Programme of activities design document form

(Version 08.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the PoA	Senegal Rural Electrification Program
Version number of the PoA-DD	10.0
Completion date of the PoA-DD	15/02/2018
Coordinating/managing entity	Agence Sénégalaise d'Electrification Rurale (ASER)
Host Parties	Senegal
Applied methodologies and standardized baselines	AMS-III.BL Version 01.0 Integrated methodology for electrification of communities AMS III.AR: Version 5.0 Substituting fossil fuel based lighting with LED/CFL lighting systems
Sectoral scopes linked to the applied methodologies	Sectoral scope for AMS-III.BL: 1 – Energy Industries (renewable- / non-renewable sources) [mandatory] Sectoral scope for AMS III.AR: 1 – Energy Industries (renewable- / non-renewable sources) [mandatory]

PART I. Programme of activities (PoA)

SECTION A. Description of PoA

A.1. Purpose and general description of PoA

Policy/measure or stated goal that the PoA seeks to promote

The overall objective of the PoA is to contribute to the increase in rural electrification rates in Senegal from 24% in 2012 to 60% in 2017 and universal access in 2025[1]. The Senegalese Rural Electrification Agency (ASER)[2] has the responsibility to define strategy for rural electrification. To achieve national electrification goals ASER has, between 2000 and 2010, electrified more than 1,000 villages throughout the country, using the following technologies: grid extensions, Solar Home Systems, and isolated mini-grids connected to diesel generators. Because of the last 10 years' energy crisis, ASER is facing many problems regarding the cost of fuel required for the operation of the installed diesel generators. The level of revenues collected in these villages cannot cover the operating costs. Thus, the Senegalese Government has decided since 2009 to initiate a two-track programme to dramatically scale up rural electrification:

- One component of this is to finance the extension of the geographical coverage of the rural medium voltage (MV) lines in areas where these mini-grids have been installed, in order to displace diesel generators and connect the villages to the existing interconnected transmission and distribution network, as well as to increase the number of households and enterprises that have access to electricity.
- In parallel, a second off-grid electrification component has also been launched to use solar home systems with energy efficient lamps, solar PV and hybrid solar PV-diesel mini-grids and to distribute solar charged lanterns.

The majority of the activities will be implemented through an innovative concession programme that harnesses private sector finance, including international capital and expertise, to extend access to affordable energy services. For the main electrification effort, the country is divided into 10 concession areas, grouping a number of localities for which an international bidding process has been used to select the concessionaires. ASER and other entities may also be involved in the implementation of the activities at a national or sub-national scale to accelerate the scaling-up of the rural access to electricity services.

Framework for the implementation of the proposed PoA

ASER is currently responsible for coordinating all rural electrification activities in Senegal. ASER has been set up to promote access to electricity for rural households and communities. ASER acts as an implementing agency for the government in rural electrification by managing the Rural Electrification Fund and working with key partners and collaborators from the project developers, banks, NGOs, CBOs, and Government agencies to mobilise resources in order to promote and facilitate improved access to electricity in rural Senegal. ASER has been coordinating several projects and activities with a large number of donors involved in the rural electrification sector.

To further accelerate the rural electrification programme, ASER is developing a CDM Programme of Activity (PoA) under which individual projects could claim the carbon credit benefits. The PoA will provide a platform for overcoming institutional, financial and structural hurdles for the development

[1] Based on the "Document de Formulation du Programme National D'Electrification Rurale"

[2] Agence Senegalaise d'Electrification Rurale

of a variety of rural electrification technologies, including extension of the grid, renewable energy systems and hybrid systems at various scales and solar lanterns.

As the coordinating/managing entity for the proposed small-scale PoA, ASER will undertake the following main activities: (i) coordinate the implementation of the PoA, (ii) screen and accept CPAs under the programme, (iii) support the effective commercialization of CERs, (iv) liaise with CPA implementers to maintain the required database for verification, (v) any other functions that are required to be performed as per the PoA rules.

The CPAs will be implemented by concessionaires and any other entities selected by ASER. Where the implementation is via concessionaires, they will have contracts with ASER to deliver a minimum number of connections in their specified rural areas. ASER's contract with the CPA implementers will give ASER the legal rights to deal with the carbon credits that will be generated from these projects and monitor the project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA.

Confirmation that the PoA is a voluntary action by the CME

The proposed PoA is a voluntary initiative by ASER to encourage investments in rural electrification projects in view of increasing electricity access in rural Senegal. This voluntary action will contribute to achieving the national objectives to increase access to electricity in rural areas. There are no mandatory requirements in Senegal to oblige ASER and the CPA implementers to undertake this type of rural electrification project as a CDM project.

Contribution to sustainable development

The regulation supporting the CDM DNA for Senegal[3] also specifies the sustainable development criteria that CDM projects must meet for approval. Table 1 below explains how the PoA supports these sustainable development goals.

Table 1. Application of Senegal sustainable development criteria to this PoA

Criteria	Application to this PoA
Environmental Criteria	
Contribution to the local environment	Rural electrification does not have negative environmental impacts, as evidenced by the classification of this type of project activity by government as low risk
Investment made possible by the CDM	The entire programme support investment in multiple MW of mini-grid systems, and more than 10 MW of solar home systems, as well as investment in grid infrastructure.
Economic Criteria	
Job creation	Access to electricity creates opportunities for income generating activities that require night lighting New jobs are also created in the installation and maintenance of rural electricity systems
Social Criteria	
Consideration of needs of local population in project development and implementation	Increased access to electricity services (e.g. modern and affordable lighting) will benefit local rural populations through educational opportunities, health services and social institutions that need these services to operate effectively Public lighting increases public safety

[3] http://www.jo.gouv.sn/spip.php?article5278

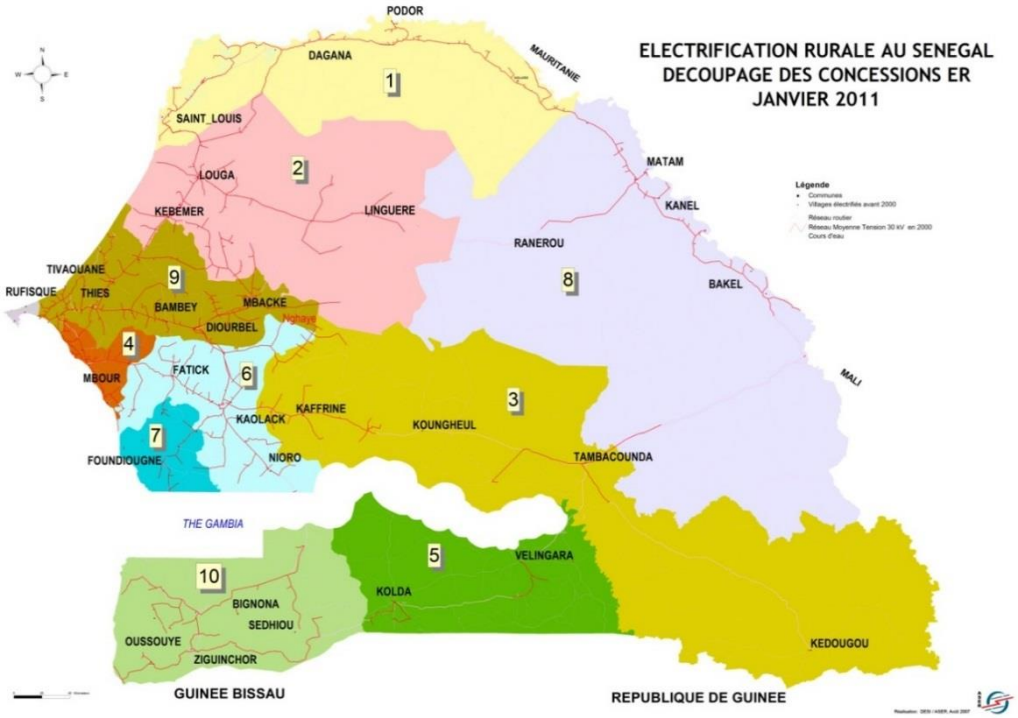
Any accompanying social measures	"luminotheques" in schools located in non- electrified villages provide more than 300,000 school children with better learning conditions and can study at night. This is part of the broader program, but does not have committed funding and is not in the CDM PoA

This program is in line with the National Strategy for Economic and Social Development (SNDES, 2012), where the Government is committed to develop access to electricity in rural areas in an affordable and equitable way. It is also aligned with the sub-regional (ECOWAS) White Paper on Energy Access (2006). The Senegalese Government has also committed to the UN Sustainable Energy For All (SE4ALL) initiative and considers rural electrification as one of the most important components of the global program.

A.2. Physical/geographical boundary of PoA

The boundary of a PoA is defined as the geographical area within which all the small-scale Component Project Activities (SSC-CPAs) included in the PoA will be implemented. The geographical boundary is the country of Senegal (Latitude: 14.00, Longitude: -14.00). The concession areas for the rural electrification programme are shown in Figure 1 for reference, although, in practice, most of the CPAs will cover the entire country.

Figure 1. Map of rural electrification concession areas



A.3. Technologies/measures

This PoA in part of an overall rural electrification program undertaken by the Senegalese Government in order to scale up access to electricity in rural areas and contribute to poverty alleviation in these areas. The PoA includes the following technologies for providing electricity services: solar home systems, solar PV or hybrid PV-diesel mini-grids, grid extension and solar lanterns. Each CPA will have only one of these technologies, meaning that there will be four types of CPAs, one for each technology. The technologies will displace fossil fuel-based electricity

generation and lighting (e.g. kerosene) in households, as well as in other consumers' premises such as schools, health centres and SMMEs. The installation and the operation of equipment will be done mainly by private rural electrification concessionaires selected. ASER and other entities may also implement projects in selected localities.

Solar home systems

The typical service levels and system capacities for solar home systems[4] are shown in Table 2. The specific capacities used in each CPA will be provided in the CPA DD. Solar home system packages will generally include 12V batteries, a charge regulator, and DC compact fluorescent lamps (CFLs) or light-emitting diode (LED) lamps. For the largest systems (i.e. >150W), an inverter will also be included in most cases, and AC bulbs.

The ASER "Minima Techniques - Règles Environementales" (Minimum Technical & Environmental Standards) includes comprehensive standards for the solar home system components and systems In addition, this document refers to IEC 61215 and IEC 61646 for the PV modules, and a laboratory testing standard IECQ QC 001002

Table 2. Service levels and typical capacity for solar home systems

Service level	Capacity range (W_{peak})
SL1	<=50
SL2	>50-90
SL3	>90-180
SL4	Not limited (>180)

Solar mini-grids

The mini-grids will include solar PV plants ranging from approximately 5-100 kW_{peak}[5] and will also include a battery system for energy storage. In the case of hybrid solar PV-diesel, the mini-grids will also have a diesel backup generator. Based on ASER's experience, the ex-ante estimate of the energy to be provided by diesel could be up to 45% of net generation, but this will be monitored in each CPA. The mini-grids will also include the local distribution network to connect new houses to the power source, as well as the interior wiring for the households.

The mini-grid connections for the lower service levels (SL1, SL2, and SL3) could have power limiting technology, as shown in Table 3, while the highest service level (SL4) will not have limits and be metered directly through a standard meter or pre-payment meter. A consumer may upgrade from a lower service levels to a higher service level, and vice-versa. The specific load limits used in each CPA will be provided in the CPA DD.

Table 3. Service levels and typical load limits for mini-grids

Service level	Power limit (watts)
SL1	<=50
SL2	>50-90
SL3	>90-180
SL4	Not limited (>180)

The ASER "Minima Techniques - Règles Environnementales" (Minimum Technical & Environmental Standards) include technical standards for low voltage and medium voltage distribution systems, diesel generators (which could be part of hybrid systems) and transformers. The document is currently being expanded to cover standards for renewable energy power plants and their connection

[4] The actual rated capacity may be different and will be monitored ex-post.

[5] The actual rated capacity may be different and will be monitored ex-post.

to the mini-grid. The revised standard will be a requirement for all rural electrification concessionaires and other implementers of mini-grids.

Grid extension

The grid connections for the lower service levels (SL1, SL2, and SL3) could have power limiting technology, as shown in Table 4, while the highest service level (SL4) will not have limits and be metered directly through a standard meter or pre-payment meter. A consumer may upgrade from a lower service levels to a higher service level and vice-versa. The specific load limits used in each CPA will be provided in the CPA DD. New customers will also be provided with internal wiring.

Table 4. Service levels and typical load limits for grid connections

Service level	Power limit (watts)
SL1	<=50
SL2	>50-90
SL3	>90-180
SL4	Not limited (>180)

The ASER "Minima Techniques - Règles Environnementales" (Minimum Technical & Environmental Standards) include technical standards for low voltage and medium voltage distribution lines as part of grid extensions and transformers.

Solar lanterns

The solar lantern component of the rural electrification programme sits in in context of ensuring universal access and ensure affordable and modern lighting services for all. The activities will serve the poorest of the poor with solar lanterns, as modern and sustainable lighting equipment. These solar lanterns could be pay-as-you-go systems or could be sold directly through retailers. Subsidies will be provided through the distributor (i.e. not directly to the consumer) to make these products affordable. Distribution may also involve women's associations in rural areas to meet goals of gender mainstreaming in the electrification programme.

The portable lanterns will be charged by solar PV chargers, and will have CFL or LED lighting, but also potentially provide radio and cell phone charging services. All lanterns distributed under the PoA will be required to meet the Lighting Global Minimum Quality Standards (MQS).

A.4. Coordinating/managing entity

The CME is the Agence Senegalaise d'Electrification Rurale (ASER) (in English, Senegal Rural Electrification Agency).

A.5. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Senegal (host Party)	Agence Senegalaise d'Electrification Rurale (ASER)	No
Sweden	International Bank for Reconstruction and Development (IBRD) as trustee of the Carbon Initiative for Development (Ci-Dev)	No

A.6. Public funding of PoA

The public funding resources available for the financing of the rural electrification plan will not purchase any GHG emission reductions generated by the proposed PoA.

SECTION B. Management system

The CME uses a management system to ensure all CPAs under the PoA are implemented, operated, and monitored in an effective and verifiable manner. The management system covers the following aspects of the CPAs under the PoA:

a) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;
b) Records of arrangement for training and capacity development for personnel;
c) Procedures for technical review of inclusion of CPAs;
d) Procedures to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a GS project activity or as a CPA of another PoA);
e) Records and documentation control process for each CPA under the PoA;
f) Measures for continuous improvements of the PoA management system.

The Management System is described below:

a) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;

The programme is managed by ASER as the CME of the PoA. The CME will also act as the CPA Implementer for some CPAs, but not necessarily all of them.

The roles of the different actors and their responsibilities are shown in the table below.

Table 5. Responsibilities of each actor

Actor	Responsibilities
CME (ASER)	Supervise all activities under the PoA Develop data recording formats and provide them to the CPA implementer or sub-contractors in each region. Manage a centralised database system and maintain the data of each CPA. Carry out quality control and quality assurance of data and CPA operation. Supervise the data gathering process after project implementation to document emission reductions according to the Monitoring Plan. Calculate the emission reduction based on monitored parameters Prepare periodic monitoring reports Responsible for reviewing the monitoring parameters on a quarterly basis
CPA Manager	Responsible for all activities under the CPA: management, overall standard setting and supervision. In charge of suggesting immediate corrective actions and preparing a summary of the monthly data Manage database for CPA in line with CDM requirements under the supervision of CME. Report CPA data and monitoring information to ASER (Quarterly reports). Database maintenance in accordance with the monitoring plan. Ensure training for all relevant personnel trained on data recording and monitoring parameters.
Operational Team	Responsible for collecting and collating data on installations, system operation and other field data records, including field visits where necessary.

Actor	Responsibilities
	Send data on installations, system operations and field operations to CPA Manager Supervise or carry out maintenance and, where appropriate, operation of any monitoring systems. Capture hard copy data (where mobile capture is not used) in appropriate data recording format (logbook), every month, where necessary.

The CME will ensure that all parties involved in the operation of the CPA (e.g. concessionaires, distributors, equipment suppliers) are aware of and have agreed that their activity is being included in the CDM PoA. Awareness and agreement will be secured through informational material, community trainings and in contractual agreements between ASER and key actors. These contracts will include, among other things, of ownership of CERs and data monitoring requirements. The CME will issue the CME Approval Letter if the CPA meets all eligibility criteria of the PoA. The CME is familiar with the eligibility criteria of the PoA and the latest guidelines and standards of the CDM EB.

The CME reviews the description of the technologies/measures to be employed under the CPA along with the relevant technical specifications. The CME will review all aspects of the proposed CPA, specifically the monitoring plan, eligibility criteria, and compliance of the CPA with the methodologies. The roles of the CME reviewing the various aspects of the CPA are listed in the following table . If the details are adequate, the CME will consider the CPA for inclusion to the PoA. Each CPA implementer will collect and report, in addition to the requirements above, all required data to effectively monitor the emission reductions in accordance with the monitoring plan detailed in each of the CPAs. The installation, connection and/or sales information will be sent to the CME regularly so it can be entered into the electronic database management system operated by the CME.

Each relevant implementer will verify that they have read, understood, and agree to comply with the requirements and guidelines of the CME management system, through the contractual process mentioned above, prior to inclusion of each CPA into the PoA.

Table 6. CME staff and their responsibilities concerning management and training

Role	Responsibility	Competency
CME Program Manager	Manage the electronic database and ensure the data collected on each CPA is of high quality and complete. Continuously improve the training and support offered to partner organizations implementing the CPAs Approve the monitoring reports Communicate with the CDM EB	Previous experience overseeing and implementing training and managing information databases Previous experience with CDM activities
CME Program Manager Assistant	Review the data collected on a monthly basis and ensure it is complete Communicate with all partner organizations implementing the CPAs Prepare draft monitoring reports	Technical degree in science or engineering
CME Program Implementation Personnel	Verify a sample of the data collected for newly established CPAs Train the entities collecting the CPA data on the proper use of the electronic database and data management system. Supervise the sample surveys across CPAs to collect sampling data	Knowledge of local culture and proficiency in local or national language as well as previous training to avoid bias and ensure neutrality when performing on the ground monitoring

b) Records of arrangement for training and capacity development for personnel;

Upon inclusion of a CPA implemented by a CPA Implementer who has not already implemented a CPA under the PoA, there will be a training conducted by the CME for the CPA Implementer. The

training will be documented in the form of a training report and cover the main aspects of the implementation of CPAs under the PoA, including but not limited to the following:

- CME Management System
- Technological Requirements
- Sampling Plan
- Monitoring Methodology

The training will ensure that the monitoring activities are unbiased and provide a conservative estimate of the CERs generated by the activity. The training will be continuously updated by the CME to ensure its effectiveness.

The responsibility for monitoring and reporting lies with the CME. Trained staff will be dedicated to carry out the monitoring process including data recording, reporting, archiving and management. The training will take place just before each CPA becomes operational or as soon as is practical in the implementation period. This is in order to ensure that the monitoring activity will take place in accordance with the methodology and monitoring plan requirements and to guaranty a smooth verification and issuance process thereafter.

All members of the CME's team will have undertaken, as a minimum, training on the following: (a) CDM PoA rules & regulations, (b) grid-connection, solar lighting, and solar home system technologies, and their quality criteria, and (c) assessment of PoA eligibility criteria.

c) Procedures for technical review of inclusion of CPAs;

The CME will review the following documents to ensure the CPA Implementer has met all the eligibility criteria required for inclusion under the PoA:

- Technology description and technical specification,
- Proof that the CPA is located within the PoA boundary
- Evidence that the CPA meets the criteria to satisfy additionality
- Demonstration that the CPA is either exempt from a de-bundling check or meets the necessary debundling requirements
- Adherence to the procedure to avoid double counting (i.e. use of a unique identifiers)
- Proof that the start date of the CPA is on or after the start date of the PoA
- Evidence that the CPA has the relevant type of crediting period
- Evidence that the CPA is not receiving funding for purchasing CERs that is dedicated as Official Development Assistance (ODA)
- Evidence that the CPA complies with the relevant methodologies
- Confirmation that the CPA will adhere to the monitoring plan

The CME will review the CPA Design Document and all appendixes to ensure the criteria for inclusion are met before including the CPA under the PoA. The CME will show that to the best of its knowledge that all criteria for inclusion have been met by issuing the CPA Implementer with a CME Approval letter.

If any of the required information above is not available or insufficient, the CME will notify the CPA Implementer and request the missing or insufficient information. In the event, the CPA Implementer cannot provide the requested information, the CME will notify the CPA Implementer that the proposed CPA cannot be included in the PoA.

The table below shows the roles and responsibilities for CPA inclusion.

Table 7. CME staff and their responsibilities concerning inclusion of a CPA

Role	Responsibility	Competency
Program Manager	Manages the review process of the documentation submitted by the CPA implementer for inclusion of the proposed CPA Notifies the CPA Implementer of acceptance or rejection of the proposed CPA	Previous experience overseeing and implementing training and managing information databases Previous experience with CDM activities
Program Manager Assistant	Assists the CPA Implementer in the preparation of the required documentation for inclusion of the CPA under the PoA and performs the initial review of the documentation Review UNFCCC database and CME's CPA database to ensure no double-counting	Technical degree in science or engineering

The CME reserves the right to revoke a CPA Implementer's participation in the PoA if the CPA Implementer does not adhere to the management system and/or perform the necessary tasks required for monitoring of the CPA. The CME may remove the CPA Implementer from the CPA and/or not pursue verification and issuance of CERs under said CPA.

d) Procedures to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a CDM project activity or as a CPA of another PoA)

Each CPA is required to meet eligibility criteria 6, measures to avoid double-counting. The CME's team also will check the described CPA against the UNFCCC database and the CME's CPA database to ensure no double-counting. The Program Manager will be responsible for this, with input from the Program Manager Assistant.

The technologies under each CPA of the PoA will avoid double accounting of emissions reductions through unique identifiers. Grid connections, mini-grid connections and solar home systems will be uniquely identified through, for example contract number, address, user name, GPS coordinates etc., in the CME database, as they are fixed systems. A unique identifier showing clearly that they are not under another CDM activity will mark solar lanterns distributed by the CPA. If there is any doubt regarding the identification of a product, it will be excluded from the PoA.

e) Records and documentation control process for each CPA under the PoA

The CME will operate and manage an electronic data management system that will store information on and track all or a fraction of technologies under the PoA.

