Approved consolidated baseline and monitoring methodology ACM0022

"Alternative waste treatment processes"

I. SOURCES, DEFINITIONS AND APPLICABILITY

Source

This baseline and monitoring methodology is based on the following approved baseline and monitoring methodology and elements of the following proposed new methodologies:

- NM0090: "Organic waste composting at the Matuail landfill site Dhaka, Bangladesh" whose baseline study, monitoring and verification plan and project design document were prepared by World Wide Recycling B.V. and Waste Concern;
- NM0127: "PT Navigat Organic Energy Indonesia Integrated Solid Waste Management (GALFAD) project in Bali, Indonesia" whose baseline study, monitoring and verification plan and project design document were prepared by Mitsubishi Securities Co.;
- NM0032: "Municipal solid waste treatment cum energy generation project, Lucknow, India" whose baseline study, monitoring and verification plan were prepared by Infrastructure Deve lopment Finance Company Limited on behalf of Prototype Carbon Fund;
- NM0178: "Aerobic thermal treatment of municipal solid waste (MSW) without incineration in Parobé - RS" whose baseline study, monitoring and verification plan and project design document were prepared by ICF Consulting;
- NM0174-rev: "MSW Incineration Project in Guanzhuang, Tianjin City" whose baseline study, monitoring and verification plan and project design document were prepared by Global Climate Change Institute (GCCI) of Tsinghua University, Energy Systems International and Tianjin Taida Environmental Protection Co. Ltd;
- AM0025: "Alternative waste treatment processes";
- AM0039: "Methane emissions reduction from organic waste water and bioorganic solid waste using co-composting".

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

- "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period";
- "Combined tool to identify the baseline scenario and demonstrate additionality";
- "Project emissions from flaring";
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption";
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";
- "Tool to determine the baseline efficiency of thermal or electric energy generation systems".
- "Emissions from solid waste disposal sites";
- "Project and leakage emissions from composting";
- "Project and leakage emissions from anaerobic digesters";
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream".

For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/index.html>.

Selected approach from paragraph 48 of the CDM modalities and procedures

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

or

"Existing actual or historical emissions, as applicable"

Definitions

For the purpose of this methodology the following definitions apply:

Anaerobic digester. Equipment that is used to generate biogas from liquid or solid waste through anaerobic digestion. The digester is covered or encapsulated to enable biogas capture for heat and/or electricity generation or feeding biogas into a natural gas network.

Anaerobic digestion. Degradation and stabilization of organic materials by the action of anaerobic bacteria that result in production of methane and carbon dioxide. Typical organic materials that undergo anaerobic digestion are municipal solid waste (MSW), animal manure, wastewater, organic industrial effluent and biosolids from aerobic wastewater treatment plants.

Anaerobic lagoon. A treatment system consisting of a deep earthen basin with sufficient volume to permit sedimentation of settable solids, to digest retained sludge, and to anaerobically reduce some of the soluble organic substrate. Anaerobic lagoons are not aerated, heated, or mixed and anaerobic conditions prevail except possibly for a shallow surface layer in which excess undigested grease and scum are concentrated.

Biogas. Gas generated from a digester. Typically, the composition of the gas is 50 to 70% CH_4 and 30 to 50% CO_2, with traces of H_2S and NH_3 (1 to 5%).

By-products. By-products from the waste treatment plant(s) established under the project activity. This includes, for example, aluminium or glass collected from the sorting of waste prior to subsequent treatment.

Co-composting. A type of composting where solid wastes and wastewater containing solid biodegradable organic material are composted together.

Composting. A process of biodegradation of waste under aerobic (oxygen-rich) conditions. Waste that can be composted must contain solid biodegradable organic material. Composting converts biodegradable organic carbon to mostly carbon dioxide (CO_2) and a residue (compost) that can be used as a fertilizer. Other outputs from composting can include, inter alia, methane (CH_4), nitrous oxide (N_2O), and run-off wastewater (in case of co-composting).

Digestate. Spent contents of an anaerobic digester. Digestate may be liquid, semi solid or solid. Digestate may be further stabilized aerobically (e.g. composted), applied to land, sent to a solid waste disposal site (SWDS), or kept in a storage or evaporation pond.

Fresh waste. Solid waste that is intended for disposal in a SWDS but has not yet been disposed. This may comprise MSW and excludes old waste and hazardous waste.

Gasification. The process of thermal decomposition of organic compounds at high temperatures, typically more than 800˚C. Gasification converts organic compounds, of both biogenic and fossil origin, into combustible gas, e.g. syngas.

Incineration. The controlled combustion of organic compounds of both biogenic and fossil origin with or without heat capture and utilisation. Ideally, all the organic content is converted into CO_2 and H_2O. Practically, as combustion is incomplete and as inert matter is also in the combusted waste, ashes are also an important by-product.

Industrial and hospital waste. Waste typically generated by industry or at a hospital. Waste generated by industry may be hazardous and waste from a hospital may be infectious (material-containing pathogens that can cause diseases), sharps (any items that can cause a cut), pathological (body tissues), pharmaceutical and radioactive (such as radioactive substances used for diagnosis and treatment of diseases). This type of waste is not suitable for being treated by several waste treatment options.

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.

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. For the purpose of this methodology, captured LFG can be flared or used.

Municipal solid waste (MSW). A heterogeneous mix of different solid waste types, usually collected by municipalities or other local authorities. MSW includes household waste, garden/park waste and commercial/institutional waste.

Old waste. Solid waste that has been disposed of in a SWDS. Old waste has different characteristics than fresh waste, such as a lower organic matter content, limiting its application to some alternative treatment options that require waste with a minimum level of organic material (e.g. composting and anaerobic digesters).

Organic waste. Solid waste that contains degradable organic matter. This may include, for example, domestic waste, commercial waste, industrial waste (such as sludge from wastewater treatment plants), hospital waste, and MSW.

Refuse-derived fuel (RDF). A fuel which is derived from the mechanical and/or thermal treatment of waste and which is used in an incineration or co-incineration process. RDF is produced by shredding and dehydrating solid waste with a waste converter technology.

Sludge pits. A pit or tank where untreated liquid sludge is pumped and stored for at least one year. Anaerobic bacteria decompose the liquid sludge and decrease the organic matter content, resulting in emissions of CO_2, CH_4, hydrogen sulphide (H_2S) and ammonia. Once the pits are dried out and the sludge is stable, the solids are removed and used, e.g. as fertiliser for non-food crops.

Stabilized biomass (SB). A fuel which is derived from the mechanical and/or thermal treatment of waste and which is used in an incineration or co-incineration process. SB is produced from agricultural waste and is treated to prevent further degradation in the environment. Examples of SB are: pellets, briquettes and torrified wood chips.

Solid waste. Discarded and insoluble material (including gases or liquids in cans or containers).

Solid waste disposal site (SWDS). Designated areas intended as the final storage place for solid waste. Stockpiles are considered a SWDS if: (a) their volume to surface area ratio is 1.5 or larger; and if (b) a

visual inspection by the DOE confirms that the material is exposed to anaerobic conditions (i.e. it has a low porosity and is moist).

Stockpile. A pile of solid waste (not buried below ground). Anaerobic conditions are not assured in a stockpile with low volume to surface area ratios (less than 1.5) because the waste may be exposed to higher aeration.

Syngas. A gas mixture consisting primarily of carbon monoxide and hydrogen and small amounts of carbon dioxide. It is produced from gasification and may be used as a fuel for energy generation or as an intermediate for the production of other chemicals.

Run-off wastewater. Wastewater that is generated as a by-product from a waste treatment plant established under the project activity. This term does not refer to wastewater that is used as feed in an anaerobic digester or co-composting plant established under the project activity.

Scope and applicability

This methodology applies to project activities where fresh waste, originally intended for disposal in a SWDS, is treated using any (combination) of the waste treatment options listed in Table 1 below. The project activity therefore avoids emissions of methane associated with disposing organic waste in a SWDS with or without a partial LFG capture system. In addition, the project activity may also potentially claim emission reductions for:

- Avoiding methane emissions from degradation of wastewater in an anaerobic lagoon or sludge pit by treating the wastewater in combination with fresh waste by either co-composting or anaerobic digestion;
- Displacing natural gas in a natural gas distribution system with upgraded biogas;
- Displacing electricity in a grid or electricity generation by a fossil fuel fired captive power-only or cogeneration plant; and
- Displacing heat generation by a fossil fuel fired cogeneration plant, boiler or air heater.

Table 1 provides the applicability conditions that apply for each specific treatment option. In addition, the following general applicability conditions apply to all project activities using this methodology:

- The project activity involves the construction of a new plant to implement one or several of the alternative waste treatment options provided in Table 1 below;
- In the project plant, except for the case of composting, co-composting and anaerobic digestion, only wastes for which emission reductions are claimed (fresh waste or wastewater) are processed. In the case of anaerobic digestion, only run-off wastewater may be processed in addition to fresh waste and wastewater;
- Neither organic fresh waste nor products and by-products from the waste treatment plant established under the project activity are stored on-site under anaerobic conditions. For example, no organic materials are stored in a stockpile that is considered a SWDS;
- Any run-off wastewater is treated within the project boundary;
- The project does not reduce the amount of waste that would be recycled in the absence of the project activity. Detailed justifications shall be provided and documented in the CDM-PDD for demonstrating that the project activity does not reduce the amount of waste that would be recycled in the absence of the project activity.

Finally, the methodology is only applicable if the procedure for the selection of the most plausible baseline scenario, as outlined below, results in that the baseline scenario is:

(a) The disposal of the fresh waste in a SWDS with or without a partial LFG capture system (M2 or M3);

(b) In the case of co-composting or the use of wastewater in an anaerobic digester: the treatment of organic wastewater in an existing or new to be built anaerobic lagoon or sludge pit without methane recovery (W1 or W4);

(c) In the case that the project activity generates electricity: the electricity is generated in an existing/new captive fossil fuel fired power-only plant, captive cogeneration plant and/or in the grid (P2, P4 or P6);

(d) In the case that the project activity generates heat and this displaces heat generation in the baseline: the heat is generated in an existing/new fossil fuel fired cogeneration plant, boiler or air heater (H2 or H4).

Under this methodology, emission reductions can only be claimed for the baseline scenarios indicated above. If project participants wish to claim emission reductions from the use of the products or by-products in other activities than those specified above, then they may request registration for a separate project activity, applying a relevant methodology.

In addition, in the particular case where heat is generated from combustion of a product or by-product from the waste treatment options and used in the cement industry, the emission reductions for this use shall not be claimed under this methodology but in a separate project activity, applying the relevant methodology (e.g. ACM0003).

Note that in the case that applicable laws or regulations require the use of the waste treatment option(s) implemented under the project activity, the compliance rate of such laws and regulations should be below 50% in the period for which issuance of CERs is requested in order to claim emission reductions for that period.

Table 1: Applicability conditions for different waste treatment options

Waste treatment option under the project activity	Applicable types of wastes that may be treated	Applicable products and their use	Applicable waste by-products	Specific applicability conditions for the treatment option
Composting or co-composing	• Types of waste specified in the scope and applicability section of the methdological tool "Project and leakage emissions from composting"; • Run-off wastewater • Excluding hospital and industrial waste	Compost : any use applicable	• Glass, aluminium, ferrous metals and plastics from waste sorting stages; • Run-off wastewater	Any applicability conditions specified in the methodological tool "Project and leakage emissions from composting"
Anaerobic digestion	• Wastewater; • Fresh waste, excluding hospital and industrial waste	Biogas which may be flared, used to generate electricity or heat, and/or is upgraded and distributed in a natural gas distribution grid	• Glass, aluminium, ferrous metals and plastics from waste sorting stages; • Run-off wastewater; • Digestate	Any applicability conditions specified in the methodological tool "Project and leakage emissions from anaerobic digesters"
Thermal treatment	Fresh waste, excluding hospital and industrial waste	RDF/SB: any use is applicable	• Glass, aluminium and ferrous metals from waste sorting stages	-
Mechanical treatment	Fresh waste, excluding hospital and industrial waste	RDF/SB: any use is applicable	• Run-off wastewater; • Glass, aluminium and ferrous metals from waste sorting stages	-

Waste treatment option under the project activity	Applicable types of wastes that may be treated	Applicable products and their use	Applicable waste by-products	Specific applicability conditions for the treatment option
Gasification	Fresh waste	• Syngas which may be used to generate electricity and/or heat	• Gasification by-products (e.g. inert materials); • Run-off wastewater; • Glass, aluminium and ferrous metals from waste sorting stages	-
Incineration	Fresh waste	Electricity and/or heat	• Incineration by-product (e.g. inert materials); • Run-off wastewater; • Glass, aluminium and ferrous metals from waste sorting stages	• Incineration technology is rotary kiln, rotating fluidized bed, circulating fluidized bed, hearth or grate type; • The fraction of energy generated by auxiliary fossil fuels is not more than 50% of the total energy generated in the incinerator

II. BASELINE METHODOLOGY PROCEDURE

Procedure for the selection of the most plausible baseline scenario and demonstration of additionality

Identify the baseline scenario and demonstrate additionality using the "Combined tool to identify the baseline scenario and demonstrate additionality" and following the requirements below.

