Approved baseline and monitoring methodology AM0025

"Avoided emissions from organic waste through alternative waste treatment processes"

I. SOURCE AND APPLICABILITY

Source

This baseline methodology is based on the following proposed methodologies:

- "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;
- "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.;
- "Municipal solid waste treatment cum energy generation project, Lucknow, India" whose baseline study, monitoring and verification plan were prepared by Infrastructure Development Finance Company Limited on behalf of Prototype Carbon Fund;
- "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.
- "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.

For more information regarding these proposals and their consideration by the Executive Board, please refer to the following cases at http://cdm.unfccc.int/goto/MPappmeth.

- NM0090: "Organic waste composting at the Matuail landfill site Dhaka, Bangladesh";
- NM0127: "PT Navigat Organic Energy Indonesia Integrated Solid Waste Management (GALFAD) project in Bali, Indonesia";
- NM0032: "Municipal Solid Waste Treatment cum Energy Generation Project, Lucknow, India";
- NM0174-rev: "MSW Incineration Project in Guanzhuang, Tianjin City";
- NM0178: "Aerobic thermal treatment of municipal solid waste (MSW) without incineration in Parobé - RS".

This methodology also refers to the approved baseline and monitoring methodology "Avoided methane emissions from organic waste-water treatment" (AM0013), approved small-scale methodology AMS-I.D "Grid connected renewable electricity generation" and the latest approved versions of the "Tool to determine project emissions from flaring gases containing methane", the "Tool for the demonstration and assessment of additionality", the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" and the "Tool to calculate the emission factor for an electricity system" .

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".

Applicability

The methodology is applicable under the following conditions:

- The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed of in a landfill:
  a) a composting process in aerobic conditions;
  b) gasification to produce syngas and its use;
  c) anaerobic digestion with biogas collection and flaring and/or its use;
  d) mechanical/thermal treatment process to produce refuse-derived fuel (RDF)/stabilized biomass (SB) and its use. The thermal treatment process (dehydration) occurs under controlled conditions (up to 300 degrees Celsius). In case of thermal treatment process, the process shall generate a stabilized biomass that would be used as fuel or raw material in other industrial process. The physical and chemical properties of the produced RDF/SB shall be homogenous and constant over time;
  e) incineration of fresh waste for energy generation, electricity and/or heat. The thermal energy generated is either consumed on-site and/or exported to a nearby facility. Electricity generated is either consumed on-site, exported to the grid or exported to a nearby facility. The incinerator is rotating fluidized bed or hearth or grate type.
- In case of anaerobic digestion, gasification or RDF processing of waste, the residual waste from these processes is aerobically composted and/or delivered to a landfill.
- In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills.
- In case of RDF/stabilized biomass processing, the produced RDF/stabilized biomass should not be stored in a manner that may result in anaerobic conditions before its use.
- If RDF/SB is disposed of in a landfill, project proponent shall provide degradability analysis on an annual basis to demonstrate that the methane generation, , in the life-cycle of the SB is below 1% of related emissions. It has to be demonstrated regularly that the characteristics of the produced RDF/SB should not allow for re-absorption of moisture of more than 3%. Otherwise, monitoring the fate of the produced RDF/SB is necessary to ensure that it is not subject to anaerobic conditions in its lifecycle.

- In the case of incineration of the waste, the waste should not be stored longer than 10 days. The waste should **not** be stored in conditions that would lead to anaerobic decomposition and, hence, generation of CH_4 .

- The proportions and characteristics of different types of organic waste processed in the project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity.

- The project activity may include electricity generation and/or thermal energy generation from the biogas, syngas captured, RDF/stabilized biomass produced, combustion heat generated in the incineration process, respectively, from the anaerobic digester, the gasifier, RDF/stabilized biomass combustor, and waste incinerator. The electricity can be exported to the grid and/or used internally at the project site. In the case of RDF produced, the emission reductions can be claimed only for the cases where the RDF used for electricity and/or thermal energy generation can be monitored.

- Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulation that mandates the treatment of the waste, if any, using any of the project activity treatment options mentioned above;

- In case of waste incineration, the residual waste from the incinerator does not contain more than 1% residual carbon.

- The compliance rate of the environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with the MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is not enforced is no longer tenable;

- Local regulations do not constrain the establishment of RDF production plants/thermal treatment plants nor the use of RDF/stabilized biomass as fuel or raw material.

- In case of RDF/stabilized biomass production, project proponent shall provide evidences that no GHG emissions occur, other than biogenic CO_2, due to chemical reactions during the thermal treatment process (such as Chimney Gas Analysis report);

- The project activity does not involve thermal treatment process of neither industrial nor hospital waste;

This methodology is **not applicable** to project activities that involve capture and flaring of methane from **existing waste** in the landfill. This should be treated as a separate project activity due to the difference in waste characteristics of existing and fresh waste, which may have an implication on the baseline scenario determination.

Summary

This methodology addresses project activities where fresh waste (i.e. the organic matter present in new domestic, and commercial waste/municipal solid waste), originally intended for landfilling, is treated either through one or a combination of the following process: composting, gasification, anaerobic digestion, RDF processing/thermal treatment without incineration, and incineration. The project activity avoids methane emissions by diverting organic waste from disposal at a landfill, where methane emissions are caused by anaerobic processes, and by displacing electricity/ thermal energy through the utilization of biogas, syngas captured, RDF/stabilized biomass produced from the waste, combustion heat generated in the incineration process. By treating the fresh waste through alternative treatment options these methane emissions are avoided from the landfill. The GHGs involved in the baseline and project activity are CO_2, CH_4 and N_2O.

II. BASELINE METHODOLOGY

Procedure for the selection of the most plausible baseline scenario

Step 1: identification of alternative scenarios.

Project participants should use step 1 of the latest version of the "Tool for the demonstration and assessment of additionality", to identify all realistic and credible baseline alternatives. In doing so, relevant policies and regulations related to the management of landfill sites should be taken into account. Such policies or regulations may include mandatory landfill gas capture or destruction requirements because of safety issues or local environmental regulations.[1] Other policies could include local policies promoting productive use of landfill gas such as those for the production of renewable energy, or those that promote the processing of organic waste. In addition, the assessment of alternative scenarios should take into account local economic and technological circumstances.

National and/or sectoral policies and circumstances must be taken into account in the following ways:

- In Sub-step 1b of the "Tool for the demonstration and assessment of additionality", the project developer must show that the project activity is not the only alternative that is in compliance with all regulations (e.g. because it is required by law);
- Via the adjustment factor AF in the baseline emissions, which is based on the approved consolidated baseline methodology ACM0001 "Consolidated baseline methodology for landfill gas project activities", project developers must take into account that some of the methane generated in the baseline may be captured and destroyed to comply with regulations or contractual requirements;
- The project developer must monitor all relevant policies and circumstances at the beginning of each crediting period and adjust the baseline accordingly.

Alternatives for the disposal/treatment of the fresh waste in the absence of the project activity, i.e. the scenario relevant for estimating baseline methane emissions, to be analysed should include, *inter alia*:

M1. The project activity (i.e. composting, gasification, anaerobic digestion, RDF processing/thermal treatment without incineration of organic waste or incineration of waste) not implemented as a CDM project;

M2. Disposal of the waste at a landfill where landfill gas captured is flared;

M3. Disposal of the waste on a landfill without the capture of landfill gas.

If energy is exported to a grid and/or to a nearby industry, or used on-site realistic and credible alternatives should also be separately determined for:

- Power generation in the absence of the project activity;
- Heat generation in the absence of the project activity.

For power generation, the realistic and credible alternative(s) may include, *inter alia*:

P1. Power generated from by-product of one of the options of waste treatment as listed in M1 above, not

[1] 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 Executive Board 22nd meeting and any other forthcoming guidance from the Board on this subject.

undertaken as a CDM project activity;

P2. Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant;

P3. Existing or Construction of a new on-site or off-site renewable based cogeneration plant;

P4. Existing or Construction of a new on-site or off-site fossil fuel fired captive power plant;

P5. Existing or Construction of a new on-site or off-site renewable based captive power plant ;

P6. Existing and/or new grid-connected power plants.