The electronic data management system will include an overview of each CPA containing the following information:

1. CPA Implementer
2. CPA Title
3. CPA Category (i.e. 1-4)
4. Date of Inclusion of the CPA
5. Start Date of the CPA
6. CERs issued to Date under the CPA
7. Total Products Distributed or connections made/consumers under the CPA to Date

The database will contain the following information for solar home systems:

1. CPA number for this village/installation
2. Location of the system (such as address or GPS coordinates)

3. Contact details (name, organization, name of the village/suburbs, mobile phone number) of the end-user, in case the technology requires maintenance, is moved to another address or transferred to another owner
4. Date of installation
5. Type of user (household or SME/institution/public lighting)
6. Capacity of the system (Watts)
7. Unique identifier for system (e.g. serial number of PV modules)
8. Warranty information of the system
9. Service level (1 to 4)
10. Type of consumer according to the methodology classification (i.e. Type I, II, or IV – see Part II, Section I. 5 for explanation)
11. The monitoring approach used (i.e. metering (A), sample survey (B) or deemed consumption (D) – see Part II, sections I.5 and I.6.1 for further explanation)

The system will contain the following information for new and existing connections to mini-grids and grid extension:

1. CPA number for this village or location
2. Location (such as address or GPS coordinates)
3. Contact details (name, organization, mobile phone number) of the end-user in case the technology requires maintenance, is moved to another address or transferred to another owner
4. Date of operational connection
5. Type of user (household or SME/institution/public lighting)
6. Load limit on the connection (Watts)
7. Service level (1 to 4)
8. Type of consumer according to the methodology classification (i.e. Type I, II, III or IV – see Part II, Section I.5 for explanation)
9. The monitoring approach used (i.e. metering (A), sample survey (B), or distribution metering with consumer numbers (C) – see Part II, I.5 and I.6.1 for further explanation)

The system will contain the following information for solar lanterns:

1. CPA number for this group of lanterns
2. Unique identifier/serial number (i.e. which will also be linked to the CPA number)
3. Contact details (name, mobile phone number) of the purchaser of unit
4. Date of sale
5. Type of lamp (i) and charging mechanism (j) (e.g. make and model number or solar lantern system)

All data will be stored for at least two (2) years after the expiry of the crediting period.

Quality assurance and quality control (QA/QC) procedures will be as specified in the individual parameter tables. The CME will be responsible for implementing QA/QC procedures in the management of the electronic database, to ensure data accuracy within the database.

The uncertainty levels, methods and the associated accuracy level of measuring instruments to be used for parameters will be as specified in the individual parameter tables.

Emergency procedures in the case of an inability to monitor in line with the monitoring plan will apply conservative assumptions, in line with current CDM standards.

f) Measures for continuous improvements of the PoA management system

The CME will at least every two years submit a performance review to each CPA Implementer assessing the performance of their CPAs under the PoA, communication with the CME, and requesting feedback on methods for improving the PoA management system based on the experiences of the CPA Implementer. The CME will evaluate the feedback and expand/revise the management system if deemed appropriate.

SECTION C. Demonstration of additionality of PoA

As discussed above, this PoA will have four types of CPAs, where each consists of only one of the following technologies: solar home systems, solar and hybrid solar PV-diesel mini-grids, grid extension and solar lanterns. The approaches for demonstration of additionality are specific for each of these technologies, and are summarised in the table below.

Table 8. References or tools used for additionality demonstration

Technology	Methodology	Additionality Tool	Criteria	Relevant CPA threshold
Solar PV and hybrid solar PV-diesel mini-grids	AMS III.BL	Demonstration of additionality of microscale activities, Version 8	CDM Unit < 20 $ktCO_2e$/year reductions and in an LDC	20 $ktCO_2e$/year perCDM Unit
Grid extension	AMS III.BL	Demonstration of additionality of microscale activities, Version 8	CDM Unit < 20 $ktCO_2e$/year reductions and in an LDC	20 $ktCO_2e$/year per CDM Unit
Solar Home Systems	AMS III.BL	Demonstration of additionality of microscale activities, Version 8	CDM Unit < 20 $ktCO_2e$/year reductions and in an LDC	20 $ktCO_2e$/year per CDM Unit
Solar Lanterns	AMS III.AR	Demonstration of additionality of microscale activities, Version 8	CDM Unit < 20 $ktCO_2e$/year reductions and in an LDC	20 $ktCO_2e$/year per CDM Unit

The demonstration of additionality applies the "Methodological Tool: Demonstration of additionality of microscale activities", Version 08.0.[6] The tool states, "Other project activities not included in paragraphs 8 or 9 above, that is Type III project activities that aim to achieve emission reductions at a scale of no more than 20 $ktCO_2e$ per year, are additional if any one of the following conditions is satisfied:

(a) The geographic location of the project activity is an LDC/SIDS or SUZ of the host country as identified by the government in accordance with the paragraph 8(a)(i) above;
(b) The project activity is an emission reduction activity with both conditions (i) and (ii) below satisfied:
    (i) Each of the independent subsystems/measures in the project activity achieves an estimated annual emission reduction equal to or less than 600 tCO_2e per year; and
    (ii) End users of the subsystems or measures are households/communities/SMEs.

This first criterion is met because Senegal is an LDC.[7] The threshold of 20 $ktCO_2e$ per year is met at the CDM Unit level, and therefore included in the eligibility criteria for any CPA to ensure that the microscale rules shall apply.

The Tool further states, "PoAs that consist of one or more microscale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the methodological tool 'Demonstration of additionality of microscale project activities' [and] PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v8.pdf

[7] http://www.un.org/en/development/desa/policy/cdp/ldc/profile/country_168.shtml

methodological tool 'Demonstration of additionality of small-scale project activities'". These are included in the eligibility criteria outlined below in section K.

The Tool further notes that, "Notwithstanding the provisions in paragraphs 8−10 above, the methodological tool 'Demonstration of additionality of microscale project activities' may be applied to a CPA that applies one or more large-scale CDM methodologies or small-scale CDM methodologies, or a combination of large-scale and small-scale CDM methodologies, if the aggregate size of all units in the CPA is below the microscale thresholds. However, if a CPA solely consists of 'microscale CDM units' as defined in this tool, this tool may be applied irrespective of the aggregate size of all units in the CPA."

While the Project Standard requirements on prior consideration do not apply to PoAs (paragraph 30 of Project Standard version 09.0), ASER did voluntarily submit a Prior Consideration notice on 07/06/2011.[8]

To understand why the CPAs would not occur in the absence of the PoA, it useful to explain some of the constraints on renewable energy development in rural areas. Senegal is a Least Developed Country (LDC) based on 3 criteria: i) low-income, measured using the Gross National Income, GNI; ii) human development, assessed using the Human Assets Index, based on nutrition, health, school enrolment and literacy, and iii) economic vulnerability, which is considered using the Economic Vulnerability Index, compromising natural shocks, trade shocks, exposure to shocks, economic size and economic remoteness[9]. The country remains one of the poorest countries in the world. It ranked 163/187 in the 2014 Human Development Index.[10] A national progress report for the MDGs in 2011[11] shows the slow progress in many areas, particularly infant mortality, maternal mortality, and the rate of completion of primary education. This low level of development severely constrains access to clean and affordable modern energy services. As a result of the barriers to accessing modern energy services,[12] rural electrification rates have remained at only 32% in 2010.[13]

SECTION D. Start date and duration of PoA

D.1. Start date of PoA

Start date of the PoA is determined by the date of submission of the Prior Consideration Form by the CME. This date is 07/06/2011.

D.2. Duration of PoA

The length of the PoA is 28 years and 0 months.

[8] http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html

[9] The Least Developed Countries Report 2010: *Towards a New International Development Architecture for LDCs*. United Nations Conference on Trade and Development.

[10] https://data.undp.org/dataset/Table-1-Human-Development-Index-and-its-components/myer-egms?

[11] http://www.undp.org/content/dam/undp/library/MDG/english/MDG%20Country%20Reports/Senegal/Progres_realises_et_defis_des_OMD__senegal_sept_2011.pdf

[12] See, for example, the discussion in Mawhood, Rebecca, and Robert Gross. "Institutional Barriers to a 'perfect' Policy: A Case Study of the Senegalese Rural Electrification Plan." *Energy Policy* 73 (October 2014): 480–90.

[13] http://www.worldenergyoutlook.org/publications/weo-2012/

SECTION E. Environmental impacts

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

PoA level: The justification for addressing environmental impacts at the PoA level is that no environmental impact assessments (EIAs) are required for rural electrification projects as they are classified as "Category 2" projects by the Senegalese government. This justification is explained in the original investigation of environmental impacts by ERM in 2004, and the Ministry of Environment has confirmed this classification.

The document showing the project is classified as "Category 2" (Classe II) has been provided. The classification is shown on page 6 of the document. Page 21 of the same document cites the Code of the Environment 2001 (Le Code de l'Environment 2001) and states in the opening paragraph that the project of Category 2 are considered not to present a threat to the environment.

E.2. Analysis of environmental impacts

The boundary of the PoA is the country of Senegal. No negative boundary or transboundary impacts were identified and as a whole the activities under the PoA will benefit the environment and contribute to the sustainable development of the host country.

The Environmental Management Framework has been provided to the DOE.

E.3. Environmental impact assessment

For the environmental impact assessment see the EIA for the program[14].

SECTION F. Local stakeholder consultation

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

The stakeholder consultation was undertaken at the PoA level.

F.2. Modalities for local stakeholder consultation

Comments from local stakeholders are solicited at the PoA level to ensure comments/concerns from all regions covered by the PoA are included at the time of registration. There are no guidelines in the host country for inviting stakeholder comments for activities covered under the PoA.

The stakeholder consultation process included several phases by ASER. Initially, to design the program ASER held a series of consultations in different regions that aligned with the potential concession areas. These consultations solicited feedback on the technical and financial aspects of the national rural electrification program. The earliest such consultation held was in 2004 as part of the "Environmental assessment of rural electrification project for concession Kebemer - Louga – Linguere" (Evaluation environnementale du projet d'électrification rurale de la concession Kebemer – Louga – Linguère) and included a wide range of both decision makers and local stakeholders. As another example, a similar later consultation was held in April 2012 as part of the "Initial Environmental Analysis Project Rural Electrification of the Concession Kaffrine-Tambacounda-Kédougou" (Analyse Environnementale Initiale du Projet d'Electrification Rurale de la Concession de Kaffrine-Tambacounda-Kédougou).

[14] http://projects.worldbank.org/P158709?lang=en

To further solicit comments from stakeholders about the rural electrification program design and documentation, ASER organised a program-level consultation in March 2016. The Directorate of Environment and Classified Establishments (DEEC), which houses the CDM DNA, sent invitations to the list of organisations and individuals listed below. The invitation was accompanied by the full project documentation (PoA DD and CPA DDs), as well as a list of invitees to the consultation.

- Director of Electricity
- Coordinator Mitigation, National Committee on Climate Change (NCCC)
- Coordinator Technology Transfer, NCCC
- Director General, SENELEC [national utility]
- President, Electricity Sector Regulatory Commission
- Coordinator, Energy Information System (EIS)
- Director, PERACOD
- Director, Centre for Studies and Research on Renewable Energy
- President, CONGAD
- Director General, National Agency for Renewable Energy
- Director General, Agency for the Economy and Energy Management
- Director, Planning and Environmental Watch
- Director, National Agency Ecovillage
- Director, Local Communities
- Mr. Aliou BA, member of NCCC, expert from energy company
- Professor Issakha YOUM, Director, CEREER
- Mr. Louis Seck, member of NCCC, expert from energy company
- WADE Sheikh, member of NCCC, expert from energy company
- Mr. Lamin Diop, member of NCCC, expert from energy company
- Mr. Abdou Fall, private sector;
- Mr. Elhadj DIOP, project developer
- The 3 heads of regional services (DREEC, ARD, local authorities) for the 14 regions of Senegal (42 people in total)
- Representatives of DEEC (08)

The local stakeholder consultation for the PoA was held on Friday, March 11, 2016 at the Hotel Ngor Diarama in Dakar, Senegal. This meeting was held with the presence of the DEEC (which serves as the DNA for CDM), the National Committee on Climate Change (COMNACC in French), ASER, the regional divisions of environment for the Regional Development Agencies, departmental advisers, civil society, the private sector, the Ministry of Energy and Development of Renewable Energy, the National Renewable Energy Agency, and the Agency for the Economy and Energy Management. The full list of participants is shown below.

Table 9. Participants at local stakeholder consultation

No	Name	Organization	Phone
01	Fatou Thiam SOW	Study Planning Unit (CEP) - Energy Information System (SIE) of the Ministry of Energy and Renewable Energy Development (MEDER)	77 645 11 37
02	Issa Laye Sonko Rohou	MEDER	77 220 93 97
03	Ahmadou Ndiaye	MEDER	77 159 87 64
04	Moussa NDONG	MEDER	77 540 93 49
05	Abdoul Aziz Ndiaye	Directorate of Electricity / MEDER	77 446 00 39
06	El Hadji Boubacar DIA	Regional Division of Environment and Classified Establishments St. Louis	77 645 16 90
07	Abdou SARR	Regional Development Agency for the region of Kedougou	77 434 49 39
08	Djibril Amadou Diallo	County Council Matam	77 642 26 86
09	youssouph DIA	Regional Development Agency of the region Sédhiou	77 542 76 50
10	Samba Lawbe MBAYE	Regional Development Agency for the region Diourbel	77 649 65 92

No	Name	Organization	Phone
11	Assane Diop	Regional Division of Environment and Classified Establishments of Sedhiou	77,650 January 83
12	Rokhy BADIANE	Regional Division of Environment and Classified Establishments of DIOURBEL	77 548 36 87
13	Maurice Coly NDIOR	Regional Division of Environment and Classified Establishments of KEDOUGOU	77 454 70 99
14	Pierre Modou Mbengue	Regional Development Agency of the region Kaffrine	77 561 32 05
15	amath DIA	Saint Louis County Council	77 643 95 74
16	Bathie NIANG	County Council Kaffrine	77 532 42 78
17	Talla Momar Diagne	County Council Kaolack	77 630 43 55
18	Moussa Gueye	Regional Division of Environment and Classified Establishments THIES	77 909 83 86
19	Badara Samb	County Council Louga	77 292 49 51
20	Fama TOURE	Regional Development Agency for the region of Louga	77 651 388
21	TOURE Mamadou Ndong	County Council Gossas	77 651 81 78
22	Ms. Sane Ass Tall Diankha	Regional Division of Environment and Classified Establishments of LOUGA	77 649 51 93
23	Abdallah L. CAMARA	Regional Division of Environment and Classified Establishments FATICK	77 671 82 77
24	Idy Niang	Regional Division of Environment and Classified Establishments Kaffrine	77 515 20 02
25	Fatoumata Jobarteh	Regional Development Agency of the Dakar region	77 682 54 41
26	Ousseynou NDIANE	Directorate of Environment and Classified Establishments / Climate Division	77 498 57 89
27	Madeleine Diouf Sarr	Directorate of Environment and Classified Establishments / Climate Division, Designated National Authority (DNA) in Senegal	77 552 44 32
30	Gabriel Ndiaye	Directorate of Environment and Classified Establishments / Climate Division, Designated National Authority (DNA) in Senegal	77 247 93 31
31	Fall Ousmane SARR	ASER / DESI	77 637 88 45
32	Alioune Badara LO	ASER / DESI	77 688 66 04
33	Ndiaga Gueye	ASER / DAC	77 529 46 38
34	Kader Diop	National Agency for Renewable Energies (ANER)	77 541 41 28
35	El Hadji Mbaye Diagne	National Climate Change Committee (COMNACC)	77 638 77 92
36	Issakha YOUM	Centre for Study and Research on Renewable Energy (CERER)	77 632 64 62
37	BA Aliou	COMNACC	77 646 58 02
38	El Hadji Diop	Private Sector / CEO of Terra Technology	76 663 45 82
39	Abdourakhmane NDOUR	Regional Division of Environment and Classified Establishments	77 563 72 53
40	Alioune Badara YOUM	CERER	77 445 36 03
41	Marie SARR Nathdio	Regional Division of Environment and Classified Establishments DAKAR	77 459 37 73
42	Antoine FAYE	COMNACC	77 120 70 14
43	birane DIOUF	CONGAD	77 528 75 54
44	Sokhna Dieng Khouma	Communications Dept, MEDD	77 362 89 95
45	Fatma Sow Thiam	Communications Dept. DEEC	77 713 29 29
46	Ouléye Kane SENE	DEEC	77 650 79 48
47	Papa Lamine DIOUF	DEEC	77 905 17 98
48	Amadou Tidiane BARRY	DEEC	77 651 51 43
49	Lamine Diatta	DEEC	77 247 17 22
50	Gora NIANG	ANER	

The meeting was chaired by Ms. Madeleine Diouf Sarr, Head of the Climate Change Division of the Directorate of Environment and Classified Establishments (DEEC) and head of the DNA for Senegal. Mr. Ousmane Fall Sarr from ASER (the CME for the PoA) presented an overview of the program, as well as the national context, including the specific interventions under the CDM PoA and how the program would be managed and implemented. Comments and questions were solicited from the audience, and Mr. Sarr replied to those comments.

F.3. Summary of comments received

The vast majority of the speakers welcomed the importance and relevance of the program. The specific questions and comments received from stakeholders, as well as the responses from the CME, are shown in the following table. Note that the CME in some cases provided a single answer for more than one question or comment. This is why some of the responses in the table are repeated for more than one question or comment.

Table 10. Summary of public participation comments

Question	Response
Are other energy sources (such as wind) being taken into account as part of this program?	Several technologies of renewable energy can be combined into hybrid options. However, for wind power, due to localization of the potential on the north coast, this technology remains confined to this area.
Is the Wind Farm St. Louis project integrated into the PoA?	Wind parks are not part of this program but they can be the subject of another CDM program.
Public consultation with local communities does not appear in the document presented.	Communities are all consulted during planning studies performed by ASER for rural electrification, to identify needs and assess their ability to pay for electricity
Do other organizations or businesses have the opportunity to contribute to the interventions in the program?	ASER under this program has the obligation concessionaires for awareness campaigns in local communities to provide information about this initiative and the modalities and procedures involved The PoA is not closed during the duration of the program - a multitude of CPAs can be integrated, provided they meet the requirements of the methodology and eligibility criteria
How can one become a CPA structure for this PoA?	The PoA is not closed during the duration of the program - a multitude of CPAs can be integrated, provided they meet the requirements of the methodology and eligibility criteria
How can you ensure that the thresholds for small scale CDM projects will be respected?	In this program each CPA covers a single technology and several CPA may be created for that technology over time to ensure they are all below the thresholds.
How do you take into account the lifetime of solar PV systems to be implemented under this program and their replacement?	To ensure sustainability and reliability of solar PV equipment, ASER, as part of its intervention strategy, requires dealers as part of their contracts to conduct periodic maintenance of equipment and its replacement to the end of its life. In terms of standards, all equipment installed must be conform to the technical minimum requirements of ASER.
How does the project deal with battery replacement and maintenance of other equipment?	To ensure sustainability and reliability of solar PV equipment, ASER, as part of its intervention strategy, requires dealers as part of their contracts to conduct periodic maintenance of equipment and its replacement to the end of its life.
Four CPA categories have cited in the PoA, while only three have been sent for approval now	Four CPA categories are included but we only have 3 for now because the CPA for solar lamps needs clarification in terms of projections.

Question	Response
What is the involvement and empowerment of all stakeholders including local communities in the project implementation to ensure its success?	ASER is committed to work with local communities on a broad awareness campaigns and information workshops, etc.
What is the communication plan and outreach with local communities and users who often prefer to use Sénélec?	ASER is committed to work with local communities on a broad awareness campaigns and information workshops, etc.
Defining the role of the Regional Directorates of Environment and Classified Establishments (DREEC) under the project;	As part of this future agreement, the DREECs would come to play an important role in monitoring the implementation of projects in the field
Explain the system of monitoring in place;	The verification of carbon credits is based on the actual quantities avoided. To do this, the parameters (such as the number of domestic subscribers, their service levels, their monthly consumption, their location, etc.) will be a monitored by ASER, who is required to periodically report this information, with the support of concessionaires and other implementation actors.
How to avoid double counting of carbon credits?	The verification of carbon credits is based on the actual quantities avoided. To do this, the parameters (such as the number of domestic subscribers, their service levels, their monthly consumption, their location, etc.) will be a monitored by ASER, who is required to periodically report this information, with the support of concessionaires and other implementation actors. The activities covered by CDM will not be considered part of the INDC for Senegal, to avoid double counting;
Provide information on the environmental and social impact study;	In terms of the environmental and social assessment of the program, ASER has already finalized an environmental management framework and policy on involuntary displacement and resettlement, which are currently being updated. Discussions are underway with the DEEC for the signing of a Convention to monitor the implementation of the program
Explain the choice of CDM compared to other mechanisms of financing such as the Green Climate Fund and others for energy;	The CDM solution was preferred by ASER because the Ci-Dev World Bank initiative is based on the principle of using the CDM as a result-based funding mechanism. It is an interesting investment opportunity for mobilizing additional resources to support the implementation of this national program
Highlight the benefits in terms of potential for job creation from the program	Jobs can be generated by the implementation of the program through the companies/ organizations that will ensure maintenance of equipment, etc.
Provide information concerning the technical standards and specifications of photovoltaic equipment used under this program;	In terms of standards, all equipment installed must be conform to the technical minimum requirements of ASER [as shown in the PoA DD].
Is this program part of the Intended Nationally Determined Contribution (INDC) of Senegal? if so, specify the carbon credit accounting methods	The activities covered by CDM will not be considered part of the INDC for Senegal, to avoid double counting;
Is it expected that there will be 4 different CPAs in each concession?	In one concession, there may be 4 technologies under the concession, and therefore 4 CPAs operating

F.4. Consideration of comments received

The comments were all essentially clarifications on the PoA implementation and the broader electrification program implementation. None of the comments necessitated a change in the PoA documentation or basic design.

SECTION G. Approval and authorization

The letter of approval was received from the Senegalese DNA on 21/07/2017. The letter of approval from the Annex I country, Sweden, was received on june 28, 2017. Copies of both letters have been provided to the DOE.

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Senegal Rural Electrification - Mini-Grids

H.2. Reference number of generic CPA

CPA Category 1

H.3. Purpose and general description of generic CPA

A typical CPA consists of the installation or extension of solar PV mini-grids. A Category 1 CPA may also include the installation or extension of hybrid solar PV-diesel mini-grids and the hybridization of existing mini-grids through the addition of solar PV power units . CPAs will be differentiated by the time period covered under each CPA. In a generic CPA the CME and CPA Implementer may or may not be the same entity. The CPA Implementer will select and manage the installation of technologies under Category 1 CPAs as well as oversee the data collection process for monitoring and verification.

The rural communities will receive access to electricity through these mini-grids, which will not be connected to any national or regional grid. A summary of the mini-grids installed/extended under this CPA and the service levels for mini-grid consumers are shown in the tables below.

Table 11. Ex-ante estimate of mini-grid generation plants in current CPA [fill in]

Item	Value	Comment
Number of power units	[fill in]	[fill in]
Average solar PV unit size (kW)	[fill in]	[fill in]

Table 12. Service levels and typical load limits for mini-grids [revise as necessary]

Service level	Power limit (watts)
SL1	<50
SL2	>50-90
SL3	>90-180
SL4	Not limited (>180)

Note: circuit breakers may be provided at each household for safety, while a power limiter is installed that limits the watts of output as per the relevant service level.

The CPA Category 1 applies Type III small-scale methodology AMS-III.BL Version 1. The CPA is therefore a Type III CPA. The CPA also qualifies as a Type III microscale CPA. The CPA is implemented entirely in and LDC and the size of each CDM Unit, defined as a single mini grid, is limited to emission reductions of 20,000 tCO_2e or less per annum.

H.4. Technologies/measures

Target Group
Under CPA Category 1, the project activity targets households and SMEs/institutions in rural communities with no previous electricity access or previously connected to mini-grids that operated on fossil fuels.

