may assist the smaller POs to seek carbon finance;
- POs other than Grameen Shakti then provided IDCOL with letters stating that they would allow
- IDCOL to seek carbon benefits on their behalf. While Grameen Shakti stated that it would pursue its own carbon finance activities, with the arrival of Programmatic CDM it decided to become a CPA Implementer under the program; and
- The issue of CDM revenue sharing was discussed and subsequently resolved through PO Agreements

### **SECTION G. Approval and authorization**

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The Letter of Approval for both the participating parties (IDCOL of this PoA has been submitted.

## **PART II. Generic component project activity (CPA)**

### **SECTION H. Description of generic CPA**

#### **H.1. Title of generic CPA**

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#### **H.2. Installation of Solar Home Systems in Bangladesh (DD/MM/YYYY to DD/MM/YYYY) by IDCOL<sup>36</sup> / Grameen Shakti Reference number of generic CPA**

>>

2765-P1-XXXX-CPX

#### **H.3. Purpose and general description of generic CPA**

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The proposed Component project activity (CPA) is a bundle of estimated<sup>37</sup> xxxxx units of Solar Home Systems

(SHSs), with various capacities ranging from xx Wp to xx Wp, to be installed from DD/MM/YYYY to DD/MM/YYYY in rural regions in Bangladesh that are not connected to the electricity grid. Electricity is generated by the SHS on site by the end user for own use. Households<sup>38</sup> currently

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<sup>36</sup> This includes all Partner Organizations of IDCOL excluding Grameen Shakti

<sup>37</sup> Actual figures to be confirmed during verification.

<sup>38</sup> As households are the predominant SHS consumers the term households is used in the PoA and CPA. Reference to households in this PoA and the CPAs does not preclude other users from partaking in the program.

use kerosene lamps for lighting and batteries to run television sets and other small electrical appliances. The batteries are charged from time to time at local village stores by small diesel generators. The proposed CPA is a voluntary initiative taken by Grameen Shakti (GS) or Infrastructure Development Company Ltd (IDCOL).

Grameen Shakti and IDCOL are implementing a rural electrification program to provide electricity to users in off-grid, remote and rural areas with SHS. These SHS users currently have no access to grid connected electricity and currently use kerosene for lighting or batteries as discussed above. The proposed SHS program involves providing:

- Soft credit through instalments to makes SHS attractive<sup>39</sup>;
- Intense grassroots promotion through demonstrations, fairs, meetings at the local level, etc.;
- Community involvement and social acceptance of SHS; and
- Free Operation & Maintenance service for three years after SHS installation. After this period, further service can be obtained, upon payment, at minimal charge.

In the absence of the proposed CPA, the most likely alternative is that households would have continued using kerosene as fuel for their lighting application and batteries charged from local stores using diesel generator for other appliances like TV. Thus kerosene consumption for lighting and diesel consumption for charging batteries for low power electrical use is avoided. Hence, greenhouse gas (GHG) emissions are reduced from the avoidance of burning fossil fuels. The CPA will generate an estimated xxx t CO<sub>2</sub>e emission reductions during the first 7 years.

The proposed CPA will contribute to the following sustainable development objectives in Bangladesh:

- The introduction of SHS will reduce Bangladesh's dependency on imported fossil fuels such as kerosene and diesel. The proposed CPA will help create new business and job opportunities related to the operation and maintenance of SHS. For example, the PO / IDCOL trained local technicians will provide maintenance and repair services to the SHS users;
- The increase in reliability of electricity supply will promote the development of micro-enterprises. The improved lighting quality from SHS will enable longer and reliable working hours and support higher income-generation. Tailoring businesses, convenience stores, cafés and restaurants can serve more clients by working longer business hours. New income opportunities such as, mobile phone charging services and longer renting time on mobile phones, will also be generated. This will have a positive socio-economic impact.
- SHS users will have healthier home and work environments. Since SHS will replace the conventional soot-producing kerosene lamps, they will significantly reduce, indoor air pollution thus reducing the incidence of respiratory diseases, eye ailments, etc. This is expected to reduce the health-care expenditures by the end users.

#### H.4. Technologies/measures

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Description of Technology/Measure: The proposed CPA will introduce SHS of various capacities that will comprise of:

- a) Solar Module (PV panel),

<sup>39</sup> Program and SHS financing: GTZ and KfW have provided a grant to the SHS program towards the buy down cost of each SHS by \$XX. In addition, upon installation of an SHS, the technician / PO undertaking the installation receives an installation fee from the GTZ/KfW grant; and The World Bank has provided an IDA loan to the Government of Bangladesh which is lent via IDCOL, to the various POs. The POs extend credit to the SHS users at 6%, install and maintain the SHS. The SHS user is required to provide a down payment of 10% - 25% of the cost of SHS which is repaid in up to 5 years over equal instalments.

- b) Battery,
- c) Charge controller,
- d) Fluorescent tube lights with special electronic ballasts,
- e) Mounting structure,
- f) Installation kits, and
- g) Cables and connecting devices

The capacity of individual SHS which are installed will vary according to the consumer's choice and demand. The schematic diagram of connected loads to a typical XXWp system is shown below:

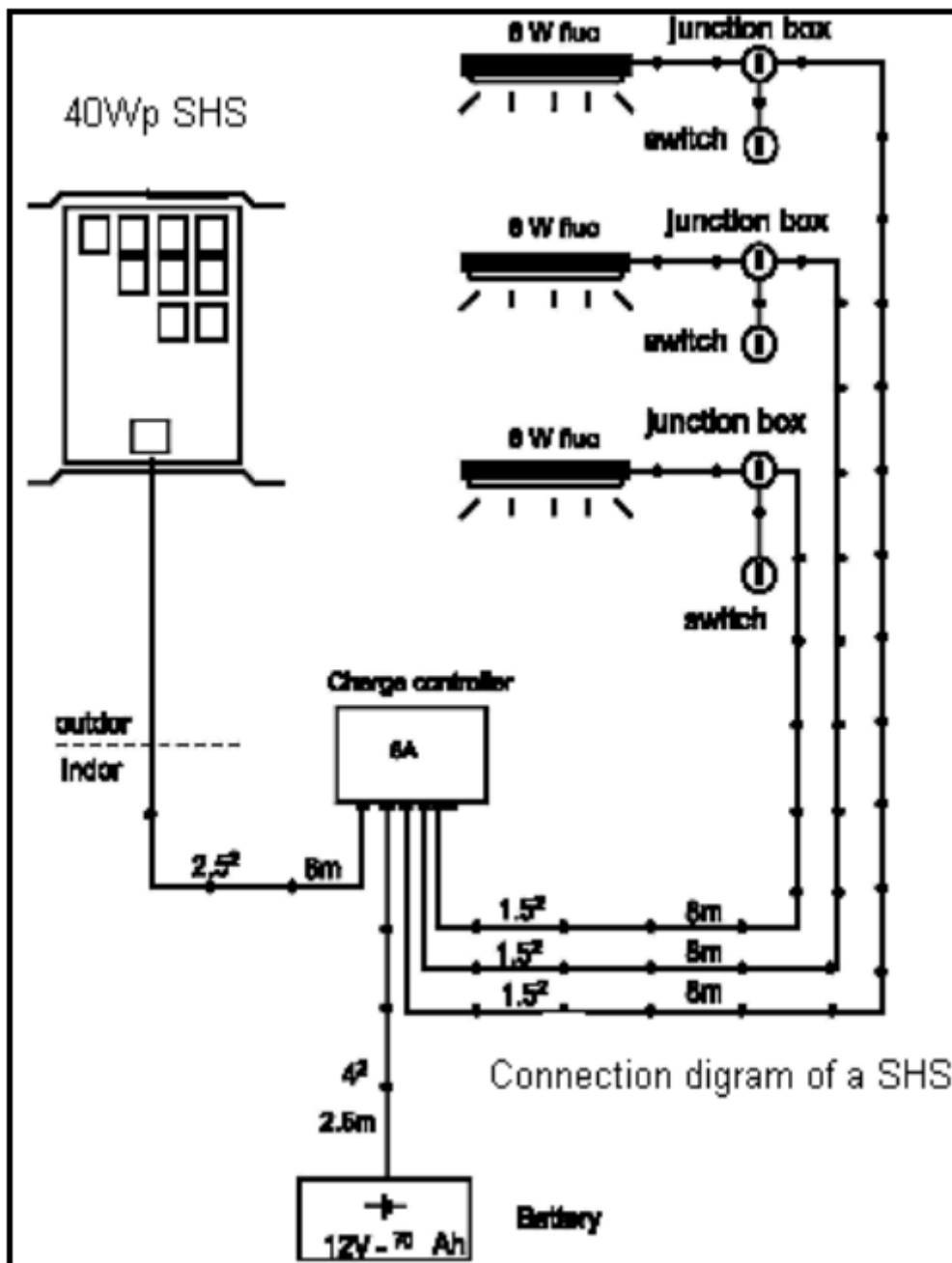


Figure 3. SHS System Circuit Diagram

Connected Load	SHS Rating, Wp	SHS Rating, Wp	SHS Rating, Wp	SHS Rating, Wp
	xx	xx	xx	xx
<b>CFL Lights</b>				
Nos.	x			
Wattage/light	x			
Hours per day	x			
<b>TV - Black &amp; White</b>				
Nos.	1			
Wattage	10			
Hours per day	3			
<b>Mobile Charger</b>				
wattage	x			
hours per day	x			