For heat generation, the realistic and credible alternative(s) may include, *inter alia*:

H1. Heat generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;

H2. Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant[2];

H3. Existing or Construction of a new on-site or off-site renewable based cogeneration plant[3] ;

H4. Existing or new construction of on-site or off-site fossil fuel based boilers;

H5. Existing or new construction of on-site or off-site renewable energy based boilers;

H6. Any other source such as district heat; and

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

STEP 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable.

Demonstrate that the identified baseline fuel 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 may consider an alternative fuel that result in lowest baseline emissions during the period of partial supply.

Detailed justification shall be provided for the selected baseline fuel. As a conservative approach, the lowest carbon intensive fuel such as natural gas through out the period may be used.

NOTE: Steps 3 and 4 shall be applied for each component of the baseline, i.e. baseline for waste treatment, electricity generation and heat generation.

STEP 3: Step 2 and/or step 3 of the latest approved version of the "Tool for demonstration and assessment of additionality" shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).

STEP 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.

NOTE: The methodology is only applicable if:

[2] Scenarios P2 and H2 are related to the same fossil fuel cogeneration plant.
[3] Scenarios P3 and H3 are related to the same renewable energy based cogeneration plant.

(a) the most plausible baseline scenario for the waste treatment component is identified as either the disposal of the waste in a landfill without capture of landfill gas (M3) or the disposal of the waste in a landfill where the landfill gas is partially captured and subsequently flared (M2).

(b) the most plausible baseline scenario for the energy component of the baseline scenario is one of the following scenarios described in Table 1 below.

Table 1: Combinations of baseline options and scenarios applicable to this methodology

Scenario	Baseline			Description of situation
	waste	electricity	Heat	
1	M2/M3	P4 or P6	H4	The disposal of the waste in a landfill site without capturing landfill gas or the disposal of the waste in a landfill site where the landfill gas is partly captured and subsequently being flared. The electricity is obtained from an existing/new fossil based captive power plant or from the grid and heat from an existing/new fossil fuel based boiler.
2	M2/M3	P2	H2	The disposal of the waste in a landfill site without capturing landfill gas or the disposal of the waste in a landfill site where the landfill gas is partly captured and subsequently being flared. The electricity and/or heat are generated by an existing/new fossil fuel based cogeneration plant.

Additionality

The additionality of the project activity shall be demonstrated and assessed using the latest version of the ***"Tool for the demonstration and assessment of additionality"*** agreed by the CDM Executive Board.[4]

Barrier analysis for the various baseline options may include:

(i) Investment barrier: A number of other, financially more viable alternatives, to the project activity exist for treating municipal solid waste. The project proponent shall demonstrate this through the identification of the lowest tipping fee option. The tipping fee is the fee that has to be paid per ton of waste to be treated and disposed. The option requiring the least tipping fee reflects the fact that municipalities usually choose the cheapest disposal option within the restrictions set by the MSW Rules. The minimum tipping fee is calculated by using the same project IRR (internal rate of return) for all the options. All costs and income should be taken into account, including the income from electricity generation and fertilizer sale. All technical and financial parameters have to be consistent across all baseline options.

[4] Please refer to: < http://cdm.unfccc.int/goto/MPappmeth>

(ii) Technological barrier: The project technology is the most technologically advanced option of the baseline options. Other options are less technologically advanced alternatives to the project activity and involves lower risks due to the performance uncertainty and low market share. The project proponent should provide evidence of the state of development of the project technology in the country and document evidence of barriers to the implementation of more the project technology.

(iii) Common practice: The project proponent should provide evidence of the early stage of development of the project activity and that it is not common practice in the country. To this end, they should provide an analysis of waste management practices.

In the case of RDF/stabilized biomass production, a key uncertainty for additionality is the price of RDF/stabilized biomass could attain such level in the region that RDF/stabilized biomass will be produced. The RDF/stabilized biomass price will be directly affected by its demand and the availability of other substitute products. Another evaluation of the stabilized biomass price should be carried out at the end of each crediting period (if the renewable crediting period is to be selected).

Project boundary

The spatial extent of the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity generation and/or consumption, onsite fuel use, thermal energy generation, waste water treatment plant and the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site.

In the case that the project provides electricity to a grid, the spatial extent of the project boundary will also include those plants connected to the energy system to which the plant is connected.

The **greenhouse gases** included in or excluded from the project boundary are shown in Table 1.

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 decomposition of waste at the landfill site	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 organic waste are not accounted.[a]
	Emissions from electricity consumption	CO_2	Included	Electricity may be consumed from the grid or generated onsite/offsite in the baseline scenario
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO_2	Included	If thermal energy generation is included in the project activity
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

	Source	Gas		Justification / Explanation
Project Activity	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	Included	May be an important emission source. It includes vehicles used on-site, heat generation, start up of the gasifier, etc.
		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. If electricity is generated from collected biogas/syngas, these emissions are not accounted for. CO_2 emissions from fossil based waste from RDF/stabilized biomass combustion to generate electricity to be used on-site are accounted for.
		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.
	Direct emissions from the waste treatment processes.	N_2O	Included	May be an important emission source for composting activities. N_2O can be emitted from incineration, Syngas[a] produced, anaerobic digestion of waste and RDF/stabilized biomass 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 organic waste are not accounted.[b]
		CH_4	Included	The composting process may not be complete and result in anaerobic decay. 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 stacks[a] from incineration, the gasification process and the RDF/stabilized biomass combustion.
	Emissions from waste water treatment	CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted. [b]
		CH_4	Included	The wastewater treatment should not result in CH_4 emissions, such as in anaerobic treatment; otherwise accounting for these emissions should be done.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

[a] Project proponents wishing to neglect these emission sources shall follow the clarification in annex 2 of EB 22 report which states that "magnitude of emission sources omitted in the calculation of project emissions and leakage effects (if positive) should be equal to or less than the magnitude of emission sources omitted in the calculation of baseline emissions".

[b] CO_2 emissions from the combustion or decomposition of *biomass* (see definition by the EB in Annex 8 of the EB's 20[th] 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.

Project emissions

The project emissions in year y are:

$$PE_y = PE_{elec,y} + PE_{fuel,\ on\text{-}site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} \quad (1)$$

Where:

PE_y	is the project emissions during the year y (tCO_2e)
$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO_2e)
$PE_{fuel,\ on\text{-}site,y}$	is the emissions on-site due to fuel consumption on-site in year y (tCO_2e)
$PE_{c,y}$	is the emissions during the composting process in year y (tCO_2e)
$PE_{a,y}$	is the emissions from the anaerobic digestion process in year y (tCO_2e)
$PE_{g,y}$	is the emissions from the gasification process in year y (tCO_2e)
$PE_{r,y}$	is the emissions from the combustion of RDF/stabilized biomass in year y (tCO_2e)
$PE_{i,y}$	is the emissions from waste incineration in year y (tCO_2e)
$PE_{w,y}$	is the emissions from waste water treatment in year y (tCO_2e)

Emissions from electricity use ($PE_{elec,y}$)

Where the project activity involves electricity consumption, CO_2 emissions are calculated as follows:

$$PE_{elec,y} = EG_{PJ,FF,y} * CEF_{elec} \quad \textbf{(2)}$$

Where:

$EG_{PJ,FF,y}$	is the amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity, measured using an electricity meter (MWh)
CEF_{elec}	is the carbon emissions factor for electricity generation in the project activity (tCO_2/MWh)

In cases where electricity is generated in an on-site fossil fuel fired power plant, project participants should use, as CEF_{elec}, the default emission factor for a diesel generator with a capacity of more than 200 kW for small-scale project activities (0.8 tCO_2/MWh, see AMS-I.D, Table I.D.1 in the simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories).