Technology
Under CPA Category 1, the rural communities will receive access to renewable energy through the implementation of solar photovoltaic systems. CPA mainly consists of the installation/extension of solar PV mini-grids. Category 1 CPAs may also include the installation/extension of hybrid solar PV-diesel mini-grids and the hybridization of existing mini-grids through the addition of solar PV power units. A description of technologies/measures to be employed by under each specific Category 1 CPA will be provided in the specific CPA document, including all technical specifications required by the applied methodology.

CPA Boundary
Category 1 CPAs have a project boundary covering the mini-grids installed or extended as a result of the project activity as well as any project distribution systems and the physical sites of the consumer served by the project activity.

The geographic boundary of a Category 1 CPAs is the country of Senegal. Category 1 CPAs will be differentiated users grouped by time of connection. No two users will overlap in different Category 1 CPAs.

Record Keeping System
Category 1 CPAs utilize an electronic monitoring system database to record the electricity generated and distributed by the mini-grids under the project activity. The record keeping system to prove adherence to the management system detailed in Part I Section B of the PoA-DD.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

The approved methodology used is AMS-III.BL "Integrated methodology for electrification of communities", Version 01.0[15]. The methodology also refers to the following approved methodologies, tools and guidelines:

- "AMS-I.D.: Grid connected renewable electricity generation", Version 18.0[16];
- "AM0045: Grid connection of isolated electricity systems", Version 03.0[17];
- "AM0104: Interconnection of electricity grids in countries with economic merit order dispatch", Version 02.0[18];

[15] https://cdm.unfccc.int/methodologies/DB/XJQ7APPRHQWLO6VSC3161I5Q8MCMNQ

[16] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[17] https://cdm.unfccc.int/methodologies/DB/UH7XSIREUC5C4QL5EU963O54CSFWGV

[18] https://cdm.unfccc.int/methodologies/DB/OEZDV2912B4QUOOC5W7RC2JDP9BQTD

- "Tool to calculate the emission factor for an electricity system", Version 05.0[19];
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", Version 03.0[20];
- "Standard: Sampling and surveys for CDM project activities and PoAs", Version 07.0[21].

Additionality for this category of CPA under the proposed PoA is demonstrated with reference to the "Methodological Tool: Demonstration of additionality of microscale activities", Version 08.0.[22].

I.2. Applicability of methodologies and standardized baselines

a) Demonstration of how the applicability conditions are met in accordance with the approved methodology and the PoA.

The table below lists each of the applicability conditions for the relevant approved methodology and explain how these are met by this CPA.

Table 13. Applicability conditions for mini-grids and AMS III.BL

Applicability Conditions	Applicability to this CPA
(3) This methodology is applicable in situations where consumers that were not connected to a national/regional grid, prior to project implementation are supplied with electricity generated from the project activity. It is also applicable in situations where a fraction of consumers that were supplied with electricity from a fossil based individual energy system or fossil fuel based mini-grid prior to the implementation of the project, are supplied with electricity from the project activity (e.g. moving from carbon intensive mini-grid to less carbon intensive grid or mini grid).	A typical CPA will include both consumers that were not connected prior to the project and consumers that were connected to a fossil fuel based mini-grid prior to the project. The CPA monitoring database will track previous status from consumers prior to project implementation.
(4) Electricity consumers may include households, commercial facilities such as shops, public services/buildings and small, medium and micro enterprises (SMMEs). Applications may include lighting, household electrical appliances (e.g. refrigerators, TV, radio), public lighting and water pumps. At least 75 per cent (by number) of the consumers connected by the project activity shall be households.	The type of end-user (i.e. household or SME/Institution) will be recorded at the time of connection. The CPA monitoring database will track the percentage of households versus SMEs/Institutions. If during monitoring it is found that the percentage of households (by number) under the CPA is less than 75%, SMEs/Institutions under the CPA will be removed from monitoring the monitoring period in question until the percentage of end-users (by number) is at least 75% households. plan.
(5) This methodology is applicable to electrification of a community of consumers which is achieved through one or more of the following technologies/measures: (a) New construction of individual energy systems (renewable or hybrid) such as roof-top solar photovoltaic systems or hybrid energy systems; (b) Rehabilitation (or refurbishment) of individual energy systems, mini-grid or hybrid energy system may be undertaken, if it can be demonstrated that the	A typical CPA will include installation and/or extension of a mini-grid that distributes electricity generated from renewable energy systems or hybrid energy systems, and may include hybridization of existing

[19] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

[20] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

[21] https://cdm.unfccc.int/Reference/Standards/index.html

[22] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v8.pdf

existing system(s) i) are not part of another CDM activity; ii) are non-operational and iii) require a substantial investment for them to be rehabilitated to or above the original electricity generation capacity. To demonstrate compliance with this condition, the project participants shall provide documentation that:(i) The existing system has not generated electricity, or that alternative fuels (e.g. kerosene) have been used, for at least six months prior to Project Design Document (PDD) or SSC-CPA-DD submittal; and (ii) Substantial investments are required to rehabilitate the existing systems (e.g. investments greater than half of the cost to install a new power generation system with the same electricity generation capacity); (c) Installation or extension of a mini-grid that distributes electricity generated from renewable energy systems or hybrid energy systems; (d) Hybridization of existing fossil fuel powered mini-grids using renewable energy systems; (e) Extension of a grid (national or regional) to supply new consumers as well as consumers currently connected to mini-grid.	fossil fuel powered mini-grids using renewable energy systems (i.e. (c) and (d) in the list)
(6) Project equipment shall comply with applicable international standards or comparable national, regional or local standards/guidelines and, when relevant, the PDD shall indicate the standard(s) applied for main project equipment.	All relevant national and international standards are specified by the CME in contracts with implementing agents and vendors for this CPA.
(7) For projects involving the installation of hydro power plants with reservoirs the requirements prescribed under AMS-I.D shall be followed.	Not applicable – no hydropower plants are included in this category of CPA
(8) Measures are limited to those that result in emission reductions of less than or equal to 20 $ktCO_2$ equivalent at the CDM Unit level annually.	The CPA will only utilise AMS III.BL for mini-grids. The total emission reductions under a CPA do not exceed 20 $ktCO_2e$ annually per CDM Unit and will remain below this limit throughout the entire crediting period. This will be confirmed during monitoring.

b) Demonstration that the CPA qualifies as Type I, II, and/or III during every year of the crediting period in accordance with applicable provisions for project activity eligibility in the Project standard.

The CPA is a Type III activity. In terms of the size limit, the CPA must stay below the micro-scale threshold of 20 $ktCO_2$ at the CDM Unit level of annual emission reductions to utilise the additionality provisions in the "Methodological Tool: Demonstration of additionality of micro-scale project activities", Version 7.2. The ex-ante estimate of total emissions reductions is shown, along with the calculations, in section I.6.3. The actual emissions reductions will be verified during each monitoring and verification period to ensure that they do not exceed these thresholds.

I.3. Application of multiple methodologies

The CPA applies a single methodology.

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

The project boundary and GHG sources are summarised and discussed below.

Table 14. Sources and GHGs included in this CPA

	Source	GHG	Included?	Justification/Explanation
Baseline	Fossil fuels for lighting and electricity generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available
Project activity	Fossil fuels for lighting and electricity generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available

The methodology states that, "For project activities involving mini-grids, the spatial extent of the project boundary includes all power plants connected through transmission and/or distribution lines to the mini-grid that is being built or extended through the project activity…For all project types, the spatial extent of the project boundary also includes the physical sites of the end-use consumers served by the project activity." For a typical CPA, the project boundary therefore includes all plants in the mini-grid (renewable and fossil fuel), as well as the physical sites of the consumers (e.g. households and other consumers).

Gases included in the project boundary for baseline emissions are carbon dioxide emissions from fossil fuel-fired power plants or fuel consumption for lighting. Project emissions would include carbon dioxide emissions from fossil fuel consumption in any mini-grid plants. Project emissions from any solar PV plants added to a mini-grid would be zero.

Figure 2. Mini-grids: flow diagram for baseline scenario, showing project boundary (dashed line) and emissions sources

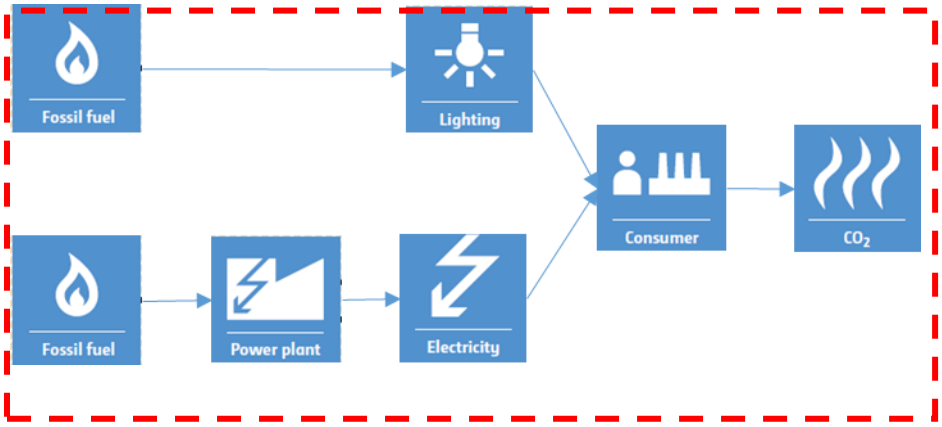
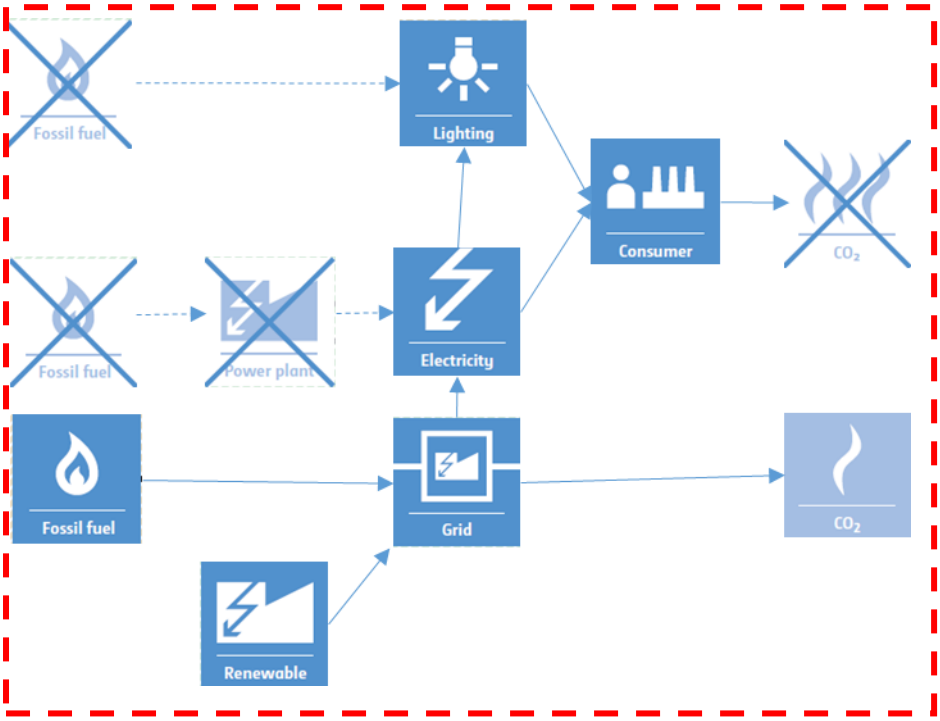


Figure 3. Mini-grids: flow diagram for project scenario, showing project boundary (dashed line) and emissions sources



I.5. Establishment and description of baseline scenario

According to the methodology, the baseline is related to the type of consumers served, as follows.

(a) Type I – consumers who were not connected to a national/regional grid or a mini-grid prior to the project implementation and who consume less than 500 kWh per year;

(b) Type II – includes two separate consumer groups (i) consumers that were previously supplied by a stand-alone fossil fuel power system such as diesel generators who consume less than 500 kWh[23], and (ii) consumers who use more than 500 kWh per year and had no supply prior to the project or were previously supplied by a stand-alone fossil fuel power system such as diesel generators;

(c) Type III – consumers who were connected to a mini-grid system prior to the project activity;

(d) Type IV - consumer category includes water pumping and public lighting consumers, regardless of their previous supply of electricity.

A typical CPA may include all four types of consumers. The methodology states that the baseline scenario for Type I consumers is, “A combination of fuel based lighting and stand-alone fossil fuel generators”, while the baseline scenario for Type II and Type IV consumers is stand-alone fossil fuel generation. For type III consumers, the baseline scenario is generation from the existing mini-grid. As per the eligibility criteria, the CPA monitoring database will keep a record of the new connection types as well as consumer classification (technology used and consumption type) prior to project implementation.

[23] For consumers whose baseline technology can be identified as the operation of fossil fuel generator and can be documented.

As per the methodology, each CPA will provide an ex-ante estimate of the number of consumers that will fall into each group or type, based on business plans or other similar project documents. During project implementation, the exact number of consumers by type and project technology/measure shall be recorded as part of the monitoring plan during the first monitoring period.

The first step of the baseline scenario process will be to identify the consumers during implementation (i.e. as they are connected) and present consumer numbers in the table format below. Only consumers that are served by a mini-grid at the end of a given monitoring period should be included in this table.[24] For a typical Category 1 CPA, only the second column of the table is relevant:

Table 15. Format for reporting of consumer numbers by type and project technology/measure – Category 1 CPAs

	Project technology/measure		
Type	**Individual System**	**Mini-Grid**	**Grid Extension**
I	N/A		N/A
II	N/A		N/A
III	N/A		N/A
IV	N/A		N/A

The second step is to determine the consumption of each consumer type and sub-group. Based on the flow charts presented in the methodology (Figure 1 and Figure 2 of the methodology), the following options are relevant for Category 1 CPAs:

- Type I consumers may use metering, sample survey or distribution metering and consumer numbers. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type II consumers may only use metering or sample survey. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type III consumers may use metering or a sample survey. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type IV consumers are only required to use metering if their consumption is greater than 1000 kWh/year. Below that consumption level, according to the methodology they may use metering or sample survey.

The third step is to determine baseline emissions, which is explained in detail in section I.6 below.

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

Total baseline emissions are the sum of all the individual consumer groups.

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{T3,y} + BE_{T4,y} \quad \text{Equation (1)}$$

Where:

[24] If a consumer initially received a mini-grid connection, but then later is connected to the grid, then that consumer (and the relevant baseline and project emissions) should be reported under the relevant grid connection CPA, not the mini-grid CPA.

BE_y = Baseline emissions in year y (tCO_2)

$BE_{T1,y}$ = Baseline emission from Type I consumers in year y (tCO_2)

$BE_{T2,y}$ = Baseline emission from Type II consumers in year y (tCO_2)

$BE_{T3,y}$ = Baseline emission from Type III consumers in year y (tCO_2)

$BE_{T4,y}$ = Baseline emission from Type IV consumers in year y (tCO_2)

For Type I consumers, baseline emissions are calculated as follows:

$$BE_{T1,y} = \sum_{x=1}^{N} \left(EC_{T1,x,y} \times EF_{CO2,T1} \right) \quad \text{Equation (2)}$$

Where:

$BE_{T1,y}$ = Baseline emission from Type I consumers in year y (tCO_2)

$EC_{T1,x,y}$ = Annual electricity consumption of Type I consumer x in year y (MWh)

$EF_{CO2,T1}$ =
- If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then:
  - For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then:
  - For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and
  - For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh);
- If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)[25]

N_y = Number of Type I consumers in year y

X = Type I consumer (x = 1, 2, 3, …)

As per the methodology, consumption levels for each type of consumer are determined ex post using one of the following options (A, B, C or D) prescribed below, depending on the technology/measure being implemented at that consumer site:

> Option A: Metering (standard electrical meter or pre-payment meter) – All consumer types may use metering. However, for any consumer with annual consumption greater than 1000 kWh, then Option A is mandatory.
> Where pre-payment meters are used, consumption shall be determined from the billing records. The total electricity consumed for each consumer is the summation of the pre-paid

[25] Type I consumers are defined as having less than 500 kWh/year consumption at the start of the project activity. In the event that average electricity consumption of Type-I consumers monitored during the crediting period exceeds 500 kWh/year, they should be reclassified as Type II consumers at the renewable of the crediting period.

electricity purchased during the monitoring period, which excludes the last purchase during the monitoring period and includes the last purchase of the previous monitoring period;

Option B. Sample survey (stratified random sampling) – All consumer types with expected annual consumption less than 1000 kWh may undertake a sample survey to determine the average consumption for specific consumer sub-groups (e.g. service levels, load limits, or other connection controls or sizes);

Option C. Distribution metering and consumer numbers – Only Type I consumers served by a mini-grid or grid connection may choose to estimate consumption levels from the total metered consumption of a community/consumer group, less the sum of consumption by other consumer types, divided by the number of operational connections, taking into account distribution losses;

Option D. Deemed consumption – as a special case, Type I, II and Type IV consumers that are served by an individual renewable energy systems may determine consumption based on the installed system capacity and an availability factor.

While some Type I consumers may have some form of metering (normally pre-payment meters), some may have only power limiting devices without meters, so Option C ("Distribution metering and consumer numbers") may be used to determine consumption. This will only be used when there is a master meter at the main sub-station in the community, or similar overall meter for total electricity distributed. Alternatively, a sample survey may be used to determine the average consumption for Type I consumers in each service level.

If Option C is used to determine annual average electricity consumption of Type I consumers (which are not metered) in a project area, it is calculated from:

(a) Total electricity supply to the project area monitored at the nearest sub-station or by monitoring electricity outputs of plants feeding a mini-grid; and

(b) The total electricity consumption from other consumer groups (metered).

The annual average electricity consumption of Type I consumers is then calculated using the equation below:

$$EC_{T1,x,y} = \frac{\left(ES_{tot} \times \left(1 - TL_p\right)\right) - \sum EC_{T2,z,y} - \sum EC_{T3,w,y} - \sum EC_{T4,i,y}}{N_y} \quad \text{Equation (3)}$$

Where

$EC_{T1,x,y}$ = Annual electricity consumption of Type I consumer x in year y (MWh)

$ES_{tot,y}$ = Total electricity supply to all consumers (MWh)

TL_p = Transmission and distribution losses within the project area (%), with 10 per cent as a default value

$EC_{T2,z,y}$ = Annual electricity consumption of Type II consumer z in year y (MWh)

$EC_{T3,w,y}$ = Annual electricity consumption of Type III consumer w in year y (MWh)

$EC_{T4,i,y}$ = Annual electricity consumption of Type IV consumer i in year y (MWh)

N_y = Number of Type I consumers in year y

For Type II consumers, baseline emissions are calculated as follows:

$$BE_{T2,y} = \sum_{z=1}^{M} \left(EC_{T2,z,y} \times EF_{CO2,T2} \right)$$ Equation (4)

Where:

$BE_{T2,y}$ = Baseline emission from Type II consumers in year y (tCO_2)

$EC_{T2,z,y}$ = Annual electricity consumption of Type II consumer z in year y (MWh)

$EF_{CO2,T2}$ = Baseline emissions factor for Type II consumers (1.0 tCO2/MWh)

M_y = Number of Type II consumers in year y

z = Type II consumer (z = 1, 2, 3, …)

For Type III consumers, baseline emissions are calculated as follows:

$$BE_{T3,y} = \sum_{w=1}^{P} \left(EC_{T3,w,y} \times EF_{CO2,T3} \right)$$ Equation (5)

Where:

$BE_{T3,y}$ = Baseline emission from Type III consumers in year y (tCO_2)

$EC_{T3,w,y}$ = Annual electricity consumption of Type III consumer w in year y (MWh)

$EF_{CO2,T3}$ = Baseline emissions factor for Type III consumers (tCO2/MWh) For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, emission factor can be determined using the emissions factors given below. For all other mini-grids it shall be calculated as the weighted average emissions for the current generation mix following the procedure provided in "AMS-I.D: Grid connected renewable electricity generation"

P_y = Number of Type III consumers in year y

w = Type III consumer (w = 1, 2, 3, …)

In terms of the baseline emission factor, where the CPA is the hybridization of an existing mini-grid, the existing mini-grid would include only fossil fuel plants, as so use the default emission factors presented below. For a CPA involving the extension of an existing mini-grid to new consumers, the choice of emissions factor will depend on whether there are already renewable energy plants in the mini-grid system, so either of the two approaches specified in the methodology might be used.

Table 16. Default emission factors for diesel generator systems (in kg CO_2e/kWh[(a)]) for three different levels of load factors[(b)]

Cases	Mini-grid with 24-hour service	Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW	0.8	0.8	0.8

(a) A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories);

(b) Values derived from figures reported in RETScreen International's PV 2000 model retrieved from: <http://retscreen.net/>;

For Type IV consumers, baseline emissions are calculated as follows:

$$BE_{T4,y} = \sum_{i=1}^{Q} \left(EC_{T4,i,y} \times EF_{CO2,T4} \right)$$ Equation (6)

Where:

$BE_{T4,y}$ = Baseline emission from Type IV consumers in year y (tCO_2)

$EC_{T4,i,y}$ = Annual electricity consumption of Type IV consumer i in year y (MWh)

$EF_{CO2,T4}$ = Baseline emissions factor for Type IV consumers (1.0 tCO_2/MWh).

Q_y = Number of Type IV consumers in year y

Project emissions are calculated as follows.

$$PE_{G,y} = \frac{\left(ES_{tot,y} \times EF_{grid,CO2,y} \right)}{\left(1 - TL_{grid} \right)}$$ Equation (7)

Where:

$PE_{G,y}$ = Project emissions from renewable and hybrid mini-grids (new or rehabilitated) and grid extension in year y (tCO_2)

$ES_{tot,y}$ = Total electricity supply to all consumers (MWh)

$EF_{grid,CO2}$ = Emission factor for the project electricity system in year y (tCO_2/MWh)
The emissions factor is determined as either: (a) for a mini grid system where all generators use exclusively fuel oil and/or diesel fuel using the emissions factors in Table 4 [of the methodology]; or (b) for all other mini-grids per the weighted average emissions for the current generation mix following the procedure provided in AMS-I.D.

TL_{grid} = Transmission losses in the project electricity system, where the project activity is grid extension, with a 10% default value. This does not apply to a mini-grid, because local distribution losses are already captured as TLp in equation 10 below (i.e. TL_{grid} = 0 for mini-grid)

A typical CPA will include the installation/extension of solar PV mini-grids. Category 1 CPAs may also include the installation/extension of hybrid mini-grids and the hybridization of existing mini-grids. In these cases, the project electricity system is likely to have both fossil and renewable generating units, so the procedure in AMS I.D will be used to determine the project emissions factor for each mini-grid.

$ES_{tot,y}$ for each mini-grid is either determined by the measurement at an electricity meter at the point of supply to community, or as the sum of electricity consumption of all consumers. Note that, if Option C is used for calculating consumption by any consumer groups, then $ES_{tot,y}$ shall be measured directly.

