CDM-SSCWG46-A03

Draft Small-scale Methodology

AMS-I.L: Electrification of rural communities using renewable energy

Version 02.0

Sectoral scope(s): 01

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The recommended revision of "AMS-I.L.: Electrification of rural communities using renewable energy" is based on the request for revision "SSC_715: Electrification of rural communities using renewable energy to allow increased flexibility to determine system availability factor for solar PV systems".

2. Purpose

2. The purpose of the recommended revision of the "AMS-I.L.: Electrification of rural communities using renewable energy" is to allow flexibility to determine system availability factor for solar PV systems using the software such as "RETScreen Clean Energy Project Analysis Software".

3. Key issues and proposed solutions

3. The methodology proposes a global default value of 12 per cent for availability factor of solar photovoltaic (PV) electricity systems for calculating the net amount of renewable electricity delivered to all the consumers connected to the project renewable electricity generation system(s). The availability factor for a solar PV electricity system depends on the amount of sunlight in specific countries and locations, the orientation of the system, the solar technology as well as the proper maintenance of the system. The literature in different countries shows that availability factors in the field are typically 15 per cent to 21 per cent. Use of a lower default availability factor as against location specific value has direct impact on emission reduction potential from these systems and might also impact the economics of project implementation based on expected carbon revenues.

4. Considering this, in order to provide more flexibility for project developers to calculate the location specific availability factor for the systems installed, the revision proposes the following three options:

   (a) Assume a default value of 12 per cent availability; or

   (b) Calculate the availability based on availability of data for required parameters using RETScreen or a similar internationally recognised tool for renewable energy analysis; or

   (c) Manufacture specified guaranteed value based on location of its installation and system model/performance details.

4. Impacts

5. The increased options for determination of availability factor of solar PV electricity systems allow project proponents flexibility to choose the one based on data availability that is required to calculate the site/location specific system availability factor, which ultimately has direct impact of emission reduction potential.

5. Subsequent work and timelines

6. The methodology is recommended by the SSC WG for consideration by the Board at its eighty-first meeting. No further work is envisaged.

6. Recommendations to the Board

7. The SSC WG recommends that the Board adopt this final draft revised methodology, to be made effective at the time of the Board's approval.

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1. Introduction

1. The following table describes the key elements of the methodology.

Table 1. Methodology key elements

Typical project(s)	Communities which did not have electricity prior to project implementation are supplied with electricity from renewable based systems (e.g. solar home systems, renewable mini grid)
Type of GHG emissions mitigation action	Renewable energy Displacement of fossil fuel use

2. Scope, applicability and entry into force

2.1. Scope

2. This methodology is applicable to electrification of a community achieved through the installation of renewable electricity generation systems that displace fossil fuel use, such as in fuel-based lighting systems, stand-alone power generators, and fossil fuel based mini-grids. The two categories of applicable project activities are:

   (a) Implementation of individual, renewable energy systems such as roof top solar photovoltaic systems;

   (b) Installation or extension of an isolated mini-grid which distributes electricity generated only from renewable energy systems.

2.2. Applicability

3. This methodology is applicable to electrification of a community achieved through the installation of renewable electricity generation systems that displace fossil fuel use, such as in fuel-based lighting systems, stand-alone power generators, and fossil fuel based mini-grids. The two categories of applicable project activities are:

   (a) Implementation of individual, renewable energy systems such as roof top solar photovoltaic systems;

   (b) Installation or extension of an isolated mini-grid which distributes electricity generated only from renewable energy systems.

4. This methodology is applicable to:

   (a) ~~New construction of (~~Greenfield~~)~~ individual, renewable energy system projects or mini-grid activities; and/or

   (b) Rehabilitation (or refurbishment) of individual, renewable energy systems if it can be demonstrated that the baseline system(s) are not part of another CDM activity and are non-operational and require a substantial investment[1] for them to be

[1] On-going or deferred maintenance is not eligible under this ~~(See definition of rehabilitation provided in paragraph 15(c) of this document)~~.

rehabilitated to or above the original electricity generation capacity. Options for demonstrating compliance with this condition include providing 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 component programme activity design document ~~CDM-SSC-~~(CPA-DD) submittal; and/or

(ii) Substantial investments are required to rehabilitate the existing systems, e.g. investments greater than half of the cost to install a new system with the same electricity generation capacity.