In cases where electricity is purchased from the grid, the emission factor CEF_{elec} should be calculated according to the “Tool to calculate the emission factor for an electricity system”**.**

NOTE: Project emissions from electricity consumption do not need to be calculated in case this electricity is generated by the project activity from biogas, or syngas. In case of electricity generation from RDF/stabilized biomass or incineration, project emissions are estimated as per equations (12) and (13) or (14).

Emissions from fuel use on-site ($PE_{fuel,\ on\text{-}site,y}$)

Project participants shall account for CO_2 emissions from any on-site fuel combustion (other than electricity generation, e.g. vehicles used on-site, heat generation, for starting the gasifier, auxiliary fossil fuels need to be added into incinerator to increase the temperature of the incinerator, etc.). Emissions are calculated from the quantity of fuel used and the specific CO_2-emission factor of the fuel, as follows:

$$PE_{fuel,\ on\text{-}site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel} \quad \textbf{(3)}$$

Where:

$PE_{fuel,\ on\text{-}site,y}$	is the CO_2 emissions due to on-site fuel combustion in year y (tCO_2)
$F_{cons,y}$	is the fuel consumption on site in year y (l or kg)
NCV_{fuel}	is the net caloric value of the fuel (MJ/l or MJ/kg)
EF_{fuel}	is the CO_2 emissions factor of the fuel (tCO_2/MJ)

Local values should be preferred as default values for the net calorific values and CO_2 emission factors. If local values are not available, project participants may use IPCC default values for the net calorific values and CO_2 emission factors.

Emissions from composting ($PE_{c,y}$)

$$PE_{c,y} = PE_{c,N2O,y} + PE_{c,CH4,y} \quad \textbf{(4)}$$

Where:

$PE_{c,N2O,y}$	is the N_2O emissions during the composting process in year y (tCO_2e)
$PE_{c,CH4,y}$	is the emissions during the composting process due to methane production through anaerobic conditions in year y (tCO_2e)

N_2O emissions

During the storage of waste in collection containers, as part of the composting process itself, and during the application of compost, N_2O emissions might be released. Based upon Schenk[5] and others, a total loss of 42 mg N_2O-N per kg composted dry matter can be expected (from which 26.9 mg N_2O during the composting process). The dry matter content of compost is around 50% up to 65%.

Based on these values, project participants should use a default emission factor of 0.043 kg N_2O per tonne of compost for $EF_{c,N2O}$ and calculate emissions as follows:[6]

$$PE_{c,N2O,y} = M_{compost,y} * EF_{c,N2O} * GWP_{N2O} \quad \textbf{(5)}$$

Where:

$PE_{c,N2O,y}$	is the N_2O emissions from composting in year y (tCO_2e)
$M_{compost,y}$	is the total quantity of compost produced in year y (tonnes/a)

[5] Manfred K. Schenk, Stefan Appel, Diemo Daum, "N_2O emissions during composting of organic waste", Institute of Plant Nutrition University of Hannover, 1997

[6] Assuming 650 kg dry matter per ton of compost and 42 mg N_2O-N, and given the molecular relation of 44/28 for N_2O-N, an emission factor of 0.043 kg N_2O / tonne compost results.

$EF_{c,N2O}$ is the emission factor for N_2O emissions from the composting process (tN_2O/t compost)

GWP_{N2O} is the Global Warming Potential of nitrous oxide, (tCO_2/tN_2O)

CH_4 emissions

During the composting process, aerobic conditions are neither completely reached in all areas nor at all times. Pockets of anaerobic conditions – isolated areas in the composting heap where oxygen concentrations are so low that the biodegradation process turns anaerobic – may occur. The emission behaviour of such pockets is comparable to the anaerobic situation in a landfill. This is a potential emission source for methane similar to anaerobic conditions which occur in unmanaged landfills. The duration of the composting process is less than the duration of the crediting period. This is because of the fact that the compost may be subject to anaerobic conditions during its end use, which is not foreseen that it could be monitored. Assuming a residence time for the compost in anaerobic conditions equal to the crediting period is conservative. Through pre-determined sampling procedures the percentage of waste that degrades under anaerobic conditions can be determined. Using this percentage, project methane emissions from composting are calculated as follows:

$$PE_{c,CH4,y} = MB_{composty} * GWP_{CH4} * S_{a,y} \quad \textbf{(6)}$$

Where:

$PE_{c,CH4,y}$ is the project methane emissions due to anaerobic conditions in the composting process in year y (tCO_2e)

$S_{a,y}$ is the share of the waste that degrades under anaerobic conditions in the composting plant during year y (%)

$MB_{compost,y}$ is the quantity of methane that would be produced in the landfill in the absence of the composting activity in year y (tCH4). $MB_{compost,y}$ is estimated by multiplying MB_y estimated from equation 18 by the fraction of waste diverted, from the landfill, to the composting activity (f_c) relative to the total waste diverted from the landfill to all project activities (composting, gasification, anaerobic digestion and RDF/stabilized biomass, incineration)

GWP_{CH4} is the Global Warming Potential of methane (tCO2e/tCH4)

Calculation of $S_{a,y}$

$S_{a,y}$ is determined by a combination of measurements and calculations. Bokhorst et al[7] and Richard et al[8] show that if oxygen content is below 5% - 7.5%, aerobic composting processes are replaced by anaerobic processes. To determine the oxygen content during the process, project participants shall measure the oxygen content according to a predetermined sampling scheme and frequency.

These measurements should be undertaken for each year of the crediting period and recorded each year. The percentage of the measurements that show an oxygen content below 10% is presumed to be equal to the share of waste that degrades under anaerobic conditions (i.e. that degrades as if it were landfilled), hence the emissions caused by this share are calculated as project emissions ex-post on an annual basis:

[7] Jan Bokhorst. Coen ter Berg – Mest & Compost Behandelen beoordelen & Toepassen (Eng: Manure & Compost – Treatment, judgement and use), Louis Bolk Instituut, Handbook under number LD8, Oktober 2001
[8] Tom Richard, Peter B. Woodbury, Cornell composting, operating fact sheet 4 of 10, Boyce Thompson Institute for Plant Research at Cornell University Cornell University

$S_{a,y} = S_{OD,y} / S_{total,y}$ **(7)**

Where:

$S_{OD,y}$ is the number of samples per year with an oxygen deficiency (i.e. oxygen content below 10%)

$S_{total,y}$ is the total number of samples taken per year, where $S_{total,y}$ should be chosen in a manner that ensures the estimation of $S_{a,y}$ with 20% uncertainty at a 95% confidence level.

The produced compost can either be used as soil conditioner or disposed of in landfills. In case it is disposed of in landfills, emissions are estimated as per the leakage section. In case it is used as soil conditioner, its fate should be monitored as per the provisions of the monitoring methodology to ensure that it is not eventually disposed of in landfills. Otherwise, it should be conservatively assumed that the compost is disposed of in landfills and accordingly emissions should be estimated as per the leakage section.

Emissions from anaerobic digestion ($PE_{a,y}$)

$PE_{a,y} = PE_{a,l,y} + PE_{a,s,y}$ **(8)**

Where:

$PE_{a,l,y}$ is the CH_4 leakage emissions from the anaerobic digesters in year y (tCO_2e)

$PE_{a,s,y}$ is the total emissions of N_2O and CH_4 from stacks of the anaerobic digestion process in year y (tCO_2e)

CH_4 Emissions from leakage ($PE_{a,l,y}$)

A potential source of project emissions is the physical leakage of CH_4 from the anaerobic digester. Three options are provided for quantifying these emissions, in the following preferential order:

Option 1: Monitoring the actual quantity of the gas leakage;

Option 2: Applying an appropriate IPCC physical leakage default factor, justifying the selection:

$PE_{a,l,y} = P_l * M_{a,y}$ **(9)**

Where:

$PE_{a,l,y}$ is the leakage of methane emissions from the anaerobic digester in year y (tCO_2e)

P_l is the physical leakage factor from a digester (fraction)

$M_{a,y}$ is the total quantity of methane produced by the digester in year y (tCO_2e)

Option 3: Applying a physical leakage factor of zero where advanced technology used by the project activity prevents any physical leakage. In such cases, the project proponent must provide the DOE with the details of the technology to prove that the zero leakage factor is justified.

