CLEAN DEVELOPMENT MECHANISM

CDM-MP88-A08

Draft Small-scale Methodology

AMS-I.F.: Renewable electricity generation for captive use and mini-grid

Version 05.0

Sectoral scope(s): 01

DRAFT

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 to as TOOL33). TOOL33 contains default values for of (a) carbon dioxide (CO_2) emission factors for diesel generator systems used for off-grid power generation purposes and (b) CO_2 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 CO_2 emission factors for diesel generator system were contained in "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" (hereinafter referred to as AMS-I.F.) and values for CO_2 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 CO_2 emission factor for diesel generator systems and minor editorial improvements.

3. Key issues and proposed solutions

5. The proposed revision refers to TOOL33 that contains recently updated default values for CO_2 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.

TABLE OF CONTENTS **Page**

1. INTRODUCTION 5

2. SCOPE, APPLICABILITY, AND ENTRY INTO FORCE 5

2.1. Scope 5

2.2. Applicability 5

2.3. Entry into force 7

2.4. Applicability of sectoral scopes 7

3. NORMATIVE REFERENCES 7

4. DEFINITIONS 8

5. BASELINE METHODOLOGY 8

5.1. Project boundary 8

5.2. Baseline emissions 9

5.3. Project emissions 10

5.4. Leakage 11

5.5. Emission reductions 11

6. MONITORING METHODOLOGY 11

6.1. Parameters for monitoring during the crediting period 11

1. Introduction

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

Table 1. Methodology key elements

Typical project(s)	Production of electricity using renewable energy technologies such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s)
Type of GHG emissions mitigation action	Renewable energy: Displacement of electricity that would be provided to the user(s) by more-GHG-intensive means

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit, i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:

(a) A national or a regional grid (grid hereafter);

(b) A fossil fuel fired captive power plant;[1]

(c) A carbon intensive mini-grid.

2.2. Applicability

3. This methodology is applicable for project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition,[2]

[1] Under such situations, the consumers of the captive electricity should be also connected to the grid.

[2] A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) The installation of a new power plant beside the existing power plant/units; or (ii) The installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

(c) Involve a retrofit[3] of (an) existing plant(s); or (d) Involve a replacement[4] of (an) existing plant(s).

4. Illustration of respective situations under which each of the methodology (AMS-I.D., AMS-I.F. and AMS-I.A.[5]) applies is included in Table 2 below.

Table 2. Applicability of AMS-I.D, AMS-I.F and AMS-I.A based on project types

	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid[6] system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

5. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[7] from the existing units.

6. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.

[3] Retrofit (or rehabilitation or refurbishment). A retrofit is an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

[4] Replacement. Investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The new power plant or unit has the same or a higher power generation capacity than the plant or unit that was replaced.

[5] "AMS-I.D.: Grid connected renewable electricity generation", "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" and "AMS-I.A.: Electricity generation by the user".

[6] The sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW.

[7] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

7. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel,[8] the capacity of the entire unit shall not exceed the limit of 15 MW.

8. Combined heat and power (co-generation) systems are not eligible under this category.

9. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:

   (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir;

   (b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2;

   (c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2.

10. If electricity and/or steam/heat produced by the project activity is delivered to a third party, i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions.

11. In the case the project activities utilizes biomass, the "TOOL16: Project and leakage emissions from biomass" shall be applied to determine the relevant project emissions from the cultivation of biomass and the utilization of biomass or biomass residues.

2.3. Entry into force

12. 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

13. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 01 is mandatory and application of sectoral scope 13 and 15 is conditional.

3. Normative references

14. Project participants shall apply the "General guidelines for SSC CDM methodologies" provided at <https://cdm.unfccc.int/Reference/Guidclarif/index.html> mutatis mutandis.

[8] A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justification are provided.

15. This methodology also refers to the latest approved versions of the following approved methodologies and tools:

    (a) "ACM0002: Grid-connected electricity generation from renewable sources" (hereinafter referred to as ACM0002);

    (b) "AMS-I.A.: Electricity generation by the user" (hereinafter referred to as AMS-I.A);

    (c) "AMS-I.C.: Thermal energy production with or without electricity" (hereinafter referred to as AMS-I.C);

    (d) "AMS-I.D.: Grid connected renewable electricity generation" (hereinafter referred to as AMS-I.D);

    (e) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred to as TOOL05);

    (f) "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (hereinafter referred to as TOOL03);

    (g) "TOOL07: Tool to calculate the emission factor for an electricity system" (hereinafter referred to as TOOL07);

    (h) "TOOL16: Project emissions from cultivation of biomass" (hereinafter referred to as TOOL16);

    (i) "TOOL33: Default values for common parameters (hereinafter referred to as TOOL33).

