Project design document form
(Version 10.1)

Title of the project activity	Canhanduba Landfill Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	6.1
Completion date of the PDD	07/11/2018
Project participants	Itajaí Biogás e Energia S.A.
Host Party	Brazil
Applied methodologies and standardized baselines	ACM0001 - “Flaring or use of Landfill Gas” (version 13.0.0)
Sectoral scopes linked to the applied methodologies	13 - Waste handling and disposal 1 - Energy industries (renewable / non-renewable sources) (project’s electricity generation component)
Estimated amount of annual average GHG emission reductions	77,385 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The Canhanduba Landfill Project encompasses the construction and operation of a landfill gas (LFG) collection and flaring system with electricity generation using LFG as gaseous fuel at the Canhanduba landfill (Aterro Sanitário Canhanduba), located to the Southwest of the city of Itajaí, Santa Catarina State, Brazil.

The Canhanduba landfill is a private landfill, owned and operated by Ambiental Limpeza Urbana e Saneamento Ltda. With an area of 27.52 ha, the landfill started its operations in January 2006. The landfill currently receives Municipal Solid Waste (MSW) as well as clinical/hospital waste[1], from the cities of Itajaí, SC and Balneário do Camboriú, SC. The Canhanduba landfill, which is expected to operate at least until 2032[2], has an estimated total waste disposal capacity of 4,166,630 ton and has been receiving an average of 300 ton of waste per day since its opening.
In October 2012, Ambiental Limpeza Urbana e Saneamento Ltda awarded Itajaí Biogás e Energia S.A.[3] the rights to develop the LFG collection and destruction/utilization project at the Canhanduba landfill under the Clean Development Mechanism.

The equipment that will be installed as part of the proposed project activity includes *inter alia* a LFG collection network comprising vertical LFG collection wells and eventually horizontal LFG collection trenches, a LFG flaring station (comprising high temperature enclosed flare(s) and monitoring and control systems) and an electricity generation facility using LFG as fuel. Electricity generated will be exported to the grid (with electricity demand for the project activity being totally met by imports of grid electricity). A backup captive off-grid electricity generator (fuelled by diesel) for emergency purposes will also be installed.

The baseline scenario for LFG management at the Canhanduba landfill is the same as the scenario existing prior to the implementation of the project activity: LFG (with high content of methane) being freely emitted into the atmosphere without any treatment, collection, combustion or control. While methane is a strong greenhouse gas (GHG), the current situation of emission of LFG into the atmosphere thus contributes to global warming. Furthermore, free emissions of methane trough the landfill surface also create a risk of fire, explosion as well as bad odours[4].

Collection and combustion of LFG through the implementation and operation of an active LFG collection and flaring system and/or electricity generation facility clearly reduces such risks and also promotes abatement of GHG emissions from the Canhanduba landfill. Furthermore, generation of electricity using collected LFG as fuel also displaces existing electricity generation using fossil fuel (that would be otherwise generated in existing fossil-fuel power generation sources connected to the National Electricity Grid of Brazil and/or new additions of fossil-fuel power generation sources). It is estimated that the project activity will promote average annual GHG emissions reductions of 77,385 tCO_2e per year over a selected 7-year renewable crediting period.

Besides climate change mitigation through abatement of GHG, the project activity also provides important local environmental benefits. LFG contains trace amounts of volatile organic compounds, which are local air pollutants. Capturing of LFG using an active forced collection system and its combustion (by flaring or use for power generation) greatly reduces such emissions and thereby contributes towards Sustainable Development in Brazil.

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[1] The landfill receives around 1.26 ton per day of clinical/hospital waste. The clinical waste was not taken into account for the calculation of the ex-ante emission reductions.

[2] The project participants acknowledge that forecasted waste disposal rate can be changed (trend to be potentially increased).

[3] The project participant of the Canhanduba Landfill Project Clean Development Mechanism project activity.

[4] Although there are drains of LFG at the landfill, the LFG is not passively or actively destructed by combustion.

The project also provides the following additional important local environmental and social benefits:

- Destruction of other air pollutants, such as hydrogen sulphide, that is present in trace quantities in LFG;
- Reduction of risks of occurrence of fire and explosion at the landfill, through improved LFG management;
- Reduction of odour in the landfill;
- Promotion of electricity generation using non-conventional renewable energy source;
- Potential of promotion of local job opportunities (for building and operating the project activity).

The project when fully implemented (including an electricity generation facility fuelled by LFG) can be used as a technological demonstration initiative for the promotion of electricity generation using non-conventional renewable energy source. The use of LFG as fuel for electricity generation is not common practice in Brazil. It is the intention of the project participant to establish cooperation agreements with local NGOs, academia and community in order to demonstrate and promote this type of initiative.

Project Activity non-representing CPA excluded from a previously registered PoA:
While registered under the CDM since 22/05/2014, the project activity does not represent a Component Project Activity (CPA) that has been excluded from a previously registered CDM Programme of Activities (CDM-PoA) as a result of erroneous inclusion of CPAs.

A.2. Location of project activity

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The Canhanduba landfill is located at Estrada Geral de Canhanduba, to the West of the Municipality of Balneário do Camboriú, SC, and to the Southwest of the Municipality of Itajaí in State of Santa Catarina, Brazil.

The geographical coordinates of the project site are as follows:

Format	Latitude	Longitude
Decimal	-26.975407	-48.704497
DMS[5]	26° 58' 31.47" S	48° 42' 16.19" W

[5] Degree, Minute, Second.

The following images show the location of the project activity.