Emissions from anaerobic digestion stacks ($PE_{a,s,y}$)

Biogas produced from the anaerobic digestion process may be either flared or used for energy generation. The final stack emissions (either from flaring or energy generation process) are monitored from the final stack and estimated as follows:

$$PE_{a,s,y} = SG_{a,y} * MC_{N2O,a,y} * GWP_{N2O} + SG_{a,y} * MC_{CH4,a,y} * GWP_{CH4} \quad \textbf{(10)}$$

Where:

$PE_{a,s,y}$	is the total emissions of N_2O and CH_4 from stacks of the anaerobic digestion process in year y (tCO_2e)
$SG_{a,y}$	is the total volume of stack gas from the anaerobic digestion in year y (m^3/yr)
$MC_{N2O,a,y}$	is the monitored content of nitrous oxide in the stack gas from anaerobic digestion in year y (tN_2O/m^3)
GWP_{N2O}	is the Global Warming Potential of nitrous oxide (tCO_2e /tN_2O)
$MC_{CH4,a,y}$	is the monitored content of methane in the stack gas from anaerobic digestion in year y (tCH_4/m^3)
GWP_{CH4}	is the Global Warming Potential of methane (tCO_2e /tCH_4)

Emissions from gasification ($PE_{g,y}$) or combustion of RDF/Stabilized Biomass ($PE_{r,y}$) or waste incineration($PE_{i,y}$)

The stack gas from the gasification process and the combustion of RDF[9] may contain small amounts of methane and nitrous oxide. Moreover, fossil-based waste CO_2 emissions from the gasification process and the combustion of RDF should be accounted for.

$$PE_{g/r/i,y} = PE_{g/r/i,f,y} + PE_{g/r/i,s,y} \quad \textbf{(11)}$$

Where:

$PE_{g/r/i,f,y}$	is the fossil-based waste CO_2 emissions from gasification, waste incineration or RDF/stabilized biomass combustion in year y (tCO_2e)
$PE_{g/r/i,s,y}$	is the N_2O and CH_4 emissions from the final stacks from gasification, waste incineration or RDF/stabilized biomass combustion in year y (tCO_2e)

Emissions from fossil-based waste ($PE_{g/r/i,f,y}$)

The CO_2 emissions are calculated based on the monitored amount of fossil-based waste fed into the gasifier, waste incineration plant or RDF/stabilized biomass combustion, the fossil-derived carbon content, and combustion efficiency. The calculation of CO_2 derived from gasification/incineration of waste of fossil origin and combusting RDF/stabilized biomass including waste of fossil origin, is estimated as follows:

$$PE_{g/r/i,f,y} = \sum_i A_i \times CCW_i \times FCF_i \times EF_i \times \frac{44}{12} \quad \textbf{(12)}$$

Where:

[9] RDF can be combusted to produce electricity, thermal energy or both (cogeneration).

$PE_{g/r/i,f,y}$	is the fossil-based waste CO_2 emissions from gasification/RDF-combustion/waste incineration in year y (tCO_2e)
A_i	is the amount of waste type i fed into the gasifier or RDF/stabilized biomass combustor or into the waste incineration plant (t/yr)
CCW_i	is the fraction of carbon content in waste type i (fraction)
FCF_i	is the fraction of fossil carbon in waste type i (fraction)
EF_i	is the combustion efficiency for waste type i (fraction)
44/12	is the conversion factor (tCO_2/tC)

Emissions from gasification stacks or RDF/stabilized biomass combustion or waste incineration ($PE_{g/r/i,s,y}$)

Emissions of N2O and CH4 may be estimated from either of the options given below:

Option 1:

$$PE_{g/r/i,s,y} = SG_{g/r,y} * MC_{N2O,g/r/i,y} * GWP_{N2O} + SG_{g/r/i,y} * MC_{CH4,g/r/i,y} * GWP_{CH4} \quad \textbf{(13)}$$

Where:

$PE_{g/r,s,y}$	is the total emissions of N_2O and CH_4 from gasification, waste incineration or RDF/stabilized biomass combustion in year y (tCO_2e)
$SG_{g/r/i,y}$	is the total volume of stack gas from gasification, waste incineration or RDF/stabilized biomass combustion in year y (m^3/yr)
$MC_{N2O,g/r/i,y}$	is the monitored content of nitrous oxide in the stack gas from gasification, waste incineration or RDF/stabilized biomass combustion in year y (tN_2O/m^3)
GWP_{N2O}	is the Global Warming Potential of nitrous oxide (tCO_2e/tN_2O)
$MC_{CH4,g/r/i,y}$	is the monitored content of methane in the stack gas from gasification, waste incineration or RDF/stabilized biomass combustion in year y (tCH_4/m^3)
GWP_{CH4}	is the Global Warming Potential of methane ($tCO_2e\ /tCH_4$)

Option 2:

$$PE_{g/r/i,s,y} = Q_{biomass,y} \cdot \left(EF_{N2O} \cdot GWP_{N2O} + EF_{CH4} \cdot GWP_{CH4}\right) \cdot 10^{-3} \quad \textbf{(14)}$$

Where:

$Q_{biomass,y}$	is the amount of waste gasified, incinerated or RDF/stabilized biomass combusted in year y (tonnes/yr)
EF_{N2O}	is the aggregate N_2O emission factor for waste combustion (kgN_2O/tonne of waste)
EF_{CH4}	is the aggregate CH_4 emission factor for waste combustion ($kgCH_4$/tonne of waste)

Tables 5.4 and 5.3, chapter 5, volume 5 of IPCC 2006 guidelines should be used to estimate EF_{N2O} and EF_{CH4} , respectively.

In case the RDF/stabilized biomass is used offsite, N_2O and CH_4 emissions should be accounted for as leakage and estimated as per one of the options given above.

If IPCC default emission factor is used, a conservativeness factor should be applied to account for the high uncertainty of the IPCC default values. The level of the conservativeness factor depends on the uncertainty range of the estimate for the IPCC default N_2O and CH_4 emission factor. Project participants shall select the appropriate conservativeness factor from Table 3 below and shall multiply the estimate for the N_2O / CH_4 emission factor with the conservativeness factor.

Table 3. Conservativeness factors

Estimated uncertainty range (%)	Assigned uncertainty band (%)	Conservativeness factor where higher values are more conservative
Less than or equal to 10	7	1.02
Greater than 10 and less than or equal to 30	20	1.06
Greater than 30 and less than or equal to 50	40	1.12
Greater than 50 and less than or equal to 100	75	1.21
Greater than 100	150	1.37

Emissions from waste water treatment ($PE_{w,y}$)

If the project activity includes waste water release, methane emissions shall be estimated. If the wastewater is treated using aerobic treatment process, the CH_4 emissions from waste water treatment are assumed to be zero. If wastewater is treated anaerobically or released untreated, CH_4 emissions are estimated as follows:

$$PE_{CH4,w,y} = Q_{COD,y} \cdot P_{COD,y} \cdot B_0 \cdot MCF_p \quad \textbf{(15)}$$

Where:

$PE_{CH4,w,y}$	Methane emissions from the waste water treatment in year y (tCH_4/y)
$Q_{COD,y}$	Amount of wastewaster treated anaerobically or released untreated from the project activity in year y (m3/yr), which shall be measured monthly and aggregately annually.
$P_{COD,y}$	Chemical Oxygen Demand (COD) of wastewaster (tCOD/ m^3), which will be measured monthly and averaged annually.
B_0	Maximum methane producing capacity (t CH_4/t COD)
MCF_p	Methane conversion factor (fraction), preferably local specific value should be used. In absence of local values, MCF_p default values can be obtained from table 6.3, chapter 6, volume 4 from IPCC 2006 guidelines.

