CLEAN DEVELOPMENT MECHANISM

AM0036

Large-scale Methodology

Use of biomass in heat generation equipment

Version 06.0

Sectoral scope(s): 01 and 04

United Nations
Framework Convention on
Climate Change

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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)	Fuel switch from fossil fuels to biomass in the generation of heat. Applicable activities are retrofit or replacement of existing heat generation equipment and installation of new heat generation equipment
Type of GHG emissions mitigation action	Renewable energy: Displacement of more-GHG-intensive heat generation using fossil fuel and avoidance of CH_4 emissions from anaerobic decay of biomass residues

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology is applicable to project activities that operate biomass (co-)fired heat generation equipment. The CDM project activity may include the following activities or, where applicable, combinations of these activities:

(a) The installation of new plants at a site where currently no heat generation occurs (Greenfield project activities);

(b) The installation of new plants at a site where currently heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion project activities);

(c) The improvement of energy efficiency of existing biomass-based plants (energy efficiency improvement project activities), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant;

(d) The total or partial replacement of fossil fuels by biomass in existing plants or in new plants that would have been built in the absence of the project (fuel switch project activities), e.g. by increasing the share of biomass use as compared to the baseline, or by retrofitting an existing plant to use biomass.

2.2. Applicability

3. The methodology is applicable under the following conditions:

(a) The heat generated in the heat generation equipment is either not used for power generation or, if power is generated using the heat generated by the heat generation equipment, it is not increased as a result of the project activity, i.e.:

(i) The power generation capacity installed remains unchanged due to the implementation of the project activity and is maintained at the pre-project level throughout the crediting period; and

(ii) The annual power generation during the crediting period is not more than 10% larger than the highest annual power generation in the most recent three years prior to the implementation of the project activity.

(b) The use of biomass residues or increasing the use of biomass residues beyond historical levels is technically not possible at the project site without a significant capital investment in:

(i) Either the retrofit or replacement of existing heat generation equipment or the installation of new heat generation equipment; or

(ii) Establishing a new dedicated biomass supply chain for the purpose of the project activity (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes).

(c) Biomass types used by the project activity are limited to biomass residues, biogas, Refuse Derived Fuel (RDF) and/or biomass from dedicated plantations. Refuse Plastic Fuel (RPF) can also be co-fired in the equipment, but for the purpose of this methodology RDF and RPF shall be considered as fossil fuels;[1]

(d) Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 50% of the total fuel fired on an energy basis;

(e) The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical-degradation, etc.) prior to combustion. Drying and mechanical processing, such as shredding and pelletisation, are allowed;

(f) The biomass used at the project site, i.e. the site where the project activity is implemented, are not be stored for more than one year.

4. For project activities that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar cane, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process.

5. In the case biomass from dedicated plantations is used, the applicability conditions of “TOOL16: Project and leakage emissions from biomass” apply.

6. If biogas is used, it must be generated by anaerobic digestion of wastewater, and:

(a) If the wastewater generation source is registered as a CDM project activity, the details of the wastewater project shall be included in the PDD, and emission reductions from biogas energy generation are claimed using this methodology;

(b) If the wastewater source is not a CDM project, the amount of biogas does not exceed 50% of the total fuel fired on energy basis.

7. In case of project activities that involve the replacement or retrofit of existing heat generation equipment, emission reductions may only be accounted until the time when the existing equipment would have reached the end of its technical time in the crediting

[1] If the project participants want to claim emission reduction for the biodegradable component in RPF, a revision to this methodology shall be required.

period, i.e. after the point in time when the existing equipment would have to be replaced due to the expiry of its technical lifetime in the baseline scenario, emission reductions cannot be accounted. For the purpose of demonstrating this applicability condition, project participants should determine and document the remaining lifetime of each unit of the existing heat generation equipment in accordance with "TOOL10: Tool to determine the remaining lifetime of equipment". In the case of several existing units with a different remaining lifetime, the shortest lifetime among the units should be used to determine the point in time until which CERs can be claimed.

8. In addition, the applicability conditions of the methodological tools referred below shall apply.

2.3. Entry into force

9. The date of entry into force is the date of the publication of the EB 108 meeting report on 14 December 2020.

2.4. Applicability of sectoral scopes

10. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scopes 01 and 04 is mandatory.

11. If emission reductions are claimed for preventing disposal and/or preventing uncontrolled burning of biomass residues in the baseline, then sectoral scope 13 applies.

3. Normative references

12. This baseline and monitoring methodology is based on elements from the following approved baseline and monitoring methodologies:

(a) "ACM0014: Treatment of wastewater";

(b) "AMS-III.H.: Methane recovery in wastewater treatment".

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

(a) "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality";

(b) "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

(c) "TOOL04: Emissions from solid waste disposal sites";

(d) "TOOL07: Tool to calculate the emission factor for an electricity system";

(e) "TOOL09: Determining the baseline efficiency of thermal or electric energy generation systems";

(f) "TOOL10: Tool to determine the remaining lifetime of equipment";

(g) "TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of a crediting period";

(h) "TOOL12: Project and leakage emissions from transportation of freight";

(i) "TOOL16: Project and leakage emissions from biomass".

14. For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

3.1. Selected approach from paragraph 48 of the CDM modalities and procedures.

15. "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment".

4. Definitions

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

17. The following definitions apply for this methodology:

(a) **Heat** - useful thermal energy that is generated in a heat generator and transferred to a heat carrier (e.g. hot liquids, hot gases,[2] steam, etc.) for utilization in thermal applications and processes. For the purposes of this methodology, heat does not include waste heat, i.e. heat that is transferred to the environment without utilization, for example, heat in flue gas, heat transferred to cooling towers or any other heat losses. Note that heat refers to the *net* quantity of thermal energy that is transferred to a heat carrier at the heat generation unit. For example, in case of a boiler it refers to the difference of the enthalpy of the steam generated in the boiler and the enthalpy of the feed water or, if applicable, any condensate return;

(b) **Heat generation equipment** - a facility that generates heat by combustion of fuels and supplies heat to thermal applications or processes. This includes, for example, a boiler that supplies steam or hot water, a heater that supplies hot oil or thermal fluid, or a furnace that supplies hot gas or combustion gases. When several heat generation equipment's are included in one project activity, each heat generation equipment is referred to as "unit";

(c) **Efficiency of heat generation** - the quantity of heat generated per unit quantity of fuel fired (both expressed in terms of energy using the same units). The average net efficiency of heat generation refers to the efficiency of heat generation over a longer time interval (e.g. one year) that is representative for different loads and operation modes, including start-ups. When considering more than one unit, the average efficiency of heat generation corresponds respectively to the heat generated by all units divided by the quantity of fuel fired in the same units (based on Net Calorific Values).