In applying Step 1a of the tool:

In identifying baseline alternatives for the treatment of the fresh waste, the following alternatives or combinations of these alternatives shall, inter alia, be considered:

M1: The project activity without being registered as a CDM project activity (i.e. any (combination) of the waste treatment options listed in Table 1);

M2: Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG;

M3: Disposal of the fresh waste in a SWDS without a LFG capture system;

M4: Part of the fresh fraction of the solid waste is recycled and not disposed in the SWDS;

M5: Part of the fresh fraction of the solid waste is treated aerobically and not disposed in the SWDS;

M6: Part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS;

M7: Part of the organic fraction of the solid waste is gasified and not disposed in the SWDS;

M8: Part of the organic fraction of the solid waste is treated in an anaerobic digester and not disposed in the SWDS;

M9: Part of the organic fraction of the solid waste is mechanically or thermally treated to produce RDF/SB and not disposed in the SWDS.

In identifying baseline alternatives for the treatment of the organic wastewater, the following alternatives or combinations of these alternatives shall, inter alia, be considered:

W1: Continuation of current practice of using anaerobic lagoons or sludge pits without methane recovery;

W2: Anaerobic lagoons or sludge pits with methane recovery and flaring of the recovered methane;

W3: Anaerobic lagoons or sludge pits with methane recovery and utilization of the recovered methane for electricity and/or heat generation;

W4: Construction of a new anaerobic lagoon or sludge pits without methane recovery;

W5: Construction of a new anaerobic lagoon or sludge pits with methane recovery and flaring of the recovered methane;

W6: Using the organic wastewater for co-composting (the project activity implemented without being registered as a CDM project activity);

W7: Other treatment options provided in table 6.3, Volume 5, chapter 6 of the IPCC 2006 guidelines for greenhouse gas inventory.

If electricity generation is an aspect of the project activity, then alternative scenarios for the generation of electricity shall also be identified. Alternative(s) shall include, inter alia:

P1: Electricity generated as an output of one of the waste treatment options listed in Table 1, not undertaken as a CDM project activity;

P2: Use of an existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;

P3: Existing or new construction of an on-site or off-site renewable based cogeneration plant;

P4: Existing or new construction of an on-site or off-site fossil fuel fired electricity plant;

P5: Existing or new construction of an on-site or off-site renewable based electricity plant;

P6: Electricity generation in existing and/or new grid-connected electricity plants.

If heat generation is an aspect of the project activity, then alternative(s) scenarios for the generation of electricity shall also be identified. Alternative(s) shall include, inter alia:

H1: Heat generated as a by-product from one of the options for waste treatment listed in Table 1, not undertaken as a CDM project activity;

H2: Use of (an) existing or construction of (a) new on-site or off-site fossil fuel fired cogeneration plant(s);[1]

[1] Scenarios P2 and H2 are related to the same fossil fuel cogeneration plant.

H3: Use of (an) existing or construction of (a) new on-site or off-site renewable based cogeneration plant(s);[2]

H4: Use of (an) existing or construction of (a) new on-site or off-site fossil fuel based boiler(s) or air heater(s);

H5: Use of (an) existing or construction of (a) new on-site or off-site renewable energy based boiler(s) or air heater(s);

H6: District heat;

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

For the supply of upgraded biogas to a natural gas distribution network, the baseline is assumed to be the supply with natural gas.

In applying Sub-step 1b of the tool, mandatory applicable legal and regulatory requirements may include mandatory LFG capture or destruction requirements because of safety issues or local environmental regulations.[3] Other policies could include local policies promoting productive use of LFG, such as those for the production of renewable energy, or those that promote the processing of fresh waste.

In applying Step 3 of the tool, all costs and income shall be taken into account, including the income generated for the project participants from the products and by-products listed in Table 1. All technical and financial parameters have to be consistent across all baseline options.

If the products or by-products are used by another CDM project activity and if the project participants of both CDM projects are the same, then the following provision shall be followed:

- The by-products shall be considered to have market value when assessing additionality of the project activity applying this methodology;
- The by-products shall be considered to have no value when assessing additionality of the second project activity.

Identification of the baseline fuel for heat and/or electricity generation

Project participants shall demonstrate that the identified baseline fuel used for generation of heat is available in abundance in the host country and there is no supply constraint. In case of partial supply constraints (seasonal supply), the project participants shall consider the period of partial supply among potential alternative fuel(s) the one that results in the lowest baseline emissions.

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

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2 Scenarios P3 and H3 are related to the same renewable energy based cogeneration plant.

3 The project developer must bear in mind the relevant clarifications on the treatment of national and/or sectoral policies and regulations in determining a baseline scenario as per annex 3 to the 22nd meeting of the Board and any other forthcoming guidance from the Board on this subject.

Project boundary

The spatial extent of the project boundary is the SWDS where the waste is disposed of in the baseline,[4] anaerobic lagoons or sludge pits treating organic wastewater in the baseline, and the site of the alternative waste treatment process(es). The boundary also includes on-site electricity and/or heat generation and use, on-site fuel use and the wastewater treatment plant used to treat the wastewater by-products of the alternative waste treatment process(es). The project boundary does not include facilities for waste collection and transport.

In the case that the project provides electricity to a grid, then the spatial extent of the project boundary will also include those plants connected to the energy system to which the plant is connected. If upgraded biogas is fed to a natural gas distribution system, then the natural gas distribution system is also included in the boundary.

Diagrams for each alternative waste treatment option illustrating which aspects should be included in the project boundary are included in appendix 1.

The GHGs included in or excluded from the project boundary are listed in Table 2.

Table 2: Summary of gases and sources included in the project boundary and justification/explanation where gases and sources are not included

	Source	Gas		Justification/Explanation
Baseline	Emissions from heat generation	CO_2	Included	Major emission source if heat generation is included in the project activity and displaces more carbon intensive heat generation in the baseline
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Emissions from decomposition of waste at the SWDS	CH_4	Included	The major source of emissions in the baseline
		N_2O	Excluded	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of this gas is conservative
		CO_2	Excluded	CO_2 emissions from the decomposition of fresh waste are not accounted for[a]
	Emissions from anaerobic lagoons or sludge pits	CO_2	Excluded	CO_2 emissions from biomass source are considered GHG neutral
		CH_4	Included	Methane emission from anaerobic process
		N_2O	Excluded	Not significant. Excluded for simplification and conservativeness
	Emissions from electricity generation	CO_2	Included	Major source if electricity generation is included in the project activity and is sent to the grid or displaces fossil fuel fired electricity generation in the baseline
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Emissions from use of natural gas	CO_2	Excluded	Excluded for simplification. This is conservative
		CH_4	Included	Major emission source if supply of upgraded biogas through a natural gas distribution network is included in the project activity
		N_2O	Excluded	Excluded for simplification. This is conservative

[4] If supressed demand is considered for the baseline identified, SWDS need not be identified or included in the project boundary.

	Source	Gas		Justification/Explanation
Project Activity	Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	Included	May be an important emission source. Includes heat generation for mechanical/thermal treatment process, start up of the gasifier, auxiliary fossil fuels needed to be added into incinerator, etc. It does not include transport
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Emissions from on-site electricity use	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Emissions from the waste treatment processes	N_2O	Included	N_2O may be emitted from composting, incineration, syngas produced and RDF/SB combustion
		CO_2	Included	CO_2 emissions from incineration, gasification or combustion of fossil based waste shall be included. CO_2 emissions from the decomposition or combustion of fresh waste are not accounted[a]
		CH_4	Included	CH_4 leakage from the anaerobic digester and incomplete combustion in the flaring process are potential sources of project emissions. CH_4 may be emitted from incineration, gasification, composting and RDF/SB combustion
	Emissions from wastewater treatment	CO_2	Excluded	CO_2 emissions from the decomposition of fresh waste are not accounted[a]
		CH_4	Included	CH_4 emissions from anaerobic treatment of wastewater are accounted for. Aerobic treatment of wastewater shall not result in CH_4 emissions
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small

[a] *CO_2 emissions from the combustion or decomposition of biomass (see definition by the Board in annex 8 of the Board's 20th meeting report) are not accounted as GHG emissions. Where the combustion or decomposition of biomass under a CDM project activity results in a decrease of carbon pools, such stock changes should be considered in the calculation of emission reductions. This is not the case for waste treatment projects.*

Baseline emissions

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. Methane emissions from the treatment of organic wastewater in the absence of the project activity;

C. Energy generated or electricity consumed by the grid in the absence of the project activity;

D. Natural gas used from the natural gas network in the absence of the project activity.

In the case that legislative or regulatory requirements mandate the use of any (combination) of the waste treatment options *t* that are being implemented in the project activity, then the rate of compliance with these requirements in the host country shall be monitored ($RATE_{compliance,t,y}$). This rate is then used to adjust the baseline emissions calculation, according to equation 1. It shall be described and justified in the CDM-PDD which baseline emission sources apply for each waste treatment option *t* implemented under the project activity.

$$BE_y = \sum_t \left(BE_{CH4,t,y} + BE_{WW,y} + BE_{EN,t,y} + BE_{NG,t,y}\right) \times DF_{RATE,t,y} \quad (1)$$

With:

$$DF_{RATE,t,y} = \begin{cases} 1 - RATE_{compliance,t,y}, & if\, RATE_{compliance,t,y} < 0.5 \\ 0, & if\, RATE_{compliance,t,y} \geq 0.5 \end{cases} \quad (2)$$

Where:

BE_y	=	Baseline emissions in year y (t CO_2e)
$BE_{CH4,t,y}$ y	=	Baseline emissions of methane from the SWDS in year y (t CO_2e)
$BE_{WW,y}$	=	Baseline methane emissions from anaerobic treatment of the wastewater in open anaerobic lagoons or of sludge in sludge pits in the absence of the project activity in year y (t CO_2e)
$BE_{EN,t,y}$	=	Baseline emissions associated with energy generation in year y (t CO_2)
$BE_{NG,t,y}$	=	Baseline emissions associated with natural gas use in year y (t CO_2)
$DF_{RATE,t,y}$	=	Discount factor to account for $RATE_{Compliance,t,y}$
$RATE_{compliance,t,y}$	=	Rate of compliance of a requirement that mandates the use of alternative waste treatment option t in year y
t	=	Type of alternative waste treatment option

For simplification, the type of alternative waste treatment option t is hitherto omitted.

Procedure (A): Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

Baseline emissions of methane from the SWDS are determined using the methodological tool "Emissions from solid waste disposal sites". The following requirements shall be complied with when applying the tool:

(1) $W_{j,x}$ in the tool is the amount of organic fresh waste prevented from disposal in the baseline SWDS due to its treatment in any (combination) alternative waste treatment option;

(2) Emissions are calculated using Application B in the tool, meaning that only waste avoided from the disposal after the start of the first crediting period shall be considered in the tool;

(3) Sampling to determine the fractions of different waste types is necessary (note that for the case that the waste is combusted in the project activity, then the parameter $Q_{j,c,y}$ in this methodology is equivalent to the variable $W_{j,x}$ in the tool);

(4) The tool instructs that f_y shall be determined based on historic data or contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available). The following additional instruction applies:

   (i) If the regulation requirements specify a percentage of the LFG that is required to be flared, the amount shall equal f_y;

(ii) If the regulation requirements do not specify the amount or percentage of LFG that should be destroyed but require the installation of a capture system, without requiring the captured LFG to be flared then f_y = 0; and

(iii) If the requirement do not specify any amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG, then it is assumed f_y = 0.2.[5]

Baseline under a suppressed demand scenario

A MCF factor of 0.4[6] for the baseline emissions calculations may be used to account for the existence of a suppressed demand situation as described in the "Guidelines on the consideration of suppressed demand in CDM methodologies" when all of the following conditions apply:

(a) It can be demonstrated that waste is being dumped in an uncontrolled manner in human settlement areas under the current practice due to a lack of organized waste collection and disposal system;

(b) It can be demonstrated that only the municipal solid waste is being treated under the project activity and wastes from other sources such as agricultural or agro-industrial wastes are not being treated under the project activity;

(c) It can be demonstrated that entire portion of the waste treated under the project activity would comply with the above two conditions.

Procedure (B): Baseline emissions from organic wastewater

In determining the baseline emissions of methane from wastewater treatment, the quantity of wastewater treated in the baseline shall include only wastewater and not any run-off wastewater.

To determine the baseline emissions, the he lower value shall be used between the amount of methane produced after the implementation of the project activity and the amount of methane calculated using the methane conversion factor method for the estimation of methane emissions from anaerobic lagoons or sludge pits, as follows:

$$BE_{WW,y} = min\left\{Q_{CH4,y}; BE_{CH4,MCF,y}\right\} \quad \textbf{(3)}$$

5 Project participants may propose and justify an alternative default value as a request for revision to this methodology.

6 Shallow landfill (<5m) is a realistic and conservative technology for disposing MSW, and it is also the least cost alternative for providing comparable level of service to alternative waste treatment technologies applicable in the methodology. The MCF value is chosen from the definition provided in 2006 IPCC Guideline applicable to unmanaged shallow landfills that do not have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and do not include any cover material, mechanical compacting and levelling of the waste. The project participants can choose to select and justify a different baseline scenario expected under a suppressed demand scenario. If they choose to do so, the alternatives considered shall include inter alia alternatives M1 through M9 discussed in the Procedure for the selection of the most plausible baseline scenario and demonstration of additionality.

Where:

$BE_{WW,y}$	=	Baseline methane emissions from anaerobic treatment of the wastewater in open anaerobic lagoons or of sludge in sludge pits in the absence of the project activity in year *y* (t CO_2e)
$Q_{CH4,y}$	=	Amount of methane produced from wastewater in year *y* after the implementation of the project activity (t CO_2e)
$BE_{CH4,MCF,y}$	=	Baseline methane emissions determined using the Methane Conversion Factor (t CO_2e)

Procedure (B.1): Methane produced ($Q_{CH4,y}$)

Projects proponent shall use Step 1 "Determination of the quantity of methane produced in the digester ($Q_{CH4,y}$)" of the latest version of the tool "Project and leakage emissions from anaerobic digesters" to determine the amount of methane produced from wastewater after the implementation of the project activity ($Q_{CH4,y}$).