The technical specifications of the SHS proposed to be installed under the programme are as follows:

Measured Qty	SHS Rating, Wp				
	xx	xx	xx	xx	xx
Rated Peak Power, Wp	x	x	x	x	x
Type (a-Si, crystalline Si, etc)	x	x	x	x	x
Useful Energy (Ah/day)	x	x	x	x	x
Open circuit voltage (V)	x	x	x	x	x
Short Circuit current (A)	x	x	x	x	x
Vmax	x	x	x	x	x
Imax	x	x	x	x	x
Number of cells in series	x	x	x	x	x

## SECTION I. Application of methodologies and standardized baselines

### I.1. References to methodologies and standardized baselines

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Title : Type I: Renewable energy projects  
Reference : AMS-I.A. - Electricity generation by the user<sup>40</sup>  
Version : 17, EB 103  
Sectoral scope : 1, Energy industries (renewable / non-renewable sources)

The following guideline is also referred:

- General guidelines for SSC CDM methodologies, Version 23.0, EB 104, Annex 5<sup>41</sup>
- Standard for Sampling and surveys for CDM project activities and programme of activities", Version 08, EB 105
- Guidelines for sampling and surveys for CDM project activities and programmes of activities, Version 04, EB 86
- Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period, Version 03.0.1, EB 66.

It is confirmed that the selected methodology is applicable for the CPAs under the small scale PoA.

<sup>40</sup><https://cdm.unfccc.int/UserManagement/FileStorage/RIZFLYM7S6QH8X3NJOPVG5A0EB29U4>

<sup>41</sup>[https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20190916153417994/MethSSC\\_guid25.pdf](https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20190916153417994/MethSSC_guid25.pdf)

## I.2. Applicability of methodologies and standardized baselines

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The component project activity is the electricity generation by the user. The CPAs under the proposed PoA introduces renewable energy generation units that supply individual households or users with a small amount of electricity under the category as defined in AMS-I.A. - Electricity generation by the user, version 17, EB 103. The applicability is limited to the households and the users without grid connection.

The SHS units use solar power technology to produce electricity, all of which is used on-site by the user. The total capacity of all these renewable energy units, per CPA shall not exceed 15 MW.

The General Guidelines for SSC CDM methodologies, version 23 dated 12 September 2019, paragraph 4.17 states the following:

In the case of CPAs solely composed of “microscale CDM units”, the coordinating/managing entity is not required to demonstrate compliance with the small-scale CDM thresholds at the aggregate level of the CPA. In such cases:

- a) The definition of ‘microscale CDM units’ provided under section “5.1 Application of microscale thresholds at unit level for CPAs”<sup>42</sup> of the methodological tool “Demonstration of additionality of microscale project activities” shall apply;
- b) 95/10 precision shall be applied for sampling surveys in accordance with the standard for “Sampling and surveys for CDM project activities and programmes of activities”.

Further section 6 of the Tool: Demonstration of additionality of microscale project activities, version 9, dated 29 Nov 2018 mentions the following:

For CPAs applying microscale thresholds at the unit level rather than at the aggregate level of the CPA, the term ‘project activities’ in paragraphs 4 and 11 to 13 above shall be read as ‘units’.

If each of the units contained in the CPA satisfies the condition to qualify as a ‘microscale CDM unit’, then the coordinating/managing entity is not required to demonstrate compliance of the CPA with the microscale or small-scale thresholds at the aggregate level of the CPA. In such cases, the requirements related to de-bundling stated in paragraph 6 above do not apply.

Para 11 of the aforesaid Tool refers to renewable energy technology up to 5 MW installed capacity and the project activity is located in a LDC country along with it being a solar PV technology for distributed energy generation where end users are households, communities or small and medium-sized enterprises.

Thus, all units will remain under the micro-scale limit throughout the year, and, compliance with the requirement of methodology is not required as per aforesaid and para 124(m) of Standard: CDM project standard for programmes of activities, version 2.0.

“If the generic CPA is small-scale or microscale, conditions to ensure that CPAs that will be included meet the small-scale or microscale thresholds and remain within those thresholds throughout the crediting period of the CPAs. However, if the generic CPA consists solely of units that qualify as “microscale CDM units” as defined in the “Methodological tool: Demonstration of additionality of microscale project activities”, these conditions are not required.”

Hence, the applicable baseline methodology for the proposed component project activity is as per AMS-I.A. – Electricity generation by the user, version 17, EB 103 of indicative simplified baseline and monitoring methodologies.

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<sup>42</sup> Units of capacity up to 5 MW that employ renewable energy technology or that achieve energy savings at a scale of no more than 20 GWh per year or that achieve emission reductions at a scale of no more than 20 ktCO<sub>2</sub>e per year, located in LDCs or SIDS or special underdeveloped zones (SUZs) of non-Annex I countries.

The justification of applicability conditions (as per methodology AMS-I.A.- Electricity generation by the user, version 17, EB 103) are also listed in the following tables:

No.	Applicability condition	Justification
1.	This category comprises renewable electricity generation units, such as solar photovoltaic, hydro, wind and renewable biomass that supply electricity to individual households/users or groups of households/users.	Applicable.  The SHS units are the renewable energy generation using Solar power that supplies electricity to the dedicated households.
2.	The methodology is applicable to project activities that involve new installations (greenfield) or replace existing onsite fossil-fuel-fired generation.	Applicable  The SHS units are greenfield in nature. The SHS unit would replace the existing fossil fuel usage of kerosene as fuel for lighting application and diesel in generator sets at local stores used for charging the domestic batteries
3.	The applicability of the methodology is limited to individual households and users that do not have a grid connection except when: a) A group of households or users are supplied with electricity through a standalone mini-grid powered by renewable energy generation unit(s) where the capacity of the generating units does not exceed 15 MW (i.e. the sum of installed capacities of all renewable energy units connected to the mini-grid is less than 15 MW) e.g. a community-based stand-alone off-the-grid renewable electricity systems; or b) For renewable energy-based lighting applications, the emission reductions per system is less than 5 tonnes of CO <sub>2</sub> e a year and it shall be demonstrated that that fossil fuels would have been used in the absence of the project activity by: i. A representative sample survey of target households; or ii. Official statistics from the host country government agencies; c) A group of households or users are connected to a grid prior to the start date of the project activity (or the start date of validation with due justification), however the electricity from the grid is available for the households and users for less than 36 hours in any given calendar month during the crediting period or the grid connected household coverage in the host country is less than 50%.	Applicable.  The SHS units are greenfield in nature and the individual household do not have a grid connection.
4.	The methodology is not applicable to project activities that include units that will be connected to the grid at any time during the	IDCOL Inspectors randomly inspect the newly installed SHS to confirm the technical standards and that the SHS has been



	crediting period.	installed in a rural area to a non-grid connected household. An Inspection Report is produced. The results of the Inspection Report are fed into the IDCOL data base. If the inspection Report indicates that a SHS has been installed in conflict with the program eligibility criteria such as, in an urban area or to a grid connected household, a Discrepancy Report is generated. The SHS then becomes ineligible under the program and is accordingly not eligible to receive any IDCOL financing. A clear system exists for excluding ineligible SHS under the program.
5.	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: a. The project activity is implemented in an existing reservoir with no change in the volume of reservoir; b. The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity is greater than 4 W/m <sup>2</sup> ; c. The project activity results in new reservoirs and the power density of the power plant, is greater than 4 W/m <sup>2</sup> .	Not applicable as this is not a hydro power plant.
6.	Combined heat and power (cogeneration) systems are not eligible under this category	Not applicable as this is not a Combined heat and power (cogeneration) system.
7.	If the electricity generation unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable as this project don't have non-renewable component.
8.	Project activities that involve retrofit or replacement of an existing renewable electricity generation unit are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	Not Applicable as this project doesn't involves retrofit or replacement of existing renewable electricity generation.
9.	In the case of project activities that involve the addition of renewable electricity generation units to an existing renewable electricity generation facility, the total capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable as the total capacity will not be more than 15 MW.
10.	In cases where the project activity utilizes biomass, the applicability conditions of "TOOL16: Project and leakage emissions from biomass" shall apply.	Not applicable as the component project activity doesn't utilizes biomass.