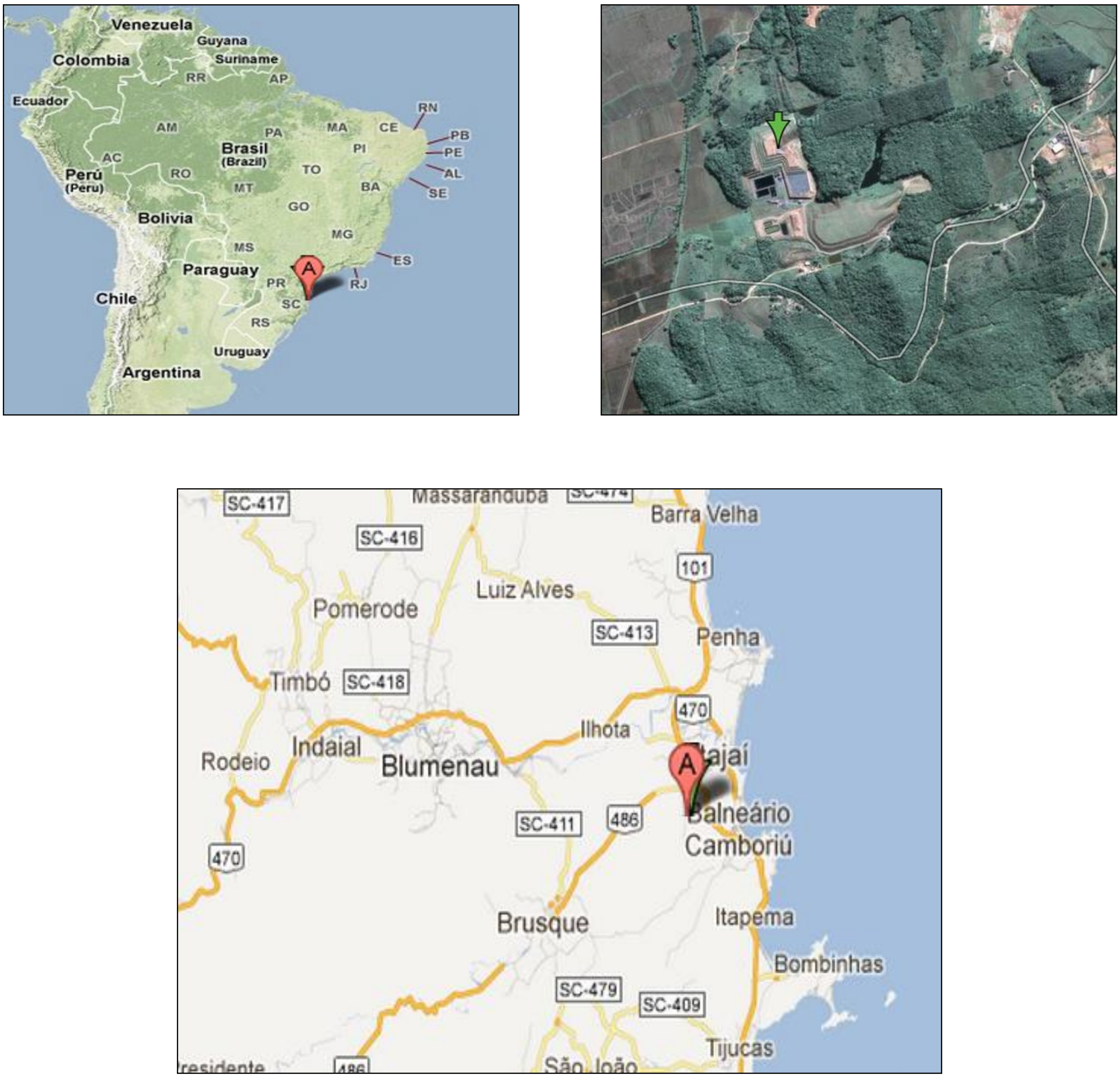

Figure 1 - Location of the project activity
(Above: Landfill location in the country on the left; satellite view of the landfill location on the right.
Below: Santa Catarina State map showing location of the landfill).

Figure 2 – Aerial view of the Canhanduba landfill, July 2012

A.3. Technologies/measures

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The currently existing and pre-project scenario (scenario prior to the implementation of the project activity) is the non-existence of appropriate equipment and practice dedicated to promote LFG collection and destruction/utilization at the landfill site. In the existing pre-project scenario there are some drains which were implemented to allow passive venting of LFG in order to avoid significant LFG accumulation inside the landfill (thus reducing the risk of fire and explosions). At baseline scenario (absence of the proposed project activity) it is assumed that the landfill site would continue to have no appropriate equipment installed for promoting LFG collection and destruction or utilization.

Currently there is no legal municipal, state or national requirement in Itajaí, Santa Catarina State nor Brazil respectively, that establish any management requirement for LFG in new or old landfills or waste dump sites[6].

The baseline scenario is thus the continuation of current practice (no LFG collection and destruction being performed the Canhanduba landfill). The baseline scenario is therefore identical to the scenario existing prior to the implementation of the project activity.

The previously conceived overall design and management plan of the Canhanduba landfill will not change as a result of the implementation of the project activity. While no practice to increase methane generation has been occurring prior to the implementation of the project activity, no practice to increase methane generation will occur after the implementation of the project activity either. As required by the applied baseline and monitoring methodology ACM0001 (version 13.0.0), any change in the management of the Canhanduba landfill after the implementation of the project activity will be reported and will be justified by referring to applicable technical or regulatory specifications.

The project activity encompasses the implementation of an advanced active LFG collection and flaring system with utilization of LFG as fuel for electricity generation (use of electricity generation engine-generator set(s) fuelled uniquely by LFG), and a 60 kW backup captive off-grid electricity generator (fuelled by diesel) for emergency purposes. The equipment/infrastructure which will be installed as part of the project activity includes:

[6] Evidence and further considerations about the non-obligation to flare LFG subject are addressed in section B.2.

- New vertical LFG collection wells[7] and/or horizontal LFG collection trenches;
- LFG collection pipeline network, with HDPE[8] pipes;
- High temperature enclosed flare(s);
- Monitoring and control systems to measure flow[9] and composition of the landfill gas and equipment to measure operational parameters of the flare depending on the selected option of the methodological tool “Project emissions from flaring” (Version 02.0.0) chosen;
- Engine-generator set(s), LFG pre-treatment system and required electrical connections, including power transformers, as well as additional flow meters for each item of the electricity generation component of the project activity;
- A backup captive off-grid electricity generator (fuelled by diesel) for emergency purposes.

The operation of the project will consist on collecting LFG from the landfill in a forced manner with the use of centrifugal blower(s) and direct all collected LFG to combustion in high temperature flare(s) and/or in the engine-generator set(s) of the electricity generation facility. Such measures will enable methane contained in the LFG to be destroyed thus promoting GHG emission reductions. The project system is expected to be equipped with all needed monitoring system to ensure that all required measurements (as per ACM0001 (version 13.0.0) and applicable methodological tools) are performed (LFG flow, methane content in LFG, etc.). Furthermore, CO_2 emission reduction associate with displacement of equivalent amount of electricity generation (that would otherwise occur in fossil fuel power generation sources in the National Electricity Grid of Brazil) are also promoted.

The project activity is planned to be implemented from the beginning of its operation both LFG collection and flaring as well as electricity generation using collected LFG as gaseous fuel.

The technology that will be used is environmentally safe and sound; it includes a LFG flaring system and power generation facility with the following characteristics:

- Safe and low emission combustion guaranteed by a high temperature enclosed flare;
- Safety devices such as flame arrester, slam shut valve and flame detection.
- LFG pre-treatment system, in order to dry and clean landfill gas to be directed to the engine-generator sets;
- Engine-generator sets.

The expected operational lifetime for the LFG flaring system and electricity generation facility is at least 20 years. However, project lifetime may even exceed 20 years if required maintenance is performed correctly. No technology substitution is expected during the 7 year renewable crediting period.

Although the equipment suppliers are not yet defined or selected, based on the forecasted volume for collection of LFG and also based on preliminary consultation with existent equipment suppliers and LFG-to-electricity experts, the characteristics of typical LFG destruction and utilization equipment to be installed might be as follows:

[7] Depending on the outcome of the yet to occur project engineering, some of the existing LFG venting drains may be eventually converted into appropriate LFG collection wells which will be part of the project activity. As an alternative, existing LFG venting drains will be covered/unutilized and new LFG collection wells will be built.