Procedure (B.2): Baseline methane emissions determined using the methane conversion factor ($BE_{CH4,MCF,y}$)

$BE_{CH4,MCF,y}$ is determined based on the chemical oxygen demand (*COD*) of the wastewater that would enter the lagoon in the absence of the project activity ($COD_{BL,y}$), the maximum methane producing capacity (B_o) and a methane conversion factor ($MCF_{BL,y}$) which expresses the proportion of the wastewater that would decay to methane, as follows:

$$BE_{CH4,MCF,y} = GWP_{CH4} \times MCF_{BL,y} \times B_o \times COD_{BL,y} \quad \textbf{(4)}$$

Where:

$BE_{CH4,MCF,y}$	=	Baseline methane emissions determined using the Methane Conversion Factor (t CO_2e)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (t CO_2e/t CH_4)
B_o	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (t CH_4/tCOD)
$MCF_{BL,y}$	=	Average baseline methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{BL,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity
$COD_{BL,y}$	=	Quantity of chemical oxygen demand that would be treated in anaerobic lagoons or sludge pits in the absence of the project activity in year *y* (tCOD)

Procedure (B.2.1): Determination of $COD_{BL,y}$

In principle, the baseline chemical oxygen demand ($COD_{BL,y}$) corresponds to the chemical oxygen demand that is treated under the project activity ($COD_{PJ,y}$). But, if there would be effluent from the lagoons or the sludge pit in the baseline, COD_{BL} should be adjusted by an adjustment factor which relates the *COD* supplied to the lagoon or sludge pit with the *COD* in the effluent.

$$COD_{BL,y} = \rho \times \left(1 - \frac{COD_{out,x}}{COD_{in,x}}\right) \times COD_{PJ,y} \quad \textbf{(5)}$$

Where:

$COD_{BL,y}$	=	Quantity of chemical oxygen demand that would be treated in anaerobic lagoons or sludge pits in the absence of the project activity in year *y* (tCOD)
$COD_{PJ,y}$	=	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year *y* (tCOD)
$COD_{out,x}$	=	COD of the effluent in the period *x* (tCOD)
$COD_{in,x}$	=	COD directed to the anaerobic lagoons or sludge pits in the period *x* (tCOD)
x	=	Representative historical reference period
ρ	=	Discount factor to account for the uncertainty of the use of historical data to determine $COD_{BL,y}$

$COD_{PJ,y}$ is determined as follows:

$$COD_{PJ,y} = \sum_{m=1}^{12} F_{PJ,AD,m} \times COD_{AD,m} \quad \textbf{(6)}$$

Where:

$COD_{PJ,y}$	=	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year *y* (tCOD)
$F_{PJ,AD,m}$	=	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* (m^3)
$COD_{AD,m}$	=	Chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* ($tCOD/m^3$)
m	=	Months of year *y* of the crediting period

Procedure (B.2.2): Determination of $MCF_{BL,y}$

The quantity of methane generated from COD disposed of in the baseline in open anaerobic lagoons or sludge pits depends mainly on the temperature and the depth of the lagoon or sludge pit. Accordingly, the methane conversion factor is calculated based on a factor f_d, expressing the influence of the depth of the lagoon or sludge pit on methane generation, and a factor $f_{T,y}$ expressing the influence of the temperature on the methane generation. In addition, a conservativeness factor of 0.89 is applied to account for the uncertainty associated with this approach. $MCF_{BL,y}$ is calculated as follows:

$$MCF_{BL,y} = f_d \times f_{T,y} \times 0.89 \quad \textbf{(7)}$$

Where:

$MCF_{BL,y}$	=	Average baseline methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{BL,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity
f_d	=	Factor expressing the influence of the depth of the anaerobic lagoon or sludge pit on methane generation
$f_{T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year *y*
0.89	=	Conservativeness factor

<u>*Determination of f_d*</u>

f_d represents the influence of the average depth of the anaerobic lagoons or sludge pits on methane generation.

$$f_d = \begin{cases} 0\,; & if\ D < 1m \\ 0.5; & if\ 1\,m \le D < 2\,m \\ 0.7; & if\ D \ge 2\,m \end{cases} \qquad \textbf{(8)}$$

Where

f_d	=	Factor expressing the influence of the depth of the anaerobic lagoon or sludge pit on methane generation
D	=	Average depth of the anaerobic lagoons or sludge pits used in the baseline scenario (m)

Determination of $f_{T,y}$

A high temperature in the lagoon will result in a higher generation of methane due to various factors, including an increasing solubility of the organic compounds and enhanced biological and chemical reaction rates. The factor $f_{T,y}$ is calculated with the help of a monthly stock change model which aims at assessing how much *COD* degrades in each month.

For each month *m*, the quantity of wastewater directed to the anaerobic lagoon, the quantity of organic compounds that decay and the quantity of any effluent from the lagoon is balanced, giving the quantity of *COD* that is available for degradation in the next month: the amount of organic matter available for degradation to methane ($COD_{available,m}$) is assumed to be equal to the amount of organic matter directed to the anaerobic lagoon or sludge pit, less any effluent, plus the *COD* that may have remained in the lagoon or sludge pit from previous months, as follows:

$$COD_{available,m} = COD_{BL,m} + (1\text{-}f_{T,m-1}) \times COD_{available,m-1} \text{ with} \qquad \textbf{(9)}$$

$$COD_{BL,m} = \left(1 - \frac{COD_{out,x}}{COD_{in,x}}\right) \times COD_{PJ,m} \text{ and} \qquad \textbf{(10)}$$

$$COD_{PJ,m} = F_{PJ,AD,m} \times COD_{AD,m} \qquad \textbf{(11)}$$

Where:

$COD_{available,m}$	=	Quantity of chemical oxygen demand available for degradation in the anaerobic lagoon or sludge pit in month *m* (tCOD)
$COD_{BL,m}$	=	Quantity of chemical oxygen demand that would be treated in anaerobic lagoons or sludge pits in the absence of the project activity in month *m* (tCOD)
$COD_{PJ,m}$	=	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* (tCOD)
$F_{PJ,AD,m}$	=	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* (m^3)
$COD_{AD,m}$	=	Chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* ($tCOD/m^3$)
$f_{T,m-1}$	=	Factor expressing the influence of the temperature on the methane generation in month *m-1*
m	=	Months of year *y* of the crediting period
$COD_{out,x}$	=	COD of the effluent in the period *x* (t COD)
$COD_{in,x}$	=	COD directed to the open lagoons or in sludge pits in the period *x* (t COD)
x	=	Representative historical reference period

In case of emptying the anaerobic lagoon or sludge pit, the accumulation of organic matter restarts with the next inflow and the COD available from the previous month should be set to zero. The monthly factor to account for the influence of the temperature on methane generation is calculated based on the following "van't Hoff-Arrhenius" approach:

$$f_{T,m} = \begin{cases} 0.104 & if \quad T_{2,m} < 278K \\ e^{\left(\frac{E^*(T_{2,m}-T_1)}{R^*T_1^*T_{2,m}}\right)} & if \quad 278K \leq T_{2,m} \leq 302.5K \\ 0.95 & if \quad T_{2,m} > 302.5K \end{cases} \tag{12}$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
e	=	Activation energy constant (15,175 cal/mol)
$T_{2,m}$	=	Average temperature at the project site in month *m* (K)
T_1	=	303.15 K (273.15 K + 30 K)
R	=	Ideal gas constant (1.986 cal/K mol)
m	=	Months of year *y* of the crediting period

The annual value $f_{T,y}$ is calculated as follows:

$$f_{T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{available,m}}{\sum_{m=1}^{12} COD_{BL,m}} \tag{13}$$

Where:

$f_{T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year *y*
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
$COD_{available,m}$	=	Quantity of chemical oxygen demand available for degradation in the anearobic lagoon or sludge pit in month *m* (tCOD)
$COD_{BL,m}$	=	Quantity of chemical oxygen demand that would be treated in anaerobic lagoons or sludge pits in the absence of the project activity in month *m* (tCOD)
m	=	Months of year *y* of the crediting period

Procedure (C): Baseline emissions from generation of energy

This procedure is distinguished depending on whether the baseline is the separate generation of electricity and heat or the combined generation of heat and electricity by cogeneration.

Procedure (C.1): Separate generation of electricity and heat

$$BE_{EN,y} = BE_{EC,y} + BE_{HG,y} \tag{14}$$

$BE_{EN,y}$	=	Baseline emissions associated with energy generation in year *y* (t CO_2)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year *y* (t CO_2)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year *y* (t CO_2)

Procedure (C.1.1): Baseline emissions from separate generation of electricity ($BE_{EC,y}$)

The baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) shall be calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". When applying the tool:

- 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
- $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated by the alternative waste treatment option *t* and exported to the grid or displacing fossil fuel fired captive energy plant in year *y* ($EG_{t,y}$).

Procedure (C.1.2): Baseline emissions associated with separate generation of heat ($BE_{HG,y}$)

If the facility where heat generated by the project activity is used is a cement plant, then project participants may not account for baseline emissions associated with heat generation under this methodology.

For use of heat in other facilities where the baseline heat generation was a fossil fuel fired boiler or air heater, and if the facilities are included in the project boundary, the baseline emissions associated with heat generation in year *y* ($BE_{HG,y}$) are determined based on the heat generation in the project activity, as follows:

$$BE_{HG,y} = \frac{HG_{PJ,y} \times EF_{CO2,BL,HG}}{\eta_{HG,BL}} \quad \textbf{(15)}$$

Where:

$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year *y* (t CO_2)
$\eta_{HG,BL}$	=	Efficiency of the boiler or air heater used for heat generation in the baseline (ratio)
$HG_{PJ,y}$	=	Quantity of heat supplied by the project activity displacing baseline heat generation by a fossil fuel boiler or air heater in year *y* (TJ)
$EF_{CO2,BL,HG}$	=	CO_2 emission factor of the fossil fuel type used for heat generation by the boiler or air heater in the baseline (t CO_2/TJ)

To estimate the baseline energy efficiency of the boiler or air heater in the baseline ($\eta_{HG,BL}$) project participants shall apply the "Tool to determine the baseline efficiency of thermal or electric energy generation systems".

Procedure (C.2): Cogeneration of electricity and heat

Baseline emissions from electricity and heat cogeneration are calculated by multiplying electricity generation ($EG_{t,y}$) and the quantity of heat supplied ($HG_{PJ,y}$) with the CO_2 emission factor of the fuel used by the cogeneration plant, as follows:

$$BE_{EN,y} = \frac{(EG_{t,y} \times 3.6) \times 10^{-3} + HG_{PJ,y}}{\eta_{cogen}} \times EF_{\mathrm{CO2,BL,CG}} \quad \textbf{(16)}$$

Where:

$BE_{EN,y}$	=	Baseline emissions associated with energy generation in year y (t CO_2)
$EF_{CO2,BL,CG}$	=	CO_2 emission factor of the fossil fuel type used for energy generation by the cogeneration plant in the baseline (t CO_2/TJ)
$HG_{PJ,y}$	=	Quantity of heat supplied by the project activity displacing baseline heat generation by a fossil fuel cogeneration plant in year y (TJ)
$EG_{t,y}$	=	Electricity generated by the alternative waste treatment option t and exported to the grid or displacing fossil fuel fired power-only and/or cogeneration captive energy generation in year y
η_{cogen}	=	Efficiency of the cogeneration plant that would have been used in the absence of the project activity (ratio)

Procedure (D): Baseline emissions associated with natural gas use ($BE_{NG,y}$)

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

$$BE_{NG,y} = BIOGAS_{NG,y} \times NCV_{BIOGAS,NG,y} \times EF_{CO2,NG,y} \quad \textbf{(17)}$$

Where:

$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year y (t CO_2)
$BIOGAS_{NG,y}$	=	Quantity upgraded biogas sent to the natural gas network due to the project activity in year y (Nm^3)
$NCV_{BIOGAS,NG,y}$	=	Net calorific value of the upgraded biogas sent to the natural gas network due to the project activity in year y (TJ/Nm^3)
$EF_{CO2,NG,y}$	=	Average CO_2 emission factor of natural gas in the natural gas network in year y (t CO_2/TJ)

$EF_{CO2,NG,y}$ is determined using the relevant provisions in the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”.

Project emissions

The project emissions in year y are calculated for each alternative waste treatment option implemented in the project activity as follows:

$$PE_y = PE_{COMP,y} + PE_{AD,y} + PE_{GAS,y} + PE_{RDF\_SB,y} + PE_{INC,y} \quad \textbf{(18)}$$

Where:

PE_y	=	Project emissions in year y (t CO_2e)
$PE_{COMP,y}$	=	Project emissions from composting or co-composting in year y (t CO_2e)
$PE_{AD,y}$	=	Project emissions from anaerobic digestion and biogas combustion in year y (t CO_2e)
$PE_{GAS,y}$	=	Project emissions from gasification in year y (t CO_2e)
$PE_{RDF\_SB,y}$	=	Project emissions associated with RDF/SB in year y (t CO_2e)
$PE_{INC,y}$	=	Project emissions from incineration in year y (t CO_2e)

Project emissions from composting or co-composting ($PE_{COMP,y}$)

Project emissions associated with composting or co-composting ($PE_{COMP,y}$) are calculated according to the methodological tool “Project and leakage emissions from composting”.