IPCC 2006 guidelines specifies the value for B_0 as 0.25 kg CH_4/kg COD. Taking into account the uncertainty of this estimate, project participants should use a value of 0.265 kg CH_4/kg COD as a conservative assumption for Bo.

In case of all the CH_4 are emitted into air directly, then

$$PE_{w,y} = PE_{CH4,w,y} \cdot GWP_{CH4} \quad \textbf{(16)}$$

If flaring occurs, the "Tool to determine project emissions from flaring gases containing methane" should be used to estimate methane emissions. In this case, $PE_{CH4,w,y}$ will be calculated ex-ante as per equation 15, and then monitored during the crediting period.

Baseline emissions

To calculate the baseline emissions project participants shall use the following equation:

$$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y} \quad \textbf{(17)}$$

Where:

BE_y	is the baseline emissions in year y (tCO_2e)
MB_y	is the methane produced in the landfill in the absence of the project activity in year y (t_4CO_2e)
$MD_{reg,y}$	is methane that would be destroyed in the absence of the project activity in year y (t_4CO_2e)
$BE_{EN,y}$	Baseline emissions from generation of energy displaced by the project activity in year y (tCO_2e).

CO_2

Adjustment Factor (AF)

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$, an Adjustment Factor (AF) shall be used and justified, taking into account the project context. In doing so, the project participant should take into account that some of the methane generated by the landfill may be captured and destroyed to comply with other relevant regulations or contractual requirements, or to address safety and odour concerns.

$$MD_{reg,y} = MB_y * AF \quad \textbf{(18)}$$

Where:

AF is Adjustment Factor for MB_y (%)

The parameter AF shall be estimated as follows:

- In cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements, the ratio between the destruction efficiency of that system and the destruction efficiency of the system used in the project activity shall be used;
- In cases where a specific percentage of the "generated" amount of methane to be collected and destroyed is specified in the contract or mandated by the regulation, this percentage divided by an assumed efficiency for the collection and destruction system used in the project activity shall be used.

The 'Adjustment Factor' shall be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in the future.

Rate of compliance

In cases where there are regulations that mandate the use of one of the project activity treatment options and which is not being enforced, the baseline scenario is identified as a gradual improvement of waste management practices to the acceptable technical options expected over a period of time to comply with the MSW Management Rules. The adjusted baseline emissions ($BE_{y,a}$) are calculated as follows:

$$BE_{y,a} = BE_y * (1 – RATE^{Compliance}{}_y) \quad \textbf{(19)}$$

Where:

BE_y	Is the CO_2-equivalent emissions as determined from equation (14).
$RATE^{Compliance}{}_y$	Is the state-level compliance rate of the MSW Management Rules in that year *y*. The compliance rate shall be lower than 50%; if it exceeds 50% the project activity shall receive no further credit.

In such cases $BE_{y,a}$ should replace BE_y in Equation (25) to estimate emission reductions.

The compliance ratio $RATE^{Compliance}{}_y$ shall be monitored *ex post* based on the official reports for instance annual reports provided by municipal bodies.

Methane generation from the landfill in the absence of the project activity (MB_y)

The amount of methane that is generated each year (MB_y) is calculated as per the latest version of the approved "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", considering the following additional equation:

$$MB_y = BE_{CH4,SWDS,y} \quad \textbf{(20)}$$

Where:

$BE_{CH4,SWDS,y}$	is the methane generation from the landfill in the absence of the project activity at year y, calculated as per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site". The tool estimates methane generation adjusted for, using adjustment factor (f) any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for in equation 17, "f" in the tool shall be assigned a value 0.

Note: Where for a particular year it can not be demonstrated that the waste would have been disposed of in the landfill, the waste quantities prevented from disposal ($W_{j,x}$) in the tool should be assigned a value 0 (zero).

$A_{j,x}$	is the amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year), this is the value to be used for variable $W_{j,x}$ in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".

Baseline emissions from generation of energy displaced by the project activity.

Scenario 1 (see table 1 above)

$$BE_{EN,y} = BE_{elec,y} + BE_{thermal,y} \quad \textbf{(21)}$$

Where:

$BE_{elec,y}$	is the baseline emissions from electricity generated utilizing the biogas/syngas

collected/RDF/stabilized biomass/combustion heat from incineration in the project activity and exported to the grid or displacing onsite/offsite fossil fuel captive power plant (tCO_2e)

$BE_{thermal,y}$ is the baseline emissions from thermal energy produced utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing thermal energy from onsite/offsite fossil fuel fueled boiler (tCO_2e)

$$BE_{elec,y} = EG_{d,y} * CEF_d \quad (22)$$

Where:

$EG_{d,y}$ is the amount of electricity generated utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity and exported to the grid or displacing onsite/offsite fossil fuel captive power plant during the year y (MWh)

CEF_d is the carbon emissions factor for the displaced electricity source in the project scenario (tCO_2/MWh)

Determination of CEF_d

Where the project activity involves electricity generation from the biogas/syngas/RDF/stabilized biomass/combustion heat from incineration, CEF_d should be chosen as follows:

- In case the generated electricity from the biogas/syngas/RDF/stabilized biomass/combustion heat from incineration displaces electricity that would have been generated by an on-site/off-site fossil fuel fired captive power plant in the baseline, project proponents shall estimate the emission factor as follows:

$$CEF_d = \frac{EF_{fuel,b}}{\varepsilon_{gen,b}.} * 3.6 \cdot \quad (23)$$

Where:

$EF_{fuel,b}$ is the emission factor of baseline fossil fuel used, as identified in the baseline scenario identification procedure, expressed in tCO2/GJ

$\varepsilon_{gen,b}$ is the efficiency of baseline power generation plant.

3.6 equivalent of GJ energy in a MWh of electricity.

To estimate electricity generation efficiency, project participants may use the highest value among the following three values as a conservative approach:

1. Measured efficiency prior to project implementation
2. Measured efficiency during monitoring
3. Data from manufacturer for efficiency at full load
4. Default efficiency of 60%

- In case the generated electricity from the biogas/syngas/RDF/stabilized biomass/combustion heat from incineration displaces electricity that would have been generated by other power plants in the grid in the baseline, CEF_d should be calculated according to the "Tool to calculate the emission factor for an electricity system".

$$BE_{thermal,y} = \frac{Q_y}{\varepsilon_{boiler} \cdot NCV_{fuel}} \cdot EF_{fuel,b} \quad \textbf{(24)}$$

Where :

Q_y	the quantity of thermal energy produced utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing thermal energy from onsite/offsite fossil fuel fueled boiler during the year y in GJ
ε_{boiler}	the energy efficiency of the boiler used in the absence of the project activity to generate the thermal energy
NCV_{fuel}	Net calorific value of fuel, as identified through the baseline identification procedure, used in the boiler to generate the thermal energy in the absence of the project activity in GJ per unit of volume or mass
$EF_{fuel,b}$	Emission factor of the fuel, as identified through the baseline identification procedure, used in the boiler to generate the thermal energy in the absence of the project activity in tons CO_2 per unit of volume or mass of the fuel.

To estimate boiler efficiency, project participants may choose between the following two options:

Option A

Use the highest value among the following three values as a conservative approach:

1. Measured efficiency prior to project implementation;
2. Measured efficiency during monitoring;
3. Manufacturer's information on the boiler efficiency.

Option B

Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach.

In determining the CO_2 emission factors (EF_{fuel}) of fuels, reliable local or national data should be used if available. Where such data is not available, IPCC default emission factors should be chosen in a conservative manner.