4. Definitions

16. The definitions contained in the "Glossary: CDM terms" shall apply.

17. For the purpose of this methodology following definition apply:

    (a) **Mini-grid** - is ~~defined~~ a~~s~~ small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.

5. Baseline methodology

5.1. Project boundary

18. The spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system as per the requirements provided in TOOL07[9] to which the project power plant is connected.

[9] ~~Refer to the latest approved version of the TOOL07.~~

5.2. Baseline emissions

19. For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table 1 of TOOL33 ~~Table 2~~.

~~**Table 2. Emission factors for diesel generator systems (in kg CO2e/kWh[(a)]) for three different levels of load factors[(b)]**~~

~~Cases~~	~~Mini-grid with 24 hour service~~	~~(a) Mini-grid with temporary service (4-6 hr/day); (b) Productive applications; (c) 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[(c)]~~	~~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/>;~~

~~(c) Default values.~~

20. Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} \times EF_{CO2,y}$$ Equation (1)

Where:

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

$EG_{BL,y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,y}$ = Emission factor (t CO_2/MWh)

- The emission factor of an electric grid shall be calculated as per the procedures provided in AMS-I.D.;
- For a mini-grid system other than described in paragraph 18 above, the baseline emission factor shall be determined as per the weighted average emissions for the current generation mix following the procedure provided in AMS-I.D.;
- The emission factor for captive electricity generation shall be calculated as per the procedures described in the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

21. For project activities that displace electricity consumed from the electric grid and from a fossil fuel fired on-site captive power plant, the baseline emission factor shall reflect the emissions intensity of the grid and the captive power plant in the baseline scenario, i.e. the weighted average emission factor for the displaced electricity is calculated using values based on the historical (prior three year ratio~~s~~) of electricity from captive plants and the grid.[10] For new facilities, the most conservative (lowest) of the emission factor for the two power sources should be used.

22. For landfill gas, waste gas, wastewater treatment and agro-industries projects, emission reductions from recovered methane are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for captive use, the baseline emisions shall be calculated in accordance with paragraphs 19 ~~18~~ and 20 ~~19~~ above. If the recovered methane is used for heat generation or cogeneration, it is eligible under methodology AMS-I.C., and if generated electricity is supplied to a grid then use AMS-I.D.

23. For project activities that involve retrofit of an existing facility and/or capacity addition at an existing facility, $EG_{BL,y}$ in equation (1) above shall be determined following the applicable procedures prescribed in AMS-I.D.

24. For project activities using biomas, the quantities and types of biomass and the biomass to fossil fuel ratio (in case of co-fired system) to be used during the crediting period shall be explained and documented transparently in the CDM project design document (PDD). For the selection of the baseline scenario, an ex ante estimation of these quantities should be provided.

5.3. Project emissions

25. Project emissions for the following categories of project activities, including relevant definitions, shall be considered following the procedure described in the ~~most recent version of~~ ACM0002:[11]

(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.

26. For the other types of renewable energy projects, $PE_y = 0$.

27. The CO_2 emissions from on-site consumption of fossil fuels by the project activity shall be calculated using ~~the latest version of the~~ TOOL03.

28. For project activities that utilize biomass and/or biomass residues, the TOOL16 shall be applied to determine the following project emissions sources, including the simplifications for small-scale and microscale project activities:

(a) Project emissions resulting from the cultivation of biomass in a dedicated plantation of a CDM project activity that uses biomass (PE_{BC});

[10] For example, if in the baseline 80 per cent of annual electricity requirement was met by grid import and the remaining by captive generation, the weighted average emission factor ($EF_{electricity}$) would be 0.8 EF_{grid} + 0.2 $EF_{captive}$.

[11] ~~"ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources".~~

(b) Project emissions resulting from the transportation of biomass (PE_{BT});

(c) Project emissions resulting from the processing of biomass (PE_{BP});

(d) Project emissions resulting from the transportation of biomass residues (PE_{BRT}) if the project consumes biomass residues;

(e) Project emissions resulting from the processing of biomass residues (PE_{BRP}) if the project consumes biomass residues.