If the sum of consumption from all consumers is used, $ES_{tot,y}$ is calculated using the following equation:

$$ES_{tot,y} = \frac{\sum_{x=1}^{N_y} EC_{T1,x,y} + \sum_{z=1}^{M_y} EC_{T2,z,y} + \sum_{w=1}^{P_y} EC_{T3,w,y} + \sum_{i=1}^{Q_y} EC_{T4,i,y}}{(1 - TL_p)} \quad \text{Equation (8)}$$

Where

$ES_{tot,y}$	=	Total electricity supply to all consumers (MWh)
$EC_{T1,x,y}$	=	Annual electricity consumption of Type I consumer x in year y (MWh)
$EC_{T2,z,y}$	=	Annual electricity consumption of Type II consumer z in year y (MWh)
$EC_{T3,w,y}$	=	Annual electricity consumption of Type III consumer w in year y (MWh)
$EC_{T4,i,y}$	=	Annual electricity consumption of Type IV consumer i in year y (MWh)
N_y	=	Number of Type I consumers in year y
M_y	=	Number of Type II consumers in year y
P_y	=	Number of Type III consumers in year y
Q_y	=	Number of Type IV consumers in year y
TL_p	=	Local distribution losses within the project area (%), with 10 per cent as a default value

When multiple mini-grids are involved, total project emissions shall be calculated as the sum of the emissions from all of the mini-grids.

A generic CPA determines leakage as per AM0045 Grid connection of isolated electricity systems Version 3:

$$LE_y = A_{def} * L_c \quad \text{Equation (9)}$$

Where

LE_y Leakage emissions in year *y* (tCO_2e/y)

A_{def} Area of land deforested in hectares

L_C Carbon stock per unit area (above ground, below ground, soil carbon, litter and dead biomass), in tonnes of CO_2 per hectare

Emission reductions (ERy) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (10)}$$

Where

ER_y Emission reductions in year *y* (tCO_2e/y)

BE_y Baseline emission in year *y* (tCO_2e/y)

PE_y Project emissions in year *y* (tCO_2e/y)

LE_y Leakage emissions in year *y* (tCO_2e/y)

I.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{CO2,T1}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type I consumers
Source of data	Default emissions factor from methodology
Value(s) applied	• If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh); • If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then: ○ For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh); • If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then: ○ For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and ○ For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh); If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	**$EF_{CO2,T2}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type II consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	$EF_{CO2,T3}$
Data unit	tCO_2/MWh
Description	Emissions factor for Type III consumers
Source of data	Default emissions factors from methodology or the procedure provided in AMS-I.D.
Value(s) applied	Varies by mini-grid
Choice of data or Measurement methods and procedures	For an existing mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, emission factor can be determined using the emissions factors given in the table below.

Cases	Mini-grid with 24 hour service	i. Mini-grid with temporary service (4-6 hr/day); ii. Productive applications; iii. Water pumps	Mini-grid with storage
Load factors [%]	**25%**	**50%**	**100%**
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW	0.8	0.8	0.8

For all other mini-grids use the weighted average emissions for the current generation mix of that mini-grid following the procedure provided in "AMS-I.D: Grid connected renewable electricity generation".

Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	$EF_{CO2,T4}$
Data unit	tCO_2/MWh
Description	Emissions factor for Type IV consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	TL_p
Data unit	%
Description	Transmission and distribution losses within the project area
Source of data	Default from methodology
Value(s) applied	10%
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	TL_{grid}
Data unit	%
Description	Transmission and distribution losses in the project electricity system supplying the project activity
Source of data	Default from methodology
Value(s) applied	0 for mini-grid, as per the methodology
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of project emissions
Additional comment	None

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

Emission reductions for technologies/measures under AMS-III.BL Version 1 for a CPA Category 1 are calculated shown below. The equations and calculations for baseline emissions, project emissions, and leakage below will be applied to each Category 1 CPA under the PoA for each year of the crediting period. The sample calculation applies the equations to be used with sample values.

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (11)}$$

Where

ER_y Emission reductions in year *y* (tCO_2e/y)

BE_y Baseline emission in year *y* (tCO_2e/y)

PE_y Project emissions in year *y* (tCO_2e/y)

LE_y Leakage emissions in year *y* (tCO_2e/y)

Project emissions under Category 1 CPA are calculated as follows:

$$PE_y = PE_{IS,y} + PE_{G,y} \quad \text{Equation (12)}$$

Where

$PE_{IS,y}$ Project emissions from new or rehabilitated individual renewable or hybrid energy systems in year y (tCO_2)

$PE_{G,y}$ Project emission from renewable and hybrid mini-grids and grid extension in year y (tCO_2)

Under Category 1 CPAs, $PE_{IS,y}$ is zero as no new or rehabilitated individual renewable or hybrid energy systems will be installed.

$$PE_{G,y} = \frac{\left(ES_{tot,y} \times EF_{grid,CO2,y}\right)}{\left(1 - TL_{grid}\right)}$$

Where

$ES_{tot,y}$ Total electricity supplied to all new and existing consumers (MWh)

$EF_{grid,CO2,y}$ Emission factor of the project electricity system in year y (tCO_2/MWh)

TL_{grid} Transmission and distribution losses in the project activity electricity system supplying the project activity (%)

$$ES_{tot,y} = \frac{\sum_{w=1}^{Py} EC_{T3,w,y}}{(1-TL_p)}$$ Equation (13)

Where

$ES_{tot,y}$ Total electricity supplied to all new and existing consumers (MWh)

$EC_{T3,w,y}$ Metered annual electricity consumption of Type III consumer *w* in year y (MWh)

TL_p Local distribution losses within the project area (%), with 10 per cent as a default value

Under a generic CPA leakage is calculated as follows:

$$LE_y = A_{def} * L_c$$ Equation (14)

Where

LE_y Leakage emissions in year *y* (tCO_2e/y)

A_{def} Area of land deforested in hectares

L_C Carbon stock per unit area (above ground, below ground, soil carbon, litter and dead biomass), in tonnes of CO_2 per hectare

Under a generic CPA, baseline emissions are calculated as follows:

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{T3,y} + BE_{T4,y}$$ Equation (15)

Where

$BE_{T1,y}$ Baseline emissions for Type I consumers in year y (tCO_2)

$BE_{T2,,y}$ Baseline emissions for Type II consumers in year y (tCO_2)

$BE_{T3,y}$ Baseline emission for Type III consumers in year y (tCO_2)

$BE_{T4,y}$ Baseline emissions for Type IV consumers in year y (tCO_2)

For all Category 1 CPAs, all end-users will be metered to measure the electricity consumption ex-post.

Baseline emissions for Type III consumers are calculated as follows:

$$BE_{T3,y} = \sum_{w=1}^{P} \left(EC_{T3,w,y} \times EF_{CO2,T3}\right)$$ Equation (16)

Where

$BE_{T3,y}$ Baseline emission for Type III consumers in year y (tCO_2)

$EC_{T3,w,y}$ Metered annual electricity consumption of Type III consumer *w* in year y (MWh)

$EF_{CO2,T3}$ Baseline emissions factor for Type III consumers (tCO2/MWh)

P_y Number of Type III consumers in year y

w Type III consumer (x = 1, 2, 3, …)

Sample Calculation

For the purposes of ex-ante estimation of emissions reductions, the following assumptions are made:

SERVICE LEVEL	Share[26]	Consumption (kWh/year)
service level 1	26%	73
service level 2	31%	88
service level 3	32%	197
service level 4	11%	986

- A typical CPA could include 45,868 new connections[27], of which 90% could be for new mini-grids, and 10% could be from an extension of existing mini-grids, where renewable energy capacity is also added to hybridize these systems.
- For the consumers in a new mini-grid, 10% may have had previous access to a stand-alone diesel generator
- For the mini-grids that are extended and hybridized, 50% of consumers will be new connections while 50% will be the existing consumers.

- Type I consumers include population with service levels 1-3 (89%) becoming new consumer from new mini grids or existing mini grids:
  Type I consumers = Type I new MG + Type I existing MG
  = 45,868 * 0.9*0.9*0.89 + 45,868 * 0.1*0.5*0.89
  = 33,066 + 2,041 = 35,107

  Average consumption for Type I = 123 kWh/year (based on service levels 1-3)
  Emission factor for Type I = 3.8 tCO_2e/MWh because average consumption is between 55 and 250 kWh/yr

- Type II consumers include population with service level 4 (11%) becoming new consumer from new mini grids or existing mini grids, plus consumers with previous access to stand-alone generator.
  Type II consumers = Type II new MG + Type II existing MG + Type II diesel generator
  = 45,868 * 0.9*0.9*0.11 + 45,868 * 0.1*0.5*0.11 + 45,868 * 0.9*0.1
  = 4,087 + 252 + 4,128 = 8,467

[26] Service level share and consumption estimates based on information from ASER electrification plan for Kolda-Dagana-Mbour region and electrification plan for Matam-Ranerou-Bakel region.

[27] Information based on implementation estimates up 2020.

Average consumption for Type II = 986 kWh/year (based on service level 4)
Emission factor for Type II = 1.0 tCO_2e/MWh

- Type III consumers include population with previous access to a fossil fuel mini-grid.
  Type III consumers = 45,868 * 0.1*0.5 = 2,293

  Average consumption for Type III = 197 kWh/year (based on service level 3)
  Emission factor for Type III = 1.3 tCO_2e/MWh (based on table 4 of methodology AMS-III.BL Version 01 for temporary service of 4-6 hrs/day and between 15 and 35 kW diesel mini-grid)

Baseline emissions would therefore be:

$BE_{T1,y}$ = 35,107 consumers * 0.123 MWh * 3.8 tCO_2/MWh = 16,233 tCO_2
$BE_{T2,y}$ = 8,467 consumers * 0.986 MWh * 1.0 tCO2/MWh = 8,348 tCO_2
$BE_{T3,y}$ = 2,293 consumers * 0.197 MWh * 1.3 tCO2/MWh = 587 tCO_2

Total baseline emissions are therefore 25,168 tCO_2.

As per AMS-I.D, the emission factor used for the calculation of project emissions is calculated based on the weighted average emissions of the generation mix in the year in which project generation occurs. For the purpose of the sample calculation, it is assumed that diesel generators are delivering 25% of the electricity to the mini-grid, and the solar panels satisfy the rest of the electricity demand (75%). The exact fraction of diesel contribution to the mini-grid will be measured during monitoring. For the determining the emissions factor from diesel generators it is assumed that:

- Fuel emission factor of diesel for project emissions: 74,800 kg/TJ[28];
- Generator Efficiency of 30%[29];

Based on the above considerations, the emission factor for the electricity generated from diesel generator is assumed to be 0.9 tCO_2/MWh.

The emission factor for the electricity generated from solar panels is zero.

Therefore, based on this generation mix, the weighted emission factor is:

0.75 * 0 tCO_2/MWh + 0.25 * 0.9 tCO_2/MWh = 0.225 tCO_2/MWh

Project emissions would be:

PE_y = (Total electricity supplied / (1 – distribution losses) *(weighted average emissions of the current generation mix)
= (13,119 MWh / (1-0.1)) * (0.225 tCO_2/MWh)
= 14,577 MWh * 0.225 tCO_2/MWh = 3,280[30] tCO_2

For the purpose of the sample calculation leakage is assumed to be less than 5% of total project emissions and therefore negligible.

LE_y = 0 tCO_2

[28] Conservative estimate using EF of Oil from IPCC guidelines

[29] Conservative estimate based on default efficiency factors from “Tool to calculate the emission factor for an electricity system”, Version 05.0

[30] Conservatively rounded up.

Emission reductions are therefore:

$ER_y = 25{,}168\ tCO_2 – 3{,}280\ tCO_2 – 0\ tCO_2 = 21{,}888\ tCO_2$

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

For the proposed PoA, the submission of the monitoring plan delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

Therefore, this section is intentionally blank.

Data/Parameter	
Data unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

I.7.2. Sampling plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

I.7.3. Other elements of monitoring plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

SECTION J. Crediting period type and duration

The CPA has a renewable crediting period.
The length of the crediting period is 7 years and 0 months.

SECTION K. Eligibility criteria for inclusion of CPAs

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical boundary	Each CPA will be located within the physical/geographical boundary of the PoA as demonstrated by the geographical boundary of the CPA-DD.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA provided in the CPA-DD
2	Start date	The CPA start dates shall not be before the start date of the PoA (07/06/2011). The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a payment receipt detailing real action, an invoice for equipment, a receipt from an end-user or technician serving as proof of installation, or signed contract.	Receipt showing payment for activities detailing a real action or an invoice for equipment or receipt showing installation of a system, or signed contract.
3	Crediting period	CPA crediting period shall be after the date of CPA inclusion and within the lifetime of the PoA (07/06/2011 to 06/06/2039) as demonstrated in the CPA-DD.	CPA starting date and crediting period (fixed or renewable) are specified in CPA-DD
4	ODA	For all CPAs, funding from Annex I Parties, if any, does not result in a diversion of ODA as evidenced through a statement on ODA.	Statement from Annex I Parties
5	Debundling	Each CPA will demonstrate that debundling does not apply as the CPA is micro-scale and applies the microscale threshold at the CDM Unit level	Each mini-grid, a CDM Unit, will result in equal to or less than 20k tCO2/year as shown in CPA DD
6	Double counting	The CPAs of PoA “Senegal Rural Electrification Program” shall not result in double counting as evidenced through unique identifiers, such as GPS coordinates	A description of the unique identifier will be collected and unique references of the customer, along with adherence to the CME Manual as shown in the CPA-DD
7	Local stakeholders and environmental analysis	The Local Stakeholder Consultation and Environmental Impact Analysis have been conducted at the PoA level. Each CPA will take into consideration the comments from the Stakeholder Consultation and abide by the environmental regulations of the host country	All CPAs will show the stakeholder consultation and environmental analysis done at PoA level and adhere to the requirements stipulated at the PoA level
8	Target group	The CPA specifies the target group of the project unit/system in the CPA-DD	The target group for the mini-grid CPAs will be more than 75% (by number) households, as opposed to institutions/ commercial sites. Ex-ante estimates of consumer numbers shown in the CPA-DD.

9	Sampling	Sampling design and calculation shall meet the requirement in the sampling standard as evidenced in the CPA-DD	The CPA-DD elaborates the sampling requirements and procedures for each relevant parameter (i.e. parameter, level at which is it sampled, sampling method, sample size, confidence/precision)
10	Microscale threshold	The CPAs shall adhere to the microscale threshold and result in emission reductions equivalent to or less than 20 $ktCO_2e$ emissions reductions at the CDM Unit level per annum.	The CPA results in emission reductions less than or equal to 20k tCO2e at the CDM Unit Level per annum.
11	Additionality	CPA shall be additional as per micro-scale additionality by being located in an LDC and resulting in less than or equal to 20k tCO_2e emission reductions at the CDM Unit level per annum.	The CPA results in emission reductions less than or equal to 20k tCO_2e at the CDM Unit Level per annum and be located in a Least Developed Country (LDC).
12	Technology[31]	CPA will install/expandsolar PV mini-grids, including both the power generation units and the associated distribution infrastructure, for electrification of communities. CPA may also include installation/extension of hybrid solar PV-diesel mini-grids and the hybridization of existing mini-grids. Equipment shall comply with applicable international standards or comparable national, regional or local standards/guidelines.	CPA-DD will include ex-ante estimate of share of consumers with previous access, and identifying these consumers shall be part of monitoring plan. The CPA monitoring database will track previous status from consumers prior to project implementation to identify which consumers were not connected to national/regional grid, or were supplied by fossil fuel individual energy system or mini grids. All mini-grid connections meet ASER Minimum Technical & Environmental Standards, and any standards referred to in this document.
13	Methodology	Each CPA will apply the CDM baseline and monitoring methodology AMS-III.BL Version 01.0, and adhere to all applicability conditions and other requirements of the methodology. At least 75% of the end-users that receive electricity from systems installed under the CPA shall be households.	The CPA applies methodology AMS-III.BL Version 1.0 and adheres to the requirement that end-users must be at least 75% households by number.

[31] The other methodology applicability conditions relevant for solar home systems are addressed by criteria 8 (§4 on consumer group), 12 (§5 on technology coverage, §6 on standards), and 10 (§8 on size).

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Senegal Rural Electrification – Grid Extension

H.2. Reference number of generic CPA

CPA Category 2

H.3. Purpose and general description of generic CPA

A typical CPA consists of the connection of new consumers to the national grid. CPAs will be differentiated by the time period covered under each CPA. In a generic CPA the CME and CPA Implementer may or may not be the same entity. The CPA Implementer will select and manage the connections under Category 2 CPAs as well as oversee the data collection process for monitoring and verification.

The rural communities will receive access to electricity through the grid connections, and may or may have been connected previously to a fossil-fuel based mini-grid. A summary of the grid extension infrastructure under this CPA, as well as the service levels for grid consumers are shown in the tables below.

Table 17. Summary of grid extension infrastructure [fill in]

Item	Value	Comment
Number of villages receiving new connections	[fill in]	[fill in]
New grid connections	[fill in]	[fill in]

Table 18. Service levels and typical load limits for grid connections [revise as necessary]

Service level	Power limit (watts)
SL1	<=50
SL2	>50-90
SL3	>90-1<=80
SL4	Not limited (>180)

The CPA applies Type III small-scale methodology AMS-III.BL Version 1. The CPA is therefore a Type III CPA. The CPA also qualifies as a Type III microscale CPA. The CPA is implemented entirely in and LDC and the size of each CDM Unit, defined as a single connection to an end user, is limited to emission reductions of 20,000 tCO_2e or less per annum.

H.4. Technologies/measures

Target Group
Under CPA Category 2, the project activity targets households and SMEs/institutions in rural communities connected to the national grid.

Technology
Under CPA Category 2, end-users who previously did not have access to the national or regional grid and either did not have power, were connected to an individual fossil fuel system, or a fossil fuel powered mini-grid, will receive access to the national grid through the new connections. A description

of technologies/measures to be employed by under each specific Category 2 CPA will be provided in the specific CPA document, including all technical specifications required by the applied methodology.

CPA Boundary

For a typical CPA, the project boundary therefore includes all plants in the grid (renewable and fossil fuel), as well as the physical sites of the consumers (e.g. households and other consumers). The geographic boundary of a Category 2 CPAs is the country of Senegal. Category 2 CPAs will be differentiated registered users grouped by time of connection. No user will overlap in different Category 2 CPAs.

Record Keeping System

Category 2 CPAs utilize an electronic monitoring system to record the electricity generated and distributed by the mini-grids under the project activity. The record keeping system to prove adherence to the management system detailed in Part I Section B of the PoA-DD.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

The approved methodology used is AMS-III.BL "Integrated methodology for electrification of communities", Version 01.0[32]. The methodology also refers to the following approved methodologies, tools and guidelines:

- "AMS-I.D.: Grid connected renewable electricity generation", Version 18.0[33];
- "AM0045: Grid connection of isolated electricity systems", Version 03.0[34];
- "AM0104: Interconnection of electricity grids in countries with economic merit order dispatch" Version 02.0[35];
- "Tool to calculate the emission factor for an electricity system", Version 05.0[36];
- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", Version 03.0[37];
- "Standard: Sampling and surveys for CDM project activities and PoAs", Version 07.0[38].

Additionality for this category of CPA under the proposed PoA is demonstrated with reference to the "Methodological Tool: Demonstration of additionality of microscale project activities", Version 08.0[39].

I.2. Applicability of methodologies and standardized baselines

a) Demonstration of how the applicability conditions are met in accordance with the approved methodology and the PoA.

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[32] https://cdm.unfccc.int/methodologies/DB/XJQ7APPRHQWLO6VSC3161I5Q8MCMNQ

[33] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[34] https://cdm.unfccc.int/methodologies/DB/UH7XSIREUC5C4QL5EU963O54CSFWGV

[35] https://cdm.unfccc.int/methodologies/DB/OEZDV2912B4QUOOC5W7RC2JDP9BQTD

[36] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

[37] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

[38] https://cdm.unfccc.int/Reference/Standards/index.html

[39] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v8.pdf

The table below lists each of the applicability conditions for the relevant approved methodology and explain how these are met by this CPA.

Table 19. Applicability conditions for AMS III.BL for grid extension

Applicability Conditions	Applicability to this CPA
(3) This methodology is applicable in situations where consumers that were not connected to a national/regional grid, prior to project implementation are supplied with electricity generated from the project activity. It is also applicable in situations where a fraction of consumers that were supplied with electricity from a fossil based individual energy system or fossil fuel based mini-grid prior to the implementation of the project, are supplied with electricity from the project activity (e.g. moving from carbon intensive mini-grid to less carbon intensive grid or mini grid).	A typical CPA will include both consumers that were not connected prior to the project and consumers that were connected to a fossil fuel based mini-grid prior to the project. The CPA monitoring database will track previous status from consumers prior to project implementation.
(4) Electricity consumers may include households, commercial facilities such as shops, public services/buildings and small, medium and micro enterprises (SMMEs). Applications may include lighting, household electrical appliances (e.g. refrigerators, TV, radio), public lighting and water pumps. At least 75 per cent (by number) of the consumers connected by the project activity shall be households.	Consumers may include all of these groups. The type of end-user (i.e. household or SME/Institution) will be recorded at the time of connection. The CPA monitoring database will track the percentage of households versus SMEs/Institutions. If during monitoring it is found that the percentage of households (by number) under the CPA is less than 75%, SMEs/Institutions under the CPA will be removed from monitoring the monitoring period in question until the percentage of end-users (by number) is at least 75% households.
(5) This methodology is applicable to electrification of a community of consumers which is achieved through one or more of the following technologies/measures: (a) New construction of individual energy systems (renewable or hybrid) such as roof-top solar photovoltaic systems or hybrid energy systems; (b) Rehabilitation (or refurbishment) of individual energy systems, mini-grid or hybrid energy system may be undertaken, if it can be demonstrated that the existing system(s) i) are not part of another CDM activity; ii) are non-operational and iii) require a substantial investment for them to be rehabilitated to or above the original electricity generation capacity. To demonstrate compliance with this condition, the project participants shall provide documentation that:(i) The existing system has not generated electricity, or that alternative fuels (e.g. kerosene) have been used, for at least six months prior to Project Design Document (PDD) or SSC-CPA-DD submittal; and (ii) Substantial investments are required to rehabilitate the existing systems (e.g. investments greater than half of the cost to install a new power generation system with the same electricity generation capacity); (c) Installation or extension of a mini-grid that distributes electricity generated from renewable energy systems or hybrid energy systems; (d) Hybridization of existing fossil fuel powered mini-grids using renewable energy systems; (e) Extension of a grid (national or regional) to supply new consumers as well as consumers currently connected to mini-grid.	A typical CPA will include extension of a national grid to supply new consumers as well as consumers currently connected to mini-grid (i.e. (e) in the list)
(6) Project equipment shall comply with applicable international standards or comparable national, regional or local	All relevant standards are specified by the CME in contracts with implementing

standards/guidelines and, when relevant, the PDD shall indicate the standard(s) applied for main project equipment.	agents and vendors for this CPA.
(7) For projects involving the installation of hydro power plants with reservoirs the requirements prescribed under AMS-I.D shall be followed.	Not applicable – no hydropower plants are installed as part of a typical CPA in this category.
(8) Measures are limited to those that result in emission reductions of less than or equal to 20 $ktCO_2$ equivalent at the CDM Unit level annually.	The CPA will only utilise AMS III.BL for grid extension. The total emission reductions under a CPA do not exceed 20 $ktCO_2e$ annually at the CDM Unit level and will remain below this limit throughout the entire crediting period. This will be confirmed during monitoring.

b) Demonstration that the CPA qualifies as Type I, II, and/or III during every year of the crediting period in accordance with applicable provisions for project activity eligibility in the Project standard.

