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Ministry of Environment, Forest and Climate Change

METHODOLOGY

BM WA03.002

Flaring or use of landfill gas

INDIAN Carb•n MARKET

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Version 1.0

Sectoral scope(s): Waste Handling and Disposal

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1. Introduction

1. This methodology is adopted and refers to the latest approved version of the UNFCCC Clean Development Mechanism Methodology ACM0001 (as valid from 14 June 2019)

2. It shall be the responsibility of the non-obligated entity and Accredited Carbon Verification Agency (ACVA) to note of any subsequent changes or revisions in the above-mentioned methodology while developing projects and performing validation and/or verification activity respectively.

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

Table 1. Methodology key elements

Typical projects	Capture of landfill gas (LFG) and its flaring and/or use to produce energy and/or use to supply consumers
Type of GHG emissions mitigation action	GHG destruction: Destruction of methane emissions and displacement of a more-GHG-intensive service

2. Definitions

4. For the purpose of this methodology the following definitions apply:

(a) **Biogas processing facility** - the facility which processes, upgrades and compresses/liquefies the biogas collected from a Solid Waste Disposal Site (SWDS) with the purpose of supplying it to end-users;

(b) **Continuous brick kiln** - a brick kiln where bricks are loaded continuously into the kiln, rather than in batches. Continuous brick kilns are distinguished as moving ware kilns and moving fire annular kilns. Moving ware kilns include tunnel and vertical shaft kilns. Moving fire annular kilns use Hoffmann, Bull's trench and Zig-zag technologies;

(c) **Existing LFG capture system** - a system that has been in operation in the last calendar year prior to the start of the operation of the project activity.

(d) **LFG capture system** - a system to capture LFG. The system may be passive, active or a combination of both active and passive components. Passive systems capture LFG by means of natural pressure, concentration, and density gradients. Active systems use mechanical equipment to capture LFG by providing pressure gradients. Captured LFG can be vented, flared or used.

(e) **Intermittent brick kiln** - bricks are loaded into the kiln and fired in batches. Types include Clamp, Scotch and Scove technologies.

(f) **Landfill gas (LFG)** - the gas generated by decomposition of waste in a SWDS. LFG is mainly composed of methane, carbon dioxide and small fractions of ammonia and hydrogen sulphide;

(g) **Reference conditions** - reference conditions are defined as 0 ^{o}C (273.15 K, 32 ^{o}F) and 1 atm (101.325 kN/m2, 101.325 kPa, 14.69 psia, 29.92 in Hg, 760 torr);

(h) **Solid waste** - material that is unwanted and insoluble (including gases or liquids in cans or containers). Hazardous waste is not included in the definition of solid waste;

(i) **Solid waste disposal site (SWDS)** - designated areas intended as the final storage place for solid waste.

3. Scope & Applicability

3.1. Scope

5. This methodology applies to project activities that include the destruction of methane emissions and displacement of a more-GHG-intensive service by capturing landfill gas from the landfill site and/or flaring and/or using to produce energy (i.e. electricity, thermal energy); and/or using to supply consumers through natural gas distribution network**,** dedicated pipeline or trucks.

3.2. Applicability

6. The methodology is applicable under any of the following conditions:

(a) Install a new LFG capture system in an existing or new (Greenfield) SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity; or

(b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:

(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and

(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available;

(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:

(i) Generating electricity;

(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace;[1] and/or

(iii) Supplying the LFG to consumers through a natural gas distribution network;

(iv) Supplying compressed/liquefied LFG to consumers using trucks;[2]

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[1] For claiming emission reductions for other heat generation equipment (including other products in kilns), a non-obligated entity may submit a revision to this methodology.

[2] If other means of transportation are used, a revision to this methodology may be requested.

(v) Supplying the LFG to consumers through a dedicated pipeline;

Activities should not reduce the amount of organic waste that would be recycled in the absence of the project activity.

Box 1. Non-binding best practice example 1: demonstration of the applicability condition 3(c)

1. When demonstrating compliance with requirement (c) above, the non-obligated entity may:
   (a) Describe the prevailing waste management practices pertinent to organic waste recycling in the area that is served by the landfill. The area served by the landfill should be clearly identified in the PDD, with supporting evidence (e.g. by providing contracts or licenses);
   (b) Identify any facility(ies) that recycle the organic fraction of the waste in the area identified in (a) above.; and
   (c) If there are facilities identified in (b) above, explain whether the project activity will impact the amount of organic waste which is recycled in the absence of the project.
   (d) If the facility(ies) identified in (c) above is(are) not operating at its maximum capacity, explain, with supporting evidence (e.g. by providing a balance of processed waste or receipts for transported waste), why the organic fraction of the solid waste would not have been treated in this(ese) facility(ies).
2. In doing so, the non-obligated entity may conduct interviews with authorities, refer to national/local statistics or studies related to MSW management in the area, and obtain opinion from relevant local experts.

7. The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

(a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and

(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln:

(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or

(ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;

(c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.

(d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

8. This methodology is not applicable:

   (a) In combination with other approved methodologies. For instance, BM WA03.002 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the ICM project activity is to implement energy efficiency measures at a kiln or glass melting furnace;

   (b) If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.

9. The applicability conditions included in the tools referred to below also apply.

3.3. Methodology Approval Date

10. The date of adoption of this document shall be effective from 27 March 2025.

3.4. Applicability of sectoral scopes

11. For validation and verification of ICM projects and programme of activities by a designated ACVA using this methodology:

   (a) If the recovered Land fill gas (LFG) is only flared and not used for any other purposes the application of sectoral scope *"03: Waste handling and disposal"* is mandatory;

   (b) If the recovered LFG is used for any other purposes than flaring, then application of sectoral scope *"03: Waste handling and disposal"* and sectoral scope *"01: Energy"* is mandatory.

3.5. Applicability of approved adopted methodology and tools

12. The methodology also refers to the latest approved version of the following methodological tools:

   (a) "BM-T-001: Combined tool to identify the baseline scenario and demonstrate additionality" (hereinafter referred to as BM-T-001);

   (b) "BM-T-002: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (hereinafter referred to as BM-T-002);

   (c) "BM-T-003: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred to as BM-T-003);

   (d) "BM-T-004: Project emissions from flaring" (hereinafter referred to as BM-T-004);

   (e) "BM-T-005: Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (hereinafter referred to as BM-T-005);

   (f) "BM-T-006: Tool to determine baseline efficiency of thermal and electricity systems" (hereinafter referred to as BM-T-006);

   (g) "BM-T-007: Project and leakage emissions from transportation of freight" (hereinafter referred to as BM-T-007).