Project emissions from anaerobic digestion ($PE_{AD,y}$)

$PE_{AD,y}$ is calculated according to the methodological tool "Project and leakage emissions from anaerobic digesters". When estimating the parameters $PE_{EC,y}$ and $PE_{FC,y}$ in the tool, the sources of electricity and fossil fuel consumption shall include processing, upgrading and compressing the biogas into the natural gas network (if this is part of the project activity).

Project emissions from gasification ($PE_{GAS,y}$)

Project emissions from gasification include carbon dioxide emissions as well as small amounts of methane and nitrous oxide emissions associated with the combustion, if fossil carbon is used in the gasification process ($PE_{COM,GAS,y}$). Project emissions from gasification shall also account for electricity consumption, fossil fuel consumption and wastewater treatment (if associated with the gasification treatment process). Project emissions are therefore determined as follows:

$$PE_{GAS,y} = PE_{COM,GAS,y} + PE_{EC,GAS,y} + PE_{FC,GAS,y} + PE_{ww,GAS,y} \quad \textbf{(19)}$$

Where:

$PE_{GAS,y}$	=	Project emissions from gasification in year y (t CO_2e)
$PE_{COM,GAS,y}$	=	Project emissions from combustion associated with gasification in year y (t CO_2)
$PE_{EC,GAS,y}$	=	Project emissions from electricity consumption associated with gasification in year y (t CO_2e)
$PE_{FC,GAS,y}$	=	Project emissions from fossil fuel consumption associated with gasification in year y (t CO_2e)
$PE_{ww,GAS,y}$	=	Project emissions from the wastewater treatment associated with gasification in year y (t CH_4)

$PE_{COM,GAS,y}$ is determined according to the procedure "Project emissions from combustion within the project boundary", where $PE_{COM,GAS,y} = PE_{COM,c,y}$ and the combustor c is the gasifier or the syngas burner.

$PE_{EC,GAS,y}$ is determined according to the procedure "Project emissions from electricity use", where $PE_{EC,GAS,y} = PE_{EC,t,y}$ and the alternative waste treatment option t is gasification.

$PE_{FC,GAS,y}$ is determined according to the procedure "Project emissions from fossil fuel use", where $PE_{FC,GAS,y} = PE_{FC,t,y}$ and the alternative waste treatment option t is gasification.

$PE_{ww,GAS,y}$ is determined according to the procedure "Project emissions from wastewater treatment", where $PE_{ww,GAS,y} = PE_{ww,t,y}$ and the alternative waste treatment option t is gasification.

Project emissions associated with mechanical or thermal production of RDF/SB ($PE_{RDF\_SB,y}$)

Project emissions associated with RDF/SB comprise both the emissions from the mechanical/thermal production process (e.g. electricity, fossil fuel consumption and wastewater treatment, if relevant) as well as the combustion of RDF/SB (if this is part of the project activity). If the RDF/SB is disposed of in a SWDS, then this is accounted for as leakage emissions according to the procedure Leakage emissions associated with RDF/SB. Project emissions are determined as follows:

$$PE_{RDF\_SB,y} = PE_{COM,RDF\_SB,y} + PE_{EC,RDF\_SB,y} + PE_{FC,RDF\_SB,y} + PE_{ww,RDF\_SB,y} \quad \textbf{(20)}$$

Where:

$PE_{RDF\_SB,y}$	=	Project emissions associated with RDF/SB in year y (t CO_2e)
$PE_{COM,RDF\_SB,y}$	=	Project emissions from combustion of fossil waste associated with combustion of RDF/SB within the project boundary in year y (t CO_2)
$PE_{EC,RDF\_SB,y}$	=	Project emissions from electricity consumption associated with RDF/SB (production and on-site combustion) in year y (t CO_2e)
$PE_{FC,RDF\_SB,y}$	=	Project emissions from fossil fuel consumption associated with RDF/SB (production and on-site combustion) in year y (t CO_2e)
$PE_{ww,RDF\_SB,y}$	=	Project emissions from the wastewater treatment associated with RDF/SB (production and on-site combustion) in year y (t CH_4)

$PE_{EC,RDF\_SB,y}$ is determined according to the procedure "Project emissions from electricity use", where $PE_{EC,RDF\_SB,y} = PE_{EC,t,y}$ and the alternative waste treatment option t is production of RDF/SB.

$PE_{COM,RDF\_SB,y}$ is determined according to the procedure "Project emissions from combustion within the project boundary", where $PE_{RDF\_SB,COM,y} = PE_{COM,t,y}$ and the combustor c is the RDF/SB combustor.

$PE_{FC,RDF\_SB,y}$ is determined according to the procedure "Project emissions from fossil fuel use", where $PE_{FC,RDF\_SB,y} = PE_{FC,t,y}$ and the alternative waste treatment option t is the production of RDF/SB.

$PE_{ww,RDF\_SB,y}$ is determined according to the procedure "Project emissions from wastewater treatment", where $PE_{ww,RDF\_SB,y} = PE_{ww,t,y}$ and the alternative waste treatment option t is the production of RDF/SB.

Project emissions from incineration ($PE_{INC,y}$)

Project emissions from incineration include emissions from combustion within the project boundary ($PE_{COM,INC,y}$). If associated with the incineration process, then project emissions shall also account for electricity consumption, fossil fuel consumption and wastewater treatment (if associated with the incineration process). Project emissions are therefore determined as follows:

$$PE_{INC,y} = PE_{COM,INC,y} + PE_{EC,INC,y} + PE_{FC,INC,y} + PE_{ww,INC,y} \quad \textbf{(21)}$$

Where:

$PE_{INC,y}$	=	Project emissions from incineration in year y (t CO_2e)
$PE_{COM,INC,y}$	=	Project emissions from combustion within the project boundary of fossil waste associated with incineration in year y (t CO_2)
$PE_{EC,INC,y}$	=	Project emissions from electricity consumption associated with incineration year y (t CO_2e)
$PE_{FC,INC,y}$	=	Project emissions from fossil fuel consumption associated with incineration in year y (t CO_2e)
$PE_{ww,INC,y}$	=	Project emissions from the wastewater treatment associated with incineration in year y (t CH_4)

$PE_{EC,INC,y}$ is determined according to the procedure "Project emissions from electricity use", where $PE_{EC,INC,y} = PE_{EC,t,y}$ and the alternative waste treatment option t is incineration.

$PE_{COM,INC,y}$ is determined according to the procedure "Project emissions from combustion within the project boundary", where $PE_{INC,COM,y} = PE_{COM,t,y}$ and the combustor c is the incinerator.

$PE_{FC,INC,y}$ is determined according to the procedure "Project emissions from fossil fuel use", where $PE_{FC,INC,y} = PE_{FC,t,y}$ and the alternative waste treatment option t is incineration.

$PE_{ww,INC,y}$ is determined according to the procedure "Project emissions from wastewater treatment", where $PE_{ww,INC,y} = PE_{ww,t,y}$ and the alternative waste treatment option t is incineration.

Project emissions from electricity use ($PE_{EC,t,y}$)

The project emissions from electricity consumption due to waste treatment process *t* implemented under the project activity ($PE_{EC,t,y}$) shall be calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". When applying the tool:

(1) Project emissions shall be calculated for the sources of electricity consumed due to the alternative waste treatment process *t*, excluding consumption of electricity that was generated by the project activity ($EC_{t,y}$);

(2) If the project activity consists of more than one alternative waste treatment process, then project participants may choose to monitor electricity consumption for the entire site and then allocate this consumption to one of the different alternative waste treatment processes (e.g apportionment based on sub-metering data is not required).

Project emissions from fossil fuel use ($PE_{FC,t,y}$)

The project emissions from fossil fuel combustion associated with waste treatment process *t* implemented under the project activity ($PE_{FC,t,y}$) shall be calculated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". When applying the tool:

(1) Processes *j* in the tool correspond to the sources of fossil fuel consumption due to the alternative waste treatment process, other than for electricity generation. Consumption sources shall include, as relevant, fossil fuels used for starting the gasifier, auxiliary fossil fuels for operating the incinerator, heat generation for mechanical/thermal treatment process and on-site fossil fuel combustion during co-firing with waste. Fossil fuels used as part of the on-site processing or management of feedstocks and by-products shall also be included;

(2) If the project activity consists of more than one alternative waste treatment process, then project participants may choose to monitor fossil fuel consumption for the entire site and then allocate consumption to one of the different alternative waste treatment processes.

Project emissions from combustion within the project boundary ($PE_{COM,c,y}$)

This procedure estimates emissions from gasifiers, incinerators, RDF/SB combustors and syngas burners ($PE_{COM,c,y}$). The procedure is not relevant for flares or biogas combustors. Emissions consist of carbon dioxide, and small amounts of methane and nitrous oxide, as follows:

$$PE_{COM,c,y} = PE_{COM\_CO2,c,y} + PE_{COM\_CH4,N2O,c,y} \quad \textbf{(22)}$$

$PE_{COM,c,y}$	=	Project emissions from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2e)
$PE_{COM\_CO2,c,y}$	=	Project emissions of CO_2 from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2)
$PE_{COM\_CH4,N2O,c,y}$	=	Project emissions of CH_4 and N_2O from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2)
c	=	Combustor used in the project activity: gasifier or syngas burner, incinerator or RDF/SB combustor

Project emissions of CO_2 from combustion within the project boundary ($PE_{COM\_CO2,c,y}$)

Carbon dioxide project emissions associated with on-site combustion ($PE_{COM\_CO2,c,y}$) are calculated based either on the fossil carbon content of the fresh waste or RDF/SB combusted, or on the fossil carbon content of the stack gas. The biogenic carbon content is not considered.[7]

Project participants may select from three options to calculate $PE_{COM\_CO2,c,y}$. Option 1 requires sorting the fresh waste into components of waste type *j* and then determining the fossil-based carbon content of each waste type *j*. Option 2 determines the fossil-based carbon content of the unsorted fresh waste or RDF/SB (noting that Option 1, sorting into waste fractions, is not applicable if only RDF/SB is combusted). Option 3 measures directly the fossil-based carbon content of the stack gas.

For gasifiers producing syngas for on-site utilisation, the fossil carbon content is determined and accounted for once, either evaluating the waste composition at the gasifier's inlet (Options 1, 2), or the stack gas at the syngas' stack (Option 3). All the syngas has to be combusted.

Option 1: Waste sorted into waste type fractions

$$PE_{COM\_CO2,c,y} = EFF_{COM,c,y} \times \frac{44}{12} \times \sum_j Q_{j,c,y} \times FCC_{j,y} \times FFC_{j,y} \quad \textbf{(23)}$$

Where:

$PE_{COM\_CO2,c,y}$	=	Project emissions of CO_2 from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2)
$Q_{j,c,y}$	=	Quantity of fresh waste type *j* fed into combustor c the in year *y* (t)
$FCC_{j,y}$	=	Fraction of total carbon content in waste type *j* in year *y* (t C/t)
$FFC_{j,y}$	=	Fraction of fossil carbon in total carbon content of waste type *j* in year *y* (weight fraction)
$EFF_{COM,c,y}$	=	Combustion efficiency of combustor *c* in year *y* (fraction)
$\frac{44}{12}$	=	Conversion factor (t CO_2/t C)
c	=	Combustor used in the project activity: gasifier, incinerator or RDF/SB combustor
j	=	Waste type

Project participants may select to either directly monitor the amount of waste type *j* fed into the combustor *c* in year *y* ($Q_{j,c,y}$) or calculate this parameter based on monitoring the total waste fed to the combustor and sampling the waste to determine the fraction of waste type *j* as per the following equation:

$$Q_{j,c,y} = Q_{waste,c,y} \times \frac{\sum_{n=1}^{z} p_{n,j,y}}{z} \quad \textbf{(24)}$$

[7] CO_2 emissions from the combustion or decomposition of *biomass* (see definition by the Board in annex 8 of the Board's 20th meeting report) are not accounted as GHG emissions. Where the combustion or decomposition of biomass under a CDM project activity results in a decrease of carbon pools, such stock changes should be considered in the calculation of emission reductions. This is not the case for waste treatment projects.

Where:

$Q_{j,c,y}$	=	Quantity of waste type *j* fed into combustor *c* the in year *y* (t)
$Q_{waste,c,y}$	=	Quantity of fresh waste or RDF/SB fed into combustor *c* in year *y* (t)
$p_{n,j,y}$	=	Fraction of waste type *j* in the sample *n* collected during the year *y* (weight fraction)
z	=	Number of samples collected during the year *y*
n	=	Samples collected in year *y*
j	=	Waste type

Option 2: Based on unsorted waste

$$PE_{COM\_CO2,c,y} = \frac{44}{12} \times EFF_{COM,c,y} \times Q_{waste,c,y} \times FFC_{waste,c,y} \quad \textbf{(25)}$$

Where:

$PE_{COM\_CO2,c,y}$	=	Project emissions of CO_2 from combustion within the project boundary associated with combustor *c* in year *y* (tCO_2)
$Q_{waste,c,y}$	=	Quantity of fresh waste or RDF/SB fed into combustor *c* in year *y* (t)
$FFC_{waste,c,y}$	=	Fraction of fossil-based carbon in waste or RDF/SB fed into combustor *c* the in year *y* (t C/t)
$EFF_{COM,c,y}$	=	Combustion efficiency of combustor *c* in year *y* (fraction)
$\frac{44}{12}$	=	Conversion factor (t CO_2/t C)
c	=	Combustor used in the project activity: gasifier, incinerator or RDF/SB combustor
j	=	Waste type, including RDF/SB

Option 3: Based on stack gas measurement

$$PE_{COM\_CO2,c,y} = \frac{44}{12} \times SG_{c,y} \times FFC_{stack,c,y} \quad \textbf{(26)}$$

Where:

$PE_{COM\_CO2,c,y}$	=	Project emissions of CO_2 from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2)
$SG_{c,y}$	=	Volume of stack gas from combustor *c* in year *y* (Nm^3)
$FFC_{stack,c,y}$	=	Concentration of fossil-based carbon in the stack gas of the combustor *c* the in year *y* (t C/Nm^3)
$\frac{44}{12}$	=	Conversion factor (t CO_2/t C)
c	=	Combustor used in the project activity: gasifier, syngas burner, incinerator or RDF/SB combustor

Project emissions of CH_4 and N_2O from combustion within the project boundary ($PE_{COM\_CH4,N2O,c,y}$)

Emissions of N_2O and CH_4 from combustion of RDF/SB are neglected because they are considered very minor. For the case of gasification or incineration, project participants may choose either Option 1 or Option 2 to estimate emissions of N_2O and CH_4 from combustion within the project boundary. Option 1 calculates the emissions based on monitoring the N_2O and CH_4 content in the stack gas.