[8] High density polyethylene

[9] As part of the project design, dedicated LFG flow meters will be applied to measure the amount of LFG sent to the each individual flare(s) and for each item (LFG combustion source) of the electricity generation facility.

Equipment	Characteristics[10]
High temperature enclosed flare	One flare with LFG destruction capacity of about 1,200 Nm^3/h
Electricity generation equipment	Three engine-generator sets fuelled only by LFG with nameplate power generation installed capacity of 1,060 kW. The engine-generator sets are currently expected to be implemented as per the following estimated installation forecest: • One unit in 2014 • One additional unit in 2015 • One additional unit in 2021[11]
LFG collecting network	Consisting on horizontal/vertical wells connected by HDPE pipeline network

The main GHG emissions source in the baseline scenario is methane, and these emissions will be reduced by the project activity compared to the baseline scenario (absence of the project activity).

The baseline scenario also includes the GHG emissions for the generation of equivalent amount of electricity that would, in the absence of the project activity, be generated by the operation of grid-connected thermal power plants (and by the future addition of new generation sources) in the National Electricity Grid of Brazil.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	Itajaí Biogás e Energia S.A. (Private Entity)	No

A.5. Public funding of project activity

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No public funding is involved in this project activity.

A.6. History of project activity

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The project activity “Canhanduba Landfill Project” is registered as under the CDM and it (and/or the infrastructure/components it encompasses) was not previously included as a component project activity (CPA) in a registered CDM programme of activities (PoA). Prior of being registered under the CDM, the project activity (and/or the infrastructure/components it encompasses) did not represent any part or a whole previously registered CDM project activity that had been deregistered. Prior of being registered under the CDM, the project activity (and/or the infrastructure/components it encompasses) were not part of a previous CPA that has been excluded from a previously registered CDM PoA either.

The project activity (and/or the infrastructure/components it encompasses) does not represent or part of a previously registered CDM project activity or a CPA under a previously registered CDM

[10] The characteristics of the equipment expected to be implemented as part of the project activity (specification sheets, etc.) were delivered to the DOE during the validation process. No equipment was yet purchased or ordered by the project participant. It is currently expected that one high temperature enclosed flare will be installed as part of the project activity. However, this will only be confirmed after the project’s equipment engineering and procurement process is finalized. In case more than one flare is installed or the installed flare(s) have specifications different than the ones hereby presented, information in the PDD will be corrected by following applicable CDM procedure and guidance for post registration changes.

[11] This schedule might be changed as a result of LFG availability at the landfill.

PoA whose crediting period has or has not expired (hereinafter referred to as former project) which existed within the same or other geographical location as the CDM project activity.

A.7. Debundling

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Not applicable.

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

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The following CDM baseline and monitoring methodology is applied:

- Consolidated baseline and monitoring CDM methodology ACM0001 - “Flaring or use of Landfill Gas” (version 13.0.0) (http://cdm.unfccc.int/methodologies/DB/EYUD9R1ZAUZ2XNZXD3HQH18OK3VWIV);

The following methodological tools are applied:

- Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0, EB 70) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v5.0.0.pdf);

- Emissions from solid waste disposal sites (version 06.0.1, EB66) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf);

- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 1, EB39) (http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf);

- Project emissions from flaring (version 02.0.0, EB 68) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf);

- Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0, EB 61) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.pdf);

- Tool to calculate the emission factor for an electricity system (version 03.0.0, EB 70) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf);

B.2. Applicability of methodologies and standardized baselines

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The consolidated baseline and monitoring methodology ACM0001 (version 13.0.0) is applied, and, in addition, the following methodological tools, which the consolidating baseline and monitoring methodology are also applied. Demonstration of how the project activity meets all applicable applicability conditions is included in the following tables:

Applicability Condition of ACM0001 (version 13.0.0)	Justification
"*This methodology is applicable to project activities which:* *(a) Install a new LFG capture system in a new or existing SWDS; or* *(b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:* *(i) The captured LFG was only vented or flared and not used prior to the implementation of the project activity; and* *(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.* *(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:* *(i) Generating electricity;* *(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or* *(iii) Supplying the LFG to consumers through a natural gas distribution network.* (d) *Do not reduce the amount of organic waste that would be recycled in the absence of the project activity."*	The project activity encompasses the installation of a new LFG collection and destruction/utilization system in an existing SWDS, therefore complying with (a). There is no existing active (forced) LFG capture system that has been in operation in the last calendar year prior to the start of the project activity. Condition (b) is assumed as not applicable. The project activity will use captured LFG for flaring and as fuel for electricity generation. Therefore condition (c) (i) is satisfied. As a result of the implementation of the project activity, it is not expected to occur (under the project scenario) any quantitative, qualitative, procedural or regulatory change in terms of MSW management activities and policies valid for the landfill or applicable in any other potential waste treatment or disposal facility under the area of influence of this landfill (that would be promoted or triggered by the project activity) in comparison with what would occur in the absence of the project activity (baseline scenario). It is also crucial to note that the operation of the landfill (waste landfilling operations) and operation of the project activity encompassing LFG collection and destruction/utilization are separated and to a certain extent independent activities as they are to be implemented and operated by different companies. Therefore one activity is independent of the other activity in this perspective. Furthermore it is crucial to note that, mainly by taking into consideration the nature of the project activity and aspects related to recycling of organic fraction of MSW in the region of the landfill and in the rest of Brazil, the implementation and operation of the project activity per se are not expected to promote any quantitative change in waste disposal activities to be undertaken at the landfill. Furthermore, no quantitative or qualitative changes

	in terms of waste management practices are expected to occur in any other existent or potential waste disposal or waste treatment facility (located or to be located in the region of the project site) as a direct outcome or consequence of the implementation of the project activity. Thus, the mere implementation of the project and its continuous operation are not expected to promote or trigger any reduction (or prevention) of the amount of organic type of MSW that would eventually be recycled or utilized in the region (e.g. prevention of implementation or reduction of activity in a waste composting facility that would promote utilization/recycling of waste in the region for example). The Canhanduba landfill per se is not expected to have any activity or initiative promoting recycling or utilization of organic fraction of waste to be disposed being included as part of its operations (such as implementation of any waste sorting or waste composting facility). Furthermore, it is also crucial to take into account that currently there is not even any existent or planned large scale MSW sorting, recycling or utilization facility for organic fraction of MSW (e.g. a waste composting plant) located in the region of influence of the landfill. As a matter of fact, recycling and utilization of organic fraction of MSW is not a common practice in the whole country of Brazil. In this sense, the implementation and operation of the project activity thus does not represent any perverse incentive or driver for the promotion of any quantitative or qualitative reduction or prevention of recycling related activities or initiatives for any type of organic fraction of waste or residue that would occur in the absence of the project activity[12]. The same is also applicable for recycling of inert waste material.