5. 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 from the project activity. It is also applicable to situations where a fraction of consumers that are supplied with electricity from a fossil fuel based mini-grid prior to the implementation of the project are now supplied with electricity from the project activity.

6. At least 75 per cent (by number) of the consumers connected to the project renewable electricity generation system(s) shall be households.

7. Project equipment shall comply with applicable international standards[2] or comparable national, regional or local standards/guidelines and the ~~Project Design Document (~~PDD~~)~~ or CPA-DD shall indicate the standard(s) applied.

8. The methodology is applicable to renewable electricity generation systems intended for permanent installation and is not applicable to portable systems, such as portable electricity generating systems or LED lanterns. The aggregate installed capacity of the renewable energy generating systems shall not exceed 15 MW.

9. For projects involving the installation of hydro power plants with reservoirs the requirements prescribed under "AMS-I.D: Grid connected renewable electricity generation" shall be followed.

2.3. Entry into force

10. The date of entry into force is the date of the publication of the EB 81 meeting report on 28 November 2014.

3. Normative references

11. Project participants shall apply the "General guidelines for SSC CDM methodologies", the "Guidelines on the demonstration of additionality of small-scale project activities" and the "General guidance on leakage in biomass project activities" (attachment C to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> mutatis mutandis.

[2] For example IEC 62124 PV stand-alone systems, design verification or another PVGAP recommended standard to verify system design and performance of stand-alone photovoltaic systems including functionality, the battery autonomy and solar fraction.

12. This methodology is originally based on the proposed small-scale methodology "NM-073: Electrification of rural communities using renewable energy" which was jointly proposed by The World Bank, UK Department for International Development (DFID) and Pöyry Management Consulting (Sweden). The methodology is revised based on: (i) "NM-092: Electrification and energization of off-grid areas using renewable energy" proposed by NIRAS A/S in cooperation with KfW and the revision request "SSC_702 Revision of AMS-I.L to further clarify monitoring requirements and baseline calculations for mini-grid system" proposed by Randall Spalding-Fecher.

13. This methodology also refers to the latest approved version of the following approved methodology:

    (a) "AMS-I.D: Grid connected renewable electricity generation";

    (b) "AMS-I.F: Renewable electricity generation for captive use and mini-grid".

4. Definitions

14. The definitions contained in the Glossary of CDM terms shall apply.

15. For the purpose of this methodology, the following definitions shall apply:

    (a) **Renewable mini-grid system** - small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all electricity generating units connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid;

    (b) **Individual, renewable electricity generation system** - renewable-based electricity generation system that supplies electricity to a single consumer (e.g. a home) and that are not interconnected with other facilities or generation systems, i.e. stand-alone systems;

    (c) **Rehabilitation (or refurbishment**) - Investment to restore existing individual, renewable electricity generation systems that are not generating electricity in their current condition. This may involve repairs, renovations or replacement of broken, missing or worn out equipment, but specifically excludes actions only involving on-going or deferred maintenance. The primary objective of rehabilitation or refurbishment is to restore the performance of the system. Rehabilitation may also lead to increase in efficiency performance of individual, renewable electricity generation systems;

    (d) **Consumer(s)** - they are end-user(s)/facility(ies) that may include households; public buildings; and/or small, medium and micro enterprises (SMMEs). Electricity uses may include interior lighting, street lighting, refrigeration, or agricultural water pumps.

5. Baseline methodology

5.1. Project boundary

16. The spatial extent of the project boundary includes the project renewable electricity generation systems, any project distribution (grid) systems, and the physical sites of the consumers served by the project activity.

17. Two parameters are required to be known to determine the baseline:

    (a) The amount of renewable electricity utilized by the consumers served by the project renewable electricity generation systems;

    (b) The number of consumers supplied with renewable electricity by the project activity.

