

CDM-MP88-A11

Draft Small-scale Methodology

AMS-III.AW.: Electrification of rural communities by grid extension

Version 02.0

Sectoral scope(s): 02

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United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 111th meeting (EB 111), considered the concept note “Improving clarity and consistency of methodological products” and requested the secretariat and the Methodologies Panel (MP) to:
 - (a) Recommend a new methodological tool containing a repository of data/parameters that are common among different methodologies; and
 - (b) Update the default values in methodologies that are found to be not conservative in accordance with the latest science.
2. The Board at its 113th meeting (EB113) approved the “TOOL33: Default values for common parameters” (hereinafter referred as TOOL33). TOOL33 contains default values for of (a) carbon dioxide (CO₂) emission factors for diesel generator systems used for off-grid power generation purposes and (b) CO₂ emission factor for kerosene usage by households and communities for lighting purposes.
3. Previously, values for above-mentioned parameters were included in a specific methodology for example, values for CO₂ emission factors for diesel generator system were contained in “AMS-I.F.: Renewable electricity generation for captive use and mini-grid” (hereinafter referred as AMS-I.F.) and values for CO₂ emission factor for kerosene usage was included in “AMS-I.L.: Electrification of rural communities using renewable energy”.

2. Purpose

4. The proposed revision introduces reference to TOOL33 for using a default value of CO₂ emission factor for diesel generator systems used for off-grid power generation purposes and minor editorial improvements and removes reference to AMS-I.F..

3. Key issues and proposed solutions

5. The proposed revision refers to TOOL33 that contains recently updated default values for CO₂ emission factors for diesel generator systems used for off-grid power generation purposes.

4. Impacts

6. The proposed default values as contained in TOOL33 will enhance the reliability of emission reductions estimates as they are based on recent studies and literature and are conservative when compared to the current values.

5. Subsequent work and timelines

7. The MP, at its 88th meeting, agreed to seek public inputs on the draft revised methodology, and any input will be discussed with the MP and forwarded to the Board for its consideration.

6. Recommendations to the Board

8. The MP recommends that the Board adopt this draft 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)	Rural communities which were not connected to a grid prior to project implementation are supplied with electricity by connection to a national or regional grid
Type of GHG emissions mitigation action	Renewable energy: Displacement of electricity that would be provided by more-GHG-intensive means

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises electrification of a rural community through extension of a national grid/regional grid (grid hereafter). The electricity distributed by the project activity displaces fossil fuel that would have been used in the absence of the project activity.

2.2. Applicability

3. The applicability is limited to households and users¹ that do not have access to a grid.
4. Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99 per cent %² in total electricity generation in the grid of that host country in each year during the crediting period.
5. Cross border electricity export and import by the host country is quantifiable, and the data on import/export is available to the project developer.
6. The project does not involve construction of new electricity generation plants/units, but involves the extension of the existing power distribution network in the host country.

¹ It may include households, public buildings, small medium and micro enterprises (SMMEs), and electricity uses may include of interior or street lighting, refrigeration, agricultural water pumps.

² The purpose of keeping this threshold stringent is to simplify project emission calculations associated with incremental demand due to the project implementation in the grid and avoid complexity of calculating emissions from the operation of marginal power plants in the system required to cover the project activity demand. The concept of operating margin and build margin in the **TOOL07** is to estimate baseline emissions and thus it would not be conservative to use the same concept in this methodology for project emissions. The project proponents are however encouraged to submit a request for revision of the methodology to include an alternative threshold or to exclude thresholds altogether with adequate provisions to determine project emissions.

7. The project does not displace existing renewable based mini-grid electricity.³ To ensure compliance with this condition, existing renewable based mini-grid system and their service area shall be identified, and it is confirmed that the project does not provide electricity to the area serviced by the renewable based existing mini-grid system.
8. To avoid possible double counting of emission reduction claims from electricity generation companies, transmission companies, distribution companies, either all relevant parties are listed as participants to the project activity, or the project developer shall obtain a written consent from other relevant entities stating voluntary release of their right to develop CDM project activity and to claim emission reductions from the same electrification project activity. End users of the electricity distributed as a result of project activity are not eligible to apply this methodology to claim emission reductions from consumption of electricity distributed by the project activity.
9. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually.

2.3. Entry into force

10. The date of entry into force is the date of the publication of the EB ## meeting report on ## Month 2022.

2.4. Applicability of sectoral scopes

11. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 02 is mandatory.