[2] Hot gases may include combustion gases from a furnace if the gases are used as heat carrier, without further combustion.

5. Baseline methodology

5.1. Project boundary

18. The spatial extent of the project boundary encompasses:

(a) The heat generation equipment and related equipment at the project site;

(b) If applicable, all off-site heat sources that supply heat to the site where the CDM project activity is located (either directly or via a district heating system);

(c) The means for transportation of biomass to the project site (e.g. vehicles);

(d) The site where the biomass residues would have been left for decay under anaerobic conditions. This is applicable only to cases where the biomass residues would in the absence of the project activity be dumped and left to decay under anaerobic conditions;

(e) If the feedstock is biomass sourced from dedicated plantations, the geographic boundaries of the dedicated plantations;

(f) If biogas is included, the site of the anaerobic digester.

Table 2. Emission sources included in or excluded from the project boundary

<table>
<tr><th colspan="2">Source</th><th>Gas</th><th>Included</th><th>Justification/Explanation</th></tr>
<tr><td rowspan="6">Baseline</td><td rowspan="3">Fossil fuel combustion for heat generation</td><td>CO_2</td><td>Yes</td><td>Important emission source</td></tr>
<tr><td>CH_4</td><td>No</td><td>Excluded for simplification. This is conservative</td></tr>
<tr><td>N_2O</td><td>No</td><td>Excluded for simplification. This is conservative</td></tr>
<tr><td rowspan="3">Uncontrolled burning or decay of the biomass residues</td><td>CO_2</td><td>No</td><td>It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector</td></tr>
<tr><td>CH_4</td><td>Yes or No</td><td>Project participants may decide to include this emission source, where cases B1, B2 or B3 as described in “TOOL16: Project and leakage emissions from biomass” are identified as the most likely baseline scenario for the use of the biomass residues</td></tr>
<tr><td>N_2O</td><td>No</td><td>Excluded for simplification. This is conservative</td></tr>
<tr><td rowspan="2">Project activity</td><td rowspan="2">On-site fossil fuel and electricity consumption</td><td>CO_2</td><td>Yes</td><td>Important emission source</td></tr>
<tr><td>CH_4</td><td>No</td><td>Excluded for simplification. This emission source is assumed to be very small</td></tr>
</table>

Source		Gas	Included	Justification/Explanation
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass	CO_2	Yes	Important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass for heat generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Yes or No	This emission source must be included if project participants include CH_4 emissions from uncontrolled burning or decay of the biomass residues in the baseline scenario
		N_2O	No	Excluded for simplification. This emission source is assumed to be small
	Wastewater from the treatment of biomass	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Yes	This emission source shall be included in cases where the waste water is treated (partly) under anaerobic conditions
		N_2O	No	Excluded for simplification. This emission source is assumed to be small
	Cultivation of land to produce biomass feedstock	CO_2	Yes	This emission source shall be included in cases biomass from dedicated plantation is used
		CH_4	Yes	This emission source shall be included in cases biomass from dedicated plantation is used
		N_2O	Yes	This emission source shall be included in cases biomass from dedicated plantation is used

5.2. Project documentation

19. The project participants shall document the specific situation of the CDM project activity in the CDM-PDD, at least for the following:

    (a) For each plant generating heat that operated at the project site in the three years prior to the start of the CDM project activity: the type and capacity of the heat generators, the types and quantities of fuels which were used in the heat generators, the type and capacity of heat engines, and whether the equipment continues operation after the start of the CDM project activity;

    (b) For each plant generating heat installed under the CDM project activity: the type and capacity of the heat generators, the types and quantities of fuels used in the heat generators, the type and capacity of heat engines and direct heat extractions;

    (c) For each plant generating heat that would be installed in the absence of the CDM project activity: the type and capacity of the plant, the type and capacity of the heat generators, and the types and quantities of fuels which would be used in each heat generator;

    (d) The average amounts of heat that would be imported from off-site sources in the absence of the CDM project activity and the import forecast for the project scenario.

5.3. Identification of the baseline scenario and demonstration of additionality

20. The selection of the baseline scenario and demonstration of additionality should be conducted by following “TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality”.

5.3.1. Identification of alternative scenarios

21. Realistic and credible alternatives should be separately determined for the following two components of the project activity:

    (a) Heat generation in the absence of the project activity;

    (b) What would happen to the biomass in the absence of the project activity.

22. The alternatives to be analyzed for **heat generation** may include, inter alia:

    (a) H1: The proposed project activity not undertaken as a CDM project activity (heat generation with biomass);

    (b) H2: Continued operation of the existing heat generation equipment using the same fuel mix or without the increased use of biomass;

    (c) H3: Continued operation of the existing unit(s) using a different fuel (mix);

    (d) H4: Improvement of the performance of the existing heat generation equipment;

    (e) H5: Continued operation of the existing unit(s) using the same fuel mix or less biomass as in the past AND installation of new heat generation equipment that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing equipment;

(f) H6: Replacement of the existing heat generation equipment with new heat generation equipment.

23. When using biomass residues, the alternative scenarios of the biomass residues in absence of the project activity shall be determined following the guidance in "TOOL16: Project and leakage emissions from biomass".

24. In addition to the alternative scenarios provided in "TOOL16: Project and leakage emissions from biomass", the alternative scenarios shall include scenario B5: The biomass residues are used for power or heat generation at the project site in new and/or existing plants.[3]

25. In case the proposed project activity includes the use of biogas, the project shall consider the following baseline alternatives for the biogas:

(a) BG1: No biogas would be generated, and wastewater would not be treated by anaerobic digestion;

(b) BG2: Biogas is captured and flared;

(c) BG3: Biogas is captured and used to produce electricity and/or thermal energy;

(d) BG4: Biogas is captured and used as feedstock or transportation fuel.