**I.3. Application of multiple methodologies**

&gt;&gt;

Not applicable.

**I.4. Project boundary, sources and greenhouse gases (GHGs)**

&gt;&gt;

The GHG reduced through this CPA is CO<sub>2</sub>. The reduction takes place through avoidance of fossil fuel,

- for use in household and small commercial establishments for lighting kupies/hurricane lamps
- for small diesel generators that would have been installed in the absence of the CDM activity to expand lighting and electricity use in rural areas, where, users were not connected to the national electricity grid.

	Source	GHG	Included?	Justification/Explanation
<b>Baseline</b>	Combustion of fossil fuel by lamps in households and electricity generators at shops for charging batteries in isolated area	CO <sub>2</sub>	Included	Main emission source
		CH <sub>4</sub>	Excluded	Excluded for simplification
		N <sub>2</sub> O	Excluded	Excluded for simplification
<b>Project activity</b>	Combustion of fossil fuel by lamps in households in isolated area	CO <sub>2</sub>	Excluded	Lamps might be used only when the SHS is not in operation and during maintenance days (25 days). Since these days are already excluded from SHS operational days and emission reduction calculations, the emission due to lamps in PoA/CPAs has been excluded.
		CH <sub>4</sub>	Excluded	No emission source
		N <sub>2</sub> O	Excluded	No emission source

The CPA is located within the Peoples Republic of Bangladesh as stated in section A.2 of this document. This is evidenced in IDCOL's comprehensive database which provides a unique identification number for each SHS consumer / installation under this CPA. The schematic diagram of connected loads to a typical 40 Wp system is shown below:

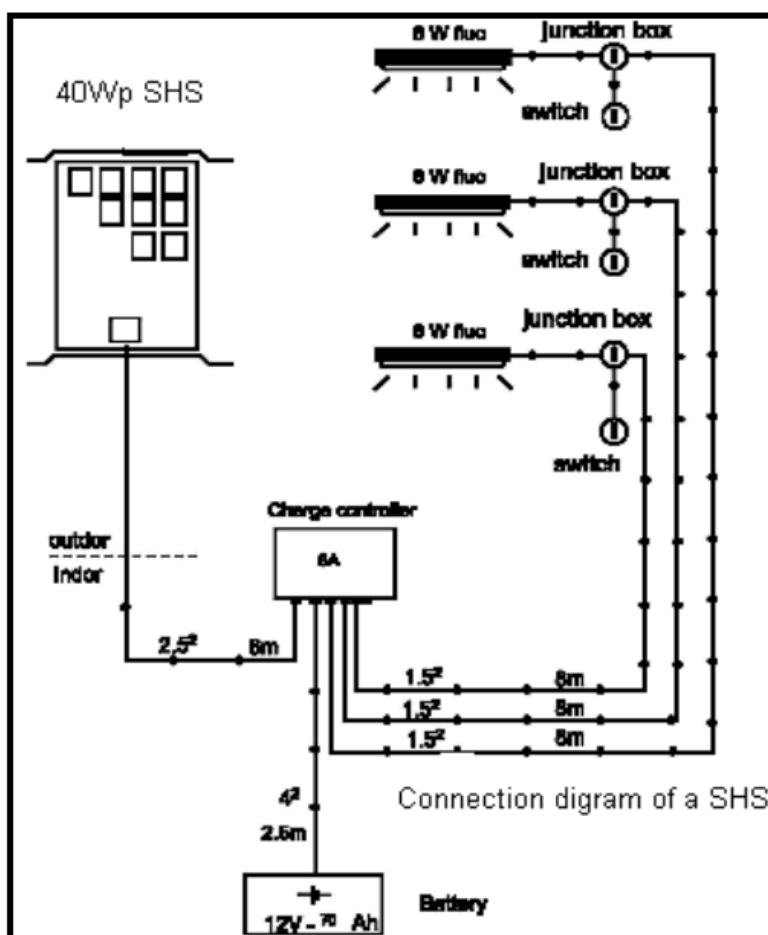


Figure 3. SHS System Circuit Diagram

There are no project emissions sources. The monitoring parameter is the count of the systems installed and operating.

### 1.5. Establishment and description of baseline scenario

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Updated baseline for the second crediting period in line with the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period." Version 03.0.1.

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 283 to 286 of Project Standard for program activities version 02.0. The tool stipulates the following steps to be carried out.

There is no other baseline scenario apart from the implementation of an alternative program of diesel generators. The baseline scenario is thus the continued usage of kerosene for lighting purpose and batteries for entertainment purpose (TV) charged from local village shops using diesel generator sets in the absence of any rural electrification program to supply the same service of electricity as supplied by the SHS CDM project

#### Step 1: Assess the validity of the current baseline for the next crediting period

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

**Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies**

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies and it shall be checked by CME before inclusion of SHS and also the condition is the part of CPA inclusion criteria.

**Step 1.2: Assess the impact of circumstances**

The program to provide electricity to users in off-grid, remote and rural areas with SHS. These SHS users currently have no access to grid connected electricity and currently use kerosene for lighting

In total rural population, currently kerosene is the source of lighting for off grid population and alternative source of the solar home system (SHS)<sup>43</sup> which is likely to continue in the absence of the program. The baseline scenario identified at the validation of the component project activity was the continuation of the current practice without any investment. Hence, the current baseline does not need to be updated for the second crediting period.

**Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested**

As explained in step 1.2, the baseline scenario was the kerosene using by household in off grid areas and the program to provide electricity to users in off-grid, remote and rural areas with SHS. The project activity in green field project and it is unlikely that any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

**Step 1.4: Assessment of the validity of the data and parameters**

There is no change in the value of the ex-ante parameters.

**Step 2: Update the current baseline and the data and parameters**

This step is only applicable if any of the Steps 1.1, 1.2, 1.3 and/or 1.4 showed that the current baseline needs to be updated.

**Step 2.1: Update the current baseline**

The current baseline emissions for the second crediting period are updated based on the latest AMS-I.A Version 17.0 applicable to the project activity.

**Step 2.2: Update the data and parameters**

All parameters remain the same.

**Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity**

There is no restriction to use of kerosene for lighting purpose as per local regulation<sup>44</sup>

In accordance with the procedures for renewal of crediting period of a registered PoA, the original baseline scenario remains valid taking new relevant national and/or sectoral policies into account; and the baseline emissions are updated in accordance with step 1.2 and 2.2 for the second crediting period.

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<sup>43</sup>

[http://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b2db8758\\_8497\\_412c\\_a9ec\\_6bb299f8b3ab/SYB-2018.pdf](http://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b2db8758_8497_412c_a9ec_6bb299f8b3ab/SYB-2018.pdf)

<sup>44</sup> <http://www.reb.gov.bd/site/page/b36a45d6-6ed2-4477-9cb1-831bd0b13d90/->

## I.6. Estimation of emission reductions

### I.6.1. Explanation of methodological choices

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Estimation of GHG emission reductions for SHS follow the requirements defined in clause 19 of AMS-I.A and are based on the fuel consumption of the technology in use or that would have been used in the absence of the component project activities to generate the equivalent quantity of lighting service using option 3. The equations are listed below:

#### 1. Calculation of Baseline emissions

As the SHS replaces usage of kerosene for lighting and usage of diesel for charging batteries for a TV at local diesel generator stations, the baseline is the:

- Amount of kerosene that is being consumed in the number of kerosene lamps equivalent to the number of CFL lamps installed per household.
- Amount of diesel consumed equivalent to quantity of electricity required to charge the batteries

A) Emission reductions due to replacement of kerosene consumption per lamp is calculated as follows:

$$BE_{CO_2y} = N_y \times \sum_j FC_{j,y} \times NCV_j \times EF_{CO_2,j}$$

Where,

$BE_{CO_2y}$	= Baseline emissions in year y (t CO <sub>2</sub> /yr)
$N_y$	= Total number of kerosene lamps replaced in year y (nos.)
$FC_{j,y}$	= Amount of fuel consumption of fuel type j per lamp in year y (litres)
$NCV_j$	= Net calorific value of fuel type j (TJ/Gg)
$EF_{CO_2,j}$	= CO <sub>2</sub> emission factor of fuel type j (t CO <sub>2</sub> /GJ)
$j$	= Fuel type used for combustion

#### Amount of fuel consumed per lamp

The amount of fuel (kerosene) required to burn the kerosene lamp is determined on conservative basis based on various studies conducted and literature surveyed. Based on this, a value of 0.04<sup>45</sup> litres/hours is used for the estimation of emission reductions.