5.4. Leakage

29. For project activities utilizing biomass and/or biomass residues, the TOOL16 shall be applied to determine the leakage. The project participants shall indicate in the PDD which leakage sources are included. If emission sources are not considered, the project participants shall provide proper justification in the PDD.

5.5. Emission reductions

30. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (2)

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. Parameters for monitoring during the crediting period

31. Relevant parameters shall be monitored as indicated in the tables below.

Data / Parameter table 1.

Data / Parameter:	$EF_{CO2,y}$
Data unit:	t CO_2/MWh
Description:	CO_2 emission factor for the grid/minigrid/captive electricity in year *y*
Measurement procedures (if any):	As prescribed in section 5.2 of this methodology
Monitoring frequency:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	**-**
Data unit:	t CO_2/MJ
Description:	CO_2 emission factor of fossil fuel type *i*
Measurement procedures (if any):	As per the TOOL03
Monitoring frequency:	As per the TOOL03
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**-**
Data unit:	MJ per unit volume or mass unit
Description:	Net calorific value of fossil fuel type *i*
Measurement procedures (if any):	As per the TOOL03
Monitoring frequency:	As per the TOOL03
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	**-**
Data unit:	Mass or volume unit/y
Description:	Quantity of fossil fuel consumed in year *y*
Measurement procedures (if any):	As per the TOOL03
Monitoring frequency:	As per the TOOL03
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	$\boldsymbol{EG_{BL,y}}$
Data unit:	MWh/y
Description:	Quantity of net electricity displaced in year *y*
Measurement procedures (if any):	As per the TOOL05
Monitoring frequency:	As per the TOOL05
Any comment:	As per the TOOL05

Data / Parameter table 6.

Data / Parameter:	**-**
Data unit:	Tonne/y
Description:	Quantity of biomass consumed in year *y*

Measurement procedures (if any):	Use mass or volume based measurements. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity of biomass shall be measured continuously or in batches. If more than one type of biomass fuel is consumed, each shall be monitored separately. Cross-check the measurements with an annual energy balance that is based on purchased quantities (e.g. with sales receipts) and stock changes. Check the consistency of measurements ex post with annual data on energy generation, fossil fuels and biomass used and the efficiency of energy generation as determined ex ante
Monitoring frequency:	Continuously or estimate using annual mass/energy balance
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	**-**
Data unit:	%
Description:	Moisture content of the biomass (wet basis)
Measurement procedures (if any):	On-site measurements. Ex ante estimates should be provided in the PDD and used during the crediting period. In case of dry biomass, monitoring of this parameter is not necessary
Monitoring frequency:	The moisture content of biomass of homogeneous quality shall be determined ex ante. The weighted average should be calculated and used in the calculations
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	**-**
Data unit:	GJ/mass or volume unit
Description:	Net calorific value of biomass type *k*
Measurement procedures (if any):	Measurement in laboratories according to relevant national/international standards. Measure quarterly, taking at least three samples for each measurement. The average value can be used for the rest of the crediting period. Measure the NCV based on dry biomass. Check the consistency of the measurements by comparing the measurement results with, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
Monitoring frequency:	Determine once in the first year of the crediting period
Any comment:	-

32. Parameters relevant to hydro and geothermal plants which are not included in the tables above shall be monitored following monitoring methodology as in ~~the most recent version of~~ ACM0002.

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Document information

Version	*Date*	*Description*
05.0	13 July 2022	MP 88, Annex 8 To be considered by the Board at EB 115. 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. Revision to: • Introduce reference to "TOOL33: Default values for common parameters"; and • Make minor editorial improvements.
04.0	11 March 2022	EB 113, Annex 21 The revision: • Indicates the emission sources that are relevant in the calculation of project emissions associated with biomass and biomass residues, in line with "TOOL16: Project and leakage emissions from biomass" (version 05.0); • Makes editorial improvements.
03.0	28 November 2014	EB 81, Annex 26 The revision: • Introduces the methodological tool "Project emissions from cultivation of biomass", streamlines biomass cultivation procedures across small and large scale methodologies; • Removes restrictions for application in a PoA.
02.0	3 June 2011	EB 61, Annex 18 The revision: • Simplifies the monitoring requirements for quantity, net calorific value and moisture content of biomass; • Clarifies the applicability conditions.
01.0	28 May 2010	EB 54, Annex 5 Initial adoption.

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