(h) "BM-T-011: "Emissions from solid waste disposal sites" (hereinafter referred to as BM-T-011);

(i) "BM-T-012: Positive lists of technologies" (hereinafter referred to as BM-T-012).

4. Methodology: Baseline Component

4.1. Project boundary

13. The project boundary of the project activity shall include the site where the LFG is captured and, as applicable:

(a) Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, glass melting furnace, kiln, natural gas distribution network, dedicated pipeline or biogas processing facility);

(b) Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity to the project activity;

(c) Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by captured LFG in the project activity;

(d) Heat generation equipment or sources which are supplying heat in the baseline that is displaced by heat generated by captured LFG in the project activity; and

(e) The transportation of the compressed/liquefied LFG from the biogas processing facility to consumers.

Table 2. Summary of greenhouse gases and sources included in and excluded from the project boundary

Source		Gas	Included	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
		CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
	Emissions from electricity generation	CO_2	Yes	Major emission source if power generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative

Source		Gas	Included	Justification/Explanation
	Emissions from heat generation	CO_2	Yes	Major emission source if heat generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	Yes	Major emission source if supply of LFG through a natural gas distribution network, dedicated pipeline or using trucks is included in the project activity
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	Yes	May be an 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
	Emissions from electricity consumption due to the project activity	CO_2	Yes	May be an 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
	Emissions from flaring	CO_2	No	Emissions are considered negligible
		CH_4	Yes	May be an important emission source
		N_2O	No	Emissions are considered negligible
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO_2	Yes	May be an important emission source
		CH_4	Yes	May be an important emission source
		N_2O	No	Emissions are considered negligible

4.2. Procedure for the selection of the most plausible baseline scenario and demonstrate additionality

14. Non-obligated entity may either apply the simplified procedures in section 4.2.1 below or the procedures in section 4.2.2 to select the most plausible baseline scenario and demonstrate additionality.

4.2.1. Simplified procedures to identify the baseline scenario and demonstrate additionality

15. For the simplified procedure to demonstrate additionality, the non-obligated entity shall refer to the methodological tool BM-T-012.

16. The baseline scenario for LFG is assumed to be the atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

17. If all or part of the electricity generated by the project activity is exported to the grid, the baseline scenario for all or the part of the electricity exported to the grid is assumed to be electricity generation in existing and/or new grid-connected power plants. If all or part of the electricity is supplied to off-grid application, the baseline electricity generation equipment is assumed to correspond to the default emission factor from BM-T-003.

18. The baseline scenario for heat is assumed to be a new natural-gas-fired heat generation equipment with a default baseline efficiency of 100 per cent or with a default baseline efficiency as provided in BM-T-006.

4.2.2. Procedures according to the "Combined tool to identify the baseline scenario and demonstrate additionality"

19. Identify the baseline scenario and demonstrate additionality using BM-T-001 and following the requirements below.

20. In applying Step 1 of the tool, baseline alternatives for the destruction of LFG, shall take into consideration, inter alia, the following alternatives:

    (a) LFG1: The project activity implemented without being registered as a ICM project activity (i.e. capture and flaring or use of LFG);

    (b) LFG2: Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons;

    (c) LFG3: Atmospheric release of the LFG or capture of LFG in an unmanaged SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons;

    (d) LFG4: LFG generation is partially avoided because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;

    (e) LFG5: LFG generation is partially avoided because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS;

    (f) LFG6: LFG generation is partially avoided because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.

Box 2. Non-binding best practice example 2: elimination of alternative LFG scenarios 20(c), (d) and (e)

1. When considering any of the alternatives above, the non-obligated entity may:
   (a) Describe the prevailing waste management practices pertinent to organic waste in the area that is served by the landfill. The area served by the landfill should be clearly identified in the PDD, with supporting evidence (e.g. by providing contracts);
   (b) Provide information on the existence of any facility(ies) that:
      (i) recycle the organic fraction of the waste (regarding alternative "LFG3") in the area identified in (a) above;
      (ii) aerobically treat the organic fraction of the waste, such as composting plants (regarding alternative "LFG4"), in the area identified in (a) above;
      (iii) incinerate the organic fraction of the waste (regarding alternative "LFG5"), in the area identified in (a) above;
   (c) If there is(are) facility(ies) identified, indicate which is the processing capacity of each facility (tonnes/day, tonnes/month, tonnes/year). If the facility(ies) is(are) operating at its maximum capacity, then the alternative scenario can be excluded. The rationale is that in the absence of the project, the organic fraction of the waste would not be recycled or aerobically treated or incinerated, for example, because the recycling or aerobic treatment or incineration plant(s) located in the region that is served by the landfill would not be able to receive more waste.
   (d) If the facility(ies) identified in (c) above is(are) not operating at its maximum capacity, explain, with supporting evidence (e.g. by providing a balance of processed waste or receipts for transported waste), why the organic fraction of the solid waste would not have been treated in this(ese) facility(ies)
2. In doing so, the non-obligated entity may conduct interviews with authorities, refer to national/local statistics or studies related to MSW management in the area, and obtain opinion from relevant local experts.

21. In addition to the alternative baseline scenarios identified for the destruction of LFG, alternative scenarios for the use of LFG shall also be identified (if this is an aspect of the project activity):

(a) For electricity generation, alternative(s) shall include, inter alia:

(i) E1: Electricity generation from LFG, undertaken without being registered as ICM project activity;

(ii) E2: Electricity generation in existing or new renewable or fossil fuel based captive power plant(s);

(iii) E3: Electricity generation in existing and/or new grid-connected power plants;

(b) For heat generation, alternative(s) shall include, inter alia:

(i) H1: Heat generation from LFG undertaken without being registered as ICM project activity;

(ii) H2: Heat generation in existing or new fossil fuel fired cogeneration plant(s);

(iii) H3: Heat generation in existing or new renewable based cogeneration plant(s);

(iv) H4: Heat generation in existing or new fossil fuel-based boiler(s), air heater(s), glass melting furnace(s) or kiln(s);

(v) H5: Heat generation in existing or new renewable energy-based boiler(s), air heater(s), glass melting furnace(s) or kiln(s);

(vi) H6: Any other source, such as district heat; and

(vii) H7: Other heat generation technologies (e.g. heat pumps or solar energy);

(c) For the supply of LFG to a natural gas distribution network and/or dedicated pipeline and/or distribution of compressed/liquefied using trucks, the baseline is assumed to be the supply with natural gas.