18. The following are the baseline emission factors for each tranche of annual amount of renewable electricity consumed per consumer during the crediting period:

    (a) For the first 55 kWh of renewable electricity consumed by each consumer the baseline emission factor is 6.8 (t CO_2/MWh);

    (b) For the facility consumption more than 55 kWh but equal to or less than 250 kWh, the baseline emission factor is 1.3 (t CO_2/MWh) for the tranche between 55 and 250 kWh;

    (c) For the facility consumption beyond 250 kWh, the baseline emission factor is 1.0 (t CO_2/MWh) for the tranche beyond 250 kWh.

5.2. Baseline emission

5.2.1. ~~calculations for new construction~~ Greenfield and/or rehabilitation of individual renewable generation systems

19. Baseline emissions for the entire project activity are calculated as:

$$BE_y = BE_{55,y} + BE_{250,y} + BE_{250\ plus,y} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2)
$BE_{55,y}$	=	Aggregate baseline emissions for consumers that consumed equal to or less than 55 kWh of renewable electricity from project renewable electricity systems in year *y* (t CO_2)
$BE_{250,y}$	=	Aggregate baseline emissions for consumers that consumed more than 55 kWh but equal to or less than 250 kWh of renewable electricity from project renewable electricity systems in year *y* (t CO_2)
$BE_{250\ plus,y}$	=	Aggregate baseline emissions for consumers that consumed more than 250 kWh of renewable electricity from project renewable electricity systems in year *y* (t CO_2)

20. For consumers that consumed equal to or less than 55 kWh, baseline emissions are calculated as:

$$BE_{55,y} = \sum_{x}^{N} EG_{x,y} \times EF_{CO2,55}$$ Equation (2)

Where:

$EG_{x,y}$ = Electricity delivered by project renewable electricity generation system to consumer *x*, where the electricity delivered to that facility is equal to or less than 55 KWh in year *y* (MWh)

$EF_{CO2,55}$ = 6.8 (t CO_2/MWh)

x = Consumer supplied with renewable electricity from operating project renewable electricity generation systems consuming equal to or less than 55 kWh in year *y*

N = Number of consumers in the project activity consuming equal to or less than 55 kWh/year

21. For consumers that consumed more than 55 kWh but equal to or less than 250 kWh, baseline emissions are calculated as:

$$BE_{250,y} = \sum_{z}^{M} \left(\left(EG_{z,y} - 0.055 \right) \times EF_{CO2,250} + C \right)$$ Equation (3)

Where:

$EG_{z,y}$ = Electricity delivered by project renewable electricity generation system to consumer *z* in year *y*, where the electricity delivered to the facility is more than 55 kWh but equal to or less than 250 kWh in year *y* (MWh)

$EF_{CO2,250}$ = 1.3 (t CO_2/MWh)

Z = Consumer supplied with renewable electricity from operating project renewable electricity generation systems consuming more than 55 kWh but equal to or less than 250 kWh in year *y*

C = 0.374 (t CO_2), a constant calculated as (0.055 MWh x 6.8 t CO_2/MWh)

M = Number of facilities in the project activity consuming more than 55 kWh but equal to or less than 250 kWh/year

22. For facilities that consumed more than 250 kWh baseline emissions are calculated as:

$$BE_{250\ plus,y} = \sum_{w}^{P} \left(\left(EG_{w,y} - 0.250 \right) \times EF_{CO2,250\ plus} + D \right)$$ Equation (4)

Where:

$EG_{w,y}$	=	Electricity delivered by project renewable electricity generation system to consumer *w* in year *y* such that the electricity delivered to the facility is more than 250 kWh in year *y* (MWh)
$EF_{CO2,250\ plus}$	=	1.0 (t CO_2/MWh)
w	=	Consumer supplied with renewable electricity from operating project renewable electricity generation systems consuming more than 250 kWh in year *y*
D	=	0.6275 (t CO_2), a constant calculated as (0.055 MWh x 6.8 t CO_2/MWh + 0.195 MWh x 1.3 t CO_2/MWh)
P	=	Number of consumers in the project activity consuming more than 250 kWh/year

5.2.2. ~~Baseline emission calculations for new construction~~ Greenfield or expansion of renewable mini-grid systems

23. An ex ante census of project electricity consumers are intended to be supplied with electricity from the project renewable mini-grid shall be carried out to document the physical location of each consumer and the anticipated annual electricity consumption of each consumer. As an option, the anticipated annual electricity consumption of individual consumer may be established based on the type of connection or payment arrangement provided (e.g. load limited, fee for service based connection). The consumers should be categorised as either households (Type I consumers) or non-households[3] (Type II consumers). Electricity consumption of each Type I consumer that is expected to consume more than 1,000 kWh per year and each Type II consumer shall be individually metered. Type I consumers whose consumption is required to be individually metered are called Type I-M consumers and Type I consumers whose consumption is not required to be individually metered are called as Type I-NM facilities.