	Furthermore, regardless of the non-existence of any MSW recycling or utilization facility that could eventually somehow compete with the landfill for organic fraction of MSW waste, aspects and actions related to promotion of recycling or utilization of organic fraction of waste are to be seen as dependent on public service policies (including policies, laws, regulations and programs) and defined/triggered by competent governmental authorities (under a regional and national level) and eventually implemented/operated by practitioners of waste recycling. In Brazil, the administrations of municipalities are the entities responsible for addressing all MSW management services. Waste management companies normally act as mere service providers, providing MSW collection and/or MSW disposal services as per directives and contractual requirements set by the municipalities from where MSW are managed. In this sense, as a MSW management company or as a CDM project participant implementing a LFG collection and destruction system in the landfill it operates, Itajaí Biogás e Energia S.A. is not under position to trigger any promotion of reduction or prevention of organic waste recycling in the region. Finally, the implementation of the project activity does not represent any incentive or driver for the municipality, any other public entity or any other relevant recycling practitioner (if existent) to promote any change in the policy and practice of recycling of inert or organic waste in the region or even outside the region of influence of the landfill. As outlined in Section B.6.1, so far, there is still no legal restriction or requirement for LFG gas collection and its destruction or utilization using high temperature enclosed flares or any other device/equipment in Brazil. Moreover, there is still no legal restriction neither requirement for passive venting of LFG or its combustion in conventional LFG

	destruction systems either (where venting of LFG in conventional drains is identified as the baseline scenario for the project activity). Actually, there is no applicable regulation that deals with LFG management in Brazil at all. Thus, the implementation of more appropriate and environmentally safe management of LFG at the landfill as an outcome of the project activity does not represent any driver or incentive to dispose incremental amount of MSW in the landfill (when compared to the situation in the absence of the project). In this sense, under no circumstance the project activity would not *per se* potentially promote any displacement of volumes of organic waste stream from eventual treatments/utilization in an existent or hypothetical MSW recycling/utilization facilities (e.g. a MSW composting plant for example) (which in the particular region is not even existent) to be disposed at the landfill because of the implementation and continuous operation of the project activity. Therefore condition (d) is also satisfied.
"*The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is* *(a) Release of LFG from the SWDS; and* *(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heat, glass melting furnace or kiln;* (i) *For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or* (ii) *For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary."*	As further demonstrated in Section B.4, the most plausible baseline scenario is the total release of the LFG from the SWDS into the atmosphere. Since the project activity will generate electricity of which equivalent amount would otherwise be generated by existing grid connected power plants and new additions, and therefore also fall into (b) (i) in terms of baseline scenario.

Non applicability conditions	Justification
(a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass meting furnace; (b) *If the management of the SWDS in the project activity is deliberately changed in order to increase methane generation compared to the situation prior to the implementation of the project activity.*	Neither (a) and (b) occur, therefore ACM0001 (version 13.0.0) is applicable to the project activity. The only emission reductions claimed are originated in the LFG flaring and use of collected LFG to promote electricity generation. After the implementation of the project activity, the landfill operator will continue current waste disposal activities at the landfill as per its normal operation conditions.

Regarding the tools:

Tool	Version	Applicability conditions	Comments
“Project emissions from flaring”	02.0.0	*“This tool is applicable to the flaring of flammable greenhouse gases where:* *(i) Methane is the component with the highest concentration in the flammable residual gas; and* *(ii) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).* *The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare.”*	LFG, whose component with the highest concentration is methane, combusted by the project’s flare(s) is obtained from the decomposition of organic waste material through a landfill fulfilling the two applicability criteria defined in the tool. The project activity will not use auxiliary fuels, and the manufacturer of the flare will provide operating specifications.
“Tool to calculate baseline, project and/or leakage emissions from electricity consumption”	01	*”This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity.* *(…)* *The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:* *<u>Scenario A:</u> Electricity consumption from the grid. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.*	This As established by ACM0001 (version 13.0.0), consumption of electricity by the project activity is to be accounted as project emissions. The project activity will have its electricity demand met by imports of grid electricity under normal operation. <u>Scenario A</u> of the tool is thus applicable. The applicability conditions of the tool are thus met. The project activity will include a backup captive

Tool	Version	Applicability conditions	Comments
		<u>Scenario B:</u> *Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.* <u>Scenario C:</u> *Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid."*	off-grid electricity generator (fuelled by diesel) for meeting the project's electricity demand during emergency situations. When that is the case <u>Scenario B</u> of the tool is also applicable to determine project emissions arising from the electricity generated at the fossil fuel fired captive power plant.
"Emissions from solid waste disposal sites"	06.0.1	*"This tool provides stepwise approach to calculate baseline, emissions of methane from solid waste disposed or prevented from disposal at a SWDS. Application A is adopted. As per the tool: if "(…) the CDM project activity mitigates methane emissions from a specific existing SWDS.", application A should be used"*	The project mitigates methane emissions from a landfill. The applicability of the methodological tool is thus met. Application A is adopted.
"Tool to calculate the emission factor for an electricity system"	03.0.0	*"This methodological tool determines the CO2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the .combined margin emission factor (CM) of the electricity system."* *(…)* *"this tool is also referred in the "Tool to calculate project emissions from electricity consumption" for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary."*	Project emissions due to the consumption of grid electricity by the project activity are determined by applying applicable guidance of "Tool to calculate project emissions from electricity consumption" (which refers to the methodological tool). The applicability conditions of the methodological tool are thus met.
"Combined tool to identify the baseline scenario and demonstrate additionality"	05.0.0	"*This tool is only applicable to methodologies for which the potential alternative scenarios to the proposed project activity available to project participants cannot be implemented in parallel to the proposed project activity"* *(…)* *For example, in the following situations a methodology could refer to this tool:*	As established by ACM0001 (version 13.0.0), this tool is applied as per the methodology for the identification of the baseline scenario and to demonstrate the additionality of the CDM project activity.

Tool	Version	Applicability conditions	Comments
		- *For an energy efficiency CDM project where the identified potential alternative scenarios are: (a) retrofit of an existing equipment, or (b) replacement of the existing equipment by new equipment, or (c) the continued use of the existing equipment without any retrofits;* - *For a CDM project activity related to the destruction of a greenhouse gas in one site where the identified potential alternative scenarios are: (a) installation of a thermal destruction unit, or (b) installation of a catalytic destruction system, or (c) no abatement of the greenhouse gas.* *In these cases, the project proponents could not implement the three alternatives in parallel but they could only implement one of them.* *However, the tool is, for example, not applicable in the following situation: the CDM project activity is the installation of a Greenfield facility that provides a product to a market (i.e. electricity, cement, etc.) where the output could be provided by other existing facilities or new facilities that could be implemented in parallel with the CDM project activity."*	The project activity encompasses the destruction of a greenhouse gas in one site where one of the identified potential alternative scenarios is no abatement of the greenhouse gas. The applicability condition of the methodological tool is thus met.
"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	02	This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	This tool is not used in the present project activity since no fossil fuel is expected to be combusted within the project boundary, besides the fossil fuel used in the backup captive off-grid electricity generator (fuelled by diesel). Moreover the options defined by project participants to account for the resulting project emissions of such fossil fuel consumption do not require the utilization of the provisions of this tool.
"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"	02.0.0	"*This tool is used to determine the mass flow of greenhouse gas i (CO_2, CH_4, N_2O, SF_6 or a PFC) in the time interval t."* *This tool provides procedures to determine $F_{i,t}$ (kg/h). The mass flow of a greenhouse gas (CO_2, CH_4, N_2O,*	As established by ACM0001 (version 13.0.0), this tool is applied as per the methodology for determining the mass flow of CH_4. The applicability condition of the

Tool	Version	Applicability conditions	Comments
		SF_6 or a PFC) in the gaseous stream in time interval t. based on measurements of: *(a) the total volume flow or mass flow of the gas stream,* *(b) the volumetric fraction of the gas in the gas stream and* *(c) the gas composition and water content.* *Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions, which is the case of the present project activity"*	methodological tool is thus met.