22. To identify the baseline fuel for electricity generation by captive fossil fuel fired power plants and/or heat generation:

(a) Non-obligated entity shall demonstrate that the identified baseline fuel used for generation of electricity and/or heat is available in India and there is no supply constraint. In case of partial supply constraints (seasonal supply), the non-obligated entity shall consider, for the period of partial supply, the potential alternative fuel(s) with the lowest baseline emissions;

(b) Detailed justifications shall be provided and documented in the ICM-PDD for the selected baseline fuel. As a conservative approach, the lowest carbon intensive fuel, such as natural gas, may be used throughout all period of the year.

4.3. Baseline emissions

23. Baseline emissions are determined according to equation (1) and comprise the following sources:

(a) Methane emissions from the SWDS in the absence of the project activity;

(b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

(c) Heat generation using fossil fuels in the absence of the project activity; and

(d) Natural gas used from the natural gas network in the absence of the project activity.

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$$ Equation (1)

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)
$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year *y* (t CO_2/yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year *y* (t CO_2/yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year *y* (t CO_2/yr)

4.3.1. Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

24. Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account:

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4} \quad \text{Equation (2)}$$

Where:

$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
OX_{top_layer}	=	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH4,\,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$F_{CH4,\,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year *y* (t CH_4/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

4.3.1.1. Ex post determination of $F_{CH4,PJ,y}$

25. During the crediting period, $F_{CH4,PJ,y}$ is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), air heater(s), glass melting furnace(s), kiln(s) and natural gas distribution, as follows:

$$F_{CH4,\,PJ,y} = F_{CH4,\,flared,\,y} + F_{CH4,\,EL,\,y} + F_{CH4,\,HG,\,y} + F_{CH4,\,NG,y} \quad \text{Equation (3)}$$

Where:

$F_{CH4,\,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$F_{CH4,\,flared,\,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)
$F_{CH4,\,EL,\,y}$	=	Amount of methane in the LFG which is used for electricity generation in year *y* (t CH_4/yr)
$F_{CH4,\,HG,\,y}$	=	Amount of methane in the LFG which is used for heat generation in year *y* (t CH_4/yr)
$F_{CH4,\,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year *y* (t CH_4/yr)

26. $F_{CH4,EL,y}$, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are determined using BM-T-005 and monitoring the working hours of the power plant(s), boiler(s), air heater(s), glass melting furnace(s) and kiln(s), so that no emission reduction are claimed for methane destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year *y* ($Op_{j,h,y}$).

27. The following requirements apply:

(a) As per the gaseous stream tool, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. The destruction efficiency of the least efficient among the destruction devices shall be used as the destruction efficiency for all destruction devices monitored by this flow meter. If there are any periods for which one or more destruction devices are not operational, BM-T-006 shall be followed;

(b) CH_4 is the greenhouse gas for which the mass flow should be determined;

(c) The simplification offered for calculating the molecular mass of the gaseous stream is valid;

(d) The mass flow should be calculated on an hourly basis for each hour *h* in year *y*;

(e) The mass flow calculated for hour *h* is 0 if the equipment is not working in hour *h* ($Op_{j,h}$=not working), the hourly values are then summed to a yearly unit basis.

28. $F_{CH4,flared,y}$ is determined as the difference between the amount of methane supplied to the flare(s) and any methane emissions from the flare(s), as follows:

$$F_{CH4,\,flared,y} = F_{CH4,\,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}} \qquad \text{Equation (4)}$$

Where:

$F_{CH4,\,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)
$F_{CH4,\,sent\_flare,y}$	=	Amount of methane in the LFG which is sent to the flare in year *y* (t CH_4/yr)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year *y* (t CO_2e/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

29. $F_{CH4,sent\_flare,y}$ is determined directly using BM-T-005, applying the requirements described above where the gaseous stream is the LFG delivery pipeline to the flare(s).

30. $PE_{flare,y}$ shall be determined using the methodological BM-T-004. If LFG is flared through more than one flare, then $PE_{flare,y}$ is the sum of the emissions for each flare determined separately.

4.3.1.2. Ex ante estimation of $F_{CH4,PJ,y}$

31. An ex ante estimate of $F_{CH4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS (according to equation (2)) in order to estimate the emission reductions of the proposed project activity in the ICM-PDD. It is determined as follows:

$$F_{CH4,PJ,y} = \eta_{PJ} \times BE_{CH4,\,SWDS,y}/GWP_{CH4} \qquad \text{Equation (5)}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (t CO_2e/yr)
η^{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

32. $BE_{CH4,SWDS,y}$ is determined using BM-T-011. The following guidance should be taken into account when applying the tool:

(a) f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation (2) of this methodology;

(b) In the tool, *x* begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and

(c) Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

4.3.1.3. Determination of $F_{CH4,BL,y}$

33. This section provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred to as requirement in this section). The four cases in Table 3 are distinguished. The appropriate case should be identified, and the corresponding instructions followed.

Table 3. Cases for determining methane captured and destroyed in the baseline

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	No	No
Case 2	Yes	No
Case 3	No	Yes
Case 4	Yes	Yes

4.3.1.3.1. Case 1: No requirement to destroy methane exists and no existing LFG capture system

34. In this situation:

$$F_{CH4,BL,y} = 0 \qquad \text{Equation (6)}$$

4.3.1.3.2. Case 2: Requirement to destroy methane exists and no existing LFG capture system

35. In this situation:

$$F_{CH4,\,BL,y} = F_{CH4,\,BL,\,R,y} \qquad \text{Equation (7)}$$

36. $F_{CH4,BL,R,y}$ should be determined based on the information contained in the requirement to destroy methane, as follows:

(a) If the requirement specifies the amount of methane that must be flared then that amount is $F_{CH4,BL,R,y}$;

(b) If the requirement specifies a percentage of the captured LFG that is required to be flared, the amount shall be calculated as follows:

$$F_{CH4,\,BL,\,R,\,y} = \rho_{reg,y} \times F_{CH4,\,PJ,\,capt,y} \qquad \text{Equation (8)}$$

Where:

$F_{CH4,\,BL,\,R,\,y}$	=	Amount of methane in the LFG which is flared in the baseline due to a requirement in year *y* (t CH_4/yr)
$\rho_{reg,y}$	=	Fraction of LFG that is required to be flared due to a requirement in year *y*
$F_{CH4,\,PJ,\,capt,y}$	=	Amount of methane in the LFG which is captured in the project activity in year *y* (t CH_4/yr)

37. Non-obligated entity may choose to calculate $F_{CH4,PJ,capt,y}$ by either of the two options:

(a) **Option 1:** Calculate using BM-T-005, applying the following requirements:

(i) The gaseous stream tool shall be applied to the LFG pipeline immediately downstream of the LFG capture system and before any split in the gaseous flow to different uses or flares;

(ii) CH_4 is the greenhouse gases for which the mass flow should be determined;

(iii) The simplification offered for calculating the molecular mass of the gaseous stream is valid; and

(iv) The mass flow should be calculated on an hourly basis for each hour *h* in year *y*.