24. Baseline emissions are the sum of emissions associated with:

    (a) Consumers that will be connected to the new or expanded mini-grid but were not connected to any existing grids prior to the project activity; these are defined as new consumers (either Type I and Type II consumers);

    (b) Consumers that will be connected to the new or expanded mini-grid but were connected to an existing grid prior to the project activity; these are defined as existing consumers (for existing consumers, whether they are Type I and Type II consumers is not relevant).

25. Baseline emissions are the sum of emissions associated with new consumers (Type I and Type II consumers) and existing consumers are calculated as follows:

$$BE_y = BE_{T1,y} + BE_{T2,y} + BE_{exist,y} \quad \text{Equation (5)}$$

[3] These include commercial consumers; small, medium and micro enterprises (SMMEs); public institutions; street lighting and small scale industrial consumers as well as agricultural facilities (such as irrigation pump sets).

Where:

BE_y = Baseline emissions in year *y* (t CO_2)

$BE_{T1,y}$ = Baseline emissions for Type I consumers in year *y* (t CO_2)

$BE_{T2,y}$ = Baseline emissions for Type II consumers in year *y* (t CO_2)

$BE_{exist,y}$ = Baseline emissions of existing consumers i.e. baseline emissions from displacement of electricity from an existing mini-grid (t CO_2) $BE_{exist,y} = 0$, if there are no existing consumers

26. Baseline emissions of existing consumers are calculated as follows:

$$BE_{exist,y} = ED_{exist,y} \times EF_{mgrid} \quad \text{Equation (6)}$$

Where:

$ED_{exist,y}$ = Total electricity delivered to existing consumers ($N_{exist,y}$) (MWh)

EF_{mgrid} = Baseline emissions factor for the mini-grid (t CO_2).

For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, emission factor can be determined per the procedure provided in "AMS-I.F: Renewable electricity generation for captive use and mini-grid".

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"

27. The following two approaches can be used to estimate baseline emissions associated with new Type I and Type II consumers.

(a) **Approach 1**. Detailed calculations based on tranches of electricity consumption;

(b) **Approach 2**. Simplified calculation based on average electricity consumption per consumer.

5.2.2.1. Approach 1. ~~Baseline emissions determination of new Type I and Type II consumers~~ Detailed calculations based on tranches of electricity consumption

28. With this approach, baseline emissions of Type II consumers, $BE_{T2,y}$ are calculated as follows:

$$BE_{T2,y} = \sum_{i}^{N_y} EC_{T2,i,y} \times EF_{CO2,T2} \quad \text{Equation (7)}$$

Where:

$BE_{T2,y}$ = Baseline emissions for Type II consumers in year *y* (t CO_2)

$EC_{T2,i,y}$ = Metered annual electricity consumption of Type II consumer *i* in year *y* (MWh)

$EF_{CO2,T2}$ = 1.0 (t CO_2/MWh)

N_y = Number of Type II consumers in year *y*

29. Baseline emissions from Type I consumers, $BE_{T1,y}$ are calculated as a function of total electricity consumed by all the Type I consumers and a baseline emission factor chosen based on the average annual electricity consumption of all Type I consumers.

$$BE_{T1,y} = \left(\left[EC_{T1NM,y} \times NM_y\right] \times EF_{CO2,T1,NM}\right) + \left(\left[EC_{T1M,y} \times M_y\right] \times EF_{CO2,T1M}\right) \quad \text{Equation (8)}$$

$$EC_{T1NM,y} = \frac{\left(EC_{tot\_T1NM,y}\right)}{NM_y} \quad \text{Equation (9)}$$

$$EC_{T1M,y} = \frac{\left(\sum_j^M EC_{T1M,j,y}\right)}{M_y} \quad \text{Equation (10)}$$

$$EC_{tot\_T1NM,y} = \left[\left(ED_{tot,y} - ED_{exist,y}\right) \times \left(1 - TL_p\right)\right] - \sum_i^N EC_{T2,i,y} - \sum_j^M EC_{T1,M,j,y} \quad \text{Equation (11)}$$