3. Normative references

12. Project participants shall apply the “General guidelines for SSC CDM methodologies”, the “TOOL21: Demonstration of additionality of small-scale project activities” and the “TOOL22: Leakage in biomass small-scale project activities”.
13. This methodology is based on the proposed small-scale methodology “NM068: Rural electrification by extension of existing low carbon intensive electricity distribution network” which was submitted by Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
14. This methodology also refers to the latest approved versions of the following methodologies, tools and standard ~~tools and methodologies mutatis mutandis~~:
 - (a) ~~“AMS I.F.: Renewable electricity generation for captive use and mini-grid” (hereinafter referred to as “AMS I.F.”);~~
 - (b) “AM0045: Grid connection of isolated electricity systems” (hereinafter referred to as AM0045);
 - (c) “TOOL07: Tool to calculate the emission factor for an electricity system” (hereinafter referred to as TOOL07);

³ Displacement of standalone/facility scale renewable energy systems (e.g. solar PV system) is not excluded.

- (d) “TOOL09: Determining the baseline efficiency of thermal or electric energy generation systems” (hereinafter referred to as TOOL09);
- (e) “TOOL33: Default values for common parameters” (hereinafter referred as TOOL33);
- (f) “Standard for sampling and surveys for CDM project activities and programme of activities”.

4. Definitions

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

5. Baseline methodology

5.1. Project boundary

- 16. The spatial extent of the project boundary encompasses the following:
 - (a) 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 electricity system⁴ to which the CDM project is being connected to;
 - (b) The physical sites of the households, public services and other facilities that are supplied with electricity by the project activity (i.e. project region).

5.2. Baseline

- 17. The energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.
- 18. The emission baseline emissions based on the fuel consumed to generate equivalent quantity of electricity distributed by the project activity is are calculated as follows:

$$BE_{CO_2,y} = \sum_i ED_{i,y} \times EF_{CO_2} \quad \text{Equation (1)}$$

Where:

- $BE_{CO_2,y}$ = Emissions in the baseline in year y , t CO₂e/yr
- EF_{CO_2} = CO₂ emission factor, t CO₂e/MWh
- \sum_i = The sum of the group of project regions
- $ED_{i,y}$ = Electricity distributed by the extended electricity distribution network to the project region i in year y , MWh/yr

- 19. A default emission factor value for 100 per cent loading shall be used for EF_{CO_2} as provided under Table 1 of TOOL 33 of 0.8 t CO₂e/MWh may be used for EF_{CO_2} if it is confirmed that

⁴ Refer to the most recent version of the TOOL07 for the definition of electricity system.

the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region. The project participant proponent may, with adequate justification use a higher emissions factor from Table 1 of TOOL33. Table 2I.F.1 under category "AMS I.F."

20. In case where the project replaces electricity from renewable sources, the default emission factor used in paragraph 19 above of 0.8 t CO₂e/MWh must shall be adjusted taking into account the renewable electricity replaced by the project activity.
21. The following procedure is used to adjust the emission factor:

$$EF_{CO_2,adjust,y} = (1 - \beta) \times 0.8 EF_{CO_2,y} \quad \text{Equation (2)}$$

$$\beta = EG_{renewable,y} / \sum_i ED_{i,y} \quad \text{Equation (3)}$$

Where:

$EF_{CO_2,adjust,y}$	=	Adjusted CO ₂ emission factor, t CO ₂ e/MWh
β	=	Discount fraction for electricity distributed by the project activity that replaces renewable electricity generated by the existing stand-alone renewable power generation units (e.g. solar PV system)
$EG_{renewable,y}$	=	Renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity, MWh/yr
\sum_i	=	The sum of the group of project regions
$ED_{i,y}$	=	Electricity distributed by the extended electricity distribution system to the project region i in year y , MWh/yr

22. To quantify renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$), project developer will prepare a list of existing stand-alone renewable power generation units in the project region for which electricity generation capacity is available through host country's energy statistics or equivalent document (e.g. host country's electricity development plan). This list shall be prepared ex ante, validated by the DOE at the time of validation, and fixed throughout the project's lifetime.
23. For each identified existing stand-alone renewable power generation unit in the project region (listed as per paragraph 22 above), the fate of each relocated/removed unit shall be documented at the time of verification. Among the list of existing stand-alone renewable power generation units, all units removed due to implementation of the project activity shall be sub-listed and the destination of relocation is documented as per host country's electricity authority's records. For the units for which relocation document cannot be provided, the baseline emission factor shall be discounted. Units removed due to the expiration of their lifetime shall be exempt from the discount if the expiration of equipment lifetime is confirmed through documented evidence.