Scenario *2 (see table 1 above):*

Baseline emissions from electricity and heat cogeneration that is displaced by the project activity

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

$$BE_{EN,y} = \frac{(EG_{d,y} \cdot 3.6)*10^{-3} + Q_y}{\eta_{cogen}} \cdot EF_{fuel,c} \qquad \textbf{(25)}$$

Where:

3.6	conversion factor, expressed as TJ/GWh
$EF_{fuel,c}$	is the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline cogeneration plant in (tCO_2 / TJ), obtained from reliable local or national data if available, otherwise, taken from the country specific IPCC 2006 default emission factors
Qy	the quantity of thermal energy produced utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing thermal energy from cogeneration during the year y in TJ,
$EG_{d,y}$	is the amount of electricity generated utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing onsite/offsite cogeneration plant during the year y in GWh
η_{Cogen}	the efficiency of cogeneration plant that would have been used in the absence of the project activity

Efficiency of the cogeneration plant (η_{Cogen}) shall be one of the following:

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

Leakage

The sources of leakage considered in the methodology are CO_2 emissions from off-site transportation of waste materials in addition to CH_4 and N_2O emissions from the residual waste from the anaerobic digestion, gasification processes and processing/combustion of RDF. Positive leakage that may occur through the replacement of fossil-fuel based fertilizers with organic composts are not accounted for. Leakage emissions should be estimated from the following equation:

$$L_y = L_{t,y} + L_{r,y} + L_{s,y} \qquad \textbf{(26)}$$

Where:

$L_{t,y}$	is the leakage emissions from increased transport in year y (tCO_2e)
$L_{r,y}$	is the leakage emissions from the residual waste from the anaerobic digester, the gasifier, the processing/combustion of RDF/stabilized biomass, or compost in case it is disposed of in landfills in year y (tCO_2e)
$L_{s,y}$	is the leakage emissions from end use of stabilized biomass

Emissions from transportation ($L_{t,y}$)

The project may result in a change in transport emissions. This would occur when the waste is transported from waste collecting points, in the collection area, to the treatment facility, instead of to existing landfills. When it is likely that the transport emissions will increase significantly, such emissions should be incorporated as leakage. In this case, project participants shall document the following data in the CDM-PDD: an overview of collection points from where the waste will be collected, their approximate distance (in km) to the treatment facility, existing landfills and their approximate distance (in km) to the nearest end-user.

For calculations of the emissions, IPCC default values for fuel consumption and emission factors may be used. The CO_2 emissions are calculated from the quantity of fuel used and the specific CO_2-emission factor of the fuel for vehicles i to n, as follows:

$$L_{t,y} = \sum_{i}^{n} NO_{vehicles,i,y} * DT_{i,y} * VF_{cons,i} * NCV_{fuel} * D_{fuel} * EF_{fuel} \quad \textbf{(27)}$$

Where:

$NO_{vehicles,i,y}$ is the number of vehicles for transport with similar loading capacity

$DT_{i,y}$ is the average additional distance travelled by vehicle type i compared to baseline in year y (km)

VF_{cons} is the vehicle fuel consumption in litres per kilometre for vehicle type i (l/km)

NCV_{fuel} is the Calorific value of the fuel (MJ/Kg or other unit)

D_{fuel} is the fuel density (kg/l), if necessary

EF_{fuel} is the Emission factor of the fuel (tCO_2/MJ)

For transport of compost to the users, the same formula applies.

Emissions from residual waste from anaerobic digester, gasifier, and processing/combustion of RDF/stabilized biomass or compost in case it is disposed of in landfills ($L_{r,y}$)

For the residual waste from the anaerobic digestion, the gasification processes , and the processing/combustion of RDF/stabilized biomass the weight ($A_{ci,x}$) of each of the waste types i in year x should be estimated. Leakage emissions from this residual waste should be estimated using the determined weights as follows:

In case the residual waste is aerobically treated through composting, emissions shall be estimated as follows:

- N_2O emissions shall be estimated using Equation 5 replacing $M_{compost,y}$ by the sum of the weights of different waste types ($A_{ci,x}$).
- CH_4 emissions shall be estimated using the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site". The value of variable $W_{j,x}$ is $A_{ci,x}$. The result should be multiplied by S_{LE} factor. S_{LE} is estimated as follows:

$$S_{LE} = S_{OD,LE} / S_{LE,total} \quad \textbf{(28)}$$

Where:

$S_{OD,LE}$ is the number of samples per year with an oxygen deficiency (i.e. oxygen content below 10%)

$S_{LE,total}$ is the total number of samples taken per year, where S_{total} should be chosen in a manner that ensures the estimation of S_a with 20% uncertainty at a 95% confidence level.

$A_{ci,x}$ weight of each of the waste types i in year x.

In case the residual waste or the compost is delivered to a landfill, CH_4 emissions are estimated through equation 18 using estimated weights of each waste type ($A_{ci,x}$).

Off-site Emissions from end use of the stabilized biomass ($L_{s,y}$)

Project proponents have to demonstrate that there is no emission associated to non-combustion end-use of stabilized biomass (SB) and that the SB is indeed stabilized. If SB is used as raw material in furniture, fertilizers or ceramic industry, no leakage other than transportation change is expected. Unless the project proponent can prove that SB for furniture industry will not be combusted in the end of its life cycle, to be conservative, the emissions will be considered using the same rationale as per equations (12) and (13) or (14).

For amount of RDF/stabilized biomass used off-site for which no sale invoices can be provided, and in cases where the project proponents cannot provide analysis of the capacity of RDF/stabilized biomass for moisture absorption, leakage emissions should be accounted for as follows:

Quantities of different types of waste input ($A_{j,x}$) to the RDF/biomass processing should be adjusted by an annual adjustment factor SA_y as follows:

$$A_{s,j,x} = SA_y * A_{j,x} \quad \textbf{(29)}$$

$$SA_y = \left(\frac{R_n}{R_t}\right) \quad \textbf{(30)}$$

Where:

SA_y is an adjustment factor for a specific year.

R_n is the weight of RDF/stabilized biomass sold offsite for which no sale invoices can be provided (t/yr)

R_t is the total weight of RDF/stabilized biomass produced (t/yr)

Annual leakage methane emissions ($L_{s,y}$) is calculated as per the latest version of the approved “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”, considering the following additional equation and using the adjusted weights ($A_{s,j,x}$) of waste input to the RDF/stabilized biomass processing facility for variable $W_{j,x}$:

$$L_{s,y} = BE_{CH4,SWDS,y} \quad \textbf{(31)}$$

Where:

$BE_{CH4,SWDS,y}$ is the methane generation from the landfill in the absence of the project activity, calculated as per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".

Emission Reductions

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

$$ER_y = BE_y - PE_y - L_y \quad \textbf{(32)}$$

Where:

ER_y	is the emissions reductions in year y (t CO_2e)
BE_y	is the emissions in the baseline scenario in year y (t CO_2e)
PE_y	is the emissions in the project scenario in year y (t CO_2e)
L_y	is the leakage in year y (t CO_2e)

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

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

No changes in the procedure are expected. If there have been changes in the regulations with respect to waste disposal or industries practices, the adjustment factor AF in the baseline emissions (used in equation 16 above) shall be re-estimated. Note, that adjustment will be needed at the time of renewal of the crediting period.

Data and parameters not monitored

Data / parameter:	$EF_{c,N2O}$
Data unit:	tN2O/tonnes of compost
Description:	Emission factor for N_2O emissions from the composting process.
Source of data:	Research literature
Measurement procedures (if any):	Ex-ante
Any comment:	Default value of 0.043kg-N_2O/t-compost, after Schenk et al, 1997. The value itself is highly variable, but reference data shall be used.

Data/Parameter:	Bo
Data unit:	tCH_4/tCOD
Description:	Maximum methane producing capacity
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Any comment:	A default value of 0.265 tCH_4/tCOD may be used.

Data/Parameter:	MCF_p
Data unit:	%
Description:	Methane conversion factor (fraction)
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Any comment:	Preferably local specific value should be used. In absence of local values, MCF_p default values can be obtained from table 6.3, chapter 6, volume 4 from IPCC 2006 guidelines.

Data/Parameter:	ε_{boiler}
Data unit:	%
Description:	Energy Efficiency of boilers used for generating thermal energy in the absence of the project activity.
Source of data:	Reference data or country specific data
Measurement procedures (if any):	To estimate boiler efficiency, project participants may choose between the following two options: Option A Use the highest value among the following three values as a conservative approach: 1. Measured efficiency prior to project implementation; 2. Measured efficiency during monitoring;

	3. Manufacturer's information on the boiler efficiency. Option B Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach.
Any comment:	Measured or estimated conservatively (e.g. using manufacturers' information on maximum efficiency). Applicable if baseline for exported energy is scenario 1.