The CPA is a Type III technology. In terms of the size limit, the total emissions reductions for a CPA must stay below the threshold of 20 $ktCO_2e$ emissions reductions to utilise the "Methodological Tool: Demonstration of additionality of microscale project activities", Version 10.0. The ex-ante estimate of total emissions reductions is shown, along with the calculations, in section I.6.3. The actual emissions reductions will be verified during each monitoring and verification period to ensure that they do not exceed these thresholds.

I.3. Application of multiple methodologies

The CPA applies a single methodology.

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

The project boundary and GHG sources are summarised and discussed below.

Table 20. Sources and GHGs included in this CPA

Source		GHG	Included?	Justification/Explanation
Baseline	Fossil fuels for lighting and electricity generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available
Project	Fossil fuels for lighting and electricity generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available

The methodology states that, "For project activities involving national or regional grids, the spatial extent of the project boundary includes all power plants within the host country physically connected through transmission and distribution lines to the national or regional grid which is being extended through the project activity… For all project types, the spatial extent of the project boundary also includes the physical sites of the end-use consumers served by the project activity." For a typical

CPA, the project boundary therefore includes all plants in the grid (renewable and fossil fuel), as well as the physical sites of the consumers (e.g. households and other consumers).

Gases included in the project boundary for baseline emissions are carbon dioxide emissions from fossil fuel-fired power plants or fuel consumption for lighting. Project emissions would include carbon dioxide emissions from fossil fuel consumption in any grid plants.

Figure 4. Grid extension: flow diagram for baseline scenario, showing project boundary and emissions sources

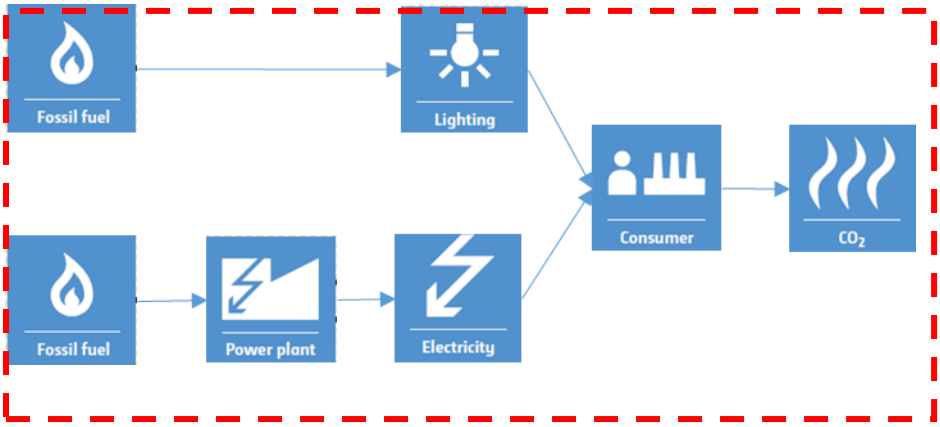
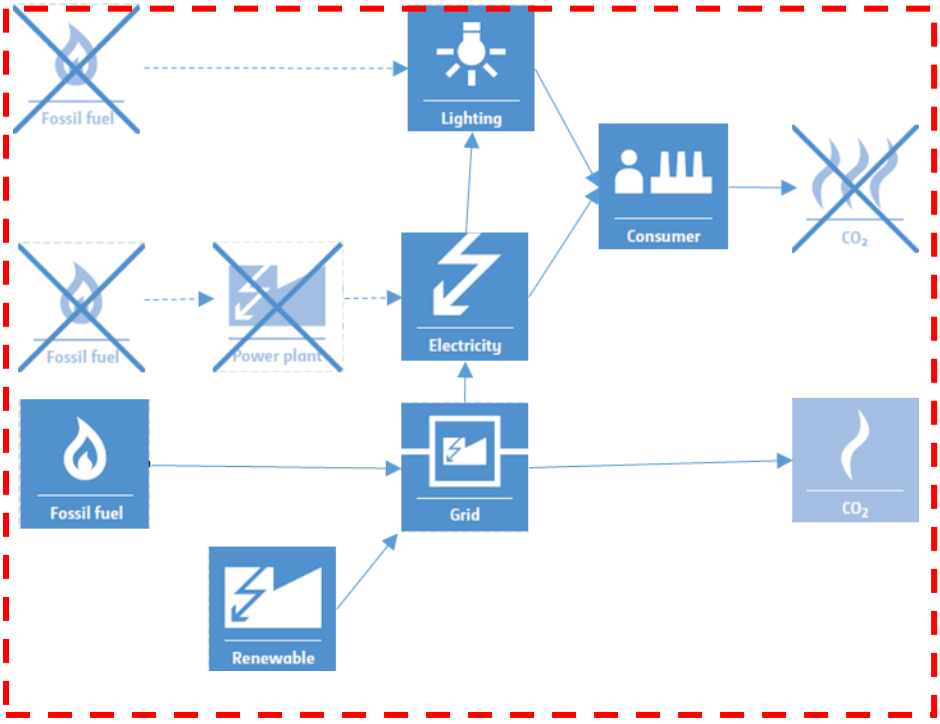


Figure 5. Grid extension: flow diagram for project scenario, showing project boundary and emissions sources



I.5. Establishment and description of baseline scenario

According to the methodology, the baseline is related to the type of consumers served, as follows.

(a) Type I – consumers who were not connected to a national/regional grid or a mini-grid prior to the project implementation and who consume less than 500 kWh per year;

(b) Type II – includes two separate consumer groups (i) consumers that were previously supplied by a stand-alone fossil fuel power system such as diesel generators who consume less than 500 kWh[40], and (ii) consumers who use more than 500 kWh per year and had no supply prior to the project or were previously supplied by a stand-alone fossil fuel power system such as diesel generators;

(c) Type III – consumers who were connected to a mini-grid system prior to the project activity;

(d) Type IV consumer category includes water pumping and public lighting consumers, regardless of their previous supply of electricity.

A typical CPA may include all four types of consumers. The methodology states that the baseline scenario for Type I consumers is, "A combination of fuel based lighting and stand-alone fossil fuel generators", while the baseline scenario for Type II and Type IV consumers is stand-alone fossil fuel generation. For Type III consumers, the baseline scenario is generation from the existing mini-grid As per the eligibility criteria, the CPA monitoring database will keep a record of the new connection types as well as consumers classification (technology used and consumption type) prior to project implementation.

As per the methodology, each CPA will provide an ex-ante estimate of the number of consumers that will fall into each group or type, based on business plans or other similar project documents. During project implementation, the exact number of consumers by type and project technology/measure shall be recorded as part of the monitoring plan during the first monitoring period.

The first step of the baseline scenario process will be to identify the consumers and present an ex-ante estimate of consumer numbers in the format below. For a typical Category 2 CPA, only the third column of the table is relevant:

Table 21. Format for reporting of consumer numbers by type and project technology/measure – Category 2 CPAs

	Project technology/measure		
Type	**Individual System**	**Mini-Grid**	**Grid Extension**
I	N/A	N/A	
II	N/A	N/A	
III	N/A	N/A	
IV	N/A	N/A	

The second step is to determine the consumption of each consumer type and sub-group. Based on the flow charts presented in the methodology (Figure 1 and Figure 2 of the methodology), the following options are relevant for Category 2 CPAs:

- Type I consumers may use metering, sample survey or distribution metering and consumer numbers. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type II consumers may only use metering or sample survey. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type III consumers may use metering or a sample survey. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type IV consumers are only required to use metering if their consumption is greater than 1000 kWh/year. Below that consumption level, according to the methodology they may use metering or sample survey.

[40] For consumers whose baseline technology can be identified as the operation of fossil fuel generator and can be documented.

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

Total baseline emissions are the sum of all the individual consumer groups.

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{T3,y} + BE_{T4,y} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2)
$BE_{T1,y}$	=	Baseline emission from Type I consumers in year y (tCO_2)
$BE_{T2,y}$	=	Baseline emission from Type II consumers in year y (tCO_2)
$BE_{T3,y}$	=	Baseline emission from Type III consumers in year y (tCO_2)
$BE_{T4,y}$	=	Baseline emission from Type IV consumers in year y (tCO_2)

For Type I consumers, baseline emissions are calculated as follows:

$$BE_{T1,y} = \sum_{x=1}^{N} \left(EC_{T1,x,y} \times EF_{CO2,T1} \right) \quad \text{Equation (2)}$$

Where:

$BE_{T1,y}$ = Baseline emission from Type I consumers in year y (tCO_2)

$EC_{T1,x,y}$ = Annual electricity consumption of Type I consumer x in year y (MWh)

$EF_{CO2,T1}$ =
- If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then:
  - For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then:
  - For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and
  - For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh);
- If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)[41]

N_y = Number of Type I consumers in year y

x = Type I consumer (x = 1, 2, 3, …)

As per the methodology, consumption levels for each type of consumer are determined ex post using one of the following options (A, B, C or D) prescribed below, depending on the technology/measure being implemented at that consumer site:

Option A: Metering (standard electrical meter or pre-payment meter) – All consumer types may use metering. However, for any consumer with annual consumption greater than 1000 kWh, then Option A is mandatory.
Where pre-payment meters are used, consumption shall be determined from the billing records. The total electricity consumed for each consumer is the summation of the pre-paid electricity purchased during the monitoring period, which excludes the last purchase during the monitoring period and includes the last purchase of the previous monitoring period;

Option B. Sample survey (stratified random sampling) – All consumer types with expected annual consumption less than 1000 kWh may undertake a sample survey to determine the average consumption for specific consumer sub-groups (e.g. service levels, load limits, or other connection controls or sizes);

Option C. Distribution metering and consumer numbers – Only Type I consumers served by a mini-grid or grid connection may choose to estimate consumption levels from the total metered consumption of a community/consumer group, less the sum of consumption by other consumer types, divided by the number of operational connections, taking into account distribution losses;

[41] Type I consumers are defined as having less than 500 kWh/year consumption at the start of the project activity. In the event that average electricity consumption of Type-I consumers monitored during the crediting period exceeds 500 kWh/year, they should be reclassified as Type II consumers at the renewable of the crediting period.

Option D. Deemed consumption – as a special case, Type I, II and Type IV consumers that are served by an individual renewable energy systems may determine consumption based on the installed system capacity and an availability factor.

While some Type I consumers may have some form of metering (normally pre-payment meters), some may have only power limiting devices without meters, so Option C ("Distribution metering and consumer numbers") may be used to determine consumption. This will only be used when there is a master meter at the main sub-station in the community, or similar overall meter for total electricity distributed. Alternatively, a sample survey may be used to determine the average consumption for Type I consumers in each service level.

If Option C is used to determine annual average electricity consumption of Type I consumers (which are not metered) in a project area, it is calculated from:

(a) Total electricity supply to the project area monitored at the nearest sub-station; and

(b) The total electricity consumption from other consumer groups (metered).

The annual average electricity consumption of Type I consumers is then calculated using the equation below:

$$EC_{T1,x,y} = \frac{\left(ES_{tot} \times \left(1 - TL_p\right)\right) - \sum EC_{T2,z,y} - \sum EC_{T3,w,y} - \sum EC_{T4,i,y}}{N_y} \quad \text{Equation (3)}$$

Where

$EC_{T1,x,y}$ = Annual electricity consumption of Type I consumer x in year y (MWh)

$ES_{tot,y}$ = Total electricity supply to all consumers (MWh)

TL_p = Transmission and distribution losses within the project area (%), with 10 per cent as a default value

$EC_{T2,z,y}$ = Annual electricity consumption of Type II consumer z in year y (MWh)

$EC_{T3,w,y}$ = Annual electricity consumption of Type III consumer w in year y (MWh)

$EC_{T4,i,y}$ = Annual electricity consumption of Type IV consumer i in year y (MWh)

N_y = Number of Type I consumers in year y

For Type II consumers, baseline emissions are calculated as follows:

$$BE_{T2,y} = \sum_{z=1}^{M} \left(EC_{T2,z,y} \times EF_{CO2,T2}\right) \quad \text{Equation (4)}$$

Where:

$BE_{T2,y}$ = Baseline emission from Type II consumers in year y (tCO_2)

$EC_{T2,z,y}$ = Annual electricity consumption of Type II consumer z in year y (MWh)

$EF_{CO2,T2}$ = Baseline emissions factor for Type II consumers (1.0 tCO_2/MWh)

M_y = Number of Type II consumers in year y

z = Type II consumer (z = 1, 2, 3, …)

For Type III consumers, baseline emissions are calculated as follows:

$$BE_{T3,y} = \sum_{w=1}^{P} \left(EC_{T3,w,y} \times EF_{CO2,T3} \right)$$ Equation (5)

Where:

$BE_{T3,y}$ = Baseline emission from Type III consumers in year y (tCO_2)

$EC_{T3,w,y}$ = Annual electricity consumption of Type III consumer w in year y (MWh)

$EF_{CO2,T3}$ = Baseline emissions factor for Type III consumers (tCO2/MWh) For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, emission factor can be determined using the emissions factors given in the table below. For all other mini-grids it shall be calculated as the weighted average emissions for the current generation mix following the procedure provided in "AMS-I.D: Grid connected renewable electricity generation"

P_y = Number of Type III consumers in year y

w = Type III consumer (w = 1, 2, 3, …)

For a CPA activity involved the extension of the grid of the consumers previously connected to a fossil fuel mini-grid, the choice of approaches will depend on whether there were renewable energy plants in the existing mini-grid system.

Table 22. Default emission factors for diesel generator systems (in kg CO_2e/kWh[(a)]) for three different levels of load factors[(b)]

Cases	Mini-grid with 24 hour service	Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW	0.8	0.8	0.8

(c) A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories);

(d) Values derived from figures reported in RETScreen International's PV 2000 model retrieved from: <http://retscreen.net/>;

For Type IV consumers, baseline emissions are calculated as follows:

$$BE_{T4,y} = \sum_{i=1}^{Q} \left(EC_{T4,i,y} \times EF_{CO2,T4} \right)$$ Equation (6)

Where:

$BE_{T4,y}$	=	Baseline emission from Type IV consumers in year y (tCO_2)
$EC_{T4,i,y}$	=	Annual electricity consumption of Type IV consumer i in year y (MWh)
$EF_{CO2,T4}$	=	Baseline emissions factor for Type IV consumers (1.0 tCO_2/MWh).
Q_y	=	Number of Type IV consumers in year y

Project emissions are calculated as follows.

$$PE_{G,y} = \frac{\left(ES_{tot,y} \times EF_{grid,CO2,y} \right)}{\left(1 - TL_{grid} \right)}$$ Equation (7)

Where:

$PE_{G,y}$	=	Project emissions from renewable and hybrid mini-grids (new or rehabilitated) and grid extension in year y (tCO_2)
$ES_{tot,y}$	=	Total electricity supply to all consumers (MWh)
$EF_{grid,CO2}$	=	Emission factor for the project electricity system in year y (tCO_2/MWh). The emissions factor is determined using one of the options prescribed below.
TL_{grid}	=	Transmission losses in the project electricity system, where the project activity is grid extension, with a 10% default value. This does not apply to a mini-grid, because local distribution losses are already captured as TL_p in the equation below (i.e. TL_{grid} = 0 for mini-grid)

The options provided in the methodology to calculate the grid emission factor are as follows:

Option 1: Emission factor is determined by ranking all the power units in the national or regional grid in decreasing order of GHG intensity. The emissions factor is the weighted average emission factor of the top 10 per cent most GHG intensive plants in the grid.[42] The emissions factors of the plants shall be calculated based on default plant efficiency provided in the "Tool to calculate the emission factor for an electricity system";

Option 2: If the project activity involves electrification of a community due to the construction of a new grid connected renewable power plant, the emission factor of zero can be applied if the following conditions are met:

(i) The main feeder supplying electricity to a community is a dedicated line "energized/ charged" from the newly constructed renewable power plant;

(ii) The feeder is not "energized/ charged" by a grid or other fossil fuel sources when the plant is not in operation. If this is not the case, project emissions shall be calculated for the proportion of electricity that is supplied by a grid or other sources, for the period of time when the plant is not in operation, using the other options mentioned in this section.

Option 3: If the projects are implemented in least developed countries (LDCs) or small island developing States (SIDS) or in countries that had 10 or fewer registered CDM project activities as of 31 December 2010 (namely, underrepresented countries (URCs)), the following alternatives are available:

(i) The emission factor of zero can be applied if the share of renewable energy mix is greater than 95% based on immediate three years' average historical data

(ii) The emissions factor is determined by the most GHG intensive fuel used in the national or regional grid and the default technology efficiency (lower range) as provided in the "Tool to calculate the emission factor for an electricity system". The default emission factors prescribed in the table below should be used.

Table 23. Default emission factors for determining project emissions

Fuel	Fuel EF from IPCC (kg/TJ)	Efficiency (%)	Default grid EF (tCO_2/MWh)
Coal	101 000	36.5	1.0
Natural gas	58 300	30	0.7
Oil	74 800	30	0.9

The Senegal national grid included hydropower, diesel and fuel oil power plants, with the vast majority of power from fuel oil plants[43]. Option 3 (ii) is chosen, with the most GHG intensive fuel being oil. The grid emissions factor is therefore 0.9 tCO_2/MWh fixed ex-ante for all Category 2 CPAs.

$ES_{tot,y}$ is either determined by the measurement at an electricity meter at the point of supply to community, or as the sum of electricity consumption of all consumers. Note that, if Option C is used for calculating consumption by any consumer groups, then $ES_{tot,y}$ shall be measured directly.
If the sum of consumption from all consumers is used, $ES_{tot,y}$ is calculated using the following equation:

$$ES_{tot,y} = \frac{\sum_{x=1}^{N_y} EC_{T1,x,y} + \sum_{z=1}^{M_y} EC_{T2,z,y} + \sum_{w=1}^{P_y} EC_{T3,w,y} + \sum_{i=1}^{Q_y} EC_{T4,i,y}}{\left(1 - TL_p\right)} \quad \text{Equation (8)}$$

Where

[43] SENELEC Annual Report 2015 http://www.senelec.sn/images/rapportannuelsenelec2015.pdf (Page 26, fuel consumptions for electricity generation: fuel oil, diesel, gasoil and gas).

$ES_{tot,y}$	=	Total electricity supply to all consumers (MWh)
$EC_{T1,x,y}$	=	Annual electricity consumption of Type I consumer x in year y (MWh)
$EC_{T2,z,y}$	=	Annual electricity consumption of Type II consumer z in year y (MWh)
$EC_{T3,w,y}$	=	Annual electricity consumption of Type III consumer w in year y (MWh)
$EC_{T4,i,y}$	=	Annual electricity consumption of Type IV consumer i in year y (MWh)
N_y	=	Number of Type I consumers in year y
M_y	=	Number of Type II consumers in year y
P_y	=	Number of Type III consumers in year y
Q_y	=	Number of Type IV consumers in year y
TL_p	=	Local distribution losses within the project area (%), with 10 per cent as a default value

A generic CPA determines leakage as per AM0045 Grid connection of isolated electricity systems Version 3:

$$LE_y = A_{def} * L_c \qquad \text{Equation (09)}$$

Where

LE_y Leakage emissions in year *y* (tCO_2e/y)

A_{def} Area of land deforested in hectares

L_C Carbon stock per unit area (above ground, below ground, soil carbon, litter and dead biomass), in tonnes of CO_2 per hectare

Emission reductions (ERy) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad \text{Equation (10)}$$

Where

ER_y Emission reductions in year *y* (tCO_2e/y)

BE_y Baseline emission in year *y* (tCO_2e/y)

PE_y Project emissions in year *y* (tCO_2e/y)

LE_y Leakage emissions in year *y* (tCO_2e/y)

I.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{CO2,T1}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type I consumers
Source of data	Default emissions factor from methodology
Value(s) applied	• If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh); • If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then: ○ For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh); • If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then: ○ For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and ○ For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh); If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	**$EF_{CO2,T2}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type II consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

<table>
<tr><td>Data/Parameter</td><td>$EF_{CO2,T3}$</td></tr>
<tr><td>Data unit</td><td>tCO_2/MWh</td></tr>
<tr><td>Description</td><td>Emissions factor for Type III consumers</td></tr>
<tr><td>Source of data</td><td>Default emissions factors from methodology or the procedure provided in AMS-I.D.</td></tr>
<tr><td>Value(s) applied</td><td>Varies by mini-grid</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>For an existing mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, emission factor can be determined using the emissions factors given in the table below.
<table>
<tr><th>Cases</th><th>Mini-grid with 24 hour service</th><th>Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps</th><th>Mini-grid with storage</th></tr>
<tr><td>Load factors [%]</td><td>25%</td><td>50%</td><td>100%</td></tr>
<tr><td><15 kW</td><td>2.4</td><td>1.4</td><td>1.2</td></tr>
<tr><td>>=15 <35 kW</td><td>1.9</td><td>1.3</td><td>1.1</td></tr>
<tr><td>>=35 <135 kW</td><td>1.3</td><td>1.0</td><td>1.0</td></tr>
<tr><td>>=135<200 kW</td><td>0.9</td><td>0.8</td><td>0.8</td></tr>
<tr><td>> 200 kW</td><td>0.8</td><td>0.8</td><td>0.8</td></tr>
</table>
For all other mini-grids use the weighted average emissions for the current generation mix of that mini-grid following the procedure provided in “AMS-I.D: Grid connected renewable electricity generation”.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>None</td></tr>
</table>

Data/Parameter	**$EF_{CO2,T4}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type IV consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	**TL_p**
Data unit	%
Description	Local distribution losses within the project area
Source of data	Default from methodology
Value(s) applied	10%
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions and project emissions
Additional comment	None

Data/Parameter	$EF_{grid,CO2,y}$
Data unit	tCO_2/MWh
Description	Emission factor for the project electricity system in year y
Source of data	Default value from methodology
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	Option 3 (ii) from the methodology is to select the default emission factors for the most GHG intensive fuel used in the grid, which for Senegal is oil. Senegal is an LDC, so can utilise this option.
Purpose of data	Calculation of project emissions
Additional comment	None

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

Emission reductions for technologies/measures under AMS-III.BL Version 1 for a CPA Category 2 are calculated shown below. The equations and calculations for baseline emissions, project emissions, and leakage below will be applied to each Category 2 CPA under the PoA for each year of the crediting period. The sample calculation applies the equations to be used with sample values.