Option 2 calculates the emissions using default emission factors for the amount of N_2O and CH_4 emitted per tonne of fresh waste combusted.

Option 1: Monitoring the N_2O and CH_4 content in the stack gas

$$PE_{COM\_CH4,N2O,c,y} = SG_{c,y} \times \left(C_{N2O,SG,c,y} \times GWP_{N2O} + \times C_{CH4,SG,c,y} \times GWP_{CH4}\right) \quad \textbf{(27)}$$

Where:

$PE_{COM\_CH4,N2O,c,y}$	=	Project emissions of CH_4 and N_2O from combustion within the project boundary of fossil carbon in combustor *c* in year *y* (t CO_2)
$SG_{c,y}$	=	Volume of stack gas from combustor *c* in year *y* (Nm^3)
$C_{N2O,SG,c,y}$	=	Concentration of nitrous oxide in the stack gas from combustor *c* in year *y* (t N_2O/Nm^3)
GWP_{N2O}	=	Global Warming Potential of nitrous oxide (t CO_2e/t N_2O)
$C_{CH4,SG,c,y}$	=	Concentration of methane in the stack gas from combustor *c* in year *y* (t CH_4/Nm^3)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (t CO_2e/t CH4)
c	=	Combustor used in the project activity: gasifier, incinerator

Option 2: Using default emission factors

$$PE_{COM\_CH4,N2O,c,y} = Q_{waste,c,y} \times \left(EF_{N2O,t} \times GWP_{N2O} + EF_{CH4,t} \times GWP_{CH4}\right) \quad \textbf{(28)}$$

Where:

$PE_{COM\_CH4,N2O,c,y}$	=	Project emissions of CH_4 and N_2O from combustion within the project boundary associated with combustor *c* in year *y* (t CO_2)
$Q_{waste,c,y}$	=	Quantity of fresh waste or RDF/SB fed into combustor *c* in year *y* (t)
$EF_{N2O,t}$	=	Emission factor for N_2O associated with waste treatment option *t* (t N_2O/t waste)
$EF_{CH4,t}$	=	Emission factor for CH_4 associated with treatment option *t* (t CH_4/t waste)
GWP_{N2O}	=	Global Warming Potential of nitrous oxide (t CO_2e/t N_2O)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (t CO_2e/tCH_4)
c	=	Combustor used in the project activity: gasifier, incinerator
t	=	Type of alternative waste treatment options: gasification, incineration

Emissions from run-off wastewater management ($PE_{ww,t,y}$)

If the run-off wastewater generated by the project activity is treated using an aerobic treatment process, such as by co-composting, then project emissions from wastewater treatment are assumed to be zero. If the run-off wastewater is treated in the anaerobic digester, then emissions are calculated according to the procedure “Project emissions from anaerobic digestion”.

If the project activity generates run-off wastewater that is treated anaerobically (other than in an anaerobic digester that is part of the project activity), stored anaerobically or released untreated, then project participants shall determine $PE_{ww,t,y}$, with the following equation. The calculation is distinguished for the situation that there is either complete, partial or no flaring/combustion of the methane generated by the run-off wastewater treatment process:

$$PE_{ww,t,y} = \begin{cases} Q_{ww,y} \times P_{COD,y} \times B_0 \times MCF_{ww} \times GWP_{CH4}, \textit{for no flaring} \\ Q_{ww,y} \times P_{COD,y} \times B_0 \times MCF_{ww} \times GWP_{CH4} + \left(\frac{PE_{flare,ww,y}}{GWP_{CH4}} - F_{CH4,flare,y} \right), \text{for partial flaring} \\ \frac{PE_{flare,ww,y}}{GWP_{CH4}}, \text{for complete flaring} \end{cases} \quad \textbf{(29)}$$

Where:

$PE_{ww,t,y}$	=	Project emissions of methane from run-off wastewater associated with alternative waste treatment option *t* in year *y* (t CO_2e)
$Q_{ww,y}$	=	Amount of run-off wastewaster generated by the project activity and treated anaerobically or released untreated from the project activity in year *y* (m^3)
$P_{COD,y}$	=	COD of the run-off wastewater generated by the project activity in year *y* (tCOD/m^3)
B_0	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (t CH_4/tCOD)
MCF_{ww}	=	Methane conversion factor (fraction)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (t CO_2e/tCH_4)
$PE_{flare,ww,y}$	=	Emissions from flaring associated with run-off wastewater treatment in year *y* (t CO_2e)
$F_{CH4,flare,y}$	=	Amount of methane in the run-off wastewater treatment emissions which is sent to the flare/combustor in year *y* (t CH_4)

The methodological tool “Project emissions from flaring” shall be used to estimate the resulting methane emissions from flaring ($PE_{flare,ww,y}$ is estimated as parameter $PE_{flare,y}$ in the tool). If the methane is combusted in an incinerator, rather than flared, then for the case that project participants have selected Option 1 to use monitored data to determine “Project emissions of CH_4 and N_2O from combustion within the project boundary” these emissions are already accounted for. If Option 2 to use default values was selected instead, then assume a 90% destruction efficiency of the methane contained in the gas, with $PE_{flare,ww,y} = PE_{com,ww,y}$ and emissions calculated as follows:

$$PE_{com,ww,y} = F_{CH4,flare,y} \times 0.1 \quad \textbf{(30)}$$

Where:

$PE_{com,ww,y}$	=	Emissions from combustion of methane generated from wastewater treatment in year *y* (t CO_2e)
$F_{CH4,flare,y}$	=	Amount of methane in the wastewater treatment gas that is sent to the flare/combustor in year *y* (t CO_2e)

$F_{CH4,flare,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, applying these requirements:

- The gaseous stream the tool shall be applied to is the wastewater treatment emissions delivery pipeline to the flare(s);
- CH_4 is the greenhouse gases for which the mass flow shall be determined;
- The flow of the gaseous stream shall be measured on continuous basis;

- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 or 17 in the tool); and
- The mass flow shall be calculated for an hourly time interval *t* (as per the tool) and then summed for the year *y* (tCH_4).

If the wastewater treated is sourced from more than one alternative waste treatment option implemented on-site, then the emissions may be estimated for the entire site and then allocated to any of the treatment options.

Leakage

Leakage emissions are associated with composting/co-composting, anaerobic digestion and the use of RDF/SB that is exported outside the project boundary. For the case that waste by-products of the alternative waste treatment option are:

- Used for soil application, this emissions shall be neglected;
- Composted or co-composted, then these shall be treated as fresh waste with emissions estimated according to the procedure project emissions from composting ($PE_{COMP,y}$).

Leakage emissions are determined as follows:

$$LE_y = LE_{COMP,y} + LE_{AD,y} + LE_{RDF\_SB,y} \tag{31}$$

Where:

LE_y	=	Leakage emissions in the year *y* (t CO_2e)
$LE_{COMP,y}$	=	Leakage emissions from composting or co-composting in year *y* (t CO_2e)
$LE_{AD,y}$	=	Leakage emissions from anaerobic digester in year *y* (t CO_2e)
$LE_{RDF\_SB,y}$	=	Leakage emissions associated with RDF/SB in year *y* (t CO_2e)

Leakage emissions from composting ($LE_{COMP,y}$)

Leakage emissions associated with composting ($LE_{COMP,y}$) are calculated according to the methodological tool "Project and leakage emissions from composting".

Leakage emissions from anaerobic digestion ($LE_{AD,y}$)

Leakage emissions associated with anaerobic digestion of waste ($LE_{AD,y}$) are calculated according to the methodological tool "Project and leakage emissions from anaerobic digesters".

Leakage emissions associated with RDF/SB ($LE_{RDF\_SB,y}$)

Leakage emissions associated with RDF/SB are accounted for the organic waste by-products of the treatment process (not by-products from the RDF/SB combustor), which may be composted or disposed of in a SWDS, and the end-use of RDF/SB that is exported off-site, as follows:

$$LE_{RDF\_SB,y} = LE_{ENDUSE,RDF\_SB,y} + L_{SWDS,WBP\_RDFSB,y} \tag{32}$$

Where:

$LE_{RDF\_SB,y}$	=	Leakage emissions associated with RDF/SB in year *y* (t CO_2e)
$LE_{SWDS,WBP\_RDF\_SB,y}$	=	Leakage emissions associated with disposing of waste by-products associated with RDF/SB production in a SWDS in year *y* (t CO_2e)
$LE_{ENDUSE,RDF\_SB,y}$	=	Leakage emissions associated with the end-use of RDF/SB exported outside the project boundary in year *y* (tCO_2e)

Leakage emissions from disposal of waste by-products from RDF/SB production in a SWDS ($LE_{SWDS,WBP\_RDF\_SB,y}$)

$LE_{SWDS,WBP\_RDF\_SB,y}$ is determined using the methodological tool "Emissions from solid waste disposal sites". In the tool, *x* begins with the start of the CDM project activity and extends to the end of year *y* (e.g. emissions are calculated using Application B in the tool and waste disposed from the start of the first crediting period shall be considered).

$W_{j,x}$ in the tool is the amount of organic waste contained in the waste by-products from the production of RDF/SB in year *y* (e.g. it does not include waste by-products that are composted instead of being disposed to a SWDS in the project activity or waste by-products from the combustion of RDF/SB).

Leakage emissions associated with end use of RDF/SB exported outside the project boundary ($LE_{ENDUSE,RDF\_SB,y}$)

The potential leakage emissions associated with the use of the RDF/SB that is exported outside the project boundary are that it may be combusted or decompose anaerobically. Emissions are therefore calculated allowing for the situation that RDF/SB exported in year *y* may have three different end uses *u,* as follows:

- End use 1: documented evidence is provided that the RDF/SB exported off-site is used as raw material in fertilizer, ceramic manufacture or as a fuel that is combusted in a CDM project activity. In this case, no leakage emissions are estimated;
- End use 2: documented evidence is provided that the RDF/SB exported off-site is combusted or used as a raw material in furniture: In this case, the RDF/SB is considered to be combusted and $LE_{ENDUSE,RDF\_SB,y}$ shall be calculated, according to procedure below;
- End use 3: no documented evidence is provided that the off-site end use of RDF/SB is either combustion, furniture manufacture, fertilizer or ceramic production. In this case, the RDF/SB may potentially degrade anaerobically or be combusted. Therefore, it is conservatively assumed that the RDF/SB degrades anaerobically according to the procedure below.

Leakage emissions from combusted off-site end use of RDF/SB ($LE_{ENDUSE,RDF\_SB,y}$) (End use 2)

This procedure estimates emissions associated with combustion of RDF/SB outside the project boundary, where the combustor is outside the control of the project participants. Carbon dioxide emissions ($LE_{ENDUSE,RDF\_SB,y}$) are calculated as follows:

$$LE_{ENDUSE,RDF\_SB,y} = Q_{RDF\_SB,COM,y} \times NCV_{RDF\_SB,y} \times EF_{CO2,RDF\_SB,y} \quad \textbf{(33)}$$

Where:

$LE_{ENDUSE,RDF\_SB,y}$	=	Leakage emissions of CO_2 from off-site combustion of RDF/SB in year *y* (t CO_2)
$Q_{RDF\_SB,COM,y}$	=	Quantity of RDF/SB exported off-site with potential to be combusted in year *y* (t)

$EF_{CO2,RDF\_SB,y}$	=	CO_2 emissions factor for RDF/SB in year *y* (t CO_2/GJ)
$NCV_{RDF\_SB,y}$	=	Net calorific value of RDF/SB in year *y* (GJ/t)

Leakage emissions from off-site anaerobic decomposition of RDF/SB (End use 3)

Emissions from anaerobic decomposition of RDF/SB are accounted for by adjusting the quantity of organic waste that produced RDF/SB that was used in Procedure (A) for the calculation of baseline emissions, as follows:

In Procedure (A) for calculating baseline emissions using the methodological tool "Emissions from solid waste disposal sites", adjust the amount of organic waste that was treated to produce the RDF/SB in year *y* ($W_{RDF\_SB,j,x}$) to account for the situation that not all of this organic waste is avoided from disposal in a SWDS. The adjusted parameter $W_{RDF\_SB,j,x,adj}$ shall be determined by multiplying the ratio of RDF/SB exported off-site that is assumed to degrade anaerobically and the amount of RDF/SB produced in year *y* as follows:

$$W_{RDF\_SB,j,x,adj} = \frac{Q_{export,RDF\_SB,y}}{Q_{RDF\_SB,y}} \times W_{RDF\_SB,j,x} \quad \textbf{(34)}$$

Where:

$W_{RDF\_SB,j,x,adj}$	=	Amount of solid waste type *j* prevented from disposal in the SWDS by using the waste to produce RDF/SB in the year *x*, adjusted by the proportion of RDF/SB that is disposed of in a SWDS (t)
$W_{RDF\_SB,j,x}$	=	Amount of solid waste type *j* prevented from disposal in the SWDS by using the waste to produce RDF/SB in the year *x* (t)
$Q_{export,RDF\_SB,y}$	=	Amount of RDF/SB exported offsite with potential to degrade anaerobically in year *y* (t)
$Q_{RDF\_SB,y}$	=	Amount of RDF/SB produced by the project activity in year *y* (t)

Emission reductions

To calculate the emission reductions the project participant shall apply the following equation:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(35)}$$

Where:

ER_y	=	Emissions reductions in year *y* (t CO_2e)
BE_y	=	Baseline emissions in year *y* (t CO_2e)
PE_y	=	Project emissions in the year *y* (t CO_2e)
LE_y	=	Leakage emissions in year *y* (t CO_2e)

If the sum of PE_y and LE_y is smaller than 1% of BE_y in the first full operation year of a crediting period, the project participants may choose to assume a fixed percentage of 1% for the sum of PE_y and LE_y for the remaining years of the crediting period.