(b) **Option 2:** Calculate as the sum of the amount of methane that is sent to the flare, electricity generating or heat generating equipment in year *y* as measured in section 4.4.3.1, however, not taking into account the working hours of the equipment;

(i) If the requirement does not specify the amount or percentage of LFG that should be destroyed but requires the installation of a capture system, without requiring the captured LFG to be flared then:

$$F_{CH4,\,BL,\,R,\,y} = 0 \qquad \text{Equation (9)}$$

(ii) If the requirement does not specify any amount or percentage of LFG that should be destroyed, but requires the installation of a system to capture and flare the LFG, then a typical destruction rate of 20 per cent is assumed:[3]

$$F_{CH4,\,BL,\,R,y} = 0.2 \times F_{CH4,\,PJ,\,capt,y} \qquad \text{Equation (10)}$$

4.3.1.3.3. Case 3: No requirement to destroy methane exists and an LFG capture system exists

38. In this situation:

$$F_{CH4,\,BL,\,y} = F_{CH4,\,BL,\,sys,\,y} \qquad \text{Equation (11)}$$

39. If the amount of methane captured with the existing system can be monitored separately from the amount captured under the project, and the efficiency of the existing system is not impacted on by the project system during the crediting period(s), then $F_{CH4,BL,sys,y}$ is determined as follows:

$$F_{CH4,\,BL,\,sys,\,y} = F_{CH4,\,sent\_flare,y} \qquad \text{Equation (12)}$$

Where:

$F_{CH4,\,BL,\,sys,\,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year *y* for the case of an existing LFG capture system (t CH_4/yr)
$F_{CH4,\,sent\_flare,y}$	=	Amount of methane in the LFG which is sent to the flare in year *y* (t CH_4/yr)

40. $F_{CH4,sent\_flare,y}$ is determined using BM-T-005 and applying the requirements described in section 4.4.3.1, where the gaseous stream the tool shall be applied to is the pipeline collecting LFG from the existing LFG capture system.

[3] This default value of 20 per cent is based on assuming a situation in which: the efficiency of the LFG capture system in the project is 50 per cent; the efficiency of the LFG capture system in the baseline is 20 per cent; and, the amount captured in the baseline is flared using an open flare with a destruction efficiency of 50 per cent (consistent with the default value provided in the tool "Project emissions from flaring"). Non-obligated entity may propose and justify an alternative default value as a request for revision to this methodology.

41. If there is no monitored data available, but there is historic data on the amount of methane that was captured in the year prior to the implementation of the project activity, then in this situation:

$$F_{CH4,\,BL,\,sys,\,y} = F_{CH4,\,hist,\,y} \qquad \text{Equation (13)}$$

42. In determining $F_{CH4,hist,y}$ it is assumed that the fraction of LFG that was recovered in the year prior to the implementation of the project activity will be the same fraction recovered under the project activity:

$$F_{CH4,\,hist,\,y} = \frac{F_{CH4,\,BL,\,x-1}}{F_{CH4,\,x-1}} \times F_{CH4,\,PJ,\,y} \qquad \text{Equation (14)}$$

Where:

$F_{CH4,\,hist,\,y}$	=	Historical amount of methane in the LFG which is captured and destroyed (t CH_4/yr)
$F_{CH4,\,BL,\,x-1}$	=	Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (t CH_4/yr)
$F_{CH4,\,x-1}$	=	Amount of methane in the LFG generated in the SWDS in the year prior to the implementation of the project activity (t CH_4/yr)
$F_{CH4,\,PJ,\,y}$	=	Amount of methane in the LFG which is captured in the project activity in year *y* (t CH_4/yr)

43. $F_{CH4,x-1}$ shall be estimated using BM-T-011. The guidance and requirements described in section 4.4.3.2 for applying the tool shall be followed. The year *y* in the tool is equivalent to the year prior to the implementation of the project activity.

44. If there is no monitored or historic data on the amount of methane that was captured in the year prior to the implementation of the project situation, then:

$$F_{CH4,\,BL,\,sys,\,y} = 0.2 \times F_{CH4,\,PJ,\,y} \qquad \text{Equation (15)}$$

45. The 20 per cent default factor is consistent with the default factor given in equation (10).

4.3.1.3.4. Case 4: Requirement to destroy methane exists and LFG capture system exists

46. $F_{CH4,BL,y}$ shall be determined based on information in contract of regulation requirements and data related to the existing LFG capture system, as follows:

$$F_{CH4,\,BL,y} = max\{F_{CH4,\,BL,\,R,\,y}; F_{CH4,\,BL,\,sys,y}\} \qquad \text{Equation (16)}$$

Where:

$F_{CH4,\,BL,\,R,\,y}$	=	Amount of methane in the LFG which is flared in the baseline due to a requirement in year *y* (t CH_4/yr)

$F_{CH4,\,BL,\,sys,\,y}$ = Amount of methane in the LFG that would be flared in the baseline in year *y* for the case of an existing LFG capture system (t CH_4/yr)

47. $F_{CH4,BL,R,y}$ and $F_{CH4,BL.sys,y}$ shall be determined according to the respective procedures for Case 2 and Case 3 above.

4.3.2. Baseline emissions associated with electricity generation ($BE_{EC,y}$)

48. The baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) shall be calculated using BM-T-003. When applying the tool:

(a) The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and

(b) $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year *y* ($EG_{PJ,y}$).