B.3. Project boundary, sources and greenhouse gases (GHGs)

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	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site.	CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity.
		CH_4	Yes	The major source of emissions in the baseline.
		N_2O	No	N_2O emissions are very small when compared to CH_4 emissions from SWDS (in tCO_2e). This is conservative.
	Emissions from electricity generation	CO_2	Yes	Major emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
Project activity	Emissions from electricity consumption by the project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small in the case of project emissions due to consumption of grid electricity by the project activity. It is important to note that residual CH_4 emission due to the combustion of LFG in enclosed flare(s) are considered in the context of the determination of baseline emissions.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small in the case of project emissions due to consumption of grid electricity by the project activity.

The schematic flow diagram below summarizes the project boundary and delineates the project activity (equipment, parameters to be monitored, and GHG included in the project boundary).

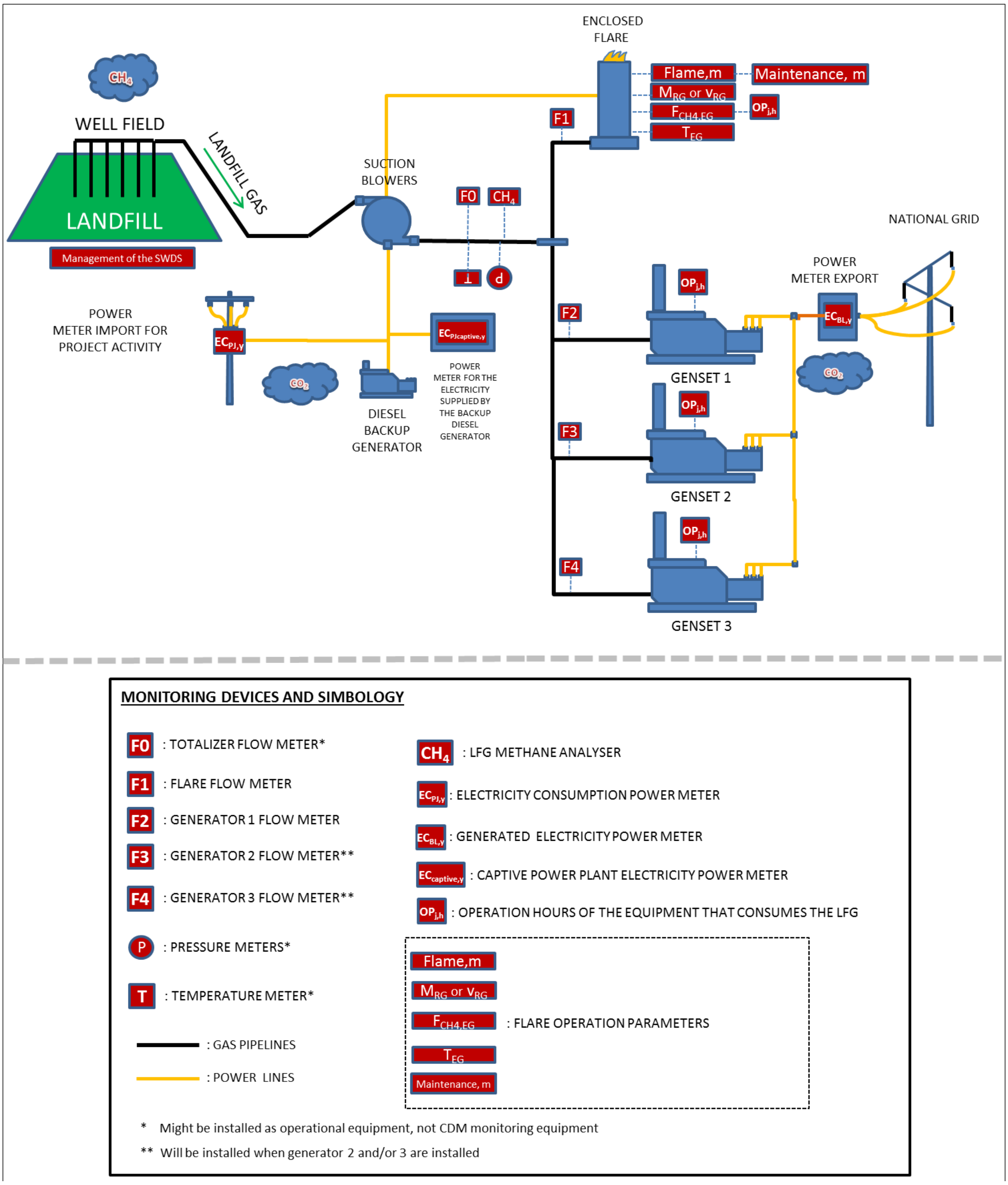

Figure 2: Schematic flow diagram: delineation of the project boundary for the project activity, monitoring parameters, mass and energy flows and predicted equipment to be installed.

B.4. Establishment and description of baseline scenario

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On the next steps, the baseline scenario for the project activity it is identified. As established by ACM0001 (version 13.0.0) the stepwise approach of the “Combined tool to identify the baseline scenario and demonstrate additionality” (version 05.0.0) is applied. The baseline scenario is identified for both the projects components involving destruction of LFG and utilization of LFG as fuel for power generation.

Step 0: Demonstration whether the proposed project activity is the *First-of-its-kind*

This optional step is not applied.

Step 1: Identification of alternative scenarios

Step 1a: Define alternatives to the proposed CDM project activity

In this step, the following baseline alternatives for the destruction of LFG are taken into consideration:

LFG1: The project activity (i.e. capture of landfill gas and its flaring and/or its use) undertaken without being registered as a CDM project activity. This is a plausible alternative scenario, however involves significant investment and additional costs of landfill operations with no associated revenues in the case of flaring of collected LFG.

LFG2: Atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulations or contractual requirements, or to address safety and odour concerns. This scenario corresponds to the continuation of the current situation (the proposed project activity or any other alternatives are not implemented).

LFG3: LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;

LFG4: LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS;

LFG5: LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.