Where:

$BE_{T1,y}$ = Baseline emissions for Type I consumers in year *y* (t CO_2)

$EC_{T1NM,y}$ = Average annual electricity consumption of all Type I-NM consumers in year *y* (MWh)

$EC_{T1M,y}$ = Average annual electricity consumption of all Type I-M consumers in year *y* (MWh)

$EC_{T1M,j,y}$ = Annual electricity consumption of Type I-M consumer *j* in year *y* (MWh)

NM_y = Number of Type I-NM consumers in year *y*

M_y = Number of Type I-M consumers in year *y*

$EF_{CO2,T1,NM}$ = (a) If $EC_{T1NM,y}$ is equal to or less than 0.055 MWh/y, then use a default value of 6.8 (t CO_2/MWh);

(b) If $EC_{T1NM,y}$ is less than or equal to 0.250 MWh/y but more than 0.055 MWh/y, then:

(i) For the portion up to and including 0.055 MWh/y, use a default value of 6.8 (t CO_2/MWh);

(ii) For the portion greater than 0.055 MWh/y, use a default value of 1.3 (t CO_2/MWh);

(c) If $EC_{T1NM,y}$ is greater than 0.250 MWh/y but less than or equal to 0.500 MWh/y, then:

(i) For the portion up to and including 0.055 MWh/y use a default value of 6.8 (t CO_2/MWh);

(ii) For the portion greater than 0.055 MWh/y and less than 0.25 MWh/y use a default value of 1.3 (t CO_2/MWh);

(iii) For the portion greater than 0.25 MWh/y use a default value of 1.0 (t CO_2/MWh);

(d) If $EC_{T1NM,y}$ is greater than 0.500 MWh/y, then use a default value of 1.0 (t CO_2/MWh) for the entire portion i.e. default values of 1.3 (t CO_2/MWh) or 6.8 (t CO_2/MWh) are not eligible for any of the portions

$EF_{CO2,T1M}$ = (a) If $EC_{T1M,y}$ is equal to or less than 0.055 MWh/y, then use a default value of 6.8 (t CO_2/MWh);

(b) If $EC_{T1M,y}$ is less than or equal to 0.250 MWh/y but greater than 0.055 MWh/y, then:

(i) For the portion up to and including 0.055 MWh/y, use a default value of 6.8 (t CO_2/MWh);

(ii) For the portion greater than 0.055 MWh/y, use a default value of 1.3 (t CO_2/MWh);

(c) If $EC_{T1M,y}$ is greater than 0.250 MWh/y but less than or equal to 0.500 MWh/y, then:

(i) For the portion up to and including 0.055 MWh/y use a default value of 6.8 (t CO_2/MWh);

(ii) For the portion greater than 0.055 MWh/y and less than 0.25 MWh/y use a default value of 1.3 (t CO_2/MWh); and

(iii) For the portion greater than 0.25 MWh/y use a default value of 1.0 (t CO_2/MWh);

(d) If $EC_{T1M,y}$ is greater than 0.500 MWh/y 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 (t CO_2/MWh) are not eligible for any of the portions

$EC_{tot\_T1NM,y}$ = Total electricity delivered to the community of all Type I-NM consumers, net of transmission and distribution losses (MWh)

$ED_{tot,y}$ = Total electricity delivered to the community of all Type I, Type-II and existing consumers (MWh)

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

5.2.2.2. Approach 2. ~~Baseline emissions determination of new Type I and Type II consumers~~ Simplified calculation based on average electricity consumption per consumer

30. With this approach, baseline emissions of Type-I and Type-II consumers, are calculated as follows:

$$BE_{T1,y} + BE_{T2,y} = \left(ED_{tot,y} - ED_{exist,y}\right) \times \left(1 - TL_p\right) \times EF_{CO2,tot} \quad \text{Equation (12)}$$

Where:

$EF_{CO2,tot}$ = 1.0 (t CO_2/MWh)

5.3. Project emissions

31. Project emissions are considered zero (i.e. PE_y =0) except in the cases below where method indicated in the most recent version of "AMS-I.D: Grid connected renewable electricity generation" is applied to calculate project emissions.