4.3.3. Baseline emissions associated with heat generation ($BE_{HG,y}$)

49. The baseline emissions associated with heat generation in year *y* ($BE_{HG,y}$) are determined based on the amount of methane in the LFG which is sent to the heat generation equipment in the project activity (boiler, air heater, glass melting furnace(s) and/or kiln), as follows:

$$BE_{HG,\,y} = NCV_{CH4} \times \sum_{j=1}^{n} \left(R_{efficiency,\,j,y} \times F_{CH4,\,HG,\,dest,j,y} \times EF_{CO2,\,BL,\,HG,\,j}\right) \quad \text{Equation (17)}$$

Where:

$BE_{HG,\,y}$ = Baseline emissions associated with heat generation in year *y* (t CO_2/yr)

NCV_{CH4} = Net calorific value of methane at reference conditions (TJ/t CH_4)

$R_{efficiency,\,j,y}$ = Ratio of the project and baseline efficiency of heat equipment type *j* in year *y*

$F_{CH4,\,HG,\,dest,j,y}$ = Amount of methane in the LFG which is destroyed for heat generation by equipment type *j* in year *y* (t CH_4/yr)

$EF_{CO2,\,BL,\,HG,\,j}$ = CO_2 emission factor of the fossil fuel type used for heat generation by equipment type *j* in the baseline (t CO_2/TJ)

j = Heat generation equipment (boiler, air heater, glass melting furnace(s) or kiln)

N = Number of different heat generation equipment used in the project activity

4.3.3.1. Determination of $R_{efficiency,j,y}$

50. The ratio of the project and baseline efficiency of an air heater, boiler, glass melting furnace or kiln is determined as follows:

$$R_{efficiency,\,j,y} = min\left\{1;\frac{\eta^{HG,\,PJ,\,j,y}}{\eta^{HG,\,BL,\,j}}\right\} \quad \text{Equation (18)}$$

Where:

$R_{efficiency,\,j,y}$	=	Ratio of the project and baseline efficiency of equipment type *j* in year *y*
$\eta^{HG,\,BL,\,j}$	=	Efficiency of the heat generation equipment type *j* used in the baseline
$\eta^{HG,\,PJ,\,j,y}$	=	Efficiency of the heat generation equipment type *j* used in the project activity in year *y*
j	=	Heat generation equipment type (boiler, air heater, glass melting furnace(s) or kiln)

51. To estimate the baseline energy efficiency of an air heater, boiler, glass melting furnace(s) or kiln ($\eta_{HG,BL,j}$) Non-obligated entity shall apply BM-T-006.

4.3.3.2. Determination of $F_{CH4,HG,dest,j,y}$

52. The amount of methane that is destroyed in the LFG that is sent to heat generation equipment *j* is determined with equation (19) if *j* is a boiler or air heater, or glass melting furnace, or with equation (20) if *j* is a brick kiln. For the particular case of intermittent brick kilns, non-obligated entity may choose to apply either equation (19) or (20).

$$F_{CH4,\,HG,\,dest,j,y} = fd_{CH4,\,HG,\,j,\,default} \times F_{CH4,\,HG,\,j,\,y} \quad \text{Equation (19)}$$

Where:

$F_{CH4,\,HG,\,dest,j,y}$	=	Amount of methane in the LFG which is destroyed for heat generation by equipment type *j* in year *y* (t CH_4/yr)
$fd_{CH4,\,HG,\,j,\,default}$	=	Default value for the fraction of methane destroyed when used for heat generation equipment type *j*
$F_{CH4,\,HG,\,j,\,y}$	=	Amount of methane in the LFG which is used for heat generation equipment type *j* in year *y* (t CH_4/yr)

53. $F_{CH4,HG,j,y}$ is determined according to section 4.4.3.1, where *j* is each item of heat generation equipment.

$$F_{CH4,\,HG,\,dest,\,j,y} = \sum_{h=1}^{8,760} \left(fd_{CH4,\,kiln,\,h} \times F_{CH4,\,HG,\,kiln,\,h}\right) \quad \text{Equation (20)}$$

54. With: $fd_{CH4,kiln,h}$ = 1 if $Q_{O2,kiln,h}$ > 0, and otherwise $fd_{CH4,kiln,h}$ = 0.

Where:

$F_{CH4,\,HG,\,dest,\,j,y}$	=	Amount of methane in the LFG which is destroyed for heat generation by brick kiln in year *y* (t CH_4/yr)
$fd_{CH4,\,kiln,\,h}$	=	Fraction of methane destroyed when used for heat generation in a brick kiln in hour *h*
$F_{CH4,\,HG,\,kiln,\,h}$	=	Amount of methane in the LFG which is used for heat generation by brick kiln in hour *h* (t CH_4/hr)
$Q_{O2,kiln,h}$	=	Average volumetric fraction of oxygen in the exhaust gas flow of the kiln in hour *h* (volume of O_2/volume of the gas stream)
H	=	Hours in year *y*

55. $F_{CH4,HG,kiln,h}$ is determined using BM-T-005, following the requirements given in section 4.4.3.1 for *j* = kiln, except that the mass flow should be summed to an hourly (not yearly) unit basis (t CH_4/hr).

4.3.4. Baseline emissions associated with natural gas use ($BE_{NG,y}$)

56. $BE_{NG,y}$ is estimated as follows:

$$BE_{NG,\,y} = 0.0504 \times F_{CH4,\,NG,y} \times EF_{CO2,NG,y} \qquad \text{Equation (21)}$$

Where:

$BE_{NG,\,y}$	=	Baseline emissions associated with natural gas use in year *y* (t CO_2e/yr)
$EF_{CO2,NG,y}$	=	Average CO_2 emission factor of natural gas in the natural gas network or dedicated pipeline or in the trucks in year *y* (t CO2e/TJ)
$F_{CH4,\,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network or dedicated pipeline or to the trucks in year *y* (t CH_4/yr)

57. $EF_{CO2,NG,y}$ is determined using BM-T-002.

4.4. Project emissions

58. Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y} \qquad \text{Equation (22)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2/yr)
$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year *y* (t CO_2/yr)
$PE_{FC,y}$	=	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO_2/yr)
$PE_{DT,y}$	=	Emissions from the distribution of compressed/liquefied LFG using trucks, in year *y* (t CO_2/yr)
$PE_{SP,y}$	=	Emissions from the supply of LFG to consumers through a dedicated pipeline, in year *y* (t CO_2/yr)

59. The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using BM-T-003. When applying the tool:

(a) $EC_{PJ,k,y}$ in the tool is equivalent to the amount of electricity consumed by the project activity in year *y* ($EC_{PJ,y}$); and

(b) If in the baseline a proportion of LFG is destroyed ($F_{CH4,BL,y}$>0), then the electricity consumption in the tool ($EC_{PJ,j,y}$) should refer to the net quantity of electricity consumption (i.e. the increase due to the project activity). The determination of the amount of electricity consumed in the baseline shall be transparently documented in the ICM-PDD.