24. The renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$) is determined as follows:

$$EG_{renewable,y} = \sum_i (EG_{renewable,replaced,i,ave}) \quad \text{Equation (4)}$$

Where:

$EG_{renewable,replaced,i,ave}$ = Historical average electricity generation of the identified existing stand-alone renewable power generation unit i , MWh/yr.

At a minimum historical annual generation record from three years shall be applied, except for the system with less than three years of historical operation record. This value will be determined at the time of validation and fixed throughout the project life time

25. In case historical electricity generation of the identified existing stand-alone renewable power generation units are not available, annual power generation may be estimated using following equation and adopting a conservative load factor:

$$EG_{renewable,replaced,i,ave} = f \times E_{renewable,replaced,i} \times 8760 \quad \text{Equation (5)}$$

Where:

f = Load factor of the identified existing stand-alone renewable power generation units replaced by the project activity. A conservative estimate shall be made for example through strategic surveys and research conducted by national or local organizations, initiatives by international organizations or non-governmental organizations or the project proponent to collect reliable and comprehensive data

$E_{renewable,replaced,i}$ = Installed capacity of the identified existing stand-alone renewable power generation unit i , MW

5.2.1. Baseline emissions from consumers historically connected to a mini-grid (exclusively diesel based)

26. Where the **electricity** grid **electricity** extension project displaces an existing mini-grid that is exclusively powered by diesel generators, the baseline for the amount of electricity historically supplied through the mini-grid will be different and base line emissions are calculated based on the historical emissions of the existing mini-grid as follows:

$$BE_{hist,y} = EG_{hist} \times EF_{hist} \quad \text{Equation (6)}$$

Where:

$BE_{hist,y}$ = Baseline emissions from consumers historically connected to a mini-grid (tCO₂)

EG_{hist} = Historical electricity generation from existing mini-grid (MWh)

EF_{hist} = Historical emissions factor for the mini-grid (tCO₂/MWh)

27. The historical emissions factor for the mini-grid is calculated from total fuel consumption and generation from mini-grid connected plants for the most recent three years.

$$EF_{hist} = \frac{\sum_i (FC_{hist,i} \times NCV_i \times EF_{CO2,i})}{\sum GEN_{hist}} \quad \text{Equation (7)}$$

Where:

EF_{hist}	=	Historical emissions factor for the mini-grid (tCO ₂ /MWh)
$FC_{hist,i}$	=	Historical consumption of fossil fuel type i in all mini-grid plants (tonnes)
NCV_i	=	Net Calorific Value of fossil fuel type i (GJ/tonne)
$EF_{CO2,i}$	=	Emission factor for fossil fuel type i (tCO ₂ /GJ)
GEN_{hist}	=	Historical electricity generation from all mini-grid plants (MWh)

28. For existing facilities with less than three years of operational data, all historical data shall be available (a minimum of one-year data would be required). In the case of no historical data/information on baseline parameters such as efficiency, energy consumption and output (e.g. the available data is not reliable due to various factors such as the use of imprecise or non-calibrated measuring equipment), the baseline parameters can be determined using a performance test/measurement campaign to be carried out prior to the implementation of the project activity. The project proponent may follow the relevant provisions from the TOOL09 "Tool to determine baseline efficiency of thermal and electricity systems".

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5.3. Leakage

29. Leakage on account of construction of new transmission/distribution lines (e.g. carbon stock loss due to deforestation) shall be calculated using the method indicated in baseline and monitoring methodology AM0045. If the estimated leakage is within 5 per cent % of the estimated emission reductions of the project, then this leakage source may be neglected, otherwise the leakage shall be deducted from the emissions reductions.