The following studies and literature is considered for arriving at historical fuel consumption data for kerosene lamps for lighting in Bangladesh:

- Report on “Impact of climate change on livelihoods and employment” by International Labour Organisation (ILO) mentions the use of 10-12.5 litres/month (0.09 – 0.12 l/h) of kerosene per household in the country.
- A paper on “Replacing Kerosene based lighting systems with the White LED in Rural Area in Bangladesh through solar energy” quotes the consumption of 0.06 l/h for a kerosene lamp.
- A report on ‘Assessment of carbon dioxide reduction potential and energy payback period of solar home systems in developing countries: Case of Bangladesh’<sup>46</sup> mentions replacement of 17 litres/month (0.16 l/h) by households opted for 35Wp system and 20 to 22 l/month (0.19-0.2 l/h) for 50 Wp system.
- A survey by Grameen Shakti for a sample of households identifies the number of lamps each household has in the baseline and estimation of fuel consumption based on standard

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<sup>45</sup> Based on Grameen Shakti survey

consumption values (based on literature data) confirms the kerosene consumption in the range of 60 to 190 litres per annum depending up on number of lamps in each household.

- Energy research Centre of Netherlands' (ECN) Global emission reduction formula suggests using 75+ 4Wp as the emission reduction potential for each SHS. This is in line with Certified Emission Reduction Procurement Tender (CERUPT) methodology for off-grid project activities.

The summary of the above is as below:

Source	Consumption, l/h	Remarks
Report on "Impact of climate change on livelihoods and employment" by ILO	0.09 – 0.12	
A paper on "Replacing Kerosene based lighting systems with the White LED in Rural Area in Bangladesh through solar energy	0.06	
A report on 'Assessment of carbon dioxide reduction potential and energy payback period of solar home systems in developing countries: Case of Bangladesh	0.16 for 35Wp 0.19-0.21 for 50 Wp	
Survey by Grameen Shakti	60 to 190 litres per annum	Based on number of lamps in each household
ECN, Netherlands	40 Wp: 235 kg CO <sub>2</sub> /yr 65 Wp: 330 kg CO <sub>2</sub> /yr 80 Wp: 395 kg CO <sub>2</sub> /yr	

Based on review of all above mentioned, to be on the conservative side, a value of 0.04l/h is considered for baseline emission calculations.

This approach is adopted for the following reasons:

1. A sample survey by Grameen Shakti during early 2009 indicated a huge variation in the consumption pattern among households. The consumption levels vary between 50 litres and more than 180 litres depending on financial capabilities of individual households.
2. Differentiating households on the basis of their financial capability and determining baseline for each category is very cumbersome and might not help much as it already indirectly reflects the capacity of SHS chosen by individual households.
3. Out of all the information sources available on baseline kerosene consumption for lamps, the adopted value is observed to be very conservative.

### ***Operating hours per day***

As per the methodology guidance, 3.5 hours are considered per day for calculation of baseline emissions.

### ***Operating days per annum***

For conservative purpose, 25<sup>47</sup> days per annum have been deducted to include any non-functioning days due to SHS system maintenance. As per the manufacturer specifications, the system is guaranteed to operate all days including rainy days. Hence, the number of days per annum is considered as 340 days.

Operating hours per annum = 3.5 x 340 = 1,190 hr

**Kerosene consumption per lamp per year = 0.04 x 1,190 = 47.6 litres**

Parameter	Value	Unit	Reference
Kerosene consumption	1	litre	

<sup>47</sup>For leap years, it is conservatively assumed to be 26 days per year

Density of kerosene	0.75	kg/litre	Web link <sup>48</sup>
Net calorific value of kerosene, NCV <sub>j</sub>	43.8	TJ/Gg	IPCC 2006 <sup>49</sup>
Emission coefficient for kerosene EFCO <sub>2,j</sub>	71.9	kg CO <sub>2</sub> /GJ	IPCC 2006 <sup>50</sup>
Kerosene consumption	0.75	kg	Calculation
	7.5E-07	Gg	Calculation
	3.29E-05	TJ	Calculation
	0.03285	GJ	Calculation
CO <sub>2</sub> emissions per litre of kerosene usage	2.3619	kg CO <sub>2</sub> /litre	Calculation

Baseline emissions per lamp per year = 47.6 x 2.3619 = 112.43 kg CO<sub>2</sub>/lamp/yr

### Number of kerosene lamps replaced per SHS of different rating (N<sub>k</sub>)

The number of kerosene lamps that would be replaced in the baseline (N<sub>k</sub>) is considered based on the conservative use of survey results done by Grameen Shakti. The following table 4 provides the number of kerosene lamps that are replaced by each rating of SHS:

SHS Rating range (Wp)	20 - 39	40 -74	75 -119	120 & above
No. of kerosene lamps that would have been replaced by the SHS, N <sub>k</sub>	1	2	3	4

For the calculation of number of kerosene lamp replacements for individual SHS ratings, the above table values will be directly referred during CER estimation.

The numbers considered here are conservative considering the following:

- The total load connected to each SHS (including lamps each of 6W and one Black & White TV of 10 W) is below the rated capacity of each SHS.
- Number of lamps selected also reflects the current lighting needs and affordability of each household based on their need, demand and capacity.

Total number of kerosene lamps replaced in the baseline will be calculated based on number of SHS installed and operational and connected lamps for each SHS.

$$N_y = \sum_j SHS_{wp,y} \times N_k$$

where,

SHS<sub>wp,y</sub> - No. of SHS of capacity Wp installed and operational in year y

N<sub>k</sub> - No. of kerosene lamps replaced per SHS of installed capacity W<sub>p</sub>

b) Emission reductions from avoiding charging batteries from local shop using diesel set

All SHS units above 40Wp of their size (Wp) are expected to operate one 10W Black & White TV. This avoids the usage of batteries and their charging from local stores using diesel sets. The following table provides details of emission reductions.

TV - Black & White	
Nos.	1
Wattage	10
Hours per day	3

<sup>48</sup> [https://www.answers.com/Q/1\\_kg\\_kerosene\\_equals\\_how\\_many\\_liter](https://www.answers.com/Q/1_kg_kerosene_equals_how_many_liter)

<sup>49</sup> IPCC 2006 ; Energy, Chapter 1 - Table 1.2

<sup>50</sup> IPCC 2006 ; Energy, Chapter 1 - Table 1.4

<b>Baseline</b>	
Battery Capacity (Ah)	30
Battery Voltage (V)	12
Battery Capacity (kWh)	0.36
No. of charges per year	24 (2 per month)
Charging efficiency of the battery (%)	85
Annual consumption (kWh)	10.2
CO <sub>2</sub> emission coefficient of diesel, (kg CO <sub>2</sub> /kWh)	0.8 (IPCC 2006)
<b>Annual CO<sub>2</sub> savings (kg CO<sub>2</sub>/yr)</b>	<b>8.1</b>

However, considering the very small potential for CO<sub>2</sub> savings out of the replacement of diesel, this portion of the baseline emissions are ignored for the final baseline calculations. This is conservative.

Baseline emissions are therefore calculated as:

$$BE_y = 112.43 \times N_y \text{ kg CO}_2/\text{yr}$$

## 2. Calculation of Project emissions

Project emissions are assumed to be zero

## 3. Leakage

As per latest the CDM guideline, "General guidelines for SSC CDM methodologies", Version 23.0, EB104, Annex 5, Section N. Leakage due to transfer of equipment, it is stated in para 26 that:

*"For Type I methodologies, the requirement that the replaced energy-generating equipment should be scrapped and that this scrapping should be independently monitored is not needed since under most circumstances the replaced equipment would most likely replace less efficient equipment outside the project boundary."*

Hence, the retaining of old kerosene lamps need not be monitored and the leakage emissions are considered to be zero for this PoA

## 4. Calculation of emission reductions

$$ER_y = (BE_y - PE_y) - LE_y$$

Where,

$ER_y$  - Emission reductions in year y (t CO<sub>2</sub>e)

$BE_y$  - Baseline emissions in year y (t CO<sub>2</sub>e)

$PE_y$  - Project emissions in year y (t CO<sub>2</sub>e)

$LE_y$  - Leakage emissions in year y (t CO<sub>2</sub>e)

### 1.6.2. Data and parameters fixedex ante

<b>Data/Parameter</b>	<b>EF<sub>CO2,j</sub></b>
Data unit	tCO <sub>2</sub> e/kl
Description	Emission factor for kerosene
Source of data	Calculated using default values provided in 2006 IPCC guidelines
Value(s) applied	2.3619
Choice of data or Measurement methods and procedures	Based on IPCC values (IPCC 2006; Energy, Chapter 1 - Table 1.2)
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable



<b>Data/Parameter</b>	<b>FC<sub>i,y</sub></b>
Data unit	Litres
Description	Annual consumption of Kerosene per lamp
Source of data	Literature survey and sample survey results of households
Value(s) applied	47.6
Choice of data or Measurement methods and procedures	As explained in Section D.6.1 of the specific CPA DD
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable

<b>Data/Parameter</b>	<b>T</b>
Data unit	Hours / day
Description	Daily usage of technologies for the generation of lighting
Source of data	A default value as suggested in AMS-I.A.
Value(s) applied	3.5
Choice of data or Measurement methods and procedures	As suggested in the methodology AMS-I.A. - Electricity generation by the user, version 17, EB 103
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable

<b>Data/Parameter</b>	<b>D</b>
Data unit	Days
Description	Annual operating days of SHS units replacing the kerosene lamps
Source of data	Manufacturer specifications
Value(s) applied	340
Choice of data or Measurement methods and procedures	As per the manufacturer specifications, the SHS is guaranteed to operate all days of the year, including rainy days, as the SHS retains charge for approximately 3 days without requiring additional charging. However, for conservative purposes, 25 days per year have been deducted to include possible days when a SHS may not be functioning, due to system maintenance or any other reasons. Hence, the number of operating days per annum is considered to be 340. The value is fixed ex-ante.
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable

<b>Data/Parameter</b>	<b>Density<sub>k</sub></b>
Data unit	kg/litre
Description	Density of kerosene
Source of data	<a href="http://www.answers.com/topic/kerosene">http://www.answers.com/topic/kerosene</a> (Columbia Encyclopaedia)
Value(s) applied	0.75
Choice of data or Measurement methods and procedures	The value is fixed ex-ante
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable

<b>Data/Parameter</b>	<b>NCV<sub>i</sub></b>
Data unit	TJ/Gg
Description	Net calorific value of kerosene
Source of data	IPCC 2006 - Volume 2 Energy, Chapter 1, Table 1.2, pg 1.18
Value(s) applied	43.8
Choice of data or Measurement methods and procedures	The value is fixed ex-ante
Purpose of data	To calculate the baseline emissions
Additional comment	Not applicable

Data/Parameter	N <sub>k</sub>				
Data unit	Units				
Description	Number of kerosene lamps replaced by a SHS				
Source of data	Fixed conservatively based on the results of Grameen Shakti survey				
Value(s) applied	Fixed for a capacity range of SHS installed as per manufacturer specifications on number of CFL installed as part of each SHS				
	SHS Rating (Wp)	20-39	40-74	75-119	120 & above
	No. of kerosene lamps that would have been replaced per SHS, N <sub>k</sub>	1	2	3	4
Choice of data or Measurement methods and procedures	This number is calculated based on a survey <sup>51</sup> conducted by Grameen Shakti using the questionnaire for sample households / SHS consumers to identify the number of SHS operational during year y				
Purpose of data	To calculate the baseline emissions				
Additional comment	Not applicable				

### I.6.3. Modalities for ex ante calculation of emission reductions

>>

AMS-I.A. - Electricity generation by the user, version 17, EB 103, provides guidelines for the determination of the baseline as follows: "The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy".

As the SHS technology replaces usage of kerosene for lighting and usage of diesel for charging batteries for a black and white TV at local diesel generator stations, the baseline is:

- Amount of kerosene that is being consumed in number of kerosene lamps equivalent to the number of CFL lamps installed in households
- Amount of diesel consumed equivalent to quantity of electricity required to charge the batteries.

As per the registered PoA, considering the very small potential for CO<sub>2</sub> savings out of the replacement of diesel, this portion of the baseline emissions are ignored for the final baseline calculations. Hence, the emissions reductions are estimated only for the replacement of kerosene lamps.

#### **Estimation of baseline emissions:**

- Number of kerosene lamps replaced per SHS of different panel rating (N<sub>k</sub>)

The number of kerosene lamps replaced by SHSs of different panel rating is taken from the survey conducted by Grameen Shakti as below:

<sup>51</sup> Survey methodology and implementation report: kerosene consumption for solar home systems in Bangladesh: January, 2009

SHS Rating range ( $W_p$ )	20 - 39	40 -74	75 -119	120 & above
No. of kerosene lamps that would have been replaced per SHS, $N_k$	1	2	3	4

b) Total number of kerosene lamps replaced in each rating ( $N_y$ )

$$N_y = \sum SHS_{WP,Y} \times N_k$$

Where,

$SHS_{WP,Y}$  - No. of SHS of capacity  $W_p$  installed and operational in year  $y$

$N_k$  - No. of Kerosene lamps replaced by SHS of installed capacity  $W_p$

No.	SHS capacity ( $W_p$ )	No. of installations	No. of kerosene lamps replaced ( $N_y$ )
1			
2			
3			
4			
5			

c) Baseline estimation

$$BE_{CO2,y} = N_y \times \sum_j FC_{j,y} \times NCV_j \times EF_{CO2,j}$$

Where,

$BE_{CO2,y}$  = Baseline emissions in year  $y$  (t CO<sub>2</sub>/yr)

$N_y$  = Total number of kerosene lamps replaced in year  $y$  (nos.)

$FC_{j,y}$  = Amount of fuel consumption of fuel type  $j$  per lamp in year  $y$  (litres)

$NCV_j$  = Net calorific value of fuel type  $j$  (TJ/Gg)

$EF_{CO2,j}$  = CO<sub>2</sub> emission factor of fuel type  $j$  (t CO<sub>2</sub>/GJ)

As discussed in Section D.6.1 of the specific CPA DD, the baseline emission for a number of SHS units that replace a single kerosene lamp is therefore calculated as:

$$BE_{CO2,y} = \left( \frac{112.43}{1000} \right) \times N_y \text{ t CO}_2/\text{yr}$$

$$= 0.11243 \times \text{xxxx}$$

$$= \text{xxxxx tCO}_2/\text{yr}$$

### **Estimation of project emissions:**

Since the power generation is from solar power, project emissions are assumed to be zero.

$$PE_y = 0 \text{ t CO}_2/\text{yr}$$

### **Estimation of leakage emissions:**

Leakage monitoring is excluded and is assumed to be zero as per latest CDM guidelines "General guidelines for SSC CDM methodologies", Version 23.0, EB 104, Annex 5, Section N. Leakage due to transfer of equipment.

$$LE_y = 0 \text{ t CO}_2/\text{yr}$$

### **Estimation of emission reductions:**

$$ER_y = (BE_y - PE_y) - LE_y$$

$$= xxxx - 0 - 0$$

## I.7. Monitoring plan

### I.7.1. Data and parameters to be monitored

Data/Parameter	SHS
Data unit	Units
Description	Number of SHS units installed
Source of data	IDCOL SHS database
Value(s) applied	xxxx
Measurement methods and procedures	Total count of SHS Installations of 100% of the households / consumers collected and stored. The number of SHS units under different rating is also monitored in the IDCOL SHS database and the values are provided in table 3 under section D.5 table 3 of the specific CPA DD.
Monitoring frequency	Continuous. The POs submit their installation data every month to IDCOL which then updates it to the SHS database
QA/QC procedures	<p>SHS on which discrepancy reports are generated, are excluded, for example, if found to be in urban areas or in grid connected households / consumers at the time of installation.</p> <p>Less than 0.5% of SHS consumers purchase a second SHS. Second SHS or ineligible SHS (SHS which generate Discrepancy Report) will be excluded from the project SHS and will be excluded from claiming emission reductions as well.</p> <p>Since the total SHS installations, without discrepancies, under a CPA vary based on inspection reports generated every month, the total number of SHS installations in IDCOL SHS database, after deducting all discrepancies, as on the end date of every monitoring period will be taken for CER calculation for the respective monitoring period. Proof of screenshot of total SHS installation without any discrepancies under each CPA at the end of a monitoring period will be captured from the IDCOL SHS database and stored for verification.</p>
Purpose of data	To calculate the baseline emissions
Additional comment	Data will be collected using the standard procedures and will be stored for the crediting period and additional two years

Data/Parameter	SHS <sub>wp,y</sub>
Data unit	Units
Description	Number of SHS that are operational
Source of data	IDCOL monitoring survey result
Value(s) applied	xxxxx (value used for ex-ante calculation. This value will be monitored through sampling surveys during ex-post emission reduction calculation).
Measurement methods and procedures	100% of project SHS information will stored in the IDCOL data base per CPA. A sample will be drawn at 95% confidence level and at 10% error margin from the IDCOL data base to monitor and calculate number of operational SHS. The monitoring survey will be carried out as a single survey for all SHS under the PoA or each survey for sub-groups of SHSs belonging to the PoA during that monitoring period. The grouping of SHSs will be decided accordingly at each monitoring period. In instances where a % of SHS units in a sample are found not to be working, a discount of the same % will be applied to the overall emission reductions of respective survey population to ensure conservativeness.
Monitoring frequency	Annual
QA/QC procedures	Random number generators from MS-Excel will be used to select samples. The total number of SHS installations, after deducting all discrepancies, at the end date of a monitoring period, will be taken to estimate the number of operational systems.
Purpose of data	To calculate the baseline emissions
Additional comment	Data will be collected using the standard procedures and will be stored for the crediting period and an additional two years.