26. When defining plausible and credible alternative scenarios for the use of biogas, the guidance below should be followed:

(a) If scenario BG1 and BG2 are selected, no biogas shall be included in the baseline scenario of the proposed project activity;

(b) If scenario BG3 is selected, the same amount of biogas produced in the project shall be included in the baseline scenario. For the purpose of calculating the "Baseline Emissions" the biogas shall be considered a biomass residue;

(c) If scenario BG4 is selected, the methodology is not applicable;

(d) In case any emission reductions are claimed for the avoidance of methane in scenario BG1, the baseline scenario for and additionality of the biogas shall be determined in a separate biogas CDM project activity using methodology ACM0014 or AMS-III.H. In addition, all baseline, project and emissions not related to energy generation shall be accounted for in the biogas CDM project activity. Any incremental costs related to biogas energy generation in the project scenario shall be included in the biogas CDM PDD (e.g. costs of pipes, burner and control systems) and not in the proposed project activity under this methodology.

27. In case the biogas is supplied by an existing CDM project activity its reference shall be included in the PDD.

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[3] If biomass residues have already been used for heat generation at the project site prior to the implementation of the project activity, the most plausible baseline scenario for the use of the biomass residues should only be determined for the additional biomass residues used over and above the historical levels.

5.4. Baseline emissions

28. Baseline emissions include CO_2 emissions from fossil fuel combustion in the heat generation equipment in the absence of the project activity and, if included in the project boundary, CH_4 emissions from the treatment of biomass in the absence of the project activity:

$$BE_y = BE_{HG,y} + BE_{BR,y} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions during the year *y* (tCO_2e/yr)
$BE_{HG,y}$	=	Baseline emissions from fossil fuel combustion for heat generation in the heat generation equipment in year *y* (tCO_2/yr)
$BE_{BR,y}$	=	Baseline emissions due to uncontrolled burning or decay of the biomass residues in year *y* (tCO_2e/yr)

5.4.1. Baseline emissions from fossil fuel combustion for heat generation (*$BE_{HG,y}$*)

29. Baseline emissions from fossil fuel combustion in the heat generation equipment are determined as follows:

$$BE_{HG,y} = \frac{HG_{PJ,biomass,y} \times EF_{FF,CO2,y}}{\eta_{heat,FF}} \quad \text{Equation (2)}$$

Where:

$BE_{HG,y}$	=	Baseline emissions from fossil fuel combustion for heat generation in the heat generation equipment in year *y* (tCO_2e/yr)
$HG_{PJ,biomass,y}$	=	Incremental heat generated with biomass used as a result of the project activity during the year *y* (GJ/yr)
$EF_{FF,CO2,y}$	=	CO_2 emission factor of the fossil fuel type displaced by biomass for the year *y* (tCO_2e/GJ)
$\eta_{heat,FF}$	=	Average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline (ratio)

5.4.1.1. Determination of *$EF_{FF,CO2,y}$*

30. For the purpose of determining $EF_{FF,CO2,y}$, as a conservative approach, the least carbon intensive fuel type (i.e. the fuel type with the lowest CO_2 emission factor per GJ) shall be used among the fossil types used in the baseline heat generation equipment at the project site during the most recent three years prior to the implementation of the project activity and the fossil fuel types used in the heat generation equipment at the project site during the year *y*.

31. The average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline shall be determined using the latest approved version of “TOOL09: Determining the baseline efficiency of thermal or electric energy generation systems”.

5.4.1.2. Determination of $HG_{PJ,biomass,y}$

32. The determination of $HG_{PJ,biomass,y}$ depends on whether only fossil fuels would be used for heat generation in the absence of the project activity (case A) or whether along with fossil fuels some biomass also would be used in the absence of the project activity (case B).

33. The guidance under case A should be followed if:

(a) No biomass has been used for heat generation at the project site during the most recent three years prior to the implementation of the project activity; and

(b) The most plausible baseline scenario is that heat would continue to be generated only with fossil fuels.

34. The guidance under case B should be followed if:

(a) Biomass has already been used in heat generation equipment for heat generation at the project site prior to the implementation of the project activity; and

(b) The most plausible baseline scenario is that heat would continue to be generated partly with fossil fuels and partly with biomass.

5.4.1.2.1. Case A: No use of biomass for heat generation in the absence of the project activity

35. In this case, $HG_{PJ,biomass,y}$ corresponds to the *total* quantity of heat generated from firing biomass ($HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y}$).

36. $HG_{PJ,biomass,total,y}$ is determined based on the fraction of biomass that are used for heat generation in the heat generation equipment, taking into account all biomass types *k* and fossil fuel types *i* fired in the project heat generation equipment during a year *y*, as follows:

$$HG_{PJ,biomass,total,y} = HG_{PJ,total,y} \times \frac{\sum_k BF_{k,y} \times NCV_k}{\sum_k BF_{k,y} \times NCV_k + \sum_i FC_{i,y} \times NCV_i}$$

Equation (3)

Where:

$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass in all heat generation equipment at the project site during the year *y* (GJ/yr)
$HG_{PJ,total,y}$	=	Total heat generated in the heat generation equipment at the project site, using both biomass and fossil fuels, during the year *y* (GJ/yr)
$BF_{k,y}$	=	Quantity of biomass types *k* fired in all units of heat generation equipment at the project site during the year *y* (tons of dry matter or liter)[4]
NCV_k	=	Net calorific value of the biomass types *k* (GJ/ton of dry matter or GJ/liter)

[4] Use tons of dry matter for solid biomass and for biogas the volume shall be referred to Normal Temperature and Pressure conditions (NTP).

$FC_{i,y}$	=	Quantity of fossil fuel types *i* fired in all heat generation equipment at the project site during the year *y* (mass or volume unit)[5]
NCV_i	=	Net calorific value of the fossil fuel types *i* (GJ/mass or volume unit)

5.4.1.2.2. Case B: Use of some biomass for heat generation in the absence of the project activity

37. In this case, only the use of biomass beyond historical levels should be attributed to the CDM project activity. Hence, $HG_{PJ,biomass,y}$ refers to the additional (i.e. additional to the baseline scenario) quantity of heat generated from the combustion of biomass, as a result of the CDM project activity.