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (11)}$$

Where

ER_y Emission reductions in year *y* (tCO_2e/y)

BE_y Baseline emission in year *y* (tCO_2e/y)

PE_y Project emissions in year *y* (tCO_2e/y)

LE_y Leakage emissions in year *y* (tCO_2e/y)

Project emissions under Category 2 CPA are calculated as follows:

$$PE_y = PE_{IS,y} + PE_{G,y} \quad \text{Equation (12)}$$

Where

$PE_{IS,y}$ Project emissions from new or rehabilitated individual renewable or hybrid energy systems in year y (tCO_2)

$PE_{G,y}$ Project emission from renewable and hybrid mini-grids and grid extension in year y (tCO_2)

Under Category 2 CPAs, $PE_{IS,y}$ is zero as no new or rehabilitated individual renewable or hybrid energy systems will be installed.

$$PE_{G,y} = \frac{(ES_{tot,y} \times EF_{grid,CO2,y})}{(1 - TL_{grid})}$$

Where

$ES_{tot,y}$ Total electricity supplied to all new and existing consumers (MWh)

$EF_{grid,CO2,y}$ Emission factor of the project electricity system in year y (tCO_2/MWh)

TL_{grid} Transmission and distribution losses in the project activity electricity system supplying the project activity (%)

$$ES_{tot,y} = \frac{\sum_{w=1}^{Py} EC_{T3,w,y}}{(1-TL_p)}$$ Equation (13)

Where

$ES_{tot,y}$ Total electricity supplied to all new and existing consumers (MWh)

$EC_{T3,w,y}$ Metered annual electricity consumption of Type III consumer *w* in year y (MWh)

TL_p Local distribution losses within the project area (%), with 10 per cent as a default value

Under a generic CPA leakage is calculated as follows:

$$LE_y = A_{def} * L_c$$ Equation (14)

Where

LE_y Leakage emissions in year *y* (tCO_2e/y)

A_{def} Area of land deforested in hectares

L_C Carbon stock per unit area (above ground, below ground, soil carbon, litter and dead biomass), in tonnes of CO_2 per hectare

Under a generic CPA, baseline emissions are calculated as follows:

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{T3,y} + BE_{T4,y}$$ Equation (15)

Where

$BE_{T1,y}$ Baseline emissions for Type I consumers in year y (tCO_2)

$BE_{T2,,y}$ Baseline emissions for Type II consumers in year y (tCO_2)

$BE_{T3,y}$ Baseline emission for Type III consumers in year y (tCO_2)

$BE_{T4,y}$ Baseline emissions for Type IV consumers in year y (tCO_2)

For all Category 1 CPAs, all end-users will be metered to measure the electricity consumption ex-post.

Baseline emissions for Type III consumers are calculated as follows:

$$BE_{T3,y} = \sum_{w=1}^{P} \left(EC_{T3,w,y} \times EF_{CO2,T3}\right)$$ Equation (16)

Where

$BE_{T3,y}$ Baseline emission for Type III consumers in year y (tCO_2)

$EC_{T3,w,y}$ Metered annual electricity consumption of Type III consumer *w* in year y (MWh)

$EF_{CO2,T3}$ Baseline emissions factor for Type III consumers (tCO2/MWh)

P_y Number of Type III consumers in year y

w Type III consumer (x = 1, 2, 3, …)

Sample Calculation

For the purposes of ex-ante estimation of emissions reductions, the following assumptions are made:

SERVICE LEVEL	Share[44]	Consumption (kWh/year)
service level 1	26%	73
service level 2	31%	88
service level 3	32%	197
service level 4	11%	986

- A typical CPA could include 130,654 new grid connections, of which 20% would have had previous access to a fossil fuel mini-grid and 5% had previous access to a stand-alone diesel generator
- For consumers with no previous access, 89% will be Type I, with average consumption of 123 kWh/year (based on service levels 1-3), while 11% will be Type II (based on consumption > 500 kWh/year), with average consumption of 986 kWh/year (based on service level 4).
- Type III consumers will have average consumption of 197 kWh/year (based on service level 3).
- None of the consumers are Type IV.
- For type III consumers, the existing mini-grid is all fossil fuel-based, a temporary service (4-6 hrs/day), and between 15 and 35 kW

Type I consumers = 130,654 * 0.75 * 0.89 = 87,212
Type II consumers = 130,654 * 0.05 + 130,654 * 0.75 * 0.11 = 17,312
Type III consumers = 130,654 * 0.2 = 26,131

Baseline emissions would therefore be:

$BE_{T1,y}$ = 87,212 consumers * 0.123 MWh * 3.8 tCO_2/MWh = 40,293 tCO_2
$BE_{T2,y}$ = 17,312 consumers * 0.986 MWh * 1.0 tCO2/MWh = 17,060 tCO_2
$BE_{T3,y}$ = 26,131 consumers * 0.197 MWh * 1.3 tCO2/MWh = 6,695 tCO_2

Total baseline emissions are therefore 64,048 tCO_2. Project emissions would be:

PE_y = (32,913 MWh / (1 – 0.1)) * 0.9 tCO_2/MWh (as per default value from the methodology) = 32,913 tCO_2

[44] Service level share and consumption estimates based on information from ASER electrification plan for Kolda-Dagana-Mbour region and electrification plan for Matam-Ranerou-Bakel region.

For the purpose of the sample calculation leakage is assumed to be less than 5% of total project emissions and therefore negligible.

$LE_y = 0\ tCO_2$

Emission reductions are therefore:

$ER_y = 64{,}048\ tCO_2 – 32{,}913\ tCO_2 - tCO_2 = 31{,}135\ tCO_2$

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

For the proposed PoA, the submission of the monitoring plan delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

Therefore, this section is intentionally blank.

Data/Parameter	
Data unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

I.7.2. Sampling plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

I.7.3. Other elements of monitoring plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

SECTION J. Crediting period type and duration

The CPA has a renewable crediting period.
The length of the crediting period is 7 years and 0 months.

SECTION K. Eligibility criteria for inclusion of CPAs

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical boundary	Each CPA will be located within the physical/geographical boundary of the PoA as demonstrated by the geographical boundary of the CPA-DD.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA provided in CPA-DD
2	Start date	The CPA start dates shall not be before the start date of the PoA (07/06/2011). The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a payment receipt detailing real action, an invoice for equipment, a receipt from an end-user or technician serving as proof of installation, or signed contract.	Starting date for CPA-DD is after 07/06/2011, based on a receipt of installation or payment for the firs equipment installed under the CPA.
3	Crediting period	CPA crediting period shall be after the date of CPA inclusion and within the lifetime of the PoA (07/06/2011 to 06/06/2039) as demonstrated in the CPA-DD.	CPA starting date and crediting period (fixed or renewable) are specified in CPA DD section C.
4	ODA	For all CPAs, funding from Annex I Parties, if any, does not result in a diversion of ODA as evidenced through a statement on ODA.	Statement from Annex I Parties
5	Debundling	Each CPA will demonstrate that debundling does not apply as the CPA is micro-scale and applies the microscale threshold at the CDM Unit level.	Each connection, a CDM Unit, will result in less than or equal to 20ktCO_2e per annum as shown in the CPA-DD
6	Double counting	The CPAs of PoA “Senegal Rural Electrification Program” shall not result in double counting as evidenced through unique identifiers or such as GPS coordinates	A description of the unique identifier will be collected and unique references of the customer, along with adherence to the CME Manual as shown in the CPA-DD
7	Local stakeholders and environmental analysis	The Local Stakeholder Consultation and Environmental Impact Analysis have been conducted at the PoA level. Each CPA will take into consideration the comments from the Stakeholder Consultation and abide by the environmental regulations of the host country	All CPAs will show the stakeholder consultation and environmental analysis done at PoA level and adhere to the requirements stipulated at the PoA level
8	Target group and distribution mechanism	The CPA specifies the target group of the project unit/system and distribution mechanisms in the CPA-DD.	The target group for the grid extension CPAs will be more than 75% (by number) households, as opposed to institutions/ commercial sites. Ex-ante estimates of consumer numbers shown in CPA DD.

9	Sampling	Sampling design and calculation shall meet the requirement in the sampling standard as evidenced in the CPA-DD	The CPA-DD elaborates the sampling requirements and procedures for each relevant parameter (i.e. parameter, level at which is it sampled, sampling method, sample size, confidence/precision)
10	Microscale threshold	The CPAs shall adhere to the microscale threshold and result in emission reductions equivalent to or less than 20 ktCO2e emissions reductions at the CDM Unit level per annum.	The CPA results in emission reductions less than or equal to 20k tCO2e at the CDM Unit Level per annum as shown in the CPA-DD
11	Additionality	CPA shall be additional as per micro-scale additionality by being located in an LDC and resulting in less than or equal to 20k tCO_2e emission reductions at the CDM Unit level per annum.	The CPA is located in a LDC and results in emission reductions less than or equal to 20k tCO2e at the CDM Unit Level per annum (i
12	Technology	CPA will extend the national grid to new consumers and consumers supplied by a mini-grid prior to the implementation of the project. Equipment shall comply with applicable international standards or comparable national, regional or local standards/guidelines.	Consumer types and connections included in the CPA are tracked in the PoA database. The CPA monitoring database will track previous status from consumers prior to project implementation to identify which consumers were not connected to national/regional grid, or were supplied by fossil fuel individual energy system or mini grids. Technical standards specified by ASER in contracts with all concessionaires or other implementers.
13	Methodology	Each CPA will apply the CDM baseline and monitoring methodology AMS-III.BL Version 01.0, and adhere to all applicability conditions and other requirements of the methodology.	The CPA applies methodology AMS-III.BL Version 1.0 and adheres to the requirement of the methodology.

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Senegal Rural Electrification – Solar Home Systems

H.2. Reference number of generic CPA

CPA Category 3

H.3. Purpose and general description of generic CPA

A typical CPA consists of the installation of solar home systems in rural communities. CPAs will be differentiated by the time period covered under each CPA. In a generic CPA the CME and CPA Implementer are usually the same entity. The CPA Implementer will select and manage the distribution of technologies under Category 3 CPAs as well as oversee the data collection process for monitoring and verification.

The rural communities will receive access to electricity through the implementation of individual, renewable energy systems comprising fixed, stand-alone solar photovoltaic systems. A description of typical technologies to be employed will be provided in the specific CPA DD document, including all technical specifications required by the applied methodology The service levels for solar home system consumers in this CPA will be provided in the CPA DD (as in the table below).

Table 24. Typical technologies used for solar home systems

[insert table showing typical types of SHS kits, capacity, components, etc.]

Table 25. Service levels and typical capacity for solar home systems [revise as necessary for each CPA]

Service level	Capacity range (W_{peak})
SL1	<=50
SL2	>50-90
SL3	>90-180
SL4	>180

The CPA qualifies for the microscale project activity type Type I as the project activity at each CDM Unit applies renewable energy as their primary technology (solar photovoltaic) with less than 5 MW output capacity. The CPA is therefore a Type I CPA. The CPA is implemented entirely in and LDC and the size of each CDM Unit, defined as a single solar home system, is also limited to emission reductions of 20,000 tCO_2e or less per annum.

H.4. Technologies/measures

Target Group
Under CPA Category 3, the project activity targets households and SMEs/institutions in rural communities with no access to electricity, through the implementation of individual, renewable energy systems comprising fixed, stand-alone solar photovoltaic systems. The CPA also targets water pumping and public lighting consumers, regardless of their previous supply of electricity.

Technology
Under CPA Category 3, end-users who previously did not have access to power or were connected to an individual fossil fuel system, will receive access to electricity through the implementation of individual, renewable energy systems comprising fixed, stand-alone solar photovoltaic systems. Consumers that were previously connected to and individual fossil fuel systems may combine its use with the solar PV system, resulting on individual hybrid systems. A description of technologies/measures to be employed by under each specific Category 3 CPA will be provided in the specific CPA document, including all technical specifications required by the applied methodology.

CPA Boundary
With reference to the methodology, the project boundary includes the project renewable electricity generation systems, any project distribution (grid) systems, and the physical sites of the end-use

facilities served by the project activity. Hence, for a typical CPA the project boundary includes the households and all facilities to be electrified and the power generation units installed at those sites (i.e. the solar PV systems). The geographic boundary of a Category 3 CPAs is the country of Senegal. Category 3 CPAs will be differentiated registered users grouped by time of connection. No user will overlap in different Category 3 CPAs.

Record Keeping System

Category 3 CPAs utilize an electronic monitoring system to record the electricity generated by the solar home systems under the project activity. The record keeping system to prove adherence to the management system is detailed in Part I Section B of the PoA-DD.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

The approved methodology used is AMS III.BL "Integrated methodology for electrification of communities", Version 01.0[45]. This methodology also refers to the following:

- AMS-I.D. "Grid connected renewable electricity generation", Version 18.0[46].

Additionality for this category of CPA under the proposed PoA is demonstrated with reference to the "Methodological Tool: Demonstration of additionality of microscale project activities", Version 7.0[47].

I.2. Applicability of methodologies and standardized baselines

a) Demonstration of how the applicability conditions are met in accordance with the approved methodology and the PoA.

The table below lists each of the applicability conditions for the relevant approved methodology and explains how these are met by a typical CPA.

Table 26. Applicability conditions for solar home systems and AMS III.BL

Applicability Conditions (paragraph numbers from methodology)	Applicability to this CPA
(3) This methodology is applicable in situations where consumers that were not connected to a national/regional grid, prior to project implementation are supplied with electricity generated from the project activity. It is also applicable in situations where a fraction of consumers that were supplied with electricity from a fossil based individual energy system or fossil fuel based mini-grid prior to the implementation of the project, are supplied with electricity from the project activity (e.g. moving from carbon intensive mini-grid to less carbon intensive grid or mini grid).	Category 3 CPAs are implemented in ASER jurisdictions which include only communities in rural areas that do not have access to the national grid. Solar home systems are renewable energy generation that supplies individual households/users or groups of households with electricity.
(4) Electricity consumers may include households, commercial facilities such as shops, public services/buildings and small, medium and micro enterprises (SMMEs). Applications may include	Consumers may include all of these groups.

[45] https://cdm.unfccc.int/methodologies/DB/XJQ7APPRHQWLO6VSC3161I5Q8MCMNQ

[46] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[47] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v7.0.pdf/history_view

Applicability Conditions (paragraph numbers from methodology)	Applicability to this CPA
lighting, household electrical appliances (e.g. refrigerators, TV, radio), public lighting and water pumps. At least 75 per cent (by number) of the consumers connected by the project activity shall be households.	The type of end-user (i.e. household or SME/Institution) will be recorded at the time of connection. The CPA monitoring database will track the percentage of households versus SMEs/Institutions. If during monitoring it is found that the percentage of households (by number) under the CPA is less than 75%, SMEs/Institutions under the CPA will be removed from monitoring the monitoring period in question until the percentage of end-users (by number) is at least 75% households. This is further described in the monitoring plan.
(5) This methodology is applicable to electrification of a community of consumers which is achieved through one or more of the following technologies/measures: (a) New construction of individual energy systems (renewable or hybrid) such as roof-top solar photovoltaic systems or hybrid energy systems; (b) Rehabilitation (or refurbishment) of individual energy systems, mini-grid or hybrid energy system may be undertaken, if it can be demonstrated that the existing system(s) i) are not part of another CDM activity; ii) are non-operational and iii) require a substantial investment for them to be rehabilitated to or above the original electricity generation capacity. To demonstrate compliance with this condition, the project participants shall provide documentation that:(i) The existing system has not generated electricity, or that alternative fuels (e.g. kerosene) have been used, for at least six months prior to Project Design Document (PDD) or SSC-CPA-DD submittal; and (ii) Substantial investments are required to rehabilitate the existing systems (e.g. investments greater than half of the cost to install a new power generation system with the same electricity generation capacity); (c) Installation or extension of a mini-grid that distributes electricity generated from renewable energy systems or hybrid energy systems; (d) Hybridization of existing fossil fuel powered mini-grids using renewable energy systems; (e) Extension of a grid (national or regional) to supply new consumers as well as consumers currently connected to mini-grid.	This CPA is entirely new construction of individual renewable energy systems (i.e. (a) in the list).
(6) Project equipment shall comply with applicable international standards or comparable national, regional or local standards/guidelines and, when relevant, the PDD shall indicate the standard(s) applied for main project equipment.	All relevant national and international standards are specified by the CME in contracts with implementing agents and vendors for this CPA.
(7) For projects involving the installation of hydro power plants with reservoirs the requirements prescribed under AMS-I.D shall be followed.	Not applicable – no hydropower plants are included in this category of CPA
(8) Measures are limited to those that result in emission reductions of less than or equal to 20k tCO_2 equivalent at the CDM Unit Level annually.	The CPA will only utilise AMS III.BL for solar home systems. The total emission reductions under a CPA do not exceed 20k tCO_2e at the CDM Unit Level annually and will remain below this limit throughout the entire crediting period. This will be confirmed during monitoring.

b) Demonstration that the CPA qualifies as Type I, II, and/or III during every year of the crediting period in accordance with applicable provisions for project activity eligibility in the Project standard.

The CPA is a Type III activity, as it follows a Type III methodology. In terms of the size limit, the CPA must stay below the micro-scale threshold of 20k tCO_2 at the CDM Unit Level of annual emission reductions to utilise the additionality provisions in the "Methodological Tool: Demonstration of additionality of micro-scale project activities". The ex-ante estimate of total capacity for solar home systems and emission reduction is shown, along with the calculations, in section I.6.3. The actual installed capacity of each system will be recorded in the CME database, and the total emission reductions will be verified during each monitoring and verification period to ensure that it does not exceed these thresholds.

I.3. Application of multiple methodologies

The CPA applies a single methodology.

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

The project boundary and GHG sources are summarised and discussed below

Table 27. Sources and GHGs included in this CPA

Source		GHG	Included?	Justification/Explanation
Baseline	Fossil fuels for lighting and power generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available
Project activity	Fossil fuels for lighting and power generation	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available

With reference to the methodology, the project boundary includes the project renewable electricity generation systems, any project distribution (grid) systems, and the physical sites of the end-use facilities served by the project activity. Hence, for a typical CPA the project boundary includes the households and all facilities to be electrified and the power generation units installed at those sites (i.e. the solar PV systems).

Gases included in the project boundary for baseline emissions are carbon dioxide emissions from diesel generator units or fuel consumption. Project emissions from solar PV systems are zero.

Figure 6. Solar home systems: flow diagram for baseline scenario, showing project boundary (dashed line) and emissions sources

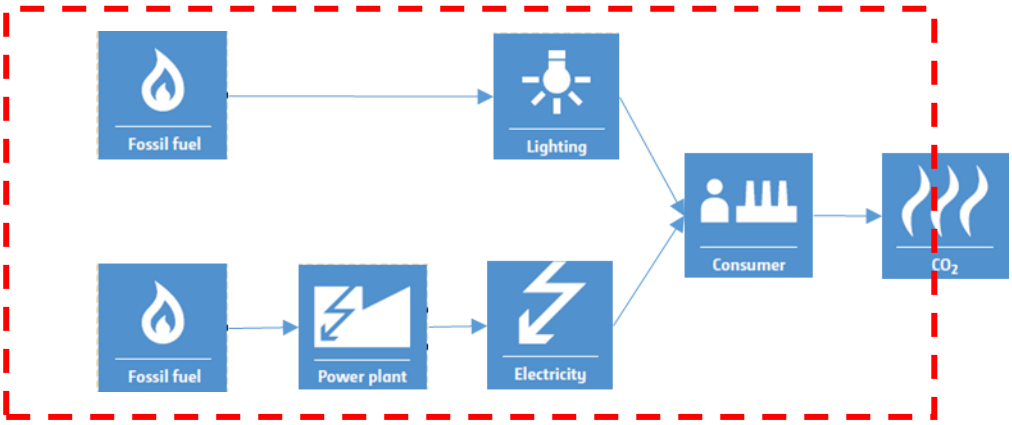
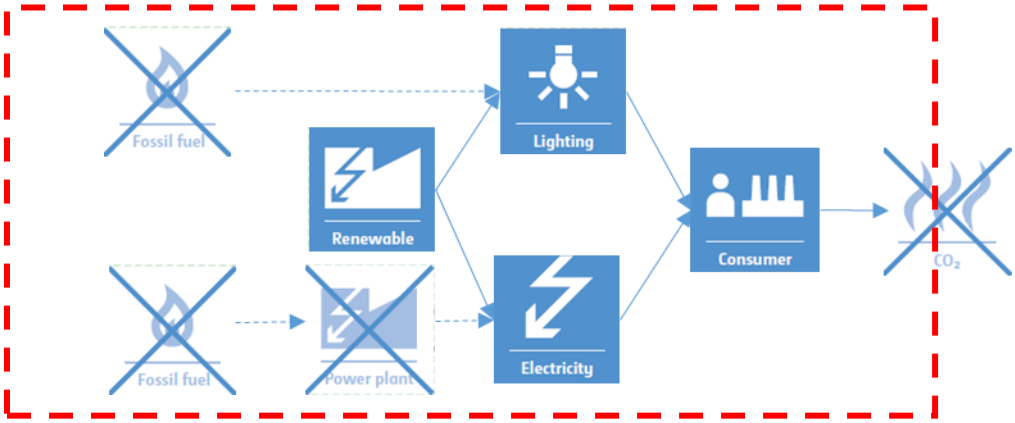


Figure 7. Solar home systems: flow diagram for project scenario, showing project boundary (dashed line) and emissions sources



I.5. Establishment and description of baseline scenario

According to the methodology, the baseline is related to the type of consumers served, as follows.

(a) Type I – consumers who were not connected to a national/regional grid or a mini-grid prior to the project implementation and who consume less than 500 kWh per year;

(b) Type II – includes two separate consumer groups (i) consumers that were previously supplied by a stand-alone fossil fuel power system such as diesel generators who consume less than 500 kWh[48], and (ii) consumers who use more than 500 kWh per year and either had no supply prior to the project or were previously supplied by a stand-alone fossil fuel power system such as diesel generators;

(c) Type III – consumers who were connected to a mini-grid system prior to the project activity;

(d) Type IV consumer category includes water pumping and public lighting consumers, regardless of their previous supply of electricity.

A typical CPA will only include Type I, Type II and Type IV consumers. In other words, solar home systems will not be provided to consumers who were already connected to a mini-grid system prior

[48] For consumers whose baseline technology can be identified as the operation of fossil fuel generator and can be documented.

to the project activity. The methodology states that the baseline scenario for Type I consumers is, "A combination of fuel based lighting and stand-alone fossil fuel generators", while the baseline scenario for Type II and Type IV consumers is stand-alone fossil fuel generation. As per the eligibility criteria, the CPA monitoring database will keep a record of the new connection types as well as consumer classification (technology used and consumption type) prior to project implementation.

As per the methodology, each CPA will provide an ex-ante estimate of the number of consumers that will fall into each group or type, based on business plans or other similar project documents. During project implementation, the exact number of consumers by type and project technology/measure shall be recorded as part of the monitoring plan during the first monitoring period.

The first step of the baseline scenario process will be to identify the consumers and present an ex-ante estimate of consumer numbers in the format below. For a typical Category 3 CPA, only the first column of the table is relevant:

Table 28. Format for reporting of consumer numbers by type and project technology/measure – Category 3 CPAs

	Project technology/measure		
Type	**Individual System**	**Mini-Grid**	**Grid Extension**
I		N/A	N/A
II		N/A	N/A
III	N/A	N/A	N/A
IV		N/A	N/A

The second step is to determine the consumption of each consumer type and sub-group. Based on the flow charts presented in the methodology (Figure 1 and Figure 2 of the methodology), the following options are relevant for Category 3 CPAs:

- Type I consumers may use metering, sample survey, or deemed consumption. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type II consumers may only use metering or sample survey. If their consumption is greater than 1000 kWh/year, however, they must use metering.
- Type IV consumer are only required to use metering if their consumption is greater than 1000 kWh/year. Below that consumption level, according to the methodology they may use metering, sample survey or deemed consumption.

Monitoring approaches by consumer type may also be reported in a table.