60. The project emissions from fossil fuel combustion for purposes other than electricity generation ($PE_{FC,y}$) shall be calculated using BM-T-002. When applying the tool:

(a) Processes *j* in the tool correspond to the sources of fossil fuel consumption due to the project activity other than for electricity generation or and any on-site transportation by trucks or cars;

(b) If in the baseline a proportion of LFG is captured and flared ($F_{CH4,BL,y}$> 0), then the fossil fuels consumption used in calculation ($FC_{i,j,y}$) should refer to the net of that consumed in the baseline. The determination of the amount of fossil fuels consumed in the baseline shall be transparently documented in the ICM-PDD.

61. The project emissions from the distribution of compressed/liquefied LFG using trucks ($PE_{DT,y}$) is determined by the sum of emissions arising from the transportation of LFG using trucks and possible leaks during the transportation, as follows:

$$PE_{DT,y} = PE_{TR,y} + PE_{leaks,y} \quad \text{Equation (23)}$$

Where:

$PE_{DT,y}$	=	Project emissions from the distribution of compressed/liquefied LFG using trucks, in year *y* (t CO_2/yr)
$PE_{TR,y}$	=	Emissions from the transportation of compressed/liquefied LFG using trucks, in year *y* (t CO_2/yr)
$PE_{leaks,y}$	=	Emissions from CH_4 leaks during the transportation of compressed/liquefied LFG, in year *y* (t CO_2/yr)

62. The project emissions from the transportation of compressed/liquefied LFG using trucks ($PE_{TR,y}$) shall be accounted using the methodological tool “Project and leakage emissions from transportation of freight”. When applying the tool the following must be considered:

(a) Transportation activity *f* in the tool corresponds to the distribution of compressing/liquefied LFG from the biogas processing plant to consumer(s) through using trucks;

(b) The freight transported is the compressed/liquefied LFG.

63. In addition to project emissions from transportation of freight, methane leak emissions from transport of the compressed/liquefied LFG by trucks shall also be computed as follows:

$$PE_{leaks,y} = GWP_{CH4} \times (F_{CH4,NG\,TR,y} - F_{CH4,NG-cons,y}) \quad \text{Equation (24)}$$

Where:

$PE_{leaks,y}$	=	Emissions from CH_4 leaks during the transportation of compressed/liquefied LFG, in year *y* (t CO_2/yr)
GWP_{CH4}	=	Global Warming Potential of CH_4
$F_{CH4,NG\,TR,y}$	=	Amount of methane in the LFG which is sent to trucks in year *y*
$F_{CH4,NG-cons,y}$	=	Amount of methane in the LFG which is delivered to consumers using trucks in year *y* (t CH_4/yr)

64. The project emissions from the supply of LFG through a dedicated pipeline ($PE_{SP,y}$) shall be determined as follows:

$$PE_{SP,y} = 0.0504 \times DEFT_{SP,y} \times F_{CH4,NG,y} \quad \text{Equation (25)}$$

Where:

$PE_{SP,y}$	=	Project emissions from the supply of LFG to consumers due to physical leakage from the dedicated pipeline, in year *y* (t CO_2/yr)
$DEFT_{SP,y}$	=	Default emission factor for the supply of LFG to consumers due to physical leakage through the dedicated pipeline (tCO_2e/TJ)[4]
$F_{CH4,NG,y}$	=	Amount of methane in the LFG which is sent to the consumer through a dedicated pipeline in year *y* (tCH4/yr)

4.5. Leakage

65. No leakage effects are accounted for under this methodology.

4.6. Emission reductions

66. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{Equation (26)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	=	Project emissions in year *y* (t CO_2/yr)

[4] This default value (2.2 tCO_2e/TJ) is based on BM-T-009: Upstream leakage emissions associated with fossil fuel use

67. Non-obligated entity should provide an ex ante estimate of emissions reductions in the ICM-PDD. This requires projecting the future GHG emissions of the SWDS for the calculation of baseline emissions.

68. If the energy component is intended to be implemented after the first year of the project activity, then Non-obligated entity may exclude the energy component from the ex ante estimation of baseline emissions. This avoids overestimating ex ante estimate of emissions if energy generation is not implemented, or a lower capacity is implemented than originally envisaged. This exclusion is not applicable to the determination of the baseline or demonstration of additionality.

4.7. Data and parameters not monitored

69. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter table 1.

Data / Parameter:	OX_{top_layer}
Data unit:	Dimensionless
Description:	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data:	Consistent with how oxidation is accounted for in BM-T-011
Value to be applied:	0.1
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	Applicable to section 4.3.1 $OX_{top-layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool “Emissions from solid waste disposal sites”. In addition to this effect, the installation of an LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was very small, as the operators of the SWDS have in most cases an incentive to maintain a high methane concentration in the LFG. For these reasons, the oxidation factor shall be included in the calculation of baseline emissions whereas the effect of oxidation is, as a conservative assumption, neglected under the project activity.

Data / Parameter table 2.

Data / Parameter:	$F_{CH4,BL,x-1}$
Data unit:	t CH_4/yr

Description:	Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity
Source of data:	Information recorded by the SWDS operator
Value to be applied:	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	

Data / Parameter table 3.

Data / Parameter:	GWP_{CH4}
Data unit:	t CO_2e/t CH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC Sixth Assessment Report (AR6)
Value to be applied:	29.8 t CO_2e/t CH_4
Monitoring frequency:	The GWP value will be updated in line with the latest available IPCC Assessment Reports.
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	NCV_{CH4}
Data unit:	TJ/t CH_4
Description:	Net calorific value of methane at reference conditions
Source of data:	Technical literature
Value to be applied:	0.0504
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	$EF_{CO2,BL,HG,j}$
Data unit:	t CO_2/TJ
Description:	CO_2 emission factor of the fossil fuel type used for heat generation by equipment type *j* in the baseline
Source of data:	Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value to be applied:	The lower limit of the 95 per cent confidence interval of the default values provided in table 1.4 of reference above shall be used
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	Applicable to section 4.4.3

Data / Parameter table 6.