38. As the level of biomass use in the absence of the project activity is associated with significant uncertainty, use, as a conservative approach, for $HG_{PJ,biomass,y}$ the minimum value among the following two options:

(a) The difference between the total quantity of heat generated from biomass in all heat generation equipment at the project site in the year *y* ($HG_{PJ,biomass,total,y}$) and the highest annual historical heat generation with biomass among the most recent three years prior to the implementation of the project activity, as follows:

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - MAX\{HG_{biomass,historic,n}; HG_{biomass,historic,n-1}; HG_{biomass,historic,n-2}\} \quad \text{Equation (4)}$$

Where:

$HG_{PJ,biomass,y}$	=	Incremental heat generated with biomass used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass in all heat generation equipment at the project site during the year *y* (GJ/yr)
$HG_{biomass,historic,n}$	=	Historical annual heat generation from firing biomass in the heat generation equipment at the project site during the year *n* (GJ/yr)
n	=	Year prior to the implementation of the project activity

(b) The difference between the total quantity of heat generated from biomass in all heat generation equipment in the year *y* ($HG_{PJ,biomass,total,y}$) and the total heat generation during the year *y* ($HG_{PJ,total,y}$) multiplied with the highest historical

[5] Use a mass unit for solid fuels and a volume unit for liquid and gaseous fuels.

fraction of heat generation with biomass residues from the most recent three years, as follows:

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - HG_{PJ,total,y} \times MAX\left\{\frac{HG_{biomass,historic,n}}{HG_{total,historic,n}};\frac{HG_{biomass,historic,n-1}}{HG_{total,historic,n-1}};\frac{HG_{biomass,historic,n-2}}{HG_{total,historic,n-2}}\right\}$$ Equation (5)

Where:

$HG_{PJ,biomass,y}$	=	Incremental heat generated with biomass used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass in all heat generation equipment at the project site during the year *y* (GJ/yr)
$HG_{PJ,total,y}$	=	Total heat generated in heat generation equipment at the project site, using both biomass and fossil fuels, during the year *y* (GJ/yr)
$HG_{biomass,historic,n}$	=	Historical annual heat generation from using biomass in heat generation equipment at the project site during the year *n* (GJ/yr)
$HG_{total,historic,n}$	=	Historical annual total heat generation, from using biomass and fossil fuels, in heat generation equipment at the project site during the year *n* (GJ/yr)
n	=	Year prior to the implementation of the project activity

39. The historical fraction of heat generation with biomass can be determined based on the quantities of biomass types *k* and fossil fuel types *i* used historically in the heat generation equipment operated at the project site, as follows:

$$\frac{HG_{biomass,historic,n}}{HG_{total,historic,n}} = \frac{\sum_k BF_{k,n} \times NCV_k}{\sum_k BF_{k,n} \times NCV_k + \sum_i FC_{i,n} \times NCV_i}$$ Equation (6)

Where:

$HG_{biomass,historic,n}$	=	Historical annual heat generation from using biomass in heat generation equipment at the project site during the year *n* (GJ/yr)
$HG_{total,historic,n}$	=	Historical annual total heat generation, from using biomass and fossil fuels, in heat generation equipment at the project site during the year *n* (GJ/yr)
$BF_{k,n}$	=	Quantity of biomass types *k* used in all heat generation equipment at the project site during the historical year *n* (tons of dry matter or liter)[4]
NCV_k	=	Net calorific value of the biomass types *k* (GJ/ton of dry matter or GJ/liter)
$FC_{i,n}$	=	Quantity of fossil fuel types *i* fired in all heat generation equipment at the project site during the historical year *n* (mass or volume unit)[5]

NCV_i	=	Net calorific value of the fossil fuel types *i* (GJ/mass or volume unit)
n	=	Year prior to the implementation of the project activity

5.4.2. Baseline emissions due to uncontrolled burning or decay of the biomass residues

40. If included in the project boundary, baseline emissions due to uncontrolled burning or decay of the biomass residues ($BE_{BR,y}$) shall be determined consistently with the most plausible baseline scenario for the use of the biomass residues, following the procedures for the respective baseline scenario, as outlined below. Where different baseline scenarios apply to different types or quantities of biomass residues, the procedures as outlined below should be applied respectively to the different quantities and types of biomass residues.

41. For this purpose, determine for each biomass residue types *k* the quantity of biomass residue used for heat generation as a result of the project activity ($BR_{PJ,k,y}$) as follows:

(a) If **no biomass** has been used for heat generation at the project site during the most recent three years prior to the implementation of the project activity and if the most plausible baseline scenario is that heat would continue to be generated only with fossil fuels, use $BR_{PJ,k,y} = BR_{k,y}$ for all biomass residue types *k*;

(b) If only **one type of biomass residue** *k* has been used for heat generation at the project site prior to the implementation of the project activity and if only this type of biomass residue is used during the year *y* after implementation of the project activity, use for $BR_{PJ,k,y}$ the product of the quantity of biomass residue types *k* fired in all heat generation equipment at the project site during the year *y* ($BR_{k,y}$) and the fraction of heat generated with biomass residues as a result of the project activity, as follows:

$$BR_{PJ,k,y} = BR_{k,y} \times \frac{HG_{PJ,biomass,y}}{HG_{PJ,biomass,total,y}} \qquad \text{Equation (7)}$$

Where:

$BR_{PJ,k,y}$	=	Quantity of biomass residue types *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[4]
$BR_{k,y}$	=	Quantity of biomass residue types *k* fired in all units of heat generation equipment at the project site during the year *y* (tons of dry matter or liter)[4]
$HG_{PJ,biomass,y}$	=	Incremental heat generated with biomass used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass residues in all heat generation equipment at the project site during the year *y* (GJ/yr)

(c) In all **other cases** (use of more than one type of biomass residue), determine $BR_{PJ,k,y}$ based on the specific circumstances of the project activity, thereby ensuring that the total quantity of all biomass residues types *k* used for heat

generation as a result of the project activity is related to the increase in heat generation from biomass as a result of the project activity, as follows:

$$\sum_{k} BR_{PJ,k,y} \times NCV_k = \sum_{k} BR_{k,y} \times NCV_k \times \frac{HG_{PJ,biomass,y}}{HG_{PJ,biomass,total,y}}$$ Equation (8)

Where:

$BR_{PJ,k,y}$	=	Quantity of biomass residue types *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[4]
$BR_{k,y}$	=	Quantity of biomass residue types *k* fired in all units of heat generation equipment at the project site during the year *y* (tons of dry matter or liter)[4]
NCV_k	=	Net calorific value of the biomass residue types *k* (GJ/ton of dry matter or GJ/liter)
$HG_{PJ,biomass,y}$	=	Incremental heat generated with biomass used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$	=	Total heat generated from firing biomass residues in all heat generation equipment at the project site during the year *y* (GJ/yr)

5.4.2.1. Aerobic decay or uncontrolled burning of the biomass residues (cases B1 and B3)

42. If the most likely baseline scenario for the use of the biomass residues is either that the biomass residues would be dumped or left to decay under mainly aerobic conditions (case B1 as described in "TOOL16: Project and leakage emissions from biomass") or burnt in an uncontrolled manner without utilizing them for energy purposes (case B3), baseline emissions are calculated assuming, for both scenarios viz., natural decay and uncontrolled burning, that the biomass residues would be burnt in an uncontrolled manner.