Data/Parameter	PR
Data unit	Units
Description	The payment receipt of easy monthly instalments (EMI) to POs by individual SHS owner
Source of data	The implementing organization
Value(s) applied	Variable has not been considered for calculation
Measurement methods and procedures	Implementing organization will collect EMI receipts from the individual households and document them.
Monitoring frequency	Continuous
QA/QC procedures	Three copies of EMI receipts are made. One for household, one for PO branch office and other for PO zonal / divisional office. Thus, at any point of time, the EMI receipts shall be cross verified by the higher-level management of PO / IDCOL. A passbook to register the number of EMIs paid is also maintained at each household.
Purpose of data	To cross check the SHS installations details
Additional comment	Data will be collected using the standard procedures and will be stored for the crediting period and an additional two years.

Data/Parameter	TR
Data unit	Units
Description	Confirmation of training or technical support provided
Source of data	The implementing organization will keep record of technical or training support provided to the SHS users
Value(s) applied	Variable has not been considered for calculation
Measurement methods and procedures	IDCOL and POs will maintain the information, hard copy records, etc. on training and technical service provided to SHS customers, technicians, and other staffs. Copy of these records will be maintained at the IDCOL and PO offices. Apart from regular training sessions, POs will provide training to every SHS households during its installation. Leaflets, brochures, notices containing instructions on operation and servicing of the SHS will be provided to the households.
Monitoring frequency	Continuous
QA/QC procedures	All the training materials provided to POs and households are reviewed / revised periodically for latest updates by IDCOL
Purpose of data	To cross check and ensure the continuous service support to SHS installations.
Additional comment	Data will be collected using the standard procedures and will be stored for the crediting period and an additional two years.

### I.7.2. Sampling plan

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#### Sampling survey to identify operational SHSs

The project proponent will use the Simple Random Sampling method to determine the number of operating SHS out of the total installed SHSs. The representative sample will be chosen so as to achieve 95% confidence level with +/- 10% error margin.

#### Sample size calculation for the proposed survey

The monitoring survey shall be carried out by grouping of SHSs across the PoA into a single group or number of sub groups. From IDCOL technical specifications<sup>52</sup> and third party literature<sup>53</sup>, it is clear the SHS performance reduces only very marginally across the years and there is no major difference among SHS of different CPAs and also with respect to the date of installation. SHS performance characteristic remains more or less uniform over the entire period of interest.

Taking the performance of SHS as a grouping criteria, all the SHSs under the PoA can be considered as a single group or number of sub groups (regrouping the SHSs under the PoA), depending upon the requirement during each verification.

The survey approaches is given in below table:

No.	Survey Approach	Sampling Method	Reliability Requirement Confidence/Precision
1	Single survey for all the SHSs belonging to entire PoA (Option A)	Simple Random Sampling	95% confidence level with +/- 10% error margin

<sup>52</sup> Technical Specifications for Solar Home System (SHS), IDCOL Solar program, Technical Standards Committee

<sup>53</sup> Performance of Solar Power Plants In India, Central Electricity Regulatory Commission, February 2011

2	Sub-grouping of SHSs across the PoA and one survey for each sub-group (Option B)		
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Situations may arise where it will be necessary to create two or more sub-groups of SHSs over the entire PoA for the monitoring survey. For example, as of now, CPA implementers, may want to have separate monitoring surveys for their installations. In such cases, all the installations of IDCOL shall be grouped under one sub-group and all of the installations of Grameen Shakti to be under another sub-group.

As the SHSs in each CPA are installed over the entire Bangladesh, the CME cannot, for instance, easily create geographical/regional criteria for sub-grouping.

Ultimately, the grouping of SHSs for monitoring surveys will depend upon the convenience and management requirement. Typical examples of SHS sub-grouping are given in the table below. It shows how the SHSs could be flexibly grouped. These examples are not intended to restrict future subgroupings of SHSs.

Sub-grouping – Example 1 (Option A):

Sub-Group	CPA Title	Total SHS installations
I	Single monitoring survey for all SHSs under the PoA	2,806,125

Sub-grouping – Example 2 (Option B):

Sub-Group	CPA Title	Total SHS installations
I	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2009) by Grameen Shakti	1,108,775
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 31/12/2012) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by IDCOL	
II	Installation of Solar Home Systems in Bangladesh (01/01/2010 to 31/12/2010) by Grameen Shakti	846,264
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 30/06/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by Grameen Shakti	
III	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2010) by IDCOL	851,086
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/07/2012 to 31/12/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/05/2014 to 31/12/2014) by Grameen Shakti	

Sub-grouping – Example 3 (Option B):

Sub-Group	CPA Title	Total SHS installations
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I	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2010) by IDCOL	1,342,858
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 30/06/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/07/2012 to 31/12/2012) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by IDCOL	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by IDCOL	
II	Installation of Solar Home Systems in Bangladesh (22/06/2007 to 31/12/2009) by Grameen Shakti	1,463,267
	Installation of Solar Home Systems in Bangladesh (01/01/2010 to 31/12/2010) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2011 to 31/12/2011) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2012 to 31/12/2012) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/01/2013 to 31/08/2013) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/09/2013 to 30/04/2014) by Grameen Shakti	
	Installation of Solar Home Systems in Bangladesh (01/05/2013 to 31/12/2014) by Grameen Shakti	

The above mentioned grouping criteria will also apply to all future CPAs to be included. In selection of any of the options, the sample survey will meet the requirement of “Standard for Sampling and surveys for CDM project activities and programme of activities”, version 08, EB 105 and “Guidelines for sampling and surveys for CDM project activities and programmes of activities”, version 04, EB 86.

#### Sample size calculation

The procedure to determine the sample size of monitoring survey will ensure that they adequately represent the broader population and minimize the sampling error. Simple random sampling is done to draw a sample of households which will participate in the SHS monitoring survey.

For the selection of sampling method “Guidelines for sampling and surveys for CDM project activities and programmes of activities, Version 04, EB 86” has been referred. The equation to give the required sample size is:

$$n \geq \frac{1.96^2 \times N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + (1.96^2 \times p \times (1-p))}$$

- $n$  - sample size
- $N$  - Total number of household SHS installations
- $p$  - Expected operational proportion (0.70 i.e., 70% of the units being operational<sup>54</sup>)
- 1.96 - Represent the 95% confidence required
- 0.1 - Represent the 10% relative precision

<sup>54</sup> Conservative value considered based on the regular random sample inspection carried out by the inspection team



The value of  $p$  (expected operational proportion) is based on the monthly SHS installation inspection report for the CPA. From the monthly SHS installation inspection reports, it was found that more than 95% of the installed units are operational. However, for conservative reasons, a value of 70% is assumed (for sample size calculation only).

Using the above equation, the sample size calculated for various approaches of monitoring survey is provided as below:

Example	Sub groups	Total population	Estimated sample size	Sample size with 20% non-responsiveness
1	I	2,806,292	165	200
2	I	1,108,775	165	200
	II	846,264	165	200
	III	851,086	165	200
3	I	1,342,858	165	200
	II	1,463,267	165	200

Each household/SHS will be given a number (for example, houses are given a number from 1 to 10 in the population). A number of houses equal to the sample size is selected from the total population randomly using the excel function RANDBETWEEN(). The results of this survey will be transmitted to IDCOL data base and will be stored electronically.

### 1.7.3. Other elements of monitoring plan

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The monitoring methodology as defined in AMS-I.A - "Electricity generation by the user", version 17, EB 103 has been applied in this CPA. The methodology options are:

An annual check of all systems or a sample thereof to ensure that they are still operating.

Sampling will be carried out to determine the number of operating units under a single group of all SHSs across the PoA or number of sub-groups of SHSs under the PoA, during a monitoring period. Ongoing loan repayment will also be documented to provide additional evidence for continuing operation of the SHS.