Data / Parameter:	η_{PJ}
Data unit:	Dimensionless
Description:	Efficiency of the LFG capture system that will be installed in the project activity
Source of data:	-
Value to be applied:	Technical specifications of the LFG capture system to be installed (if available) or a default value of 50 per cent
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	Applicable to section 4.3.1.2

Data / Parameter table 7.

Data / Parameter:	$fd_{CH4,HG,j,default}$
Data unit:	-
Description:	Default value for the fraction of methane destroyed when used for heat generation equipment type *j*
Source of data:	The values for boilers and air heaters are based on default values provided in the 2006 IPCC Guidelines (Tier 3 approach for Chapter 2: Stationary Combustion of Volume 2: Energy Use). The value for intermittent brick kilns is based on the assumption that combustion temperatures in the kiln will exceed 600 °C and that the time of exposure is sufficiently long to support 90 per cent combustion
Measurement procedures (if any):	Select the appropriate factor for the fraction of methane destroyed from the following table: **Table 4. Fraction of CH_4 destroyed by equipment type** **Fraction of CH_4 destroyed** / **Equipment type *j*** 1 – Boilers 1 – Air heaters 1 – Glass melting furnaces 0.9 – Intermittent brick kiln
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	Applicable to calculating $F_{CH4,HG,dest,j,y}$ using equation (19) in section 4.4.3.2. For intermittent brick kilns, Non-obligated entity may choose to instead determine $F_{CH4,HG,dest,j,y}$ using equation (20)

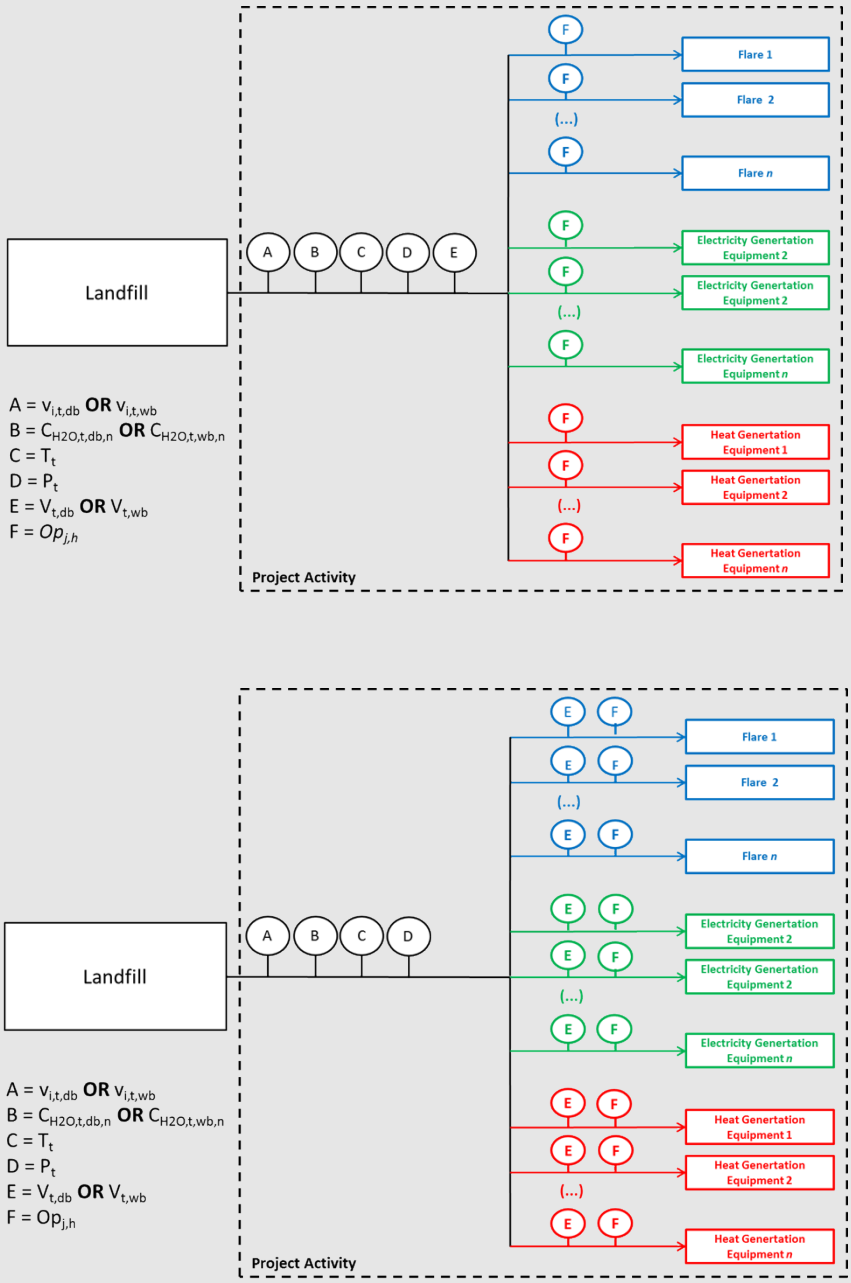
5. Methodology: Monitoring Component

5.1. Data and parameters monitored

70. In addition to the parameters listed in the tables below, the provisions on data and parameters monitored in the tools referred to in this methodology apply.

Box 3. Non-binding best practice example 3: monitoring of the gaseous streams

1. The monitoring of gas flow rate, gas composition, moisture content, temperature, and pressure, following the requirements from paragraphs 27 (a) and 29, may be made at the common header as per the diagram below. However, all methane destruction devices should be verified to be operational (e.g. by means of flame detectors records, energy generated).



Data / Parameter table 8.

Data / Parameter:	**Management of SWDS**
Data unit:	-
Description:	Management of SWDS
Source of data:	Use different sources of data: (a) Original design of the landfill; (b) Technical specifications for the management of the SWDS; (c) Local or national regulations
Measurement procedures (if any):	Non-obligated entity should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	$F_{CH4,BL,R,y}$
Data unit:	t CH_4/yr
Description:	Amount of methane in the LFG which is flared due to a requirement in year *y*
Source of data:	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	Applicable to Case 2 of section 4.3.1.1

Data / Parameter table 10.

Data / Parameter:	$\rho_{reg,y}$
Data unit:	Dimensionless
Description:	Fraction of LFG that is required to be flared due to a requirement in year *y*
Source of data:	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	Applicable to Case 2 of section 4.4.1.3

Data / Parameter table 11.