In the case that overall negative emission reductions arise in a year, 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 *y* and positive emission reductions of 100 tCO_2e occur in the year *y*+1, 0 CERs are issued for year *y* and only 70 CERs are issued for the year *y*+1.)

Changes required for methodology implementation in 2nd and 3rd crediting periods

The required changes shall be assessed using the tool for "Assessment of the validity of the current/original baseline and update of the baseline at the renewal of the crediting period".

Project activity under a programme of activities

In addition to the requirements set out in the latest approved version of the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities", the following shall be applied for the use of this methodology in a project activity under a programme of activities (PoAs).

The PoA may consist of one or several types of CPAs. CPAs are regarded to be of the same type if they are similar with regard to the demonstration of additionality, emission reduction calculations and monitoring. The CME shall describe in the CDM-PoA-DD for each type of CPAs separately:

(a) Eligibility criteria for CPA inclusion used for each type of CPAs;

(b) In case of combinations of treatment options in one CPA, the eligibility criteria shall be defined for each treatment option, separately;

(c) Emission reduction calculations for each type of CPAs;

(d) Monitoring provisions for each type of CPAs.

The CME shall describe transparently and justify in the CDM-PoA-DD which CPAs are regarded to be of the same type. CPAs are not regarded to be of the same type if one of the following conditions is different:

(a) The baseline scenario with regard to any of the following aspects:

  (i) The disposal of organic waste in a SWDS without a LFG capture system;

  (ii) The disposal of organic waste in a SWDS with a partical LFG capture system;

  (iii) In case of co-composting, the treatment of organic wastewater in:

    - Existing anaerobic lagoon;
    - New to be built anaerobic lagoon;
    - New sludge pit;
    - Existing sludge pit;

(b) The project activity with regard to a treatment option used as well as any of the following aspects of the treatment option:

  (i) Composting:

    - Closed composting;
    - Open composting (wind rows);

  (ii) Co-composting:

    - Closed composting;
    - Open composting (wind rows);

  (iii) Thermal treatment:

    - Generation of electricity;
    - Generation of heat;

- Combination of heat and electricity generation;
- Any other use;

(iv) Mechanical treatment:

- Generation of electricity;
- Generation of heat;
- Combination of heat and electricity generation;
- Any other use;

(v) Gasification:

- Generation of electricity;
- Generation of heat;
- Combination of heat and electricity generation;
- Any other use;

(vi) Incineration:

- Generation of electricity;
- Generation of heat;
- Combination of heat and electricity generation;
- Any other use;

(vii) Combination of any treatment options or use of the product/by-product (e.g. heat or electricity from biogas) for within a treatment option listed above;

(c) The legal and regulatory framework.

When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

(a) Type of solid waste disposal site:

(i) New solid waste disposal site;

(ii) Existing solid waste disposal site;

(b) Ranges of capacity of the treatment plant or unit;

(c) Composition of the waste (e.g. mixed or single type of waste);

(d) Ranges of costs (capital investment, operating and maintenance costs, etc.);

(e) Ranges of revenues (income from electricity, heat or biogas sale, subsidies/fiscal incentives, ODA).

The eligibility criteria related to the costs and revenues parameters shall be updated every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

In case the PoA contains several types of CPAs, the actual CPA-DD shall contain the description of each type of actual CPAs, be validated by a DOE and submitted for registration to the Board.

Data and parameters not monitored

As applicable, all the provisions regarding data and parameters not monitored as contained in the tools referred to in this methodology shall be followed.

Data / Parameter:	FFC_j
Data unit:	%
Description:	Fraction of fossil carbon in total carbon content of waste type *j*
Source of data:	Table 2.4, chapter 2, volume 5 of IPCC 2006 guidelines
Value to be applied:	For MSW the following values for the different waste types *j* may be applied: **Table 3: Default values for $FFC_{j,y}$** (see table below)

Table 3: Default values for $FFC_{j,y}$

Waste type *j*	**Default mrm: Internal note: the methodology's default is the largest value of the range of Table 2.4/Chapter2/Vol.5/2006 IPCC Guidelines**
Paper/cardboard	5
Textiles	50
Food waste	-
Wood	-
Garden and Park waste	0
Nappies	10
Rubber and Leather	20
Plastics	100
Metal*	NA
Glass*	NA
Other, inert waste	100

*Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common.

If a waste type is not comparable to a type listed in Table 3, or can not clearly be described as a combination of types in this table above, or if the project participants wish to measure $FFC_{j,}$, then project participants shall measure $FFC_{j,y}$ using the following standards, or similar national or international standards:

- ASTM D6866: "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis";
- ASTM D7459: "Standard Practice for Collection of Integrated Samples for the Speciation of Biomass (Biogenic) and Fossil Carbon Dioxide Emitted from Stationary Emissions Sources".

The frequency of measurement shall be as a minimum four times in year *y* with the mean value valid for year *y*

Any comment:	-

Data / Parameter:	FCC_j
Data unit:	%
Description:	Fraction of total carbon content in waste type *j*
Source of data:	Table 2.4, chapter 2, volume 5 of IPCC 2006 guidelines
Value to be applied:	For MSW the following values for the different waste types *j* may be applied: **Table 4: Default values for $FCC_{j,y}$** (see table below) *Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common
Any comment:	-

Table 4: Default values for $FCC_{j,y}$

Waste type *j*	**Default mrm: Internal note: the methodology's default is the largest value of the range of Table 2.4/Chapter2/Vol.5/2006 IPCC Guidelines (as per FFCj above)**
Paper/cardboard	50
Textiles	50
Food waste	50
Wood	54
Garden and Park waste	55
Nappies	90
Rubber and Leather	67
Plastics	85
Metal*	NA
Glass*	NA
Other, inert waste	5

*Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common

Data / Parameter:	GWP_{CH4}
Data unit:	T CO_2e/tCH_4
Description:	Global Warming Potential of methane valid for the commitment period (t CO_2e/t CH_4)
Source of data:	IPCC
Value to be applied:	21 for the first commitment period. Shall be updated for future commitment periods according to any future COP/MOP decisions
Any comment:	-

Data / Parameter:	GWP_{N2O}
Data unit:	T CO_2e/t N_2O
Description:	Global Warming Potential of N_2O
Source of data:	IPCC
Value to be applied:	310 for the first commitment period. Shall be updated for future commitment periods according to any future COP/MOP decisions
Any comment:	-

Data / Parameter:	B_O
Data unit:	$tCH_4/tCOD$
Description:	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($t\ CH_4/tCOD$)
Source of data:	Section 6.2.3.2, chapter 6, volume 5 of IPCC 2006 guidelines
Value to be applied	0.25
Any comment:	Applicable to the "Procedure to calculate project emissions from wastewater treatment"

Data / Parameter:	MCF_{ww}
Data unit:	Fraction
Description:	Methane conversion factor
Source of data:	The source of data shall be the following, in order of preference: 1. Project specific data; 2. Country specific data; or 3. IPCC default values (table 6.3, chapter 6, volume 5 of IPCC 2006 guidelines)
Measurement procedures (if any):	-
Any comment:	As per guidance from the Board, IPCC default values shall be used only when country or project specific data are not available or difficult to obtain

Data / Parameter:	$EF_{CH4,t}$
Data unit:	tCH_4/t waste (wet basis)
Description:	Emission factor for CH_4 associated with waste treatment option *t*
Source of data:	Table 5.3, chapter 5, volume 5 of IPCC 2006 guidelines

<table>
<tr><td>Measurement procedures (if any):</td><td>If country-specific data is available, then this shall be applied and the method used to derive the value as well as the data sources need to be documented in the CDM-PDD. If country-specific data are not available, then apply the default values listed in Table 5. For continuous incineration of industrial waste, apply the CH4 emission factors provided in Volume 2, Chapter 2, Stationary Combustion of IPCC 2006 Guidelines.
Table 5: CH_4 emission factors for combustion
<table>
<tr><th>Waste type</th><th colspan="2">Type of incineration/technology</th><th>CH_4 Emission Factors (t CH_4 / t waste) wet basis</th></tr>
<tr><td rowspan="6">MSW</td><td rowspan="2">Continuous incineration</td><td>stoker</td><td>$1.21x\ 0.2x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>~0</td></tr>
<tr><td rowspan="2">Semi-continuous incineration</td><td>stoker</td><td>$1.21x\ 6x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>$1.21x\ 188x10^{-6}$</td></tr>
<tr><td rowspan="2">Batch type incineration</td><td>stoker</td><td>$1.21x\ 60x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>$1.21x\ 237x10^{-6}$</td></tr>
<tr><td colspan="3">Industrial sludge (semi-continuous or batch type incineration)</td><td>$1.21x\ 9\ 700x10^{-6}$</td></tr>
<tr><td colspan="3">Waste oil (semi-continuous or batch type incineration)</td><td>$1.21x\ 560x10^{-6}$</td></tr>
</table>
A conservativeness factor of 1.21 has been applied to account for the uncertainty of the IPCC default values</td></tr>
<tr><td>Any comment:</td><td>Applicable to Option 2 of procedure to estimate $PE_{COM,c,y}$</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$EF_{N2O,t}$</td></tr>
<tr><td>Data unit:</td><td>tN_2O/t waste (wet basis)</td></tr>
<tr><td>Description:</td><td>Emission factor for N_2O associated with treatment option t</td></tr>
<tr><td>Source of data:</td><td>Table 5.6, chapter 5, volume 5 of IPCC 2006 guidelines</td></tr>
<tr><td>Measurement procedures (if any):</td><td>If country-specific data is available, then this shall be applied and the method used to derive the value as well as the data sources need to be documented in the CDM-PDD. If country-specific data are not available, then apply the default values listed in Table 6.
Table 6: N_2O emission factors for combustion
<table>
<tr><th>Type of waste</th><th>Technology / Management practice</th><th>Emission factor (t N2O / t waste wet basis)</th></tr>
<tr><td>MSW</td><td>Continuous and semi-continuous incinerators</td><td>$1.21x\ 50x10^{-3}$</td></tr>
<tr><td>MSW</td><td>Batch-type incinerators</td><td>$1.21x\ 60x10^{-3}$</td></tr>
<tr><td>Industrial waste</td><td>All types of incineration</td><td>$1.21x\ 100x10^{-3}$</td></tr>
<tr><td>Sludge (except sewage sludge)</td><td>All types of incineration</td><td>$1.21x\ 450x10^{-3}$</td></tr>
<tr><td>Sewage sludge</td><td>Incineration</td><td>$1.21x\ 900x10^{-3}$</td></tr>
</table>
A conservativeness factor of 1.21 has been applied to account for the uncertainty of the IPCC default values</td></tr>
<tr><td>Any comment:</td><td>Applicable to Option 2, of procedure to estimate $PE_{COM,c,y}$</td></tr>
</table>

Data / Parameter:	$EF_{CO2,BL,HG}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of the fossil fuel type used for heat generation by the boiler or air heater in the baseline
Source of data:	The source of data shall be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values shall be used only when country or project specific data are not available or difficult to obtain
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	η_{cogen}
Data unit:	ratio
Description:	Efficiency of the cogeneration plant that would have been used in the absence of the project activity
Source of data:	Project participants can choose one of the following approaches: (1) Highest of the measured efficiencies of similar plants; (2) Highest of the efficiency values provided by two or more manufacturers for similar plants; or (3) Maximum efficiency of 90%, based on net calorific values
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$EF_{CO2,BL,CG}$
Data unit:	tCO_2/MJ
Description:	Emission factor of baseline fossil fuel used in the cogeneration plant, as identified in the baseline scenario identification
Source of data:	The source of data shall be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values shall be used only when country or project specific data are not available or difficult to obtain
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$COD_{out,x}$ $COD_{in,x}$
Data unit:	tCOD
Description:	COD of the effluent in the period *x*. COD directed to the anaerobic lagoons or sludge pits in the period *x* (tCOD)
Source of data:	For existing plants: (a) If there is no effluent: $COD_{out,x} = 0$; (b) If there is effluent: • One year of historical data should be used, or • If one year data is not available then *x* represents a measurement campaign of at least 10 days to the COD inflow ($COD_{in,x}$) and COD outflow ($COD_{out,x}$) from the lagoon or sludge pit. For Greenfield projects: (a) Use the design COD inflow for COD in and the design effluent COD flow for COD out corresponding to the design features of the lagoon system identified in the procedure for the selection of the baseline scenario
Measurement procedures (if any):	For the measurement campaign of at least 10 days: The measurements should be undertaken during a period that is representative for the typical operation conditions of the plant and ambient conditions of the site (temperature)
Any comment:	-