43. Baseline emissions due to uncontrolled burning or decay of the biomass residues are calculated as follows:

$$BE_{R,y} = GWP_{CH4} \times \sum_{k} BR_{PJ,k,y} \times NCV_k \times EF_{burning,CH4,k,y}$$ Equation (9)

Where:

$BE_{BR,y}$	=	Baseline emissions due to uncontrolled burning or decay of the biomass residues in year *y* (tCO_2e/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
$BR_{PJ,k,y}$	=	Quantity of biomass residue types *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[4]
NCV_k	=	Net calorific value of the biomass residue types *k* (GJ/ton of dry matter or GJ/liter)
$EF_{burning,CH4,k,y}$	=	CH_4 emission factor for uncontrolled burning of the biomass residue types *k* during the year *y* (tCH_4/GJ)

k = Types of biomass residues for which the identified baseline scenario is B1 or B3 as described in “TOOL16: Project and leakage emissions from biomass”

44. To determine the CH_4 emission factor, project participants may undertake measurements or use referenced default values.

45. In the absence of more accurate information for $NCV_{BR,n,y}$ and $EF_{burning,CH4,k,y}$[6], a default value of 0.0027 t CH_4/ t biomass is recommended,[7] adjusted by a conservativeness factor (i.e. 0.73) to address the high level of uncertainty. In this case, an emission factor of 0.001971 t CH_4/t biomass should be used.

5.4.2.2. Anaerobic decay of the biomass residues (case B2)

46. If the most likely baseline scenario for the use of the biomass residues is that the biomass residues would decay under clearly anaerobic conditions (case B2 as described in “TOOL16: Project and leakage emissions from biomass”), project participants shall calculate baseline emissions using the latest approved version of “TOOL04: Emissions from solid waste disposal sites”. The variable $BE_{CH4,SWDS,y}$ calculated by the tool corresponds to $BE_{BR,y}$ in this methodology. Use as waste quantities prevented from disposal ($W_{j,x}$) in the tool those quantities of biomass residues ($BR_{PJ,k,y}$) for which B2 as described in “TOOL16: Project and leakage emissions from biomass” has been identified as the most plausible baseline scenario.

5.4.2.3. Use for energy or feedstock purposes (cases B4 or B5)

47. The biomass residues would not decay or be burnt in an uncontrolled manner and $BE_{BR,y}$ = 0.

5.5. Project emissions

48. For the purpose of determining GHG emissions of the CDM project activity, project participants shall include the following emissions sources:

    (a) Emissions from fossil fuel consumption at the project site related to the generation of heat;

    (b) Emissions from grid-connected fossil fuel power plants in the electricity system for any electricity that is imported from the grid;

    (c) Emissions from off-site transportation of biomass that are combusted in the project plant;

    (d) If applicable, CH_4 emissions from combustion of biomass residues for heat generation at the project site;

    (e) If applicable, emissions from anaerobic treatment of wastewater originating from the treatment of the biomass prior to combustion;

[6] 2006 IPCC Guidelines, Volume 4, Table 2.5, default value for agricultural residues.

[7] 2006 IPCC Guidelines, Volume 4, Table 2.5, default value for agricultural residues.

(f) If heat and/or power is produced from biomass cultivated in dedicated plantations: project emissions from cultivation of plantation (this source shall not be included if the total area of dedicated plantation is registered as one or several A/R CDM project activities).

49. Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{EC,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG,y} + PE_{BC,y} \quad \text{Equation (10)}$$

Where:

PE_y	=	Project emissions during the year *y* (tCO_2/yr)
$PE_{FF,y}$	=	Emissions from on-site fossil fuel combustion at the project site in year *y* (tCO_2/yr)
$PE_{EC,y}$	=	Emissions from on-site electricity consumption at the project site in year *y* (tCO_2/yr)
$PE_{TR,y}$	=	Emissions from off-site transportation of biomass to the project site in year *y* (tCO_2/yr)
$PE_{BR,y}$	=	Emissions from combustion of biomass in the heat generation equipment in year *y* (tCO_2e/yr)
$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass in year *y* (tCO_2e/yr)
$PE_{BG,y}$	=	Emissions from the production of biogas in year *y* (tCO_2e/yr)
$PE_{BC,y}$	=	Emissions associated with the cultivation of land to produce biomass in year *y* (tCO_2e/yr)

5.5.1. Emissions from on-site fossil fuel combustion ($PE_{FF,y}$)

50. Emissions from on-site fossil fuel combustion at the project site are calculated in accordance with the latest approved version of "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". The parameter $PE_{FF,y}$ corresponds to $PE_{FC,j,y}$ in the tool, where *j* should include all processes of fuel combustion that are attributable to the project activity, such as for on-site transportation or treatment of the biomass residues. This should not include fossil fuels co-fired in the project heat generation equipment.

5.5.2. Emissions from on-site electricity consumption ($PE_{EC,y}$)

51. Emissions from on-site electricity consumption are calculated as follows:

$$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y} \quad \text{Equation (11)}$$

Where:

$PE_{EC,y}$	=	CO_2 emissions from on-site electricity consumption at the project site in year *y* (tCO_2/yr)
$EC_{PJ,y}$	=	On-site electricity consumption at the project site in year *y* (MWh)
$EF_{grid,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)

52. The Grid emission factor *($EF_{grid,y}$)* shall be determined in accordance with "TOOL07: Tool to calculate the emission factor for an electricity system".