In all Category 3 CPAs, Type I consumers and Type IV consumers with consumption less than 1000 kWh/year will use deemed consumption (Option D in the methodology).

The third step is to determine baseline emissions, which is explained in detail in section I.6 below.

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

Baseline emissions are calculated from the sum of emissions from the relevant consumer groups. Because there will be no Type III consumers in the typical Category 3 CPA, baseline emissions will be as follows:

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{T4,y} \quad \text{Equation (1)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2)

$BE_{T1,y}$ = Baseline emission from Type I consumers in year y (tCO_2)

$BE_{T2,y}$ = Baseline emission from Type II consumers in year y (tCO_2)

$BE_{T4,y}$ = Baseline emission from Type IV consumers in year y (tCO_2)

For Type I consumers, baseline emissions are calculated as follows:

$$BE_{T1,y} = \sum_{x=1}^{N} \left(EC_{T1,x,y} \times EF_{CO2,T1} \right) \quad \text{Equation (2)}$$

Where:

$BE_{T1,y}$ = Baseline emission from Type I consumers in year y (tCO_2)

$EC_{T1,x,y}$ = Annual electricity consumption of Type I consumer x in year y (MWh)

$EF_{CO2,T1}$ =
- If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then:
  - For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh);
- If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then:
  - For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh);
  - For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and
  - For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh);
- If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)[49]

N_y = Number of Type I consumers in year y

x = Type I consumer (x = 1, 2, 3, …)

For Type II consumers, baseline emissions are calculated as follows:

$$BE_{T2,y} = \sum_{z=1}^{M} \left(EC_{T2,z,y} \times EF_{CO2,T2} \right) \quad \text{Equation (3)}$$

Where:

[49] Type I consumers are defined as having less than 500 kWh/year consumption at the start of the project activity. In the event that average electricity consumption of Type-I consumers monitored during the crediting period exceeds 500 kWh/year, they should be reclassified as Type II consumers at the renewable of the crediting period.

$BE_{T2,y}$ = Baseline emission from Type II consumers in year y (tCO_2)

$EC_{T2,z,y}$ = Annual electricity consumption of Type II consumer z in year y (MWh)

$EF_{CO2,T2}$ = Baseline emissions factor for Type II consumers (1.0 tCO_2/MWh)

M_y = Number of Type II consumers in year y

z = Type II consumer (z = 1, 2, 3, …)

For Type IV consumers, baseline emissions are calculated as follows:

$$BE_{T4,y} = \sum_{i=1}^{Q} \left(EC_{T4,i,y} \times EF_{CO2,T4} \right) \quad \text{Equation (4)}$$

Where:

$BE_{T4,y}$ = Baseline emission from Type IV consumers in year y (tCO_2)

$EC_{T4,i,y}$ = Annual electricity consumption of Type IV consumer i in year y (MWh)

$EF_{CO2,T4}$ = Baseline emissions factor for Type IV consumers (1.0 tCO_2/MWh).

Q_y = Number of Type IV consumers in year y

As per the methodology, consumption levels for each type of consumer are determined ex post using one of the following options (A, B, C or D) prescribed below, depending on the technology/measure being implemented at that consumer site:

Option A: Metering (standard electrical meter or pre-payment meter) – All consumer types may use metering. However, for any consumer with annual consumption greater than 1000 kWh, then Option A is mandatory.
Where pre-payment meters are used, consumption shall be determined from the billing records. The total electricity consumed for each consumer is the summation of the pre-paid electricity purchased during the monitoring period, which excludes the last purchase during the monitoring period and includes the last purchase of the previous monitoring period;

Option B. Sample survey (stratified random sampling) – All consumer types with expected annual consumption less than 1000 kWh may undertake a sample survey to determine the average consumption for specific consumer sub-groups (e.g. service levels, load limits, or other connection controls or sizes);

Option C. Distribution metering and consumer numbers – Only Type I consumers served by a mini-grid or grid connection may choose to estimate consumption levels from the total metered consumption of a community/consumer group, less the sum of consumption by other consumer types, divided by the number of operational connections, taking into account distribution losses;

Option D. Deemed consumption – as a special case, Type I, II and Type IV consumers that are served by an individual renewable energy systems may determine consumption based on the installed system capacity and an availability factor.

Consumption for Type II and Type IV with consumption greater than 1000 kWh/year will be determined using metering - Option A from the methodology.

Type III consumers (consumers who were connected to a mini-grid system prior to the project activity) are not considered under CPA Category 3.

Consumption for Type I consumers ($EC_{T1,x,y}$) as well as Type II consumers ($EC_{T2,x,y}$) and Type IV ($EC_{T4,l,y}$) consumers with consumption of less than 1000 kWh/year will be determined using Deemed Consumption - Option D from the methodology ("Calculate the annual average value for availability based on local site conditions and system characteristics"). For this option, RETScreen is used as a tool for the calculation. The table below shows the inputs for RETScreen other than climate data.

Table 29. RETScreen inputs used to calculate solar PV availability

Parameter	Value	Source
Solar tracking mode	Fixed	ASER Minimum Technical and Environmental Standards
Slope	15 ± 5 degrees	ASER Minimum Technical and Environmental Standards
Azimuth	0 (Due South)	ASER Minimum Technical and Environmental Standards
Type (e.g. mono-Si, poly-Si, a-Si)	Mono-Si or Poly-Si	ASER Minimum Technical and Environmental Standards
Control method	Clamped	ASER Minimum Technical and Environmental Standards

Note: Although RETScreen also requires capacity as an input, the capacity factor/availability does not vary with capacity. Operators may request ASER's permission to use thin film technology as well, which would have higher efficiency. Not including this technology is therefore conservative.

Because a typical CPA will cover the entire country (i.e. all of the concession areas and other projects), the representative location is 14:00° N 14:00° W (see PoA DD Part I, section A.2). A representative location for this is the RETScreen climate database is the town of Tambacounda (13.8 N, 13.7 W). The average daily horizontal irradiation at Tambacounda is 5.66 kWh/m^2-d, according to the RETScreen database. Based on these inputs, the minimum availability factor for solar home systems in Senegal, across the range of possible slopes, would be 15.0%, regardless of whether mono-Si or poly-Si was used.

Because energy production for solar home systems is all renewable, project emissions are considered zero (i.e. PE_y = 0). In addition, leakage need not be considered because energy generating equipment is not transferred from anther activity (i.e. LE_y = 0).

In the event the individual hybrid energy systems are installed, project emissions would need to be calculated as follows:

$$PE_{IS,y} = EG_{diesel,y} \times EF_{CO2,diesel} \qquad \text{Equation (51)}$$

Where:

$PE_{IS,y}$ = Project emissions from new or rehabilitated individual renewable or hybrid energy systems in year y (tCO_2)

$EG_{diesel,y}$ = Generation at individual systems from diesel in year y (MWh).

$EF_{CO2,diesel}$ = Emissions factor for diesel generation, based on the table below (tCO_2/MWh)

Where there are multiple hybrid energy systems, total project emissions would then be the sum of the emissions from all of the individual systems.

Table 30. Default emission factors for diesel generator systems (in kg CO_2e/kWh[(a)]) for three different levels of load factors[(b)]

Cases	Mini-grid with 24-hour service	i. Mini-grid with temporary service (4-6 hr/day); ii. Productive applications; iii. Water pumps	Mini-grid with storage
Load factors [%]	**25%**	**50%**	**100%**
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW	0.8	0.8	0.8

(a) A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories);

(b) Values derived from figures reported in RETScreen International's PV 2000 model retrieved from: <http://retscreen.net/>;

I.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{CO2,T1}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type 1 consumers
Source of data	Default emissions factor from methodology
Value(s) applied	• If $EC_{T1,x,y}$ is equal to or less than 0.055 MWh, then use a default value of 6.8 (tCO_2/MWh); • If $EC_{T1,x,y}$ is less than or equal to 0.250 MWh but greater than 0.055 MWh, then: ○ For the portion up to and including 0.055 MWh, use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh, use a default value of 1.3 (tCO_2/MWh); • If $EC_{T1,x,y}$ is greater than 0.250 MWh but less than or equal to 0.500 MWh, then: ○ For the portion up to and including 0.055 MWh use a default value of 6.8 (tCO_2/MWh); ○ For the portion greater than 0.055 MWh and less than 0.25 MWh/y use a default value of 1.3 (tCO_2/MWh); and ○ For the portion greater than 0.250 MWh use a default value of 1.0 (tCO_2/MWh); If $EC_{T1M,j,y}$ is greater than 0.500 MWh then use a default value of 1.0 (tCO_2/MWh) for the entire portion (i.e. default values of 1.3 (tCO_2/MWh) or 6.8 (tCO_2/MWh) are not eligible for any of the portions)
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	**$EF_{CO2,T2}$**
Data unit	tCO_2/MWh
Description	Emissions factor for Type II consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	$EF_{CO2,T4}$
Data unit	tCO_2/MWh
Description	Emissions factor for Type IV consumers
Source of data	Default emissions factor from methodology
Value(s) applied	1.0 tCO_2/MWh
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	**Solar PV availability**
Data unit	Percent
Description	Solar photovoltaic availability/capacity factor
Source of data	RETScreen (as per Option D2b of the methodology)
Value(s) applied	15.0%
Choice of data or Measurement methods and procedures	See table in section I.6.4 and explanation of climate data below the table
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	$EF_{CO2,diesel}$
Data unit	tCO_2/MWh
Description	Emissions factor for diesel generation
Source of data	Default emissions factor from methodology, as shown in section I.6.4
Value(s) applied	Varies by size and load factor, not used in ex-ante calculations
Choice of data or Measurement methods and procedures	N/A
Purpose of data	Calculation of project emissions
Additional comment	None

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

For the purposes of ex-ante estimation of emissions reductions, the following assumptions are made:

SERVICE LEVEL	Share[50]	Consumption (kWh/year)
service level 1	26%	66
service level 2	31%	85
service level 3	32%	230
service level 4	11%	526

[50] Service level share and consumption estimates based on information from ASER electrification plan for Kolda-Dagana-Mbour region and electrification plan for Matam-Ranerou-Bakel region as well as on RETSCreen analysis for Senegal.

- None of the solar home system installations are Type IV
- None of the solar home systems had prior access to a stand-alone diesel generator for electricity supply.
- 25% of solar home system installation have consumption > 500 kWh/year, and so are Type II consumers, with average consumption of 526 kWh/year (based on service level 4).
- 75% of the solar home installations have consumption < 500 kWh, and are Type I consumers, with average consumption of 132 kWh/year (based on service levels 1-3).
- A total of 111,100 installations are included in a typical CPA.
- The breakdown of 75/25 is determined based on the maximum allowable limit of SMEs and institutions to households as per the methodology.
- None of the individual systems is a hybrid system – they are all 100% renewable

Emission reductions for technologies/measures under AMS-III.BL Version 1 for a CPA Category 3 are calculated shown below. The equations and calculations for baseline emissions, project emissions, and leakage below will be applied to each Category 3 CPA under the PoA for each year of the crediting period. The sample calculation applies the equations to be used with sample values.

$$ER_y = BE_y - PE_y - LE_y$$ Equation (6)

Where

ER_y	Emission reductions in year *y* (tCO_2e/y)
BE_y	Baseline emission in year *y* (tCO_2e/y)
PE_y	Project emissions in year *y* (tCO_2e/y)
LE_y	Leakage emissions in year *y* (tCO_2e/y)

Under these assumptions, both PE_y and LE_y (project and leakage emissions) are zero.

Baseline emissions for Type I and Type II consumers would therefore be:

$BE_{T1,y}$ = (111,100 x 0.75) x 0.132 MWh x 3.59 tCO_2/MWh = 39,486 tCO_2
$BE_{T2,y}$ = (111,100 x 0.25) x 0.526 MWh x 1.0 tCO2/MWh = 14,609 tCO_2

Total baseline emissions are therefore 54,095 tCO_2. Because both project and leakage emissions are zero, emission reductions would also be 54,095 tCO_2.

I.7. Monitoring plan

I.7.4. Data and parameters to be monitored

For the proposed PoA, the submission of the monitoring plan delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

Therefore, this section is intentionally blank.

Data/Parameter	
Data unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

I.7.5. Sampling plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

I.7.6. Other elements of monitoring plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

SECTION J. Crediting period type and duration

The CPA has a renewable crediting period.
The length of the crediting period is 7 years and 0 months.

SECTION K. Eligibility criteria for inclusion of CPAs

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical boundary	Each CPA will be located within the physical/geographical boundary of the PoA as demonstrated by the geographical boundary of the CPA-DD.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA provided in CPA-DD

2	Start date	The CPA start dates shall not be before the start date of the PoA (07/06/2011). The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a payment receipt detailing real action, an invoice for equipment, a receipt from an end-user or technician serving as proof of installation, or signed contract.	Starting date for CPA-DD is after 07/06/2011, based on a receipt showing payment for equipment or services marking the beginning of real action of the CPA.
3	Crediting period	CPA crediting period shall be after the date of CPA inclusion and within the lifetime of the PoA (07/06/2011 to 06/06/2039) as demonstrated in the CPA-DD.	CPA starting date and crediting period (fixed or renewable) are specified in the CPA-DD.
4	ODA	For all CPAs, funding from Annex I Parties, if any, does not result in a diversion of ODA as evidenced through a statement on ODA.	Statement from Annex I Parties.
5	Debundling	Each CPA will demonstrate that debundling does not apply as the CPA is micro-scale and applies the microscale threshold at the CDM Unit level.	Each solar home system, a CDM Unit, will result in less than or equal to 20ktCO_2e per annum as shown in the CPA-DD
6	Double counting	The CPAs of PoA “Senegal Rural Electrification Program” shall not result in double counting as evidenced through unique identifiers, such as GPS coordinates	A description of the unique identifier will be collected and unique references of the customer, along with adherence to the CME Manual, as shown in the CPA-DD.
7	Local stakeholders and environmental analysis	The Local Stakeholder Consultation and Environmental Impact Analysis have been conducted at the PoA level. Each CPA will take into consideration the comments from the Stakeholder Consultation and abide by the environmental regulations of the host country	The CPA will adhere to the recommendations based on the stakeholder consultation and any requirements from the environmental analysis, done at the PoA level.
8	Target group	The CPA specifies the target group of the project unit/system in the CPA-DD.	The target group is described in the CPA-DD The target group will be =>75% (by number) households, as opposed to institutions/ commercial sites as shown in the CPA-DD.
9	Sampling	Sampling design and calculation shall meet the requirement in the sampling standard as evidenced in the CPA-DD	CPA-DD elaborates the sampling requirements and procedures for each relevant parameter (i.e. parameter, level at which is it sampled, sampling method, sample size, confidence/precision)

10	Microscale threshold	The CPAs shall adhere to the microscale threshold and result in emission reductions equivalent to or less than 20 ktCO2e emissions reductions at the CDM Unit level per annum.	The CPA results in emission reductions less than or equal to 20ktCO_2e at the CDM Unit Level per annum as shown in the CPA-DD
11	Additionality	Each CPA shall be additional as per micro-scale additionality by being located in an LDC and resulting in less than or equal to 20k tCO_2e emission reductions at the CDM Unit level per annum	The CPA is in an LDC and results in emission reductions less than or equal to 20ktCO_2e at the CDM Unit Level per annum .
12	Technology	CPA will distribute new renewable energy generating systems for electrification of a community(ies), and specifications of the systems are provided. Equipment shall comply with applicable international standards or comparable national, regional or local standards/guidelines.	Solar home systems, must meet the standards contained in the ASER "Minimal Technical & Environmental Standards", and any standards referred to in this document. The CPA monitoring database will track previous status from consumers prior to project implementation to identify which consumers were not connected to national/regional grid, or were supplied by fossil fuel individual energy system or mini grids.
13	Methodology	Each CPA will apply the CDM baseline and monitoring methodology AMS-III.BL Version 01.0, and adhere to all applicability conditions and other requirements of the methodology.	The CPA applies methodology AMS-III.BL Version 1.0 and adheres to the requirement of the methodology.

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Senegal Rural Electrification – Solar Lanterns

H.2. Reference number of generic CPA

CPA Category 4

H.3. Purpose and general description of generic CPA

A typical CPA consists of the distribution of solar-powered lanterns ("solar lanterns", hereafter) in rural communities. CPAs will be differentiated by the time period covered under each CPA. The CPA Implementer will select and manage the distribution of technologies under Category 4 CPAs as

well as oversee the data collection process for monitoring and verification, following the guidelines of the CME. The technologies used for the solar lanterns are shown below.

Table 31. Technologies used for solar lanterns [fill in]

[insert table showing relevant technical data.]

The CPA applies Type III small-scale methodology AMS-III.AR Version 5. The CPA is therefore a Type III CPA. The CPA also qualifies as a Type III microscale CPA. The CPA is implemented entirely in and LDC and the size of each CDM Unit, defined as a single lantern, is limited to emission reductions of 20,000 tCO_2e or less per annum.

H.4. Technologies/measures

Target Group
Under Category 4 CPAs, the project activity targets households and SMEs/institutions, who will receive a battery-charged LED or CFL based lighting system.

Technology
Under Category 4 CPAs, the end-users will receive or gain access to a renewable energy technology that provides lighting services, is battery charged, and runs on solar power. A description of technologies/measures to be employed under a specific Category 4 CPA will be provided in the specific CPA document including all technical specifications required by the applied methodologies.

Distribution Mechanism
Under Category 4 CPAs, project technologies will be distributed through direct sales to end-users or bulk sales to distributors and retailers. The distribution method chosen in the specific CPA will depend on which method is best suited to the project activity. Under this activity no free lanterns distributed and only sold lanterns will be considered in the specific CPA

CPA Boundary
CPAs under Category 4 have as project boundary the project lamps and the physical, geographical site of the renewable energy system. All project lamps that will be distributed or sold under the specific CPA are charged by renewable energy system.

The geographic boundary of a Category 4 CPA is the country of Mali.

Record Keeping System
CPAs under Category 4 utilize an electronic monitoring system to record the end-users who have purchased or received efficient lighting technologies. The record keeping system to prove adherence to the management system detailed in Section B in the Part I of the PoA.

CPAs under the PoA apply following methodology:

- AMS-III.AR Substituting fossil fuel based lighting with LED/CFL lighting systems Version 5

The CPA Implementer, CME, and various local partners work together to disseminate a range of eligible technologies to households and institutions within the CPA boundary. Carbon credit revenue through the sale of CERs is crucial to the sustainability of the programme.

The CPA Implementer adheres to the CME management system and provides the CME with information required to include the project activity under the PoA, and perform monitoring and verification of the activity.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

The approved methodology used is AMS-III.AR "Substituting fossil fuel based lighting with LED/CFL lighting systems", Version 05.0[51]. This methodology also refers to the following:

- AMS-I.D. "Grid connected renewable electricity generation", Version 18.0;[52];
- AMS-I.F. "Renewable electricity generation for captive use and mini-grid", Version 03.0[53];

Additionality for this category of CPA under the proposed PoA is demonstrated with reference to the *Tool 19 Demonstration of additionality of microscale project activities Version 0.8.0.*[54]

I.2. Applicability of methodologies and standardized baselines

a) Demonstration of how the applicability conditions are met in accordance with the approved methodology and the PoA.

The table below lists each of the applicability conditions for the relevant approved methodology and explains how these are met by this CPA.

Table 32. Applicability conditions for solar lanterns and AMS III. AR

Applicability Conditions	Applicability to this CPA
This methodology is applicable only to project lamps whose batteries are charged using one of the following options: [55] (a) Charged by renewable energy system (e.g. photovoltaic systems or mechanical systems such as wind battery chargers); (b) Charged by a standalone distributed generation system (e.g. a diesel generator set) or a mini-grid; (c) Charged by a grid that is connected to regional/national grid.	Category 4 CPAs are implemented in ASER jurisdictions which include only communities in rural areas that do not have access to the national grid. The lamps in this PoA will all be only solar charged - option (a). They will be supplied to households in areas where there is no access to electricity.
At a minimum project lamps shall be certified by their manufacturer to have a rated average operational life of at least: (a) 5,000 hours for Option 1, paragraph 17; (b) 10,000 hours for Option 2, paragraph 18.	ASER will only allow equipment that meets the Lighting Global Minimum Quality Standards (MQS) [56]. The MQS includes a requirement that luminous flux over 2000 hours shall not decline by more than 15%, which is equivalent to a 10,000 hour rated life. So the PoA uses option (b)
Rated average life is the life certified by the manufacturer or responsible vendor as being the time at which the lamp's initial light output will decline by no more than 30 per cent. In addition, for project	Only equipment that is tested and approved for Lighting Africa under the

[51] https://cdm.unfccc.int/methodologies/DB/4K7KI9GY79UEHUKF3140PCID64IXCV

[52] http://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[53] http://cdm.unfccc.int/methodologies/DB/9KJWQ1G0WEG6LKHX21MLPS8BQR7242

[54] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v8.pdf

[55] Project lamps may be charged by any of the listed options, however each individual project lamp shall be charged by only one of the charging options (for example 10,000 project lamps may be charged by photovoltaic (PV) systems and 10,000 may be charged by a grid, but none of the individual project lamps may be charged by both a grid and a PV system).