Data / Parameter:	$\eta_{HG,PJ,j,y}$
Data unit:	Dimensionless
Description:	Efficiency of the heat generation equipment used in the project activity in year *y*
Source of data:	Use one of the following options to determine the efficiency: (a) Measured efficiency during monitoring; (b) Manufacturer's information on the efficiency; or (c) Use a default value of 60 per cent
Measurement procedures (if any):	If measurements are conducted, use recognized standards for the measurement of the heat generator efficiency, such as the "*British Standard Methods for Assessing the thermal performance of boilers for steam, hot water and high temperature heat transfer fluids*" (BS845). Where possible, use preferably the direct method (dividing the net heat generation by the energy content of the fuels fired during a representative time period), as it is better able to reflect average efficiencies during a representative time period compared to the indirect method (determination of fuel supply or heat generation and estimation of the losses). Document measurement procedures and results and manufacturer's information transparently in the ICM-PDD
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	Applicable to section 4.4.3.1

Data / Parameter table 12.

Data / Parameter:	$Op_{j,h}$
Data unit:	-
Description:	Operation of the equipment that consumes the LFG
Source of data:	Non-obligated entity
Measurement procedures (if any):	For each equipment unit *j* using *the LFG* monitor that the plant is operating in hour *h* by the monitoring any one or more of the following three parameters: (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; (b) Flame. Flame detection system is used to ensure that the equipment is in operation; (c) Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns. $Op_{j,h}$=0 when: (a) One of more temperature measurements are missing or below the minimum threshold in hour *h* (instantaneous measurements are made at least every minute); (b) Flame is not detected continuously in hour *h* (instantaneous measurements are made at least every minute); (c) No products are generated in the hour *h.*

	Otherwise, $Op_{j,h}$=1
Monitoring frequency:	Hourly
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Amount of electricity generated using LFG by the project activity in year *y*
Source of data:	Electricity meter
Measurement procedures (if any):	Monitor net electricity generation by the project activity using LFG
Monitoring frequency:	Continuous
QA/QC procedures:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company
Any comment:	This parameter is required for calculating baseline emissions associated with electricity generation ($BE_{EC,y}$) using BM-T-003

Data / Parameter table 14.

Data / Parameter:	$EG_{EC,y}$
Data unit:	MWh
Description:	Amount of electricity consumed by the project activity in year *y*
Source of data:	Electricity meter
Measurement procedures (if any):	Sources of consumption shall include, where applicable, electricity consumed for the operation of the LFG capture system, for any processing and upgrading of the LFG, for transportation of the LFG to the flare or other applications (boilers, power generators), for the compression of the LFG into the natural gas network, etc.
Monitoring frequency:	Continuous
QA/QC procedures:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company
Any comment:	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process $t\ PE_{EC,y}$) using BM-T-003

Data / Parameter table 15.

Data / Parameter:	$F_{CH4,NG\text{-}cons,y}$
Data unit:	t CH_4/yr
Description:	Amount of methane in the LFG which is delivered to consumers using trucks in year *y*

Source of data:	-
Measurement procedures (if any):	Determined using BM-T-005
Monitoring frequency:	Per batch and aggregated annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 16.

Data / Parameter:	$F_{CH4,NG\ TR,y}$
Data unit:	t CH_4/yr
Description:	Amount of methane in the LFG which is sent to trucks in year *y*
Source of data:	-
Measurement procedures (if any):	Determined using BM-T-005
Monitoring frequency:	Per batch and aggregated annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 17.

Data / Parameter:	**CAPEX and OPEX**
Data unit:	Currency (USD, EUR, etc.)
Description:	Total investment to implement the project and total cost to operate the project
Source of data:	Engineering, procurement and construction contracts; and maintenance contracts
Measurement procedures (if any):	-
Monitoring frequency:	At the first issuance request after each phase of the project is fully implemented
QA/QC procedures:	Audited by professional, independent financial auditors. The ACVA should only verify that the data provided corresponds to the data from independent financial auditors
Any comment:	The information provided for CAPEX shall indicate the investment made: (i) in the collection and flaring system; (ii) in the power plant and connection to the grid (if applicable); and (iii) in the purchase of the new boiler or refurbishment of the existing one and in the steam/hot air pipeline if steam/hot air is exported out of the project boundary (if applicable). The information supplied for OPEX shall indicate the costs for: (i) staff and maintenance involved in the operation of the collection and flaring system; and (ii) staff and maintenance involved in the operation of the collection and power generation system. The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality

Data / Parameter table 18.

Data / Parameter:	**Tariff of electricity exported**
Data unit:	INR/KWh
Description:	Tariff of the electricity exported
Source of data:	Power purchase agreement
Measurement procedures (if any):	-
Monitoring frequency:	At the first issuance request after each phase of the project is fully implemented
QA/QC procedures:	Audited by professional, independent financial auditors. The ACVA should only verify that the data provided corresponds to the data from independent financial auditors
Any comment:	The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality

Data / Parameter table 19.

Data / Parameter:	**Revenues from the sale of heat / Savings based on the heat generated and consumed on-site**
Data unit:	INR
Description:	(a) Revenues from the heat sold outside of the project boundary; or (b) Savings based on the heat consumed on-site, which would have been generated outside of the project boundary
Source of data:	(a) Heat supply agreement; (b) Monthly average expenses of heat purchased during the previous year prior to the implementation of the project activity
Measurement procedures (if any):	-
Monitoring frequency:	At the first issuance request after each phase of the project is fully implemented
QA/QC procedures:	Audited by professional, independent financial auditors. The ACVA should only verify that the data provided corresponds to the data from independent financial auditors
Any comment:	The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality

Data / Parameter table 20.

Data / Parameter:	$F_{CH4,NG,y}$
Data unit:	tCH_4/yr
Description:	Amount of methane in the LFG which is sent to the natural gas distribution network or dedicated pipeline or to the trucks in year *y*
Source of data:	-
Measurement procedures (if any):	Determined using BM-T-005

Monitoring frequency:	Continuous and aggregated annually in case of natural gas distribution network and dedicated pipeline. Pre-batch and aggregated annually in case of trucks
QA/QC procedures:	-
Any comment:	-

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Revision/Changes in the Document

Version	*Date*	*Description*
1.0	27 March 2025	Initial Adoption