5.5.3. Emissions from transportation of biomass to the project site ($PE_{TR,y}$)

53. In cases where the biomass residues are not generated directly at the project site, and always in the case of biomass from plantations, project participants shall determine CO_2 emissions resulting from transportation of the biomass to the project plant using the latest version of "TOOL12: Project and leakage emissions from transportation of freight". $PE_{TR,m}$ in the tool corresponds to the parameter $PE_{TR,y}$ in this methodology and the monitoring period *m* is one year.

5.5.4. Emissions from combustion of biomass residues in the heat generation equipment ($PE_{BR,y}$)

54. If this source has been included in the project boundary, emissions are calculated as follows:

$$PE_{BR,y} = GWP_{CH4} \times EF_{CH4,BF} \times \sum_{k} BR_{PJ,k,y} \times NCV_k$$ Equation (12)

Where:

$PE_{BR,y}$	=	CH_4 emissions from combustion of biomass residues in the heat generation equipment (tCH_4/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2/tCH4)
$EF_{CH4,BF}$	=	CH_4 emission factor for the combustion of the biomass residues in the heat generation equipment (tCH_4/GJ)
$BR_{PJ,k,y}$	=	Quantity of biomass residue types *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[4]
NCV_k	=	Net calorific value of the biomass residue types *k* (GJ/ton of dry matter or GJ/liter)

55. To determine the CH_4 emission factor, project participants may conduct measurements at the plant site or use IPCC default values, as provided in Table **3** below. The uncertainty of the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor of 1.37 is applied.

Table 3. Default CH4 emission factors for combustion of biomass residues[8]

	Default emission factor (kg CH_4 / TJ)	**Assumed uncertainty**
Wood waste	30	300%
Sulphite lyes (Black Liquor)	3	300%

[8] Values are based on the 2006 IPCC Guidelines, Volume 2, Chapter 2, Tables 2.2 to 2.6.

	Default emission factor (kg CH_4 / TJ)	**Assumed uncertainty**
Other solid biomass residues	30	300%
Liquid biomass residues	3	300%

5.5.5. Emissions from wastewater generated from the treatment of biomass ($PE_{WW,y}$)

56. This emission source shall be estimated in cases where wastewater originating from the treatment of the biomass is (partly) treated under anaerobic conditions and where methane from the waste water is not captured and flared or combusted. Project emissions from waste water are estimated as follows:

$$PE_{WW,y} = GWP_{CH4} \times V_{WW,y} \times COD_{WW,y} \times B_{o,WW} \times MCF_{WW} \quad \text{Equation (13)}$$

Where:

$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass in year *y* (tCO_2e)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4)
$V_{WW,y}$	=	Quantity of waste water generated in year *y* (m^3)
$COD_{WW,y}$	=	Average chemical oxygen demand of the waste water in year *y* ($tCOD/m^3$)
$B_{o,WW}$	=	Methane generation potential of the waste water treatment system (t CH_4/tCOD)
MCF_{WW}	=	Methane correction factor for the waste water (ratio)

5.5.6. Emissions from the production of biogas in year y ($PE_{BG,y}$)

57. In case the project includes biogas the consideration of project emissions associated with the production of biogas depends on the selected baseline scenario for biogas and whether the biogas is sourced from a registered CDM project activity according to the following provisions:

(a) In case the biogas is provided by a registered CDM project activity, the project emissions will be covered in the PDD of the registered CDM project activity;

(b) In case the biogas is not provided by a registered CDM project activity:

(i) If baseline scenario BG1 is selected, project emissions shall be included in this proposed CDM project activity. The emission source shall include project emissions from physical leakage of methane from the anaerobic digester, from treatment of wastewater effluent from the anaerobic digester (where applicable), and from land application of sludge (where applicable). The estimation of these emission sources shall follow the procedures for these sources as identified in the project emissions section of ACM0014 or AMS-III.H.;

(ii) In case of baseline scenario BG2 and/or BG3, no project emissions need to be included.

5.5.7. Emissions associated with the cultivation of land to produce biomass in year y (***$PE_{BC,y}$***)

58. If the project includes biomass from dedicated plantations, the associated emissions shall be calculated according to “TOOL16: Project and leakage emissions from biomass”.

5.6. Leakage

59. Leakage emissions due to diversion of biomass residues from other uses applications shall be calculated according to “TOOL16: Project and leakage emissions from biomass”.

60. Leakage emissions due to shift of pre-project activities shall be calculated according to “TOOL16: Project and leakage emissions from biomass”.

61. In the case that negative overall emission reductions arise in a year through application of the leakage emissions, CERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. For example, if negative emission reductions of 30 tCO_2e occur in the year t and positive emission reductions of 100 tCO_2e occur in the year t+1, only 70 CERs are issued for the year t+1.

5.7. Emission reductions

62. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (14)}$$

Where:

ER_y	=	Emission reductions during the year *y* (tCO_2/yr)
BE_y	=	Baseline emissions during the year *y* (tCO_2/yr)
PE_y	=	Project emissions during the year *y* (tCO_2/yr)
LE_y	=	Leakage emissions during the year *y* (tCO_2/yr)

5.8. Data and parameters not monitored

Data / Parameter table 1.

Data / Parameter:	***GWP_{CH4}***
Data unit:	tCO_2e/tCH_4
Description:	GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO2/tCH4)
Source of data:	IPCC
Measurement procedures (if any):	Default value of 25 from IPCC Fourth Assessment Report (AR4). Shall be updated according to any future COP/MOP decisions

Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$\eta_{heat,FF}$
Data unit:	Ratio
Description:	Average net efficiency of the heat generation equipment if fired with fossil fuels in the baseline
Source of data:	Determined using the latest approved version of “TOOL09: Determining the baseline efficiency of thermal or electric energy generation systems” or assume an efficiency of 100% as a conservative default value
Measurement procedures (if any):	Document measurement procedures and results and manufacturer’s information transparently in the CDM-PDD
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	$HG_{biomass,historic,n}$/$HG_{biomass,historic,n-1}$/$HG_{biomass,historic,n-2}$
Data unit:	GJ/yr
Description:	Historical annual heat generation from firing biomass at the project site during the year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to the implementation of the project activity
Source of data:	Onsite measurements
Measurement procedures (if any):	Heat generation can be determined as per section 5.5.1.2.2 (Case B) or as the difference of the enthalpy of the steam or hot fluid and/or gases generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and/or gases, blow-down and any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. In case of equipment that produces hot water/oil this is expressed as difference in the enthalpy between the hot water/oil supplied to and returned by the plant. In case of equipment that produces hot gases or combustion gases, this is expressed as difference in the enthalpy between the hot gas produced and all streams supplied to the plant. The enthalpy of all relevant streams shall be determined based on the mass flow, temperature, pressure, density and specific heat of the gas

Any comment:	If the three most recent historical years prior to the implementation of the project activity are not representative for the situation at the project site (e.g. a drought in one year, an equipment or plant not operating during a certain year for technical reasons, etc.), project participants may alternatively select the five most recent historical years from which one year may be excluded if deviating significantly from other years. The selection by project participants should be documented in the CDM-PDD and be applied to all relevant provisions and equations throughout this methodology in a consistent manner, including the applicability condition

Data / Parameter table 4.