(a) Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);

(b) Emissions from water reservoirs of hydro power plants.

5.4. Leakage

32. If the energy generating equipment is transferred from another activity leakage is to be considered.

5.5. Emission reductions

33. Emission reductions on annual basis (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (13)}$$

Where:

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

BE_y = Baseline Emissions in year *y* (t CO_2/y)

PE_y = Project emissions in year *y* (t CO_2/y)

LE_y = Leakage emissions in year *y* (t CO_2/y)

6. Monitoring methodology

6.1. ~~Monitoring in the case of~~ Individual, renewable electricity generation system

34. Net annual amount of renewable electricity supplied to a facility is monitored as below:

(a) **Option 1**. Measure the net amount of renewable electricity delivered to each consumer connected to the project renewable electricity generation system(s). Such measurements shall be made continuously and recorded at least on a monthly basis;

(b) **Option 2**. Calculate the net amount of renewable electricity delivered to all the consumers connected to the project renewable electricity generation system(s) as the installed capacity of the project renewable electricity generation systems times annual average value for availability.[4] This option can only be applied to project activities involving installation or rehabilitation of individual, renewable energy systems and only for consumers (facilities) associated with those systems whose installed capacity is equal to or less than 1.0 kW. For solar photovoltaic electricity systems, the annual average value for availability can be obtained through following options[5]:

(i) **Option 2a.** Assume a conservative default value of twelve per cent (12 per cent) for the annual average value for availability[6] ~~for solar photovoltaic electricity systems.~~

(ii) **Option 2b.** Calculate the annual average value for availability based on local site conditions and system characteristics. "RETScreen® International Photovoltaic Project Model" included in the "RETScreen Clean Energy Project Analysis Software"[7] as below:

a. Complete the "Energy Model and Solar Resource & System Load" worksheet;

b. For the cells where "user inputs" are required and where online databases are provided (e.g. weather database), the latter may be used as sources for the input to the cells;

c. If the annual solar radiation[8] (MWh/m^2/year) in the sites of the project activity or the component project activity vary significantly (i.e. greater than +/-10% variation) then:

[4] This assumes that all of the renewable energy that is produced will be consumed by the facility.

[5] Availability factors for other renewable energy systems may be proposed following the procedures for request for revision of small-scale CDM methodologies.

[6] For example a 15 Wp Solar Home System would deliver 15.77 kWh annually (0.015 x 8760 x 0.12).

[7] Publicly available at <http://www.retscreen.net/ang/home.php>. Other similar software may be proposed for inclusion following the procedures for a revision of a methodology.

[8] If the solar radiation values are available for each month it may be annualized by taking the average for 12 months.

i. Perform the calculation for the site receiving the least amount of annual solar radiation; or

ii. Perform the calculation for a representative selection of sites and take the weighted average value;

d. If there is more than one type of project electricity generation system i.e. the system characteristics of the project systems differ, then perform the calculations separately for each type of system and take the weighted average value. The following parameters may be considered for defining the system characteristics:

i. The system is a mini-grid or off-grid or water pumping system;

ii. System is with or without battery backup;

iii. System includes or excludes inverters;

iv. Type of solar panel when more than one type of solar panel is used (e.g. monocrystalline silicon, polycrystalline silicon and thin films);

v. Type of tracking device when more than one type of solar tracking devices are used (i.e. fixed, one-axis, two-axis, azimuth);

vi. Type of control method, orientation and slope (i.e. maximum power point tracker and clamped control methods, degrees above horizontal for the slope, azimuth of solar panel in degrees from due South).

vii. Assume a value of 10 per cent loss for the miscellaneous losses;

(iii) **Option 2c**. Source the annual average value for availability from the project feasibility report (e.g. provided by the manufacturer/supplier of the system) when it includes the calculations for estimating the output from the system (i.e. weather data used, system characteristics and losses assumed are described).