Each installation, in each CPA, will be given a clearly distinguishable identification number (agreement code) which links to specific SHS details in the database such as the date of installation, serial number of SHS, owner of the installation, etc. The monitoring plan and procedures will be as follows:

#### 1. Follow up of the installation of SHS

- Monthly to bi-monthly report on the installations completed will be provided by the PO to IDCOL.
- IDCOL Inspectors randomly inspect the newly installed SHS to confirm the technical standards and that the SHS has been installed in a rural area to a non-grid connected household. An Inspection Report is produced. The results of the Inspection Report are fed into the IDCOL data base.
- If the Inspection Report indicates that a SHS has been installed in conflict with the program eligibility criteria such as, in an urban area or to a grid connected household, a Discrepancy Report is generated. The SHS then becomes ineligible under the program and is accordingly not eligible to receive any IDCOL financing. A clear system exists for excluding ineligible SHS under the program.

#### 2. Monitoring and follow up of the number of operational SHS

Number of installed SHSs is reported by O&M team in the unit offices and stored in central database at the IDCOL head office. All the customer details, customer loan and repayment details will be maintained in the central database.

- Loan repayment details and status of recovery of loan is maintained for all SHS customers on the PO records / data base
  - Information/records on training and technical services provided to SHS customers are maintained at the IDCOL/PO offices.
  - IDCOL inspection team will monitor and follow up with the SHS units installed in different regions by different POs every month. An inspection summary report is generated and results are shared with the POs for further corrective actions or follow up with the households.
3. Proper documentation of training materials and other records of technical services provided to SHS consumer by the PO.

All the monitored data will be kept for two years after the end of the crediting period or until the last issuance of CERs for this CPA, whichever occurs later.

<b>Data to be collected, stored and monitored</b>	<b>Description of process for data collection storage and monitoring</b>	<b>Means of verification for CDM purposes</b>
Operational SHS	POs report monthly or bi-monthly to IDCOL on all new SHS installations. IDCOL enters this information into the programme / CPA database. IDCOL undertakes own monthly inspection on reported installations	IDCOL will undertake an annual random sample survey at 95% confidence level and 10% interval based on IDCOL data base
Leakage (lamps and kupies)	Leakage monitoring is not required as per the latest SSC methodology guideline, "General guidelines for SSC CDM methodologies", Version 23.0, EB 104, Annex 05, Section N. Leakage due to transfer of equipment.	Not applicable.
SHS loan repayment details and status of loan recovery from individual households	IDCOL receives this information from POs and maintains it in the CPA database	As part of the above sample survey, IDCOL (See below) will draw information from the database to demonstrate loan repayment and loan recovery details for the randomly selected SHS users.
Technical training provided by PO to SHS consumer	POs provide training and technical support during SHS installation and thereafter as part of the agreement with SHS consumers. The individual SHS PO consumer agreements are retained at PO level onsite. Maintenance support is captured in the IDCOL database.	Documentation provided by IDCOL or POs to households

Refer Appendix 5 for more information on monitoring plan and structure.

## **SECTION J. Crediting period type and duration**

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PoA Duration : 22/06/2007 – 21/06/2035

First Crediting Period : 26//06/2012 – 25/06/2019  
 Second Crediting Period: 26/06/2019- 25/06/2026  
 Type : Renewable  
 Length of 2<sup>nd</sup> Crediting period: 7 years and 0 months

Currently the project is requesting the renewal of 2<sup>nd</sup> Crediting Period.

## SECTION K. Eligibility criteria for inclusion of CPAs

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The CPA meets the following eligibility criteria set out in the PoA:

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	The proposed CPA should have access to financing channels of the IDCOL Solar Energy Programme.  (Each proposed CPA implementer, other than IDCOL itself, should be an approved participant of the IDCOL Solar Energy programme).	The IDCOL Participation Agreement will be used to demonstrate that the CPA implementer is an approved participant of the IDCOL Solar Energy Programme. Articles III and IV of the Participation Agreement make it clear that POs are eligible to receive IDCOL financing.	Signed IDCOL Participation Agreement.
2	The CPA should be confined to the self-generation of electricity, by the end user, from SHS technology.	The CPA DD should state that the CPA is confined to the self-generation of electricity by the end user from SHS technology.	Section H.4 provides the specification of the project technology that involves installation of small SHS units to generate power and use for home appliances <sup>55</sup> only (bulb and TV). Hence, it is confirmed that CPA is confined to the self-generation of electricity by the end user from SHS as described in section A.6 of PoA.
3	At the time of CPA inclusion, the installation of SHS is not required by law in Bangladesh.	Confirmation by third party that SHS use is not mandated by law in Bangladesh.	Appropriate third-party letter stating SHS is not mandated by law in Bangladesh.
4	The proposed CPA must be within the country of Bangladesh which is an LDC	Confirmation that the specific CPA and all households /SHS consumers planned to be included in it are located within the boundaries of Bangladesh.	Section A.2 of the provides a Map of the CPA indicating that the CPA is confined to the boundaries of Bangladesh and hence all CPA SHS consumers <sup>56</sup> .  List of Least Developed Countries in UN website confirming that Bangladesh is an LDC ( <a href="http://www.unohrrls.org/en/l dc/related/62&lt;sup&gt;57&lt;/sup&gt;/">http://www.unohrrls.org/en/l dc/related/62<sup>57</sup>/</a> )

<sup>55</sup> This also implies use of appliances (bulbs, TVs, mobile charging, music players, etc.) in small commercial establishments in non-grid , rural areas which is in line with footnote 2

<sup>56</sup> This may be checked through IDCOL data base during verification

<sup>57</sup> Last accessed on 28/04/2011

5	The proposed SHScustomers in the specific CPA must be households /communities / SMEs and located in rural areas and not have grid connected electricity at the time of SHS installation.	(i) IDCOL Participation Agreement. Section 1.01 (hh) of the Participation Agreement defines the "Subproject Areas" as " <i>Subproject areas means (1) geographical areas outside the grid electrification master plan of REB; (2) areas that do not qualify for grid electrification based on the revenue ratio criteria of REB; (3) remote households not qualified for grid electrification services by PBS; and (4) islands disconnected from the mainland; and isolated pocket areas, etc.</i> "	IDCOL Participation Agreements
6	The start date of any specific CPA-DD shall be in accordance with EB 47 para 72 requirements and shall be no earlier than 22/06/2007.	Section D.1 of the document shall indicate a CPA start date of no earlier than 22/06/2007.	Section D.1 indicating a start date not before 22/06/2007.
7	The CPA is required to install SHS that meet the minimum standards as approved by the technical standards committee established by the Coordinating Entity. (Approved Solar Equipment)	Copy of the most recent minute from the SHS Committee indicating that it is actively setting standards for the whole SHS programme.  IDCOL Participation Agreement requires POs to purchase SHS from accredited suppliers.	1. Copy of recent minutes of the standards setting committee. 2. Signed IDCOL Participation Agreement Section 3.04 A, makes it clear that approved supplier equipment is required to be installed.
8	Each SSC-CPA and the SHS installed shall be uniquely identified and defined in an unambiguous manner by providing geographic information, and the year of installation covered.	1. The CPA will describe itsgeographic location and duration for which applicable. 2. Screenshot of IDCOL data base which confirms thatIDCOL is maintaining aunique identification numberfor each SHS in the SHS programme corresponding to the name of beneficiary, date of installation, location and CPA.	1. Section A.2 of the specific PoA-DD describes the geographic location of the CPA (Bangladesh). 2. A Screenshot of the IDCOL data base shows that IDCOL is maintaining a database, which lists the said requirements: SHS unique identification number, beneficiary name, date of installation and location.
9	Planned total installed capacity is within the limits of the small scale limits of 15MW installed capacity (as per Report Annex 20, EB 41,"Indicative Simplified baseline and monitoring methodologies for selected small scale CDM project activity categories") and each of the independent subsystems / measures in theproject is planned to be <=15MW.	Threshold check is not applicable as per section 1.2 above	-

10	Conditions to avoid double counting of GHG emission reductions or net anthropogenic GHG removals, such as unique identifications of product and end user locations	<ul style="list-style-type: none"> <li>Prior to seeking an entry of a new SSC-CPA under the proposed PoA, IDCOL will check the UNFCCC and database to confirm that no stand-alone CDM project activity or CPA of another SHS PoA (if registered) has already been registered or entered under another SHS PoA.</li> <li>As it is proposed to uniquely identify each SHS installed under the Program, IDCOL will also check the database of already registered CPAs to check any inclusion of SHSs registered as part of any other CPA and exclude any such cases from the said CPA. It will also check to ensure that no SHS is included in 2 CPAs. Each installation entry in the data base will show under which CPA it falls.</li> <li>The DOE requested to enter new CPAs will also verify the above.</li> </ul>	Database
11	Conditions to confirm that CPAs are neither registered as CDM project activities, included in another registered PoAs, nor the project activities that have been deregistered	<ul style="list-style-type: none"> <li>Prior to seeking an entry of a new SSC-CPA under the proposed PoA, IDCOL will check the UNFCCC and database to confirm that no stand-alone CDM project activity or CPA of another SHS PoA (if registered) has already been registered or entered under another SHS PoA.</li> <li>The DOE requested to enter new CPAs will also verify the above.</li> </ul>	Database
12	Sampling for the determination of parameter values for calculating GHG emission reductions or net anthropogenic GHG removals, conditions related to sampling requirements for the PoA in accordance with the "Standard: Sampling and surveys for CDM project activities and programme of activities"	Sampling of the program activity to be carried out as described in section B of this document.	Emission reduction calculation sheet.