Data / Parameter:	x
Data unit:	Time
Description:	Representative historical reference period
Source of data:	For existing plants: (a) *x* should represents one year of historical data; (b) If one year data is not available then *x* represents a measurement campaign of at least 10 days. For Greenfield projects this parameter is not relevant
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	ρ
Data unit:	-
Description:	Discount factor to account for the uncertainty of the use of historical data to determine $COD_{BL,y}$
Source of data:	For existing plants: (a) If one year of historical data is available ρ=1; (b) If a measurement campaign of at least 10 days is available ρ=0.89. For Greenfield projects: ρ=1
Measurement procedures (if any):	The value of 0.89 for the case where there is no one year historical data is to account for the uncertainty range (of 30% to 50%) associated with this approach as compared to one-year historical data
Any comment:	-

Data / Parameter:	B_O
Data unit:	$tCH_4/tCOD$
Description:	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (COD)
Source of data:	2006 IPCC Guidelines
Measurement procedures (if any):	No measurement procedures. The default IPCC value for B_o is 0.25 kg CH_4/kg COD shall be used. Unless the methodology is used for wastewater containing materials not akin to simple sugars, a CH_4 emissions factor different from 0.21 $tCH_4/tCOD$ has to be applied
Any comment:	Taking into account the uncertainty of this estimate, project participants should use a value of 0.21 kg CH_4/kg COD as a conservative assumption for B_o

Data / Parameter:	D
Data unit:	M
Description:	Average depth of the lagoons or sludge pits
Source of data:	For existing plants: conduct measurements. For project activities implemented in Greenfield facilities: As per the baseline lagoon design as identified in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario Identification of alternative scenarios"
Measurement procedures (if any):	Determine the average depths of the whole lagoon/sludge pit under normal operating conditions
Any comment:	-

III. MONITORING METHODOLOGY

The monitoring procedures are described in the tables below. As applicable, all the monitoring provisions contained in the tools referred to in this methodology shall be followed.

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.

Data and parameters monitored

Data / Parameter:	$RATE_{compliance,t,y}$
Data unit:	Fraction
Description:	Rate of compliance with a regulatory requirement to implement the alternative waste treatment t implemented in the project activity
Source of data:	Studies and official reports, such as annual reports provided by municipal bodies
Measurement procedures (if any):	Fraction is calculated as the number of instances of compliance divided by the number of instances of compliance plus non-compliance
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	Applicable to calculating baseline emissions and confirming applicability of the methodology

Data / Parameter:	$NCV_{BIOGAS,NG,y}$
Data unit:	TJ/Nm^3
Description:	Net calorific value of the upgraded biogas sent to the natural gas network due to the project activity in year *y*
Source of data:	Project participants
Measurement procedures (if any):	Measured directly using an online Heating Value Meter from the gas stream. The measurement must be in volume basis and adjusted to reference conditions
Monitoring frequency:	Continuous
QA/QC procedures:	Calibration shall be according to manufacturer's specifications
Any comment:	Applicable to baseline emissions procedure (D)

Data / Parameter:	$BIOGAS_{NG,y}$
Data unit:	Nm^3/yr
Description:	Quantity upgraded biogas sent to the natural gas network due to the project activity in year *y* (Nm3)
Source of data:	Project participants
Measurement procedures (if any):	Measured by a flow meter and adjusted to reference conditions. Data to be aggregated monthly and yearly
Monitoring frequency:	Continuous (average value in a time interval not greater than an hour shall be used in the calculations of emission reductions)
QA/QC procedures:	Flow meters shall be subject to a regular maintenance and testing regime to ensure accuracy. Calibration shall be according to manufacturer's specifications
Any comment:	Applicable to procedure (D)

Data / Parameter:	$EFF_{COM,c,y}$
Data unit:	Fraction
Description:	Combustion efficiency of combustor *c* in year *y*
Source of data:	The source of data shall be the following, in order of preference: 1. Project specific data; 2. Country specific data; or 3. IPCC default values
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	As per guidance from the Board, IPCC default values shall be used only when country or project specific data are not available or difficult to obtain

Data / Parameter:	$SG_{c,y}$
Data unit:	m^3/yr
Description:	Volume of stack gas from combustor *c* in year *y*
Source of data:	Project participants

Measurement procedures (if any):	The stack gas flow rate is either directly measured or calculated from other variables where direct monitoring is not feasible. Where there are multiple stacks of the same type, then it is sufficient to monitor one stack of each type. For the case that biogas is combusted, then the stack gas volume flow rate may be estimated by summing the inlet biogas and air flow rates and adjusting for stack temperature. Direct measurement of the air inlet flow rate shall be made using a flow meter
Monitoring frequency:	Continuous or periodic (at least quarterly)
QA/QC procedures:	Maintenance and calibration of equipment will be carried out according to internationally recognised procedures. Where laboratory work is outsourced, one which follows rigorous standards shall be selected
Any comment:	-

Data / Parameter:	$C_{N2O,SG,c,y}$
Data unit:	tN_2O/Nm^3
Description:	Concentration of N_2O in stack gas from combustor *c* in year *y*
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	At least every three months
QA/QC procedures:	Maintenance and calibration of equipment will be carried out according to internationally recognised procedures. Where laboratory work is outsourced, one which follows rigorous standards shall be selected
Any comment:	More frequent sampling is encouraged

Data / Parameter:	$C_{CH4,SG,c,y}$
Data unit:	tCH_4/Nm^3
Description:	Concentration of CH_4 in stack gas from combustor *c* in year *y*
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	At least every three months
QA/QC procedures:	Maintenance and calibration of equipment will be carried out according to internationally recognised procedures. Where laboratory work is outsourced, one which follows rigorous standards shall be selected
Any comment:	More frequent sampling is encouraged

Data / Parameter:	$Q_{waste,c,y}$
Data unit:	T
Description:	Quantity of fresh waste or RDF/SB fed into combustor *c* in year *y*
Source of data:	Project participants
Measurement procedures (if any):	Measured with calibrated scales or load cells
Monitoring frequency:	Continuously, aggregated at least annually

QA/QC procedures:	-
Any comment:	Parameter required for procedure to calculate project emissions from combustion within the project boundary

Data / Parameter:	$p_{n,j,y}$
Data unit:	Weight fraction
Description:	Fraction of waste type *j* in the sample *n* collected during the year *y*
Source of data:	Sample measurements by project participants
Measurement procedures (if any):	-
Monitoring frequency:	A minimum of three samples shall be undertaken every three months with the mean value valid for year *y*
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	z_y
Data unit:	-
Description:	Number of samples collected during the year *y*
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	Continuously, aggregated annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$EC_{t,y}$
Data unit:	MWh
Description:	Electricity consumption of electricity generated in an on-site fossil fuel fired power plant or from the grid as a result of the alternative waste treatment option *t* in year *y*
Source of data:	Electricity meter
Measurement procedures (if any):	Sources of consumption shall include the operation of the alternative waste treatment process, on-site processing or management of the feedstock or products associated with the treatment process and on-site combustion activity. Electricity consumption shall be monitored for all activities included in the project boundary, associated with the treatment option, as illustrated in appendix 1
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 against invoices when available
Any comment:	This parameter is required for calculating project emissions from electricity consumption due to waste treatment under the project activity process *t* ($PE_{EC,t,y}$) using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" $EC_{t,y}$ excludes consumption of any electricity generated by the project activity. In case of consumption of electricity generated by the project by RDF/SB combustion or incineration, then emissions associated with combustion of fossil carbon content of the waste are accounted for in the procedure "Project emissions from combustion", and do not need to be accounted for again in the procedure "Project emissions from electricity use"

Data / Parameter:	$EG_{t,y}$
Data unit:	MWh
Description:	Electricity generated by the alternative waste treatment option *t* and exported to the grid or displacing fossil fuel fired power-only and/or cogeneration captive energy generation in year *y*
Source of data:	Electricity meter
Measurement procedures (if any):	-
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
Any comment:	-

Data / Parameter:	$EG_{INC,y}$
Data unit:	GJ
Description:	Amount of electricity generated by incineration during the year *y*
Source of data:	Electricity meter
Measurement procedures (if any):	Electricity generation needs to be converted to thermal energy (1 MWh = 3.6 GJ)
Monitoring frequency:	Continuous, aggregate annually
QA/QC procedures:	-
Any comment:	This parameter will be used to assess that the fraction of energy generated by fossil fuel is no more than 50% of the total energy generated in the incinerator

Data / Parameter:	$HG_{PJ,y}$
Data unit:	TJ
Description:	Quantity of heat supplied by the project activity displacing baseline heat generation by a fossil fuel boiler or air heater in year *y* (TJ)

Source of data:	Steam meter
Measurement procedures (if any):	In case of steam meter: the enthalpy of steam and feed water will be determined at measured temperature and pressure and the enthalpy difference will be multiplied with quantity measured by steam meter. In case of hot air: the temperature, pressure and mass flow rate will be measured
Monitoring frequency:	Monthly, aggregated yearly
QA/QC procedures:	In case of monitoring of steam, it will be calibrated for pressure and temperature of steam at regular intervals. The meter shall be subject to regular maintenance and testing to ensure accuracy
Any comment:	The dedicated quantity of thermal energy generated for heat supply or cogeneration by the project activity if included

Data / Parameter:	$HG_{INC,y}$
Data unit:	GJ
Description:	Net mrm: the methodology states total energy. Table 1: "Fraction of energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator".quantity of thermal energy generated by incineration in year *y*
Source of data:	Steam meter
Measurement procedures (if any):	In case of steam meter: the enthalpy of steam and feed water will be determined at measured temperature and pressure and the enthalpy difference will be multiplied with quantity measured by steam meter. In case of hot air: the temperature, pressure and mass flow rate will be measured
Monitoring frequency:	Annually
QA/QC procedures:	In case of monitoring of steam, it will be calibrated for pressure and temperature of steam at regular intervals. The meter shall be subject to regular maintenance and testing to ensure accuracy
Any comment:	This parameter will be used to assess that the fraction of energy generated by fossil fuel is no more than 50% of the total energy generated in the incinerator

Data / Parameter:	$Q_{RDF\_SB,COM,,y}$
Data unit:	T
Description:	Quantity of RDF/SB exported off-site with potential to be combusted in year *y*
Source of data:	Project site
Measurement procedures (if any):	Sale invoices of the RDF/SB should be kept at the project site. They shall contain customer contact details, physical location of delivery, type, amount (in tons) and purpose of RDF/SB (use as fuel or as material in furniture, etc.). A list of customers and delivered SD amount shall be kept at the project site
Monitoring frequency:	Weekly
QA/QC procedures:	-
Any comment:	See procedure to calculate leakage emissions associated with RDF/SB for further information

Data / Parameter:	Temperature of the thermal treatment process
Data unit:	degrees Celsius
Description:	The thermal treatment process (dehydration) occurs under controlled conditions (up to 300 degrees Celsius)
Source of data:	Project site
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$Q_{export,RDF\_SB,y}$
Data unit:	T
Description:	Quantity of RDF/SB exported outside the project boundary that is considered to degrade anaerobically in year *y*
Source of data:	Project participants
Measurement procedures (if any):	Weighbridge. All RDF/SB for which documented evidence is not available that it is combusted, or used for fertilizer of furniture manufacture
Monitoring frequency:	Annually
QA/QC procedures:	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
Any comment:	-

Data / Parameter:	$Q_{RDF\_SB,y}$
Data unit:	T
Description:	Quantity of RDF/SB produced in year *y*
Source of data:	Project participants
Measurement procedures (if any):	Weighbridge
Monitoring frequency:	Annually
QA/QC procedures:	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
Any comment:	-

Data / Parameter:	$Q_{ww,y}$
Data unit:	m^3
Description:	Amount of run-off wastewaster generated by the project activity and treated anaerobically or released untreated from the project activity in year *y*
Source of data:	Measured value by flow meter
Measurement procedures (if any):	-

Monitoring frequency:	Monthly, aggregated annually
QA/QC procedures:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy
Any comment:	If the wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored

Data / Parameter:	$P_{COD,y}$
Data unit:	$tCOD/m^3$
Description:	COD of the run-off wastewater generated by the project activity in year *y*
Source of data:	Measured value by purity meter or COD meter
Measurement procedures (if any):	-
Monitoring frequency:	Monthly and averaged annually
QA/QC procedures:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy
Any comment:	If the run-off wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored

Data / Parameter:	$EG_{INC,FF,y}$
Data unit:	GJ
Description:	Energy generated by auxiliary fossil fuel added in the incinerator
Source of data:	Project site
Measurement procedures (if any):	This parameter will be estimated multiplying the amount of auxiliary fossil fuel added in the incinerator to the net calorific value of this auxiliary fossil fuel
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	This parameter will be used to assess that the fraction of energy generated by fossil fuel is no more than 50% of the total energy generated in the incinerator. $EG_{INC,FF,y} < 0.50 \times (HG_{INC,y} + EG_{INC,y})$

Data / Parameter:	$EF_{CO2,RDF\_SB,y}$
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor for RDF/SB in year *y*

<table>
<tr><td>Source of data:</td><td>$EF_{CO2,RDF\_SB,y}$ is zero for biomass residues, otherwise determine from one of the following sources:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Measurements by the project participants</td><td>This is the preferred data source</td></tr>
<tr><td>(b) IPCC default values at the upper/lower limit[8] of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a): Measurements shall be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For (a): the CO_2 emission factor shall be obtained for each shipment of RDF/SB exported from the project site for which there is documented evidence that it will be combusted, from which weighted average annual values shall be calculated.
For (b): any future revision of the IPCC Guidelines shall be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td></td></tr>
<tr><td>Any comment:</td><td>This parameter is required for the procedure to calculate leakage emissions for the combustion of RDF/SB outside the project boundary</td></tr>
</table>

Data / Parameter:	$NCV_{RDF\_SB,y}$
Data unit:	GJ/mass or volume units
Description:	Weighted average net calorific value of RDF/SB in year *y*
Source of data:	Measurements by the project participants
Measurement procedures (if any):	Measurement is not required for RDF/SB produced wholly from biomass residues, otherwise measurements shall be undertaken in line with national or international fuel standards
Monitoring frequency:	The NCV shall be obtained for each shipment of RDF/SB exported from the project site for which there is documented evidence that it will be combusted, from which weighted average annual values shall be calculated
QA/QC procedures:	
Any comment:	This parameter is required for the procedure to calculate leakage emissions for the combustion of RDF/SB outside the project boundary

[8] To be conservative, choose the upper limit where project emissions are calculated and the lower limit where baseline emissions are calculated.