Data/Parameter:	$\varepsilon_{gen,b}$
Data unit:	%
Description:	Energy Efficiency of power plant that would have generated electricity, in absence of the project activity.
Source of data:	Reference data or country specific data
Measurement procedures (if any):	To estimate electricity generation efficiency, project participants may use the highest value among the following three values as a conservative approach: 1. Measured efficiency prior to project implementation 2. Measured efficiency during monitoring 3. Data from manufacturer for efficiency at full load 4. Default efficiency of 60%
Any comment:	Applicable if baseline for exported energy is scenario 1.

Data/Parameter:	η_{Cogen}
Data unit:	%
Description:	Efficiency of cogeneration plant that would have been used, in absence of the project activity.
Source of data:	Manufacturer's data or information from similar plant operators
Measurement procedures (if any):	Efficiency of the cogeneration plant, (η_{Cogen}) shall be one of the following: 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.
Any comment:	Applicable if baseline for energy generation is Scenario 2.

Data/Parameter:	$EF_{fuel,b}$
Data unit:	tCO_2/MJ
Description:	Emission factor of baseline fossil fuel used in the boiler, as identified in the baseline scenario identification
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Any comment:	

Data/Parameter:	$EF_{fuel,c}$
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 should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Any comment:	

III. MONITORING METHODOLOGY

Data and parameters monitored

Data / parameter:	$EG_{PJ,FF,y}$
Data unit:	MWh
Description:	Amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity
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. The readings will be double checked by the electricity distribution company.
Any comment:	

Data / parameter:	CEF_{elec}
Data unit:	tCO_2/MWh
Description:	Emission factor for the production of electricity in the project activity.
Source of data:	Official utility documents.
Measurement procedures (if any):	Calculated according to the "Tool to calculate the emission factor for an electricity system", or as diesel default factor according to AMS I.D, Table I.D.1, if the conditions of the table are fulfilled or according to data from captive power plant, if any.
Monitoring frequency:	Annually or *ex-ante.*
QA/QC procedures:	Calculated as per appropriate methodology at start of crediting period.
Any comment:	

Data / parameter:	$F_{cons,y}$
Data unit:	mass or volume units of fuel
Description:	Fuel consumption on-site during year 'y' of the crediting period.
Source of data:	Purchase invoices and/or metering.
Measurement procedures (if any):	
Monitoring frequency:	Annually.
QA/QC procedures:	The amount of fuel will be derived from the paid fuel invoices (administrative obligation).
Any comment:	

Data / parameter:	NCV_{fuel}
Data unit:	MJ/mass or volume units of fuel
Description:	Net calorific value of fuel
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	Annually or *ex-ante*
QA/QC procedures:	
Any comment:	

Data / parameter:	EF_{fuel}
Data unit:	tCO_2/MJ
Description:	Emission factor of the fuel.
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	Annually or ex-ante.
QA/QC procedures:	
Any comment:	

Data / parameter:	$M_{compost,y}$
Data unit:	tonnes
Description:	Total quantity of compost produced in year ‘y’.
Source of data:	Plant records.
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	Weighed on calibrated scale; also cross check with sales of compost.
Any comment:	The produced compost will be trucked off from site. All trucks leaving site will be weighed. Possible temporary storage of compost will be weighed as well or not taken into account for calculated carbon credits.

Data / parameter:	P_l
Data unit:	fraction
Description:	Leakage of methane emissions from anaerobic digester
Source of data:	IPCC or project participant
Measurement procedures (if any):	
Monitoring frequency:	Annually or Ex ante
QA/QC procedures:	The value itself is highly variable, but reference data shall be used, as well as measurement by project participants.
Any comment:	

Data / parameter:	$M_{a,y}$
Data unit:	tCO_2/year
Description:	Total methane produced from anaerobic digester
Source of data:	Project participants
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	Data can be checked from usage records.
Any comment:	This quantity is necessary to calculate the leakage of methane from the digester which has a default leakage of 15%.

Data / parameter:	$SG_{a,y}$
Data unit:	m^3/yr
Description:	Stack gas volume flow rate.
Source of data:	Project participants
Measurement procedures (if any):	
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:	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, it is sufficient to monitor one stack of each type. The stack gas volume flow rate may be estimated by summing the inlet biogas and air flow rates and adjusting for stack temperature. Air inlet flow rate should be estimated by direct measurement using a flow meter.

Data / parameter:	$MC_{N2O,a,y}$
Data unit:	tN_2O/m^3
Description:	Concentration of N_2O in stack gas.
Source of data:	Project Participants
Measurement procedures (if any):	
Monitoring frequency:	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:	More frequent sampling is encouraged.

Data / parameter:	$MC_{CH4,a,y}$
Data unit:	tCH_4/m^3
Description:	Concentration of CH_4 in stack gas.
Source of data:	Project Participants
Measurement procedures (if any):	
Monitoring frequency:	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:	More frequent sampling is encouraged.

Data / parameter:	A_i
Data unit:	tonnes/yr
Description:	Amount of waste type 'i' fed into the gasifier or RDF/stabilized biomass combustor or into the waste incineration plant.
Source of data:	Project participants
Measurement procedures (if any):	Measured with calibrated scales/load cells.
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	CCW_i
Data unit:	Fraction
Description:	Fraction of carbon content in waste type ‘i’
Source of data:	IPCC or other reference data
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	FCF_i

Data unit:	fraction
Description:	Faction of fossil carbon in waste type i
Source of data:	Project participants
Measurement procedures (if any):	To be determined through sampling where the samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level.
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	EF_i
Data unit:	fraction
Description:	Combustion efficiency for waste type 'i'.
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	$SG_{g/r/i,y}$
Data unit:	m^3/yr
Description:	Total volume of stack gas from gasification, waste incineration or RDF/stabilized biomass combustion in year 'y'.
Source of data:	Project site
Measurement procedures (if any):	
Monitoring frequency:	Continuous or periodic (at least quarterly)
QA/QC procedures:	
Any comment:	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, it is sufficient to monitor one stack of each type. The stack gas volume flow rate may be estimated by summing the inlet biogas and air flow rates and adjusting for stack temperature. Air inlet flow rate should be estimated by direct measurement using a flow meter.

Data / parameter:	$MC_{N2O,g/r/i,y}$
Data unit:	tN_2O/m^3
Description:	Monitored content of nitrous oxide in the stack gas from gasification, waste incineration or RDF combustion in year 'y'.
Source of data:	Project site
Measurement procedures (if any):	
Monitoring frequency:	At least quarterly
QA/QC procedures:	
Any comment:	More frequent sampling is encouraged.

Data / parameter:	$MC_{CH4,g/r/i,y}$
Data unit:	tCH_4/m^3
Description:	Monitored content of methane in the stack gas from gasification, waste incineration or RDF/stabilized combustion in year 'y'.
Source of data:	Project site
Measurement procedures (if any):	
Monitoring frequency:	At least quarterly
QA/QC procedures:	
Any comment:	More frequent sampling is encouraged.

Data / parameter:	MB_y
Data unit:	tCH_4
Description:	Methane produced in the landfill in the absence of the project activity in year 'y'.
Source of data:	Calculated as per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Measurement procedures (if any):	As per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Monitoring frequency:	As per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
QA/QC procedures:	As per the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Any comment:	-

Data / parameter:	AF
Data unit:	%
Description:	Methane destroyed due to regulatory or other requirements.
Source of data:	Local and/or national authorities
Measurement procedures (if any):	
Monitoring frequency:	At renewal of crediting period
QA/QC procedures:	Data are derived from or based upon local or national guidelines, so QA/QC-procedures for these data are not applicable.
Any comment:	Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored in order to update the adjustment factor (AF), or directly $MD_{reg.}$. This is done at the beginning of each crediting period.