[56] http://www.lightingglobal.org/wp-content/uploads/2014/09/MQStandards_Jan2014_V4_3.pdf

lamps charged using Option 3(c) as provided for in paragraph 3 above, the manufacturer shall certify that the battery-charging-circuit efficiency of the project lamps, at the time of the purchase, is at least 50 per cent. For project lamps charged under option indicated in paragraph 3(b), if the mini-grid or distributed generation system is not entirely powered by renewable energy generation unit(s), the manufacturer shall certify that the project lamp's battery charging circuit efficiency, at the time of purchase, is at least 50 per cent.	MQS is permitted in the PoA, so this equipment is certified. All lamps in this PoA will be charged by solar (option a), so the other provisions do not apply.
Project lamps shall meet warranty requirements of the Lighting Global Minimum Quality Standard. The project lamps shall have a warranty of a minimum of one year from the time the end-user takes ownership or begins using the lamp. At a minimum, the warranty shall cover free replacement or repair of any failed lamps, batteries, and where applicable solar panels. The warranty shall be clearly communicated and supported through the supply chain and available to end-users of the project lamps during the warranty period. In a situation where the project lamps are distributed through intermediaries, the one-year warranty shall commence from the time that the project lamps are distributed to end-users. The full warranty terms shall be available in writing, in a regionally appropriate language and included with each unit.	All lamps have a one-year warranty covering free replacement or repair of any failed lamp, battery or solar panel. This is part of the MQS and will be presented with the lamps.
Project lamps shall meet or exceed the following minimum performance characteristics, which should be proven by third-party test results: (a) Light Output - luminous flux of 25 lumens or illuminance of 50 lux over an area ≥0.1 m2 when suspended at a distance of 0.75 meters or self-supported. The light output over a 2,000-hour lumen maintenance test should not decline by more than 15%; (b) Run Time and Battery Capacity - Daily Burn Time (DBT) shall meet the following requirements: (i) DBT shall be equal to or greater than 4 hours; For charging Option 3(a) with solar PV, the DBT is defined by the Solar Run Time for the project lamp (as determined per paragraph 9(g)) (ii) For other technologies in Option 3(a), the DBT is defined based on typical expected patterns of use. (iii) For charging Options 3(b) and 3(c): a. The maximum claimed DBT shall be less than or equal to the typical capabilities of the regional or local energy system at delivering reliable power sufficient for recharging; b. The autonomous (full battery) run-time of the project lamps shall be equal to or greater than 200 per cent of the DBT of the project lamps; c. The project lamp shall be fully recharged from a discharged state after eight hours of charging.	The PoA only allows equipment that meets the Lighting Global MQS. This includes (a) luminous flux decline of no more than 15% over 2000 hours. All equipment approved under the MQS undergoes independent testing, with results reported in an official specifications sheet that includes solar run time. ASER requires that only lamps with a rated solar run time of 4 hours or more will be included in the PoA. The distributors of the lamps will provide the relevant product certifications prior to the start of distribution
The project design document shall explain the proposed distribution method of the project lamps. It shall also explain how the proposed project activity shall: (a) Ensure that the replaced baseline lamps are those that directly consume fossil fuel. This can be done through documentation of the common practice of fuel usage for lighting in the project region (e.g. based on representative sample surveys, official data or peer reviewed literature) that demonstrates that fossil fuel is a commonly used fuel for lighting; (b) Encourage the consumers, targeted by the project activity, to use the project lamps and discourage hoarding; (c) Eliminate potential double counting of emission reductions that could occur, for example, if more than one entity (e.g. lamp manufacturers, suppliers of solar and/or battery equipment, etc.) claims credit for emission reductions for the project lamps. At a minimum, project lamps shall be marked as CDM project lamps; (d) Ensure compliance with prevailing regulations pertaining to the use and disposal of batteries.	(a) the baseline study for this concession area show the use of fuel based lighting (b) the lamps are not given to consumer for frees, so they must make a substantial investment in the lamps and would therefore use them rather than hoarding them. (c) all lamps will be marked as part of the PoA; the only other registered PoA in Senegal addressing lighting is managed by ASER – and does not cover solar CFL/LED lanterns - so these can be uniquely identified (d) the CPA entity will, at the time of lamp distribution, inform the consumers about the collection and disposal of batteries in an environmentally friendly manner and

	offer an option for replacement, collection and safe disposal of batteries to the users.
The project design document shall include the minimum requirements for the design specifications of project lamps including the following specifications: (a) Lamp wattage (in Watts) and luminous flux output (in lumens); (b) Rated lamp life (in hours); (c) Where applicable, the type and rated capacity of the renewable energy equipment used for battery-charging (in Watts); (d) Type (e.g. NiMH, Lead-Acid, Li-ion, Lithium-iron-phosphate, etc.), nominal voltage, and rated capacity of the batteries (in Ampere hours); (e) Type of charge controller (e.g. active or passive); (f) Autonomous time and DBT; (g) Solar Run Times(s) (SRT) for products with solar energy charging systems. If regional solar data are available, the maximum, minimum and average estimated SRT values for each month of a typical year shall be provided. If regional solar data are not available the standard solar day (5 kWh/m2) shall be used to estimate SRT; (h) Where applicable, the amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid); (i) Physical protection against environmental factors (e.g. rain, heat, insect ingress).	All equipment must meet the Lighting Global MQS. This covers (b) and (i). (c) and (h) are not applicable because the PoA lanterns will have built-in solar PV chargers. (f) is not applicable for solar charged lanterns, since SRT is used instead. ASER has specified minimum lamp output (a) , battery type and capacity (d), type of charge controller (e) and minimum solar run time (g) in the contract with distributors.
Measures are limited to those that result in emissions reductions of less than or equal to 20 $ktCO_2$ equivalent at the CDM Unit Level annually.	A typical CPA will have total emissions reductions less than or equal to 20k tCO_2e at the CDM Unit level.

b) Demonstration that the CPA qualifies as Type I, II, and/or III during every year of the crediting period in accordance with applicable provisions for project activity eligibility in the Project standard.

The CPA is a Type III technology. In terms of the size limit, the CPA must stay below the threshold of 20k tCO_2e per annum at the CDM Unit Level to utilise the Tool 19 on micro-scale additionality.

The actual emissions reductions will be verified during each monitoring and verification period to ensure that they do not exceed these thresholds.

I.3. Application of multiple methodologies

The CPA applies a single methodology.

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

The project boundary and GHG sources are summarised and discussed in this section for each technology.

Table 33. Sources and GHGs included in this CPA

Source		GHG	Included?	Justification/Explanation
Baseline	Fossil fuels for lighting	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions and limited data available
		N_2O	No	Minor source of emissions and limited data available
Proj	Fossil fuels for lighting	CO_2	No	No emissions from solar charging

Source		GHG	Included?	Justification/Explanation
		CH_4	No	No emissions from solar charging
		N_2O	No	No emissions from solar charging

The methodology states that:

> "the project boundary includes the project lamps as well as the charging systems, as follows: (a) If the project lamps are charged by a renewable energy system, then the project boundary includes the physical, geographical site of the renewable energy system; (b) If the project lamps are charged by a mini-grid or a distributed generation system, then the project boundary includes the physical, geographical site of the mini-grid or distributed generation system; (c)If the project lamps are charged by a regional or national grid, then the project boundary includes the physical, geographical site of the regional/national grid."

Because the lanterns in this PoA are all solar charged, the project boundary includes the lamps, charging systems, and renewable energy systems used for charging.

Gases included in the project boundary for baseline emissions are carbon dioxide emissions from fuel consumption. Project emissions from solar lanterns and their solar PV charging systems are zero.

Figure 8. Solar lanterns: flow diagram for baseline scenario, showing project boundary (dashed line) and emissions sources

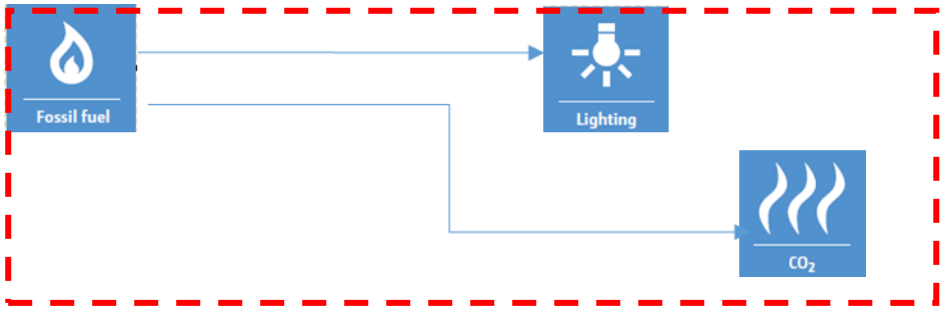
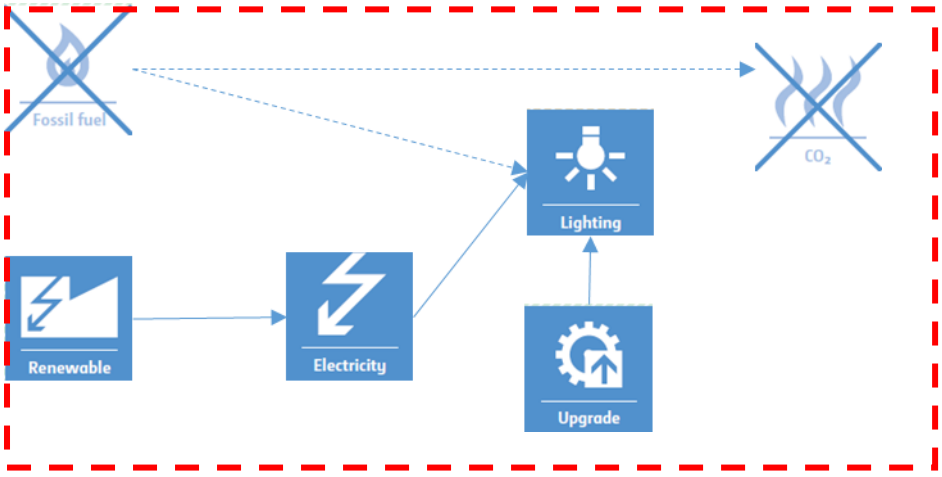


Figure 9. Solar lanterns: flow diagram for project scenario, showing project boundary (dashed line) and emissions sources



I.5. Establishment and description of baseline scenario

Small-scale methodology AMS-III.AR, Version 05.0. covers activities that replace portable fossil fuel based lamps with battery charged LED or CFL based lighting systems in residential and/or non-residential applications.

Following paragraph 1 of the methodology, the baseline scenario is the use of portable fossil fuel based lamps. Following paragraph 16 of the methodology, Option 2 is used to determine the baseline. Project lamps are assumed to operate up to seven years after distribution to end-users.

Following paragraph 18 of the methodology, baseline emissions are derived from a fixed baseline emission factors for project lamps. The default values for baseline emissions factor from paragraphs 20 and 21 of the methodology are used for this CPA.

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

Based on AMS.III.AR, Version 05.0. the following methodological choices are applied for a typical SSC-CPA:

Technology/Measure
The type of Project Lamps system under a typical CPA will be only charged by a renewable energy system.

Lamp effective useful life
For a typical CPA, Option 2 for lamp life is chosen, "project lamps are assumed to operate for seven years after Project lamp distribution to end-users, and thus emission reductions can be claimed for up to seven years per Project lamp, if all the following conditions are met." The lifetime is justified in section i.9 above.

Baseline Emissions
To calculate the baseline emissions, the CPA will use the default parameters in equations 2 and 3 for baseline emissions (equation numbers shown below are numbered for this document, and so differ from the starting number in the methodology).

$$DV = FUR \times O \times U \times EF \div 1000 \times LF \times n \times NTG \qquad \text{Equation (1)}$$

Where:

DV	=	Lamp Emission Factor (default is 0.092 t CO_2e per project lamp)
FUR	=	Fuel use rate (0.03 liters/hour)
O	=	Utilization rate (3.5 hours/day)
U	=	Annual utilization (365 days/year)
EF	=	Fuel emissions factor (2.4 $kgCO_2$/liter)
LF	=	Leakage factor (1.0)
N	=	Number of fuel-based lamps replaced per project lamp (1.0)
NTG	=	Net-to-gross adjustment factor (1.0)

Baseline emissions are calculated per equation (3):

$$BE_y = DV \times GF_y \times DB_y \qquad \text{Equation (2)}$$

Where:

BE_y = Baseline emissions per project lamp in year *y* (t CO_2e)

GF_y = Grid Factor in year *y*,
- Equal to 1.0 when charging option defined in paragraph 3(a) is used;[57]
- Equal to 1.0 if the project activity is for off-grid households/communities (defined as no grid access or less than 12 hours grid availability per day on an annual average basis);
- Otherwise it is equal to 1.0 minus (the fraction of time grid is available to the target households and communities/users in the region of project activity)

DB_y = Dynamic Baseline Factor (change in baseline fuel, fuel use rate, and/or utilization during crediting period) in year *y*. Calculated as either:
Option 1: default of 1.0 in the absence of relevant information;
Option 2: value of 1.0+*FFg* where *FFg* is the documented national growth rate of kerosene fuel use in lighting from the preceding years (use the most recent available data for a three or five years average (fraction))

The Grid Factor (GF_y) is 1.0, because only renewable charging is used (option 3a in paragraph 3 of the methodology). The Dynamic Baseline Factor is also 1.0 (option 1).

Project Emissions
Since only renewable energy charge is used, there are no project emissions associated with the PoA or this CPA ($PE_y = 0$).

Monitoring
The monitoring for the CPA, based on the choice of the lamp effective useful life, will include ex-post monitoring surveys will be done to determine the percentage of project lamps distributed to end users that are operating and in service in year y.

Annual emission reductions are calculated as:

$$ER_{y=} \sum_{i,j} N_{i,j} \times \left(BE_{y,i} - PE_{y,i,j}\right) \times \left(OF_{y,i,j}\right) \qquad \text{Equation (3)}$$

Where:

[57] Based on the demonstration that fossil fuel is the predominant practice for lighting as per paragraph 8(a), it is assumed all baseline emissions are from the consumption of fossil fuel burning for lighting.

ER_y = Emission reductions in year *y* (t CO_2e)

$N_{i,j}$ = Number of project lamps distributed to end users of type *i* with charging method *j*

$OF_{y,i,j}$ = Percentage of project lamps distributed to end users that are operating and in service in year *y*, for each lamp type *i* and charging method *j.* Assumed to be equal to 100 per cent for years 1, 2 and 3, and equal to the value determined in paragraph 30 of the methodology, for years 4, 5, 6 and 7[58]

[58] The years refer to the operational years of project lamps (e.g. for project lamps distributed in year 3 of the crediting period years 1, 2 and 3 relate to the years 3, 4 and 5 of the crediting period and so forth).

I.6.2. Data and parameters fixed ex ante

Data/Parameter	DV
Data unit	tCO_2e per lamp
Description	Lamp emission factor
Source of data	Default value from the methodology
Value(s) applied	0.092
Choice of data or Measurement methods and procedures	This is specified in the methodology where no additional local values are justified from the components of the calculation shown in equation 2 of the methodology
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	FUR
Data unit	L/hour
Description	Fuel Use Rate
Source of data	AMS-III.AR Version 5
Value(s) applied	0.03
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	O
Data unit	Hours/day
Description	Utilization Rate
Source of data	AMS-III.AR Version 5
Value(s) applied	3.5
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	U
Data unit	Days/Year
Description	Annual Utilization
Source of data	AMS-III.AR Version 5
Value(s) applied	365
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	EF
Data unit	$kgCO_2$/liter
Description	Fuel Emissions Factor
Source of data	AMS-III.AR Version 5
Value(s) applied	2.4
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	n
Data unit	-
Description	Number of fuel-based lamps replaced per project lamp
Source of data	AMS-III.AR Version 5
Value(s) applied	1
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	GF_y
Data unit	-
Description	Grid Factor in year y
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or Measurement methods and procedures	Because all charging is from renewable energy, this default factor is specified in the methodology
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	LF
Data unit	-
Description	Leakage Factor
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of leakage
Additional comment	None

Data/Parameter	NTG
Data unit	-
Description	Net-to-gross adjustment factor
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or Measurement methods and procedures	Methodology default value
Purpose of data	Calculation of baseline emissions
Additional comment	None

Data/Parameter	DB_y
Data unit	-
Description	Dynamic baseline factor in Year y
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or Measurement methods and procedures	This is the default from the methodology where there is no documented evidence showing the growth rates of kerosene fuel used for lighting
Purpose of data	Calculation of baseline emissions
Additional comment	None

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

The emission reductions generated per project lamp are:

$DV = FUR * O * U * EF / 1000 * LF * n * NTG$ Equation 4
$= 0.03$ L/hr * 3.5 hr/day * 365 day/yr * 2.4 $kgCO_2/L$ / 1000 * 1 * 1 * 1
$= 0.092\ tCO_2$

$BE_y = DV * GF_y * DB_y$ Equation 5
$= 0.092\ tCO_2 * 1.0 * 1.0$
$= 0.092\ tCO_2$

Annual emission reductions for year 1 of the crediting period are:

$ER_y = \Sigma_{i,j} N_{i,j} * BE_{y,i} * OF_{y,i,j}$ Equation 6
= [Volume of Lamps] * 0.092 tCO_2 * [Operating Fraction]
= [Emission Reductions] tCO_2

Sample Calculation

For the purposes of ex-ante calculations of emissions reductions, the following assumptions apply:
- The CPA would distribute 60,000 solar lanterns
- The average operating fraction of all lamps in a given year is 90%[59]

Emission reductions would be:

$ER_y = 60{,}000$ lamp x 0.092 tCO_2/lamp x 0.9 = 4,968 tCO_2

[59] For Option 2, the lamps are assumed to be 100% operational in years 1 to 3 and then this value if expected to fall each year thereafter. The average of 90% is used here solely for the purposes of estimating ex-ante emissions.

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

For the proposed PoA, the submission of the monitoring plan delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

Therefore, this section is intentionally blank.

Data/Parameter	
Data unit	
Description	
Source of data	
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	
QA/QC procedures	
Purpose of data	
Additional comment	

I.7.2. Sampling plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

I.7.3. Other elements of monitoring plan

For the proposed PoA, the submission of the monitoring plan is delayed and submitted either at any time prior to the submission of request for issuance for the first monitoring period, or together with the request for issuance for the first monitoring period.

There is no additional background information available at this time.

SECTION J. Crediting period type and duration

The CPA has a fixed crediting period.
The length of the crediting period is 10 years and 0 months.

SECTION K. Eligibility criteria for inclusion of CPAs

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion

1	Geographical boundary	Each CPA will be located within the physical/geographical boundary of the PoA as demonstrated by the geographical boundary of the CPA-DD.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA provided in CPA DD
2	Start date	The CPA start dates shall not be before the start date of the PoA (07/06/2011). The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a payment receipt detailing real action, an invoice for equipment, a receipt from an end-user or technician serving as proof of installation, or signed contract.	Starting date for CPA-DD is after 07/06/2011, based on the date of the invoice between ASER and a supplier of technologies under the CPA
3	Crediting period	CPA crediting period shall be after the date of CPA inclusion and within the lifetime of the PoA (07/06/2011 to 06/06/2039) as demonstrated in the CPA-DD.	CPA starting date and crediting period (fixed or renewable) are specified in CPA-DD
4	ODA	For all CPAs, funding from Annex I Parties, if any, does not result in a diversion of ODA as evidenced through a statement on ODA.	Statement from Annex I Parties
5	Debundling	Each CPA will demonstrate that debundling does not apply as the CPA is micro-scale and applies the microscale threshold at the CDM Unit level.	Each solar lamp, a CDM Unit, will result in less than or equal to 20k tCO_2e per annum as shown in the CPA-DD
6	Double counting	The CPAs of PoA “Senegal Rural Electrification Program” shall not result in double counting as evidenced through unique identifiers, such as GPS coordinates	A description of the unique identifier on the solar lanterns and unique references of the customer, along with adherence to the CME Manual, as shown in the CPA-DD.
7	Local stakeholders and environmental analysis	The Local Stakeholder Consultation and Environmental Impact Analysis have been conducted at the PoA level. Each CPA will take into consideration the comments from the Stakeholder Consultation and abide by the environmental regulations of the host country	The CPA will adhere to the recommendations based on the stakeholder consultation and any requirements from the environmental analysis, done at the PoA level.
8	Target group	The CPA specifies the target group of the project unit/system in the CPA-DD.	The target group for solar lanterns is both residential and non-residential applications.
9	Sampling	Sampling design and calculation shall meet the requirement in the sampling standard as evidenced in the CPA-DD	CPA-DDelaborates the sampling requirements and procedures for each relevant parameter (i.e. parameter, level at which is it sampled, sampling method, sample size, confidence/precision)

10	Microscale threshold	The CPAs shall adhere to the microscale threshold and result in emission reductions equivalent to or less than 20 ktCO2e emissions reductions at the CDM Unit level per annum.	The CPA results in emission reductions less than or equal to 20ktCO_2e at the CDM Unit Level per annum as shown in section the CPA-DD
11	Additionality	CPA shall be additional as per micro-scale additionality by being located in an LDC and resulting in less than or equal to 20k tCO_2e emission reductions at the CDM Unit level per annum.	The CPA is located in an LCD and results in emission reductions less than or equal to 20ktCO_2e at the CDM Unit Level per annum.
12	Technology	Each CPA covers solar powered CFL or LED lighting systems to provide energy for lighting previously supplied through kerosene or other fossil fuels. Project lamps under each Type B CPA will be charged through a solar panel or mechanical system. The lamp battery will be lithium--ion, with a passive charge controller. The project lamps will be certified by their manufacturer to have a rated operational life of at least 10,000 hours. The light output of the lamps will be at least 25 lumens or illuminance of 50 lux over an area greater than 0.1 m2. The DBT of the lamps will be equal to or greater than 4 hours. The lamps in the CPA comply with international or comparable national/regional/local standards/ guidelines, and only equipment that is tested and approved for Lighting Africa under the Lighting Global Minimum Quality Standards (MQS) is permitted under the CPA.	All CPAs will distribute only solar charged lanterns. Rated operational life of the lamps must be certified by their manufacturer. The CPA monitoring database will track the lantern model to support/demonstrate that the CPA only will involve solar powered lanterns or lanterns charged through mechanical systems. All lanterns distributed under the CPA will be required to meet the Lighting Global Minimum Quality Standards (MQS).
13	Distribution	Each CPA will use one or multiple of the following methods for distribution of appliances implemented under the CPA: 1. Direct sale/service to end--users 2. Bulk sales to distributors who sell on to the end user 3. Distribution to the end--user by an organization receiving the products/measures from the CME	The CPA describes the distribution method in the CPA-DD

14	Methodology	Each CPA will apply the CDM baseline and monitoring methodology AMS III.AR: Version 5.0, and adhere to all applicability conditions and other requirements of the methodology.	The CPA applies methodology AMS III.AR: Version 5.0 and adheres to the requirement of the methodology.

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

Coordinating/managing entity and/or project participants	☒ Coordinating/managing entity ☐ Project participant
Organization name	Agence Senegalaise d'Electrification Rurale (ASER)
Country	Senegal
Address	Ex Camp Lat-Dior, BP 11131, Dakar
Telephone	+221 33 849 47 17
Fax	+221 33 849 47 20
E-mail	ofsarr@aser.sn
Website	
Contact person	Mr. Ousmane Fall Sarr, Director of Studies and Information Systems

Coordinating/managing entity and/or project participants	☐ Coordinating/managing entity ☒ Project participant
Organization name	International Bank for Reconstruction and Development (IBRD) as trustee of the Carbon Initiative for Development (Ci-Dev)
Country	United States
Address	1818 H St NW, 20433 Washington DC
Telephone	+1 202 458 4416
Fax	+1 202 522 7432
E-mail	ibrd-carbonfinance@worldbank.org
Website	
Contact person	Mr. Jose Andreu, Manager

Appendix 2. Affirmation regarding public funding

The public funding available for the financing of the rural electrification plan and concessionaires will not purchase any GHG emission reductions generated by the proposed PoA.

Appendix 3. Applicability of methodologies and standardized baselines

The applicability of methodologies is described in Part I, section B and in the generic CPAs. No additional information is provided here.

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

No additional information provided here.

Appendix 5. Further background information on monitoring plan

No additional information provided here.

Appendix 6. Summary report of comments received from local stakeholders

No additional information provided here.

Appendix 7. Summary of post-registration changes

Not applicable

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Document information

Version	*Date*	*Description*
08.1	28 June 2017	Revision to: • Remove a duplicated instruction; • Make editorial improvement.
08.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for programmes of activities" and with the PDD and CPA-DD forms; • Make editorial improvement.
07.0	25 May 2017	Revision to: • Ensure consistency with the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN) (version 01.0); • Incorporate the "Programme design document form for small-scale CDM programmes of activities" (CDM-SSC-PoA-DD-FORM); • Make editorial improvement.

Version	*Date*	*Description*
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: • Include provisions related to choice of start date of PoA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Add exception for generic CPA where technology is under positive lists; • Make editorial improvement.
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revision to: • 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)); • Include provisions related to standardized baselines; • 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; • Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6; • Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM; • Make editorial improvement.
03.0	3 December 2012	EB 70 Revision to reflect changes to the *Guideline: Completing the programme design document form for CDM programmes of activities* (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.

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