The project activity is to be implemented at a landfill site whose purpose is the final disposition of waste through adopting of landfilling practices and techniques. As further explained in Section B.2, with or without the project activity, no recycling of the organic fraction of the waste, neither aerobic treatment, neither incineration, is expected to occur. Thus scenarios LFG3, LFG4 and LFG5 are excluded. In fact, recycling of organic matter, aerobic treatment and incineration are not common practice in Brazil[13].

In addition to the alternative baseline scenarios identified for the destruction of LFG, alternative scenarios for the use of LFG shall also be identified:

As per the project design, LFG will be used as fuel for generation of electricity for export to a grid with no other LFG utilization being considered. Thus, realistic and credible alternatives for power generation in the absence of the project activity are also determined.

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

E1: Electricity generation from LFG, undertaken without being the project being registered as CDM project activity;

E2: Electricity generation in existing or new on-site or off-site renewable based captive power plant(s);

E3: Electricity generation in existing and/or new grid-connected power plants.

Scenario E2 is excluded. Since all electricity demand from the landfill site has been historically met by a reliable supply of grid electricity (since the starting of operations of the landfill), the utilization of

[13] In fact all generated Municipal Solid Waste in Brazil is currently managed through deposition on dump sites or landfills (either controlled or uncontrolled). This is outlined in Figure 4.1.3.1 on page 44 of the publication “Panorama dos Resíduos Sólidos no Brasil – 2012”.

Available online: http://www.abrelpe.org.br/Panorama/panorama2012.pdf, accessed on 12/07/2013.

a captive off-grid electricity generation to supply electricity for the landfill site (using renewable or fossil energy sources) never occurred and it is not foreseen to occur in the project scenario either.

Heat generation scenarios using LFG collected at the landfill as fuel are not part of the project activity as there are no heat requirements at the landfill and the project activity does not encompass use of collected LFG for heating or thermal purposes (i.e. use of collected LFG as gaseous fuel in boiler, air heater, glass melting furnace(s) and/or kiln).. Therefore, scenarios H1 trough H7, are not considered on the present analysis. This is in accordance with ACM0001 (version 13.0.0).

Supply of LFG to a natural gas distribution network is not considered as part of the project activity either. There is no natural gas distribution network at the landfill. Moreover, this type of utilization for collected LFG is not part of the project activity either, therefore, not considered on the present analysis. This is in accordance with ACM0001 (version 13.0.0).

Outcome of Step 1a: the alternatives to be taken into consideration, after step 1a) are LFG1, LFG2, E1 and E3.

Step 1b: Consistency with mandatory applicable laws and regulations:

So far, there are still no legal restrictions or requirements for LFG collection and destruction in Brazil, neither for passive venting of LFG. Therefore alternative LFG1 and LFG2 are thus under compliance with applicable mandatory laws and regulations. Also there is no legal requirement to destruct LFG either[14].

Outcome of Sub-step 1b: the remaining alternatives to be taken into consideration after step 1b) are identified as LFG1, LFG2, E1 and E3.

Procedure for estimating the end of the remaining lifetime of existing equipment

As per ACM0001 (version 13.0.0), this procedure is only applicable if LFG has been utilized in existing equipment that was in operation prior to the implementation of the project activity. The project activity, of which the baseline scenario is identified as the atmospheric release of the LFG (without use of any equipment) will be implemented in an existent and operational landfill where no type of LFG utilization equipment is currently in place or would be in place in the absence of the project. Moreover, all equipment to be used for collecting and destroying LFG under the project scenario (including the enclosed flare(s)) will represent acquisition of new equipment by the project participant (as the project design does not encompass utilization of previously used equipment and/or equipment to be transferred from another site). Therefore, this procedure is not applied. This is in accordance with ACM0001 (version 13.0.0).

Prior consideration of CDM

As clearly defined in the CDM Project Standard, if the start date of the project activity is not prior to the date of publication of the PDD for the global stakeholder consultation, evidence of the prior

[14] Currently, Brazil has a National Waste Policy Directive called "*Política Nacional de Resíduos Sólidos*" (National policy for Solid Waste). This directive was instituted as a Federal Law by the Presidential Law 12305 (published on 02/08/2010). This Directive is applicable, according to §1 of Article 1 to companies or individuals, from public or private domain, responsible for waste generation and waste management. The law establishes legal grounds for waste management, including final destination, i.e. landfills. By establishing directives for management of solid waste, the law aims to be a legal framework for promoting overall improvement of waste management practices in Brazil. The "*Política Nacional de Resíduos Sólidos*" does not even refer to LFG, LFG flaring nor other types of LFG destruction or utilization technologies. Therefore it is demonstrated that LFG destruction or utilization is not mandatory in Brazil. The "*Política Nacional de Resíduos Sólidos*" is available online: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm

On 15/02/2013, there were 31 LFG flaring and/or power generation projects hosted in Brazil and registered as CDM project activities by UNFCCC. All LFG collection and destruction/utilization initiatives in Brazil are implemented as CDM project activities. That fact sustains that LFG destruction or utilization is not an obligation in Brazil.

consideration of the CDM (in accordance with applicable provisions related to the demonstration of prior consideration of the CDM in the Project standard) is not required. Although the start of the project activity is forecasted to occur only after its successful registration as a CDM project activity, the project participant has anyway informed UNFCCC and the DNA of Brazil about the intention to seek CDM status for a the project activity. Such notifications were made on 15/10/2012[15].

A timeline summarizing the chronology of relevant events that demonstrates prior CDM consideration for the project is presented under Section B.5.

B.5. Demonstration of additionality

>>

On the next steps, it is demonstrated the additionality of the project by adopting Steps 2, 3 and 4 of the "Combined tool to identify the baseline scenario and demonstrate additionality" (version 05.0.0). This section also complements the establishment of the baseline scenario for the project, which is described in Section B.4. [16]

STEP 2: Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

In Brazil there are currently no LFG collection and destruction/utilization (by use of high temperature flares and utilization of collected LFG as fuel for electricity generation) initiatives implemented or under implementation apart of the project-based ones which are currently registered as CDM project activities or under validation stage. In the view of the project participant, local competence in terms of technology for LFG collection, LFG destruction in enclosed high temperature flares and LFG utilization as gaseous fuel for electricity generation have indeed been developed within the latest years in Brazil. This is clearly a positive externality of the CDM in Brazil and other countries in Latin America. Moreover, suppliers (or representatives of the suppliers) of related LFG collection, LFG destruction and LFG utilization equipment are currently also established in Brazil. Therefore, in the view of the project participant, currently there are no technical, logistic or competence barriers for the implementation of LFG collection and destruction/utilization initiatives in landfills in Brazil. The project participant acknowledges however that use of LFG as fuel for electricity generation still not being common practice in Brazil (even when the initiatives implemented as CDM project activities are considered).