5.4. Project activity emissions

30. For the period where the host country is a net importer, the project emissions shall be calculated for that period at least on a monthly basis using the following equation. Project emissions are zero during the period the host country is net exporter.

$$PE_y = \sum_t^P ED_{i,t} \times EF_{CO2,import,y} \quad \text{Equation (8)}$$

If $EG_{export,t} > EG_{import,y}$, then $EF_{CO2,import,y} = 0$

Where:

PE_y	=	Project emissions in year y , t CO ₂ e/yr
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\sum_t^P	=	The sum of period during which the country is net importer, t can be hourly or daily or monthly
EG_{import}	=	Amount of electricity imported into the grid from other countries and monitored hourly or daily or monthly in a given year y , MWh
EG_{export}	=	Amount of electricity exported from the grid to other countries and monitored hourly or daily or monthly in a given year y , MWh
$ED_{i,t}$	=	Amount of electricity distributed by the extended electricity distribution system to project region i , monitored hourly or daily or monthly in a given year y , MWh
$EF_{CO2,import,y}$	=	CO ₂ emission factor for the electricity the host country procured internationally, t CO ₂ e/MWh (Use 1.3 tCO ₂ /MWh)

5.5. Emission reductions

31. Emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (9)}$$

6. Monitoring methodology

32. Monitoring shall consist of the following parameters listed in **the tables** below.
33. The applicable requirements specified in the “General Guidelines to SSC CDM methodologies” (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participants.

6.1. Data and parameters monitored

Data / Parameter table 1.

Data / Parameter:	ED_y
Data unit:	MWh/y
Description:	Amount of electricity distributed by the extended electricity distribution system to the project region i in year y
Source of data:	
Measurement procedures (if any):	<p>Measured using calibrated electricity meter(s).</p> <p>Measured from the supply point that serves the project area, whether that is the nearest existing transmission/distribution sub-station, a feeder from that station, or a new branch in a distribution line that serves the project area. The distribution losses shall be deducted from the amount of electricity measured. A default value of 10 per cent % shall be used for average annual technical distributions losses.</p> <p>When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to estimate the</p>

	<p>total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (N_{meter}). “Standard for sampling and surveys for CDM project activities and programme of activities” may be referred for sampling procedures.</p> <p>Validity of information source will be verified by DOE at the time of verification.</p> <p>Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method</p>
Monitoring frequency:	Continuous measurement by electricity meter(s), aggregated hourly or daily or monthly
QA/QC procedures:	Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method
Any comment:	

Data / Parameter table 2.

Data / Parameter:	N_{meter}
Data unit:	-
Description:	Number of electricity meters installed by the project activity
Source of data:	
Measurement procedures (if any):	Recorded by project developer
Monitoring frequency:	Recorded annually
QA/QC procedures:	
Any comment:	

Data / Parameter table 3.

Data / Parameter:	$EG_{import,t}$
Data unit:	MWh/y
Description:	The amount of electricity the host country imported from other countries in year y
Source of data:	
Measurement procedures (if any):	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)
Monitoring frequency:	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly
QA/QC procedures:	
Any comment:	

Data / Parameter table 4.

Data / Parameter:	$EG_{export,t}$
Data unit:	MWh/y

Description:	The amount of electricity the host country exported to other countries in year <i>y</i>
Source of data:	
Measurement procedures (if any):	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)
Monitoring frequency:	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly
QA/QC procedures:	
Any comment:	

Data / Parameter table 5.

Data / Parameter:	<i>EG_y</i>
Data unit:	MWh/y
Description:	Electricity generation in year <i>y</i> from all the power plants (renewable and others), that are within the host country, and are physically connected to the grid to which the CDM project is connected to (as per paragraph 4)
Source of data:	
Measurement procedures (if any):	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)
Monitoring frequency:	At least monthly, aggregated annually
QA/QC procedures:	
Any comment:	

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6.2. Project activity under a programme of activities

34. The methodology is applicable to a programme of activities, no additional leakage estimations are necessary other than that indicated under leakage section above.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	13 July 2022	<p>MP 88, Annex 11</p> <p>To be considered by the Board at EB 115.</p> <p>A call for public input will be issued for this draft document. Any input will be discussed with the MP and forwarded to the Board for consideration.</p> <p>Revision to:</p> <ul style="list-style-type: none"> • Introduce reference to “TOOL33: Default values for common parameters”; • Make minor editorial improvements; and • Remove reference to “AMS-I.F.: Renewable electricity generation for captive use and mini-grid”.

CDM-MP88-A11

Draft Small-scale Methodology: AMS-III.AW.: Electrification of rural communities by grid extension

Version 02.0

Sectoral scope(s): 02

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