Data / parameter:	$EG_{d,y}$
Data unit:	MWh
Description:	Amount of electricity generated utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing electricity in the baseline during the year 'y'.
Source of data:	Electricity meter
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	

Data / parameter:	CEF_d
Data unit:	tCO_2/MWh
Description:	Emission factor of displaced electricity by the project activity.
Source of data:	-Captive power plant: estimated as per equation 23. - Grid: as per the "Tool to calculate the emission factor for an electricity system"
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	$RATE^{Compliance}_{y}$
Data unit:	Number
Description:	Rate of compliance
Source of data:	Municipal bodies
Measurement procedures (if any):	The compliance rate is based on the annual reporting of the municipal bodies issuing these reports. The state-level aggregation involves all landfill sites in the country. If the rate exceeds 50%, no CERs can be claimed.
Monitoring frequency:	Annual
QA/QC procedures:	
Any comment:	

Data / parameter:	$NO_{vehicles,i,y}$
Data unit:	Number
Description:	Vehicles per carrying capacity per year
Source of data:	Counting
Measurement procedures (if any):	Counter should accumulate the number of trucks per carrying capacity
Monitoring frequency:	Annually
QA/QC procedures:	Number of vehicles must match with total amount of sold compost. Procedures will be checked regularly by DOE.
Any comment:	

Data / parameter:	$DT_{i,y}$
Data unit:	km
Description:	Average additional distance travelled by vehicle type 'i' compared to the baseline

	in year 'y'.
Source of data:	Expert estimate
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	Assumption to be approved by DOE.
Any comment:	

Data / parameter:	VF_{cons}
Data unit:	L/km
Description:	Vehicle fuel consumption in litres per kilometre for vehicle type i
Source of data:	Fuel consumption record
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / parameter:	D_{fuel}
Data unit:	kg/L
Description:	Density of fuel
Source of data:	The source of data should 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 should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	Annually or Ex-ante
QA/QC procedures:	
Any comment:	Not necessary if NCV_{fuel} is demonstrated on a per liter basis

Data / parameter:	$Q_{biomass,y}$
Data unit:	tonne/yr
Description:	Amount of waste gasified, incinerated or RDF/stabilized biomass combusted in year y.
Source of data:	
Measurement procedures (if any):	All produced stabilized biomass will be trucked off from site. All trucks leaving site will be weighed. Possible temporary storage of stabilized biomass will be weighed as well or not taken into account for calculated carbon credits.
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / parameter:	EF_{N2O}
Data unit:	kgN_2O/tonne waste (dry)
Description:	Aggregate N_2O emission factor for waste incineration.
Source of data:	As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / parameter:	EF_{CH4}
Data unit:	$KgCH_4$/tonne waste (dry)
Description:	Aggregate CH_4 emission factor for waste incineration.
Source of data:	As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain.
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / parameter:	$S_{a,y}$
Data unit:	%
Description:	Share of the waste that degrades under anaerobic conditions in the composting plant during year ‘y’.
Source of data:	
Measurement procedures (if any):	See $S_{total,y}$
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Any comment:	Used to determine percentage of compost material that behaves anaerobically.

Data / parameter:	$S_{OD,y}$
Data unit:	Number
Description:	Number of samples with oxygen deficiency (i.e. oxygen content below 10%).
Source of data:	Oxygen measurement device
Measurement procedures (if any):	See $S_{total,y}$
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Any comment:	Samples with oxygen content <10%. Weekly measurements throughout the year but accumulated once per year only.

Data / parameter:	$S_{total,y}$
Data unit:	Number
Description:	Number of samples
Source of data:	Oxygen measurement device
Measurement procedures (if any):	Statistically significant
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Any comment:	Total number of samples taken per year, where $S_{total,y}$ should be chosen in a manner that ensures estimation of $S_{a,y}$ with 20% uncertainty at 95% confidence level. To determine the oxygen content during the process, project participants shall measure the oxygen content according to a predetermined sampling scheme and frequency. These measurements should be undertaken for each year of the crediting period and recorded each year.

Data / parameter:	S_{LE}
Data unit:	%
Description:	Share of samples anaerobic
Source of data:	
Measurement procedures (if any):	See $S_{LE,total}$
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a daily basis.
Any comment:	Used to determine percentage of compost material that behaves anaerobically.

Data / parameter:	$S_{OD,LE}$
Data unit:	Number
Description:	Number of samples with oxygen deficiency
Source of data:	Oxygen measurement device
Measurement procedures (if any):	See $S_{LE,total}$
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a daily basis.
Any comment:	Samples with oxygen content <10%. Weekly measurements throughout the year but accumulated once per year only

Data / parameter:	$S_{LE,total}$
Data unit:	Number
Description:	Number of samples
Source of data:	Oxygen measurement device
Measurement procedures (if any):	statistically significant
Monitoring frequency:	Weekly
QA/QC procedures:	O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a daily basis.
Any comment:	Total number of samples taken per year, where $S_{LE,total}$ should be chosen in a manner that ensures estimation of S_{LE} with 20% uncertainty at 95% confidence level.
Data / parameter:	Degradability analysis

Data unit:	
Description:	Project proponent shall provide degradability analysis on an annual basis to demonstrate that the methane generation in the life-cycle of the SB is negligible.
Source of data:	Project site
Measurement procedures (if any):	Measurement of absorption capacity for moisture of SB according to appropriate standards.
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	If the PPs produce different types of SB, they should provide this analysis for each SB type separately.

Data / parameter:	Amount of RDF/stabilized biomass used outside the project boundary
Data unit:	Tons
Description:	Project Proponents shall monitor the amount of the RDF/stabilized biomass sold for use outside of the project boundary.
Source of data:	Project Site
Measurement procedures (if any):	Sale invoices of the RDF/stabilized biomass should be kept at the project site. They should contain Customer contact details, physical location of delivery, type, amount (in tons) and purpose of stabilized biomass (use as fuel or as material in furniture etc.). A list of customers and delivered SD amount should be kept at the project site.
Monitoring frequency:	Weekly
QA/QC procedures:	
Any comment:	

Data / parameter:	Temperature of the thermal treatment process
Data unit:	
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:	$A_{j,x}$
Data unit:	tonnes/yr
Description:	Amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year)
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:	$A_{ci,x}$
Data unit:	tonnes/yr
Description:	Amount of residual waste type 'ci' from anaerobic digestion, gasifier or processing/combustion of RDF and stabilized biomass.
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:	R_n
Data unit:	tonnes/yr
Description:	Weight of RDF/stabilized biomass sold offsite for which no sale invoices can be provided
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:	R_t
Data unit:	tonnes/yr
Description:	Total weight of RDF/stabilized biomass produced (t/yr)
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:	$Q_{COD,y}$

Data unit:	m^3/yr
Description:	Amount of wastewaster 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:	Chemical Oxygen Demand (COD) of wastewaster
Source of data:	Measured value by purity 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 wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored.

Data / Parameter:	$f_{c/g/d/r/i}$
Data unit:	%
Description:	fraction of waste diverted, from the landfill to all project activities: composting/gasification/anaerobic digestion/RDF/stabilized biomass/ incineration
Source of data:	Plant records
Measurement procedures (if any):	
Monitoring frequency:	Monthly
QA/QC procedures:	
Any comment:	

Data / Parameter:	Q_y
Data unit:	TJ
Description:	Net quantity of thermal energy supplied by the project activity 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:	Monthly
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:	Amount of compost produced
Data unit:	Tons
Description:	Project Proponents shall monitor the amount of the compost produced from the composting treatment process.
Source of data:	Project Site
Measurement procedures (if any):	Sales invoices of the compost should be kept at the project site. They should contain customer contact details, physical location of delivery, type, amount (in tons) and the use of compost. A list of customers and delivered SD amount should be kept at the project site.
Monitoring frequency:	Weekly
QA/QC procedures:	
Any comment:	

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