13	If the generic CPA is small-scale or microscale, conditions to ensure that CPAs that will be included meet the small-scale or microscale thresholds and remain within those thresholds throughout the crediting period of the CPAs. However, if the generic CPA consists solely of units that qualify as “microscale CDM units” as defined in the “Methodological tool: Demonstration of additionality of microscale project activities”, these conditions are not required;	Threshold check is not applicable as per section 1.2 above	-
14	If the generic CPA is small-scale or microscale, conditions for the debundling check based on the “Methodological tool: Assessment of debundling for small-scale project activities”. However, if the generic CPA consists solely of units that qualify as “microscale CDM units”, these conditions are not required.	De-bundling check is not applicable as per section 1.2 above	-

## Appendix 1. Contact information of coordinating/managing entity and project participants

<b>Coordinating/managing entity and/or project participants</b>	<input checked="" type="checkbox"/> Coordinating/managing entity <input checked="" type="checkbox"/> Project participant
<b>Organization name</b>	Infrastructure Development Company Limited (IDCOL)
<b>Country</b>	Bangladesh
<b>Address</b>	UTC Building Dhaka 619
<b>Telephone</b>	9114385, 8111235, 9143157 Ext 20
<b>Fax</b>	+880 – 28116663
<b>E-mail</b>	<a href="mailto:nhaque@idcol.org">nhaque@idcol.org</a>
<b>Website</b>	<a href="http://www.idcol.org">www.idcol.org</a>
<b>Contact person</b>	Mr. Nazmul Haque, Director and Head of Investment

## Appendix 2. Affirmation regarding public funding

No ODA or public funding has been diverted for this project.

External funding is provided to the Government of Bangladesh, which is then provided to the program, for good measure letters have been provided from the 2 key sources confirming that such funding does not constitute a diversion of ODA.

The World Bank Group which includes the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) has provided financing to Government for the program through the solar home system component of the Rural and Renewable Energy Development Program.

KfW, GTZ and ADB has provided financing to the program as well.  
Non-diversion of ODA letters have been provided.

## Appendix 3. Applicability of methodologies and standardized baselines

As described in section I.2 part of this document.

## Appendix 4. Further background information on ex ante calculation of emission reductions

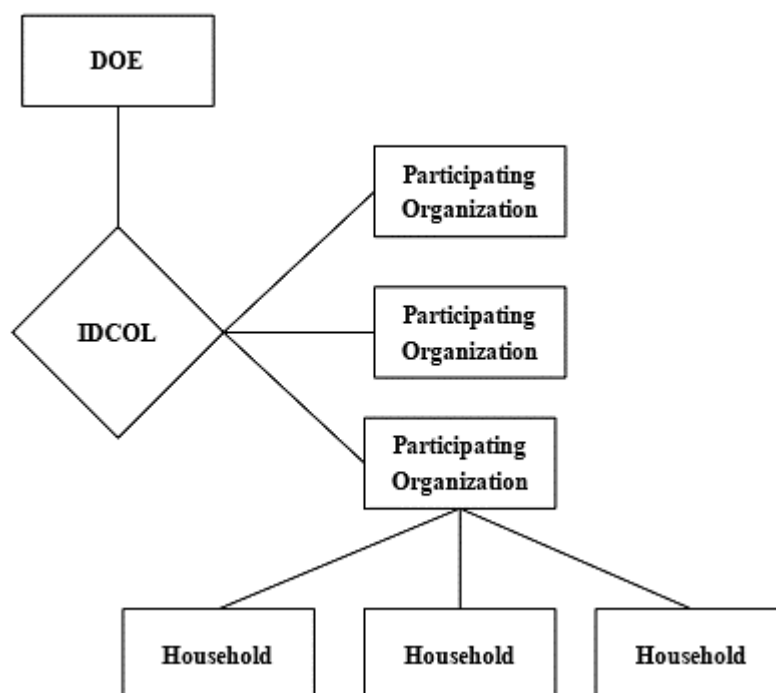
Refer to I.6.2.3 of this document.

## Appendix 5. Further background information on monitoring plan

Programme and CPA level monitoring will be undertaken as follows:

### On PoA level;

The monitoring structure on PoA level is demonstrated below. The POs collect data and report to the next higher entity.



### Organizational and management structure of POs:

POs will report to IDCOL on number of SHSs installed. The structure of a typical PO is as below. Regional / unit offices are responsible for collecting ground level data which is ultimately provided to IDCOL on regular monthly basis. Generic ground level support and management of POs is indicated below.

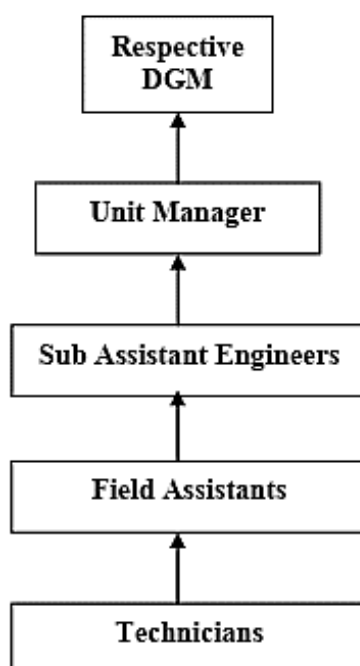


### Monitoring and reporting:

At the grassroots level, a unit office will be responsible for undertaking installations, maintenance, monitoring and reporting. One unit office will have 4-7 staff which includes 1 Unit Manager, 1-2 Sub-Assistant Engineers, 2-3 Field Assistants & 1-2 Technicians.



The organizational and monitoring structure in the typical unit office of PO is shown below:



For installation of the SHS, the PO will sign an agreement (using a specific format) with the customer giving all the relevant information, including system capacity, price, mode of payment, location / address of customer, etc. A copy of the sale agreements will be collected every month by the head office from the unit office. Based on the sale agreement, the PO inserts the information into their electronic information database at their head office under middle to senior management direct supervision.

#### **Technical Service:**

After three years of free maintenance, the customer has the option to enter into an "agreement for maintenance & servicing" with the PO by paying USD 0.35 (25 Taka) per month. In case there is no O & M agreement with the user, the PO will charge the user on a service call basis. POs educate the SHS client families and will also provide "Technician Training" to the young men & women of the local community. In case of technical problems in the long run, these certified technicians of the PO will service the complaints.

### **Appendix 6. Summary report of comments received from local stakeholders**

Refer to F.3 of this document.

### **Appendix 7. Summary of post-registration changes**

**Not Applicable**

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## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
09.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN);</li> <li>• Make editorial improvements.</li> </ul>
08.1	28 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Remove a duplicated instruction;</li> <li>• Make editorial improvement.</li> </ul>
08.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Improve consistency with the “CDM project standard for programmes of activities” and with the PDD and CPA-DD forms;</li> <li>• Make editorial improvement.</li> </ul>
07.0	25 May 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN) (version 01.0);</li> <li>• Incorporate the “Programme design document form for small-scale CDM programmes of activities” (CDM-SSC-PoA-DD-FORM);</li> <li>• Make editorial improvement.</li> </ul>
06.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revision to: <ul style="list-style-type: none"> <li>• Include provisions related to choice of start date of PoA;</li> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to local stakeholder consultation;</li> <li>• Add exception for generic CPA where technology is under positive lists;</li> <li>• Make editorial improvement.</li> </ul>
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revision to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the Guideline: Completing the programme design document form for CDM programme of activities (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1;</li> <li>• Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6;</li> <li>• Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM;</li> <li>• Make editorial improvement.</li> </ul>

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	3 December 2012	EB 70 Revision to reflect changes to the <i>Guideline: Completing the programme design document form for CDM programmes of activities</i> (EB 70, Annex 6).
02.0	13 March 2012	EB 66 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).
01.0	27 July 2007	EB 33, Annex 41 Initial publication.
Decision Class: Regulatory		
Document Type: Form		
Business Function: Registration		
Keywords: programme of activities, project design document		