Data / Parameter:	$BR_{k,n}/BR_{k,n-1}/BR_{k,n-2}$
Data unit:	Tons of dry matter or liter[4]
Description:	Quantity of biomass types *k* fired in all heat generation equipment at the project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the project activity
Source of data:	On-site measurements
Measurement procedures (if any):	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available)
Any comment:	If the three most recent historical years prior to the implementation of the project activity are not representative for the situation at the project site (e.g. a drought in one year, equipment not operating during a certain year for technical reasons, etc.), project participants may alternatively select the five most recent historical years from which one year may be excluded if deviating significantly from other years. The selection by project participants should be documented in the CDM-PDD and be applied to all relevant provisions and equations throughout this methodology in a consistent manner, including the applicability condition

Data / Parameter table 5.

Data / Parameter:	$FC_{i,n}/FC_{i,n-1}/FC_{i,n-2}$
Data unit:	Mass or volume unit[5]
Description:	Quantity of fossil fuel types *i* fired in all heat generation equipment at the project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the project activity
Source of data:	On-site measurements
Measurement procedures (if any):	Use weight or volume meters. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available)

Any comment:	If the three most recent historical years prior to the implementation of the project activity are not representative for the situation at the project site (e.g. a drought in one year, an equipment not operating during a certain year for technical reasons, etc.), project participants may alternatively select the five most recent historical years from which one year may be excluded if deviating significantly from other years. The selection by project participants should be documented in the CDM-PDD and be applied to all relevant provisions and equations throughout this methodology in a consistent manner, including the applicability condition

Data / Parameter table 6.

Data / Parameter:	EG_{hist}
Data unit:	MWh
Description:	Highest historical electricity generation at the project site during the most recent three years prior to the implementation of the project activity
Source of data:	On-site measurements
Measurement procedures (if any):	-
Any comment:	Required to assess the applicability condition referring to power generation at the project site

6. Monitoring methodology

63. Describe and specify in the CDM-PDD all monitoring procedures, including the type of measurement instrumentation used, the responsibilities for monitoring and QA/QC procedures that will be applied. Where the methodology provides different options (e.g. use of default values or on-site measurements), specify which option will be used. All meters and instruments should be calibrated regularly as per industry practices.

64. In addition to the parameters and procedures described herein, relevant monitoring provisions contained in the tools referred to in this methodology also apply.

6.1. Data and parameters monitored

Data / Parameter table 7.

Data / Parameter:	$EF_{FF,CO2,y}$
Data unit:	tCO_2e/GJ
Description:	CO_2 emission factor of the fossil fuel type displaced by biomass for the year *y*
Source of data:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default emission factors (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the value in a conservative manner and justify the choice
Measurement procedures (if any):	Measurements shall be carried out at reputed laboratories and according to relevant international standards

Monitoring frequency:	In case of measurements: At least every six months, taking at least three samples for each measurement. In case of other data sources: Review the appropriateness of the annual data
QA/QC procedures:	Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, collect additional information or conduct additional measurements
Any comment:	For the purpose of determining $EF_{FF,CO2,y}$, as a conservative approach, the least carbon intensive fuel type should be used among the fossil fuels types used at the project site during the most recent 3 years prior to the implementation of the project activity and the fossil fuels used in the equipment at the project site due the year *y*

Data / Parameter table 8.

Data / Parameter:	$HG_{PJ,total,y}$
Data unit:	GJ/yr
Description:	Total heat generated in all heat generation equipment at the project site, using both biomass and fossil fuels, during the year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	Heat generation is determined as the difference of the enthalpy of the steam or hot fluid and/or gases generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and/or gases blow-down and any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. In case of equipment that produces hot water/oil this is expressed as difference in the enthalpy between the hot water/oil supplied to and returned by the plant. In case of equipment that produces hot gases or combustion gases, this is expressed as difference in the enthalpy between the hot gas produced and all streams supplied to the plant. The enthalpy of all relevant streams shall be determined based on the monitored mass flow, temperature, pressure, density and specific heat of the gas
Monitoring frequency:	Continuously, aggregated annually
QA/QC procedures:	The consistency of metered net heat generation should be cross-checked with the quantity of biomass and/or fossil fuels fired (e.g. check whether the net heat generation divided by the quantity of fuel fired results in a reasonable thermal efficiency that is comparable to previous years)
Any comment:	The parameters mass flow, temperature, pressure, density and specific heat of the gas, shall be monitored

Data / Parameter table 9.

Data / Parameter:	$BR_{k,y}$
Data unit:	Tons of dry matter or liter[4]
Description:	Quantity of biomass types *k* fired in all units of heat generation equipment at the project site during the year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of heat generated and any fuel purchase receipts (if available)
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	The quantity of biomass combusted should be collected separately for all types of biomass. For biogas the volume shall be referred to Normal Temperature and Pressure conditions (NTP)

Data / Parameter table 10.

Data / Parameter:	**Moisture content**
Data unit:	%
Description:	Moisture content of each biomass types *k*
Source of data:	On-site measurements
Measurement procedures (if any):	-
Monitoring frequency:	The moisture content should be monitored for each batch of biomass of homogeneous quality. The weighted average should be calculated for each monitoring period and used in the calculations
QA/QC procedures:	-
Any comment:	In case of dry biomass, monitoring of this parameter is not necessary

Data / Parameter table 11.