Data / Parameter:	$F_{PJ,AD,m}$
Data unit:	m^3
Description:	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m* (m^3)
Source of data:	Measured
Measurement procedures (if any):	-
Monitoring frequency:	Parameter monitored continuously but aggregated monthly and annually for calculations
QA/QC procedures:	-
Any comment:	In case of Scenario 1, if the solid materials are also treated in the baseline and project scenario, the $F_{PJ,dig,m}$ does not account the amount of solid materials treated or separated from the wastewater stream in the anaerobic digester, if applicable

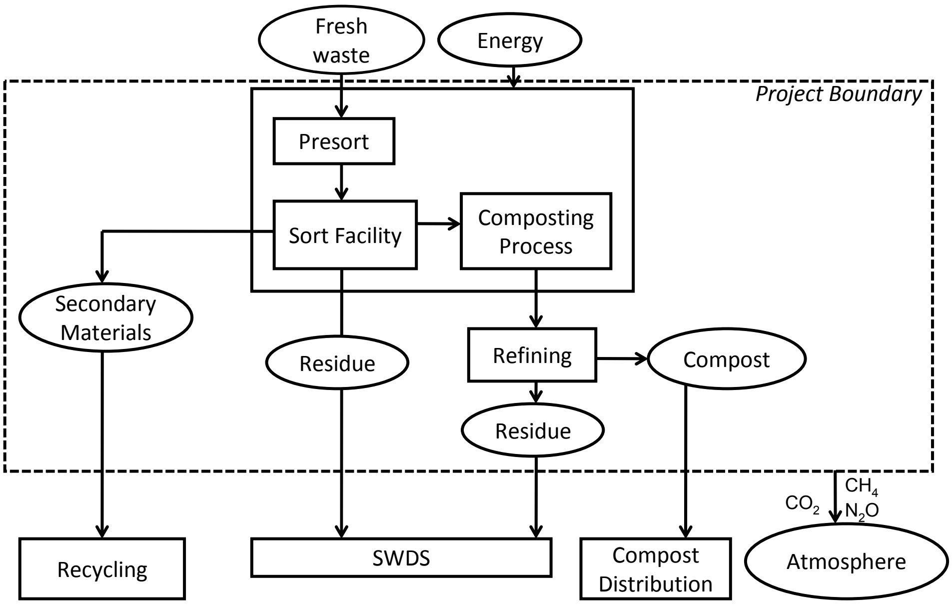
Data / Parameter:	$COD_{AD,m}$
Data unit:	T COD/m^3
Description:	Chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month *m*
Source of data:	Measurements
Measurement procedures (if any):	Measure the COD according to national or international standards If COD is measured more than once per month, the average value of the measurements should be used
Monitoring frequency:	Regularly, calculate average monthly and annual values
QA/QC procedures:	-
Any comment:	In case of Scenario 1, if the solid materials are also treated in the baseline and project scenario, the $w_{COD,dig,m}$ is not calculated for the solid materials treated or separated from the wastewater stream in the anaerobic digester, if applicable

Data / Parameter:	$T_{2,m}$
Data unit:	K
Description:	Average temperature at the project site in month *m*
Source of data:	Measurement in the project site, or national or regional weather statistics
Measurement procedures (if any):	In case that project participants decide to measure temperature in the project site: • The temperature sensor must be housed in a ventilated radiation shield to protect the sensor from thermal radiation
Monitoring frequency:	Continuously, aggregated in monthly average values
QA/QC procedures:	In case that project participants decide to measure temperature in the project site: • Uncertainty of the measurements provided by temperature sensor supplier should be discounted from the readings
Any comment:	

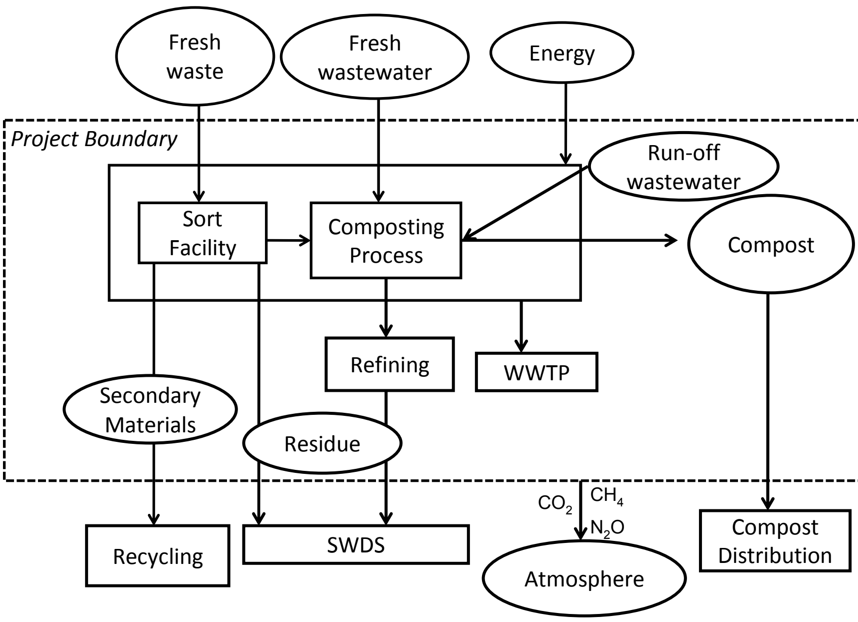
Appendix 1

Typical boundary layouts of what is included in the project boundary

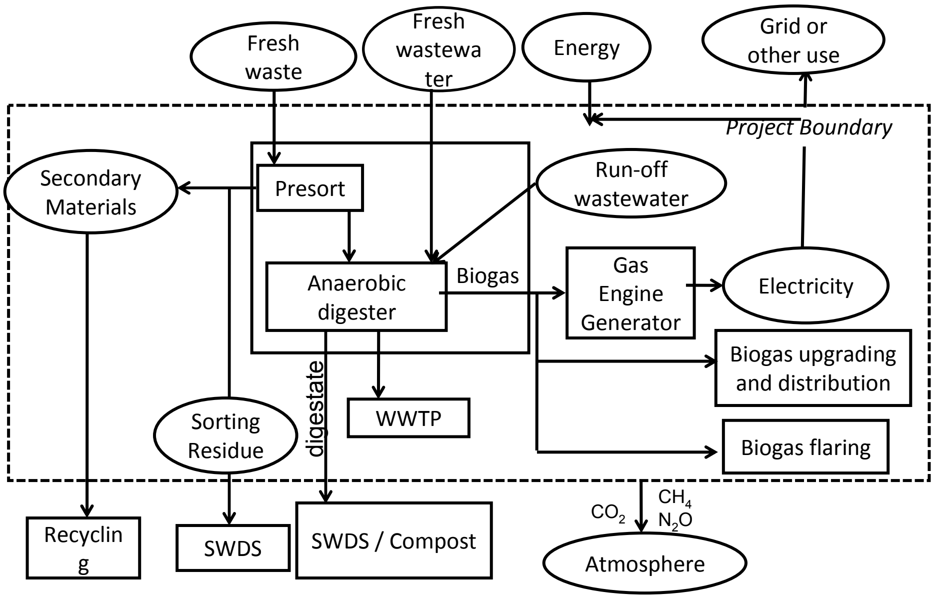
Composting



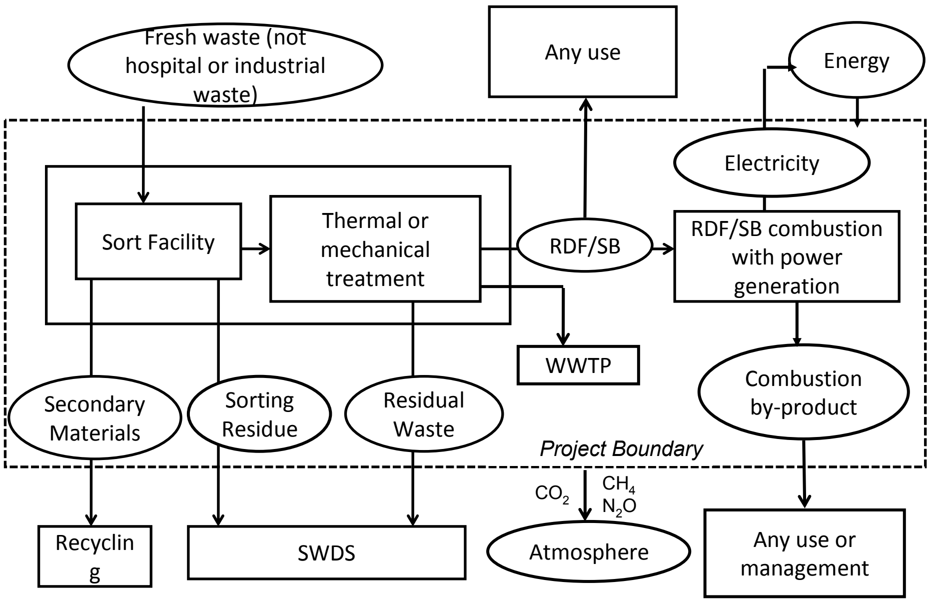
Co-composting



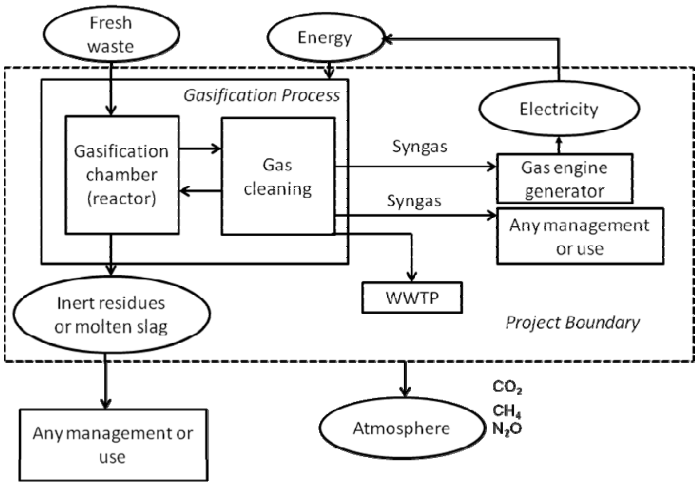
Anaerobic Digestion with biogas collection and flaring and/or its use



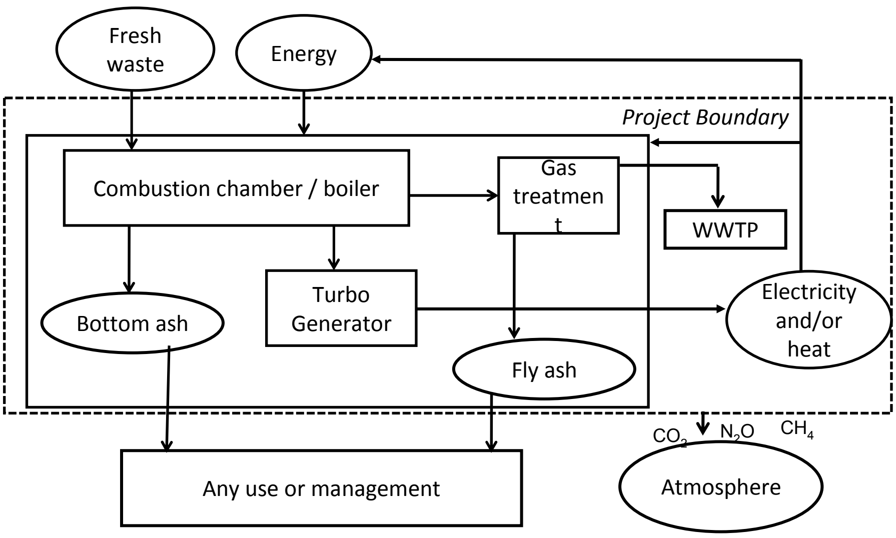
Mechanical/thermal treatment process to produce refuse-derived fuel (RDF)/stabilized biomass (SB) and on-site power generation



Gasification



Incineration



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History of the document

Version	Date	Nature of revision(s)
01.0.0	13 September 2012	EB 69, Annex 11 Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		