35. When option 2 in paragraph 34 above is applied, the number of operating project renewable electricity generation systems is determined on a sample basis either annually choosing 90/10 confidence/precision or biennially choosing 95/10 confidence/precision for the sample size estimation following the requirements under "Standard on sampling and surveys for CDM project activities and PoAs". This monitored value determines N/M/P (number of consumers) in equations (2), (3) and (4). Renewable electricity generation systems can be counted as operating only if they can be shown to be able to produce electricity by means of one of the following:

(a) The manufacturer's warranty; or

(b) Regular maintenance arrangement (e.g. with suppliers/distributors/implementers); or

(c) Showing that the systems are procured following the standards/guidelines (local/national/international) to ensure that the systems are of adequate quality and provide the required performance; or

(d) By direct monitoring of systems, if necessary on sample basis.

36. In the absence of this demonstration, the system capacity shall be de-rated following manufacturers guidelines or as per relevant international standards/guidelines.

37. Both monitoring options 1 and 2 in paragraph 34 can be used within the same project activity provided that:

(a) A procedure that ensures no double counting of emissions reductions has been implemented;

(b) Option 2 is applied to all systems with a capacity for renewable electricity generation is equal to or less than 1.0 kW.

6.2. ~~Monitoring in the case new construction~~ Greenfield or expansion of renewable mini-grid systems

38. The metering of all the relevant parameters shall be per the guidance indicated below. The applicable requirements (e.g. calibration) for monitoring plan specified in the "General guidelines for SSC CDM methodologies" are an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participant.

Data / Parameter Table 1.

Data / Parameter:	**$ED_{tot,y}$**
Data unit:	MWh/y
Description:	Electricity delivered to consumers from the grid/mini-grid system
Measurement procedures (if any):	An electricity meter shall be installed as part of the project activity to measure total gross electricity supplied to all connected consumers (new and existing) from the project renewable electricity generation system. For new mini-grid construction, the metering can be at the mini-grid plant itself. For mini-gird extension, this can be at the substation from which the electrification project is supplied
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	**$EC_{T2,i,y}$**
Data unit:	MWh/y
Description:	Electricity metered at Type II consumer *i*

Measurement procedures (if any):	Measurements are undertaken using electricity meters at the consumer electricity service entrance
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**$EC_{T1M,j,y}$**
Data unit:	MWh/y
Description:	Electricity metered at Type I-M consumer
Measurement procedures (if any):	Measurements are undertaken using electricity meters at the facility electricity service entrance
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	**$ED_{exist,y}$**
Data unit:	MWh/y
Description:	Total electricity delivered in year *y* to the existing consumers
Measurement procedures (if any):	Measurements are undertaken using electricity meters. The measurement should be taken at the nearest pre-existing substation from which the electrification project is supplied
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	**Proportion of N_y, NM_y, $N_{exist,y}$ and M_y having access to mini-grid**
Data unit:	-
Description:	Check for continued access to electricity
Measurement procedures (if any):	Annual/biennial checks that mini-grid connections are still working, done with a census or a statistically significant sample of consumers. Use 90/10 and 95/10 precision for annual and biennial checks, respectively
Monitoring frequency:	Annual/biennial
Any comment:	-

7. Project activity under a programme of activities

39. The methodology is applicable to a programme of activities; no additional leakage estimations are necessary other than that indicated under leakage section above. Both - Option 1 and Option 2 ~~in~~ under paragraph 34 for monitoring can be used for monitoring within one component project activity of a programme of activity and within the same

rural community provided that the requirements specified for the use of each option are followed during the crediting period in a consistent manner.

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Document information

Version	*Date*	*Description*
03.0	7 November 2014	SSC WG 46, Annex 3 To be considered by the Board at EB 81. The revision is in response to SSC_715, allows increased flexibility to determine system availability factor for solar PV systems.
02.0	1 June 2014	EB 79, Annex 15 The revision clarifies the baseline procedure and monitoring requirements for renewable based mini-grid, removes the requirement related to high efficiency lighting and consolidates elements from SSC-NM092 to broaden the applicability of AMS-I.L covering rehabilitation of renewable energy systems.
01.0	2 March 2012	EB 66, Annex 53 Initial adoption.

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