Data / Parameter:	$FC_{i,y}$
Data unit:	Mass or volume unit[5]
Description:	Quantity of fossil fuel types *i* fired in all heat generation equipment at the project site during the year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	-
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	The quantity of fossil fuels combusted should be collected separately for all types of fossil fuels

Data / Parameter table 12.

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	Use electricity meters. The quantity shall be cross-checked with electricity purchase receipts
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Cross-check measurement results with invoices for purchased electricity if available
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity used from the grid
Source of data:	Use “TOOL07: Tool to calculate the emission factor for an electricity system” to calculate the grid emission factor
Measurement procedures (if any):	-
Monitoring frequency:	Either once at the start of the project activity or updated annually, consistent with guidance provided in the tool
QA/QC procedures:	As per the guidance provided in the tool
Any comment:	All data and parameters to determine the grid electricity emission factor, as required by the tool, shall be included in the monitoring plan

Data / Parameter table 14.

Data / Parameter:	NCV_i
Data unit:	GJ/mass or volume unit
Description:	Net calorific value of fossil fuel types *i*
Source of data:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default net calorific values (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the values in a conservative manner and justify the choice
Measurement procedures (if any):	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Monitoring frequency:	In case of measurements: At least every six months, taking at least three samples for each measurement. In case of other data sources: Review the appropriateness of the data annually

QA/QC procedures:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, collect additional information or conduct additional measurements
Any comment:	-

Data / Parameter table 15.

Data / Parameter:	NCV_k
Data unit:	GJ/ton of dry matter or GJ/liter
Description:	Net calorific value of biomass types *k*
Source of data:	Measurements/calculations
Measurement procedures (if any):	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure/calculate the NCV based on dry biomass
Monitoring frequency:	At least every six months, taking at least three samples for each measurement
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, 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. Ensure that the NCV is determined on the basis of dry biomass
Any comment:	Biogas should be included as appropriate if applicable (in which case convenient units such as GJ/m^3 should be used)

Data / Parameter table 16.

Data / Parameter:	$EF_{CH4,BF}$
Data unit:	kg CH_4 / TJ
Description:	CH_4 emission factor for the combustion of the biomass residues in the heat generation equipment
Source of data:	On-site measurements or default values, as provided in Table **3**
Measurement procedures (if any):	The CH_4 emission factor may be determined based on a stack gas analysis using calibrated analyzers
Monitoring frequency:	At least quarterly, taking at least three samples per measurement
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, 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
Any comment:	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Note that a conservative factor shall be applied, as specified in the baseline methodology

Data / Parameter table 17.

Data / Parameter:	$EF_{burning,CH4,k,y}$
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for uncontrolled burning of the biomass residue types *k* during the year *y*
Source of data:	Undertake measurements or use referenced and reliable default values (e.g. IPCC)
Measurement procedures (if any):	Project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$
Monitoring frequency:	Review of default values: annually. Measurements: once at the start of the project activity
QA/QC procedures:	Cross-check the results of any measurements with IPCC default values. If there is a significant difference, check the measurement method and increase the number of measurements in order to verify the results
Any comment:	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Note that a conservative factor shall be applied, as specified in the baseline methodology

Data / Parameter table 18.

Data / Parameter:	$EF_{CO2,LE}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the most carbon intensive fuel used in the country
Source of data:	Identify the most carbon intensive fuel type from the national communication, other literature sources (e.g. IEA). Possibly consult with the national agency responsible for the national communication/GHG inventory. If available, use national default values for the CO_2 emission factor. Otherwise, IPCC default values may be used
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 19.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity generation during the year *y* at the project site
Source of data:	On-site measurements
Measurement procedures (if any):	-

Monitoring frequency:	Annual
QA/QC procedures:	-
Any comment:	Monitoring of this parameter is only required if power is generated at the project site. In this case, monitoring is needed to assess whether the applicability condition referring to power generation at the project site is met

Data / Parameter table 20.

Data / Parameter:	$V_{WW,y}$
Data unit:	m^3
Description:	Quantity of waste water generated in year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	-
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 21.

Data / Parameter:	$COD_{WW,y}$
Data unit:	$tCOD/m^3$
Description:	Average chemical oxygen demand of the waste water in year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	-
Monitoring frequency:	In case of measurements: At least every six months, taking at least three samples for each measurement
QA/QC procedures:	-
Any comment:	-

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Document information

Version	*Date*	*Description*
06.0	14 December 2020	EB 108, Annex 5 Revision to: • Incorporate changes identified in ACM0006; • Address inconsistencies and ambiguities in the language used in some parts of the methodology;

Version	*Date*	*Description*
		• Ensure consistency across the methodologies for biomass utilization. In addition, the title "Fuel switch from fossil fuels to biomass in heat generation equipment" changes to "Use of biomass in heat generation equipment".
05.0	31 August 2018	EB 100, Annex 3 Revision to include reference to TOOL16.
04.0	2 March 2012	EB 66, Annex 38 Revision in order to incorporate reference to the tools: • "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of a crediting period"; • "Tool for project and leakage emissions from road transportation of freight". In addition, the leakage section was modified, providing for a simpler procedure, and some minor editorial improvements were made.
03.0	4 December 2009	EB 51, Annex 6 Revision to: • Revise the applicability of the methodology to cover a broader range of heat generation equipment in addition to boilers; • References to the latest approved methodological tools were included; • To insert the correct sectoral scopes; • To clarify monitoring requirement of moisture of biomass; • To clarify that NCV of biomass can be calculated and need not only be measured; • Several minor editorial revisions were made.
02.2	17 July 2009	EB 48, Annex 8 Editorial revision to clarify that: (i) in the case of fossil fuels co-fired with biomass, the fossil fuel amount shall not exceed 50% of the total fuel fired on an energy basis; and (ii) for the purpose of this methodology, refuse derived fuel / refuse plastic fuel (RDF/RPF) should be considered as fossil fuels.
02.1	2 August 2008	EB 41, Paragraph 26(g) The title of the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" changes to "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".
02.0	27 July 2007	EB 33, Annex 9

Version	*Date*	*Description*
		Revision to correct an oversight where in the avoidance of methane emissions from anaerobic decay of biomass is credited even for that fraction of biomass, which is identified as not being surplus and thus would not have been dumped and thereby not causing methane emissions.
01.0	29 September 2006	EB 26, Annex 3 Initial adoption.

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