Outcome of Step 2a: No barriers are identified for the alternatives the implementation of the project activity (baseline alternatives LFG1 and E1) either in the context of the assessment and demonstration of additionality for the project activity.
As the alternatives LFG2 and E3 represent the continuation of current practice (with no investment being performed by the project participants), no barriers are identified also for the alternatives LFG1 and E1 in the context of the identification of baseline scenario (continuation of identification of baseline scenario as described in Section B.4).

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

In the context of the assessment and demonstration of additionality, the implementation of the proposed project activity without CDM (alternatives LFG1 and E1) is identified as not prevented by the barriers.

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[15] Documented evidences of prior CDM consideration information sent to both UNFCCC and DNA of Brazil was made available to the DOE in charge of the CDM validation assessment.

[16] Section B.4 and section B.5 below are complementary. Thus, the application of the steps of the "Combined tool to identify the baseline scenario and demonstrate additionality" as undertaken in Section B.4 are also applicable in the context of the demonstration of additionality. On the other hand, steps of this methodological tool as undertaken in Section B.5 are also applicable in the context of the determination of baseline scenario.

In the context of the identification of the baseline scenario (continuation of Section B.4), the business-as-usual scenario (alternatives LFG2 and E3) are not prevented by any barrier either.

Outcome of Step 2b: No barriers were identified in Step 2a.

Step 2: Scenarios LFG1 + E1 and LFG 2 + E3 remain after this step. Since the project activity is not the first-of-its-kind, Step 3 - investment analysis, is applied.

Step 3: Investment analysis

In the context of the assessment and demonstration of additionality and identification of the baseline scenario, the financial attractiveness of the remaining alternatives after Step 2 (scenarios LFG1 + E1 and LFG 2 + E3) are compared by conducting an investment analysis. As established in the "Combined tool to identify the baseline scenario and demonstrate additionality" the analysis includes alternative scenarios where the project participants do not undertake an investment, operational costs or revenues (alternatives S2 or S3 of the methodological tool).

For the present analysis the equivalence between the alternative scenarios defined in the "Combined tool to identify the baseline scenario and demonstrate additionality" and the scenarios defined in ACM0001 (version 13.0.0) are presented in the table below:

Alternative scenarios as per the "Combined tool to identify the baseline scenario and demonstrate additionality"		Applicable equivalent alternative baseline scenario as per the ACM0001 (for remaining alternatives after step 2)		Equivalence demonstrated?
S1	*"The proposed project activity undertaken without being registered as a CDM project activity"*	LFG1 and/or E1	LFG1: "*The project activity implemented without being registered as a CDM project activity (i.e. capture and flaring or use of LFG)"* E1: "*Electricity generation from LFG, undertaken without being registered as CDM project activity."*	Yes
S2	"*No investment is undertaken by the project participants but third party(ies) undertake(s) investments or actions which provide the same output to users of the project activity.*"	E3	*"Electricity generation in existing and/or new grid-connected power plants"*	Yes
S3	"*Where applicable, the continuation of the current situation, not requiring any investment or expenses to maintain the current situation such as (…) the continued venting of methane from a landfill*"	LFG2 and E3	LFG2: "*Atmospheric release of the LFG or partial capture of LFG and destruction to comply with regulations or contractual requirements, or to address safety and odour concerns*";	Yes

Alternative scenarios as per the "Combined tool to identify the baseline scenario and demonstrate additionality"		Applicable equivalent alternative baseline scenario as per the ACM0001 (for remaining alternatives after step 2)		Equivalence demonstrated?
			E3: *"Electricity generation in existing and/or new grid-connected power plants".*	
S4	*"Continuation of the current situation, requiring an investment or expenses to maintain the current situation"*	N/A	-	-
S5	*"Other plausible and credible alternative scenarios to the project activity scenario, including the common practices in the relevant sector, which deliver the same output."*	N/A	-	-
S6	*"Where applicable, the .proposed project activity undertaken without being registered as a CDM project activity to be implemented at a later point in time (e.g. due to existing regulations, end of-life of existing equipment, financing aspects)."*	N/A	-	-

As one of the combined alternative scenarios remaining after Step 2 corresponds to the situation equivalent to S3 and S2 (when the project's electricity generation component is considered), the Net Present Value (NPV) is chosen as the financial indicator for the analysis of those alternative scenarios.

This is in accordance with the the "Combined tool to identify the baseline scenario and demonstrate additionality". For alternative baseline scenarios LFG1 and E1 (equivalent to S1), the proposed project activity being undertaken without being registered as CDM project is analyzed below, also choosing the NPV as financial indicator.

It is important to note that implementation of the project's electricity generation component (defined as alternative E1 – when CDM revenues are not considered) is fully dependent on the implementation of a complete LFG capture and flaring system (which is defined as alternative LFG 1 – when CDM revenues are not considered). Normally, in a typical LFG collection and utilization initiative (with captured LFG being utilized for electricity generation), under planned or unplanned interruptions of operation of the electricity generation facility, LFG is normally sent to the flaring system for combustion (*inter alia* due to safety concerns). Due to that, alternative baseline scenario E1 is analysed as an alternative which is combined with alternative LFG1.

LFG1+E1

Main assumptions of the LFG1+ E1 scenario: electricity generation in the absence of CDM registration, are:

1. *Electricity sale price:* At this stage, the most reasonable assumption is that the electricity generated by the project activity will be exported through the electricity grid and it will be commercialized through an electricity supply auction as per the applicable rules and procedure of the regulated power market in Brazil. In Brazil, the results last occurred two electricity supply auctions of electricity at the time of the decision making process for the implementation of the project activity were as follows:
   - The so-called "*Leilão de Energia de Reserva*" (Auction for reserve power) of which the results were made publicly available on 18/08/2011[17]. As per the results of this action, price ceiling for electricity generated from biomass source (which is the category that electricity generation using LFG as fuel fits within the rules and practice of the Brazilian power market) were set as BRL 100.40 per MWh;
   - The so-called "*Leilão de Energia A3/2011*" (Energy A3/2011[18] Auction) of which the results were made publicly available on 17/08/2011[19]. As per the results of this action, price ceiling for electricity generated from biomass source was set as BRL 102.41 per MWh.

   For sake of conservativeness, the highest electricity price is considered in the context of income due to commercialization of excess electricity generated by the project activity within the investment analysis: BRL 102.41 per MWh.

2. *Refurbishment/Residual values of engine generation sets and remaining equipment for the project's electricity generation component*: As the expected lifetime of the project equipment is at least 20 years[20], no equipment refurbishment is planned. The applicable depreciation period is 10 years according to Brazilian Accounting Principles[21]; therefore at the end of the 20 year period of assessment, salvage value of the equipment is void.

3. *Exchange rate*: As exchange rate, an average value of 2.45 BRL/EUR was used in the financial analysis. This value corresponds to the average historical exchange rates from October 2011 to September 2012, the 12 months prior to the decision making process for developing the project activity.

4. *Benchmark rate:* In accordance with the "Guidelines on the assessment of investment analysis" (version 5) a default and conservative value for the expected minimum return on equity is used as a benchmark rate. The relevant benchmark for energy projects in Brazil (Group 1 with Moody's rating Baa3 as given in the guidelines) is 11.75% in real terms.
   Provided that the investment analysis is carried out in nominal terms, and as per the "Guidelines on the assessment of investment analysis" (version 5): "*In situations where an investment analysis is carried out in nominal terms, project participants can convert the real term values provided (…) to nominal values by adding the inflation rate. The inflation rate shall be obtained*

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[17] http://www.epe.gov.br/imprensa/PressReleases/20110818_1.pdf accessed in 10/10/2012.

[18] Note: A3/2011 means that the electricity auctioned in this procedure must be available 3 years after the auction: 2014, which is the year were most probably power generation from LFG on this project activity will enter into operation. This value obtained in this auction is thus a good indication of electricity sale price in 2013 and 2014.

[19] http://www.epe.gov.br/imprensa/PressReleases/20110817_1.pdf accessed in 10/10/2012.

[20] Source: similar UNFCCC registered projects.

[21] http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Taxation%20and%20Investment%20Guides/2013/dttl_tax_highlight_2013_Brazil.pdf accessed on 16/05/2013

from the inflation forecast of the central bank of the host country for the duration of the crediting period. If this information is not available, the target inflation rate of the central bank shall be used. If this information is also not available, then the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) or the World Bank for the next five years after the start of the project activity shall be used." As the inflation forecast and target inflation rate from the Brazilian Central Bank is only available until 2014[22], project participants choose the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) from 2013 to 2017.

According to the mentioned source the average inflation forecast for the Host Country over the next five years is presented on the following table[23]:

Year	2013	2014	2015	2016	2017	**Average**
Inflation Rate (%)	4.969	4.767	4.500	4.500	4.500	**4.6472**

Thus the benchmark rate in nominal terms is: 11.75%+4.6472%=16.40%

5. *Taxes*[24]: The combined company income tax rate in Brazil is 34%. Sales tax in Brazil is composed by the so-called ICMS, PIS and COFINS taxes. ICMS will only be applicable if the energy is sold to a final client, since this option is not defined at this time, ICMS will not be included in the analysis. This is conservative. The applicable PIS rate is 1.65% and the applicable COFINS rate is 7.60% over the projected electricity sale income. This is in accordance with current tax legislation in Brazil.

6. *Investment costs:* The forecasted installed capacities for both the LFG destruction and LFG utilization components of the project are entirely based on derived forecasts for quantity of LFG to be collected as per the LFG generation model which is applied in the methodological tool "Emission from Solid Waste Disposal Sites" (version 06.0.1).

While it is acknowledged there are significant uncertainty sources in the application such LFG generation model, all the technical options and associated investment costs will be reviewed after the project is in stable and predictable operation and will account for new technical options available at that time[25]. By considering the projections of LFG generation based on the predictions by project participants of waste amounts to be disposed at the landfill, it is assumed the implementation of electricity generation facility with final nameplate installed power generation capacity of 3,180 kW according to the following time schedule for gradual expansion of the project's electricity generation component:

[22] http://www.bcb.gov.br/pec/metas/InflationTargetingTable.pdf accessed on 10/10/2012

[23] http://www.imf.org/external/pubs/ft/weo/2012/01/weodata/weorept.aspx?pr.x=86&pr.y=14&sy=2013&ey=2017&scsm=1&ssd=1&sort=country&ds=.&br=1&c=223&s=PCPIPCH&grp=0&a=http://www.imf.org/external/pubs/ft/weo/2012/01/weodata/weorept.aspx?pr.x=86&pr.y=14&sy=2013&ey=2017&scsm=1&ssd=1&sort=country&ds=.&br=1&c=223&s=PCPIPCH&grp=0&a= accessed on 05/08/2012

[24] Brazil Highlights 2012, from Deloitte International Tax document delivered to the DOE describing the corporate tax system in Brazil as well as the description of ICMS, PIS and COFINS taxes. Also available at http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Taxation%20and%20Investment%20Guides/2013/dttl_tax_highlight_2013_Brazil.pdf accessed on 16/05/2013

[25] If required and applicable, eventual post-registration changes in the project design main aspects (such as installed power generation capacity for the project's electricity generation component as per information currently made available in the PDD) will be addressed as per applicable CDM procedure/rules for requesting approval of post-registration changes.

Year	2014	2015	2021
Total nameplate installed electricity generation capacity (kW)	1,060	2,120	3,180

Ancillary equipment for the project's electricity generation component include an appropriate LFG treatment (filtering) unit (in order to clean LFG prior of being sent to the engine-generator set(s) of the electricity generation facility), a supervision system, power connection to the grid (including appropriate protection system, power transformers, etc.). These additional investment requirements were conservatively not included in the investment analysis (as the project participants are not yet aware about the exact location of the power interconnection point to deliver generated electricity – this is to be opportunely evaluated and decided by the local electricity distribution company)[26]. Related engineering, project management costs and the backup captive off-grid electricity generator (fuelled by diesel) were not included in the investment analysis either. This is conservative.

The total required investment for the implementation of the project's LFG flaring plant and the 3,180 kW installed capacity electricity generation facility plant is 2,164,945 €[27].

7. *Operation and maintenance costs (O&M costs):* Maintenance costs for the engine-generator set(s) fuelled by LFG + ancillary equipment are assumed as proportional to the amount of electricity generated and are estimated in 20.20 € per MWh. Project participants assume an equipment availability (power capacity) of 85%[28], which results in an average electricity generation of 14.46 GWh per year during the period from 01/07/2014 to 30/06/2021. Other related O&M costs are regarded as "fixed" and include manpower, operation and maintenance of the LFG collecting system, operation and maintenance of the LFG destruction plant. These costs are estimated at approximately 195,357 € per year.

8. *NPV calculation and conclusion*: By considering_assumptions outlined above, the net present value (NPV) for LFG capture and electricity generation (in the absence of CDM revenues) is negative: - 1,102,883 €.

A sensitivity analysis based on the variation of +/- 10% of the critical parameters – electricity sale price, investment cost, operating costs, exchange rate between Euro (EUR) and Brazilian Real (BRL) and LFG generation shows that the NPV remains negative in all cases (see NPV figures in table below). The chosen parameters are considered to have a significant impact on the financials of the project:

- Electricity sale price: project revenue in this scenario;
- Exchange rate: volatility of currencies to be taken into account as main equipment is bought in Europe whereas the project is located in Brazil;
- Investment cost: initial CAPEX;
- Operating costs: as stated above, operating costs include fixed costs and variable costs. Variable costs are related to the maintenance of generators and depend on electricity production. Both kinds of costs have been considered in the sensitivity analysis;
- LFG generation: it has a direct impact on electricity production.

[26] The length of the transmission line to be built for exporting electricity generated by the project activity (and related investment requirements) depends on the location of the power interconnection point to deliver generated electricity (of which, as per applicable rules of the power sector in Brazil, is to be opportunely evaluated and decided by the local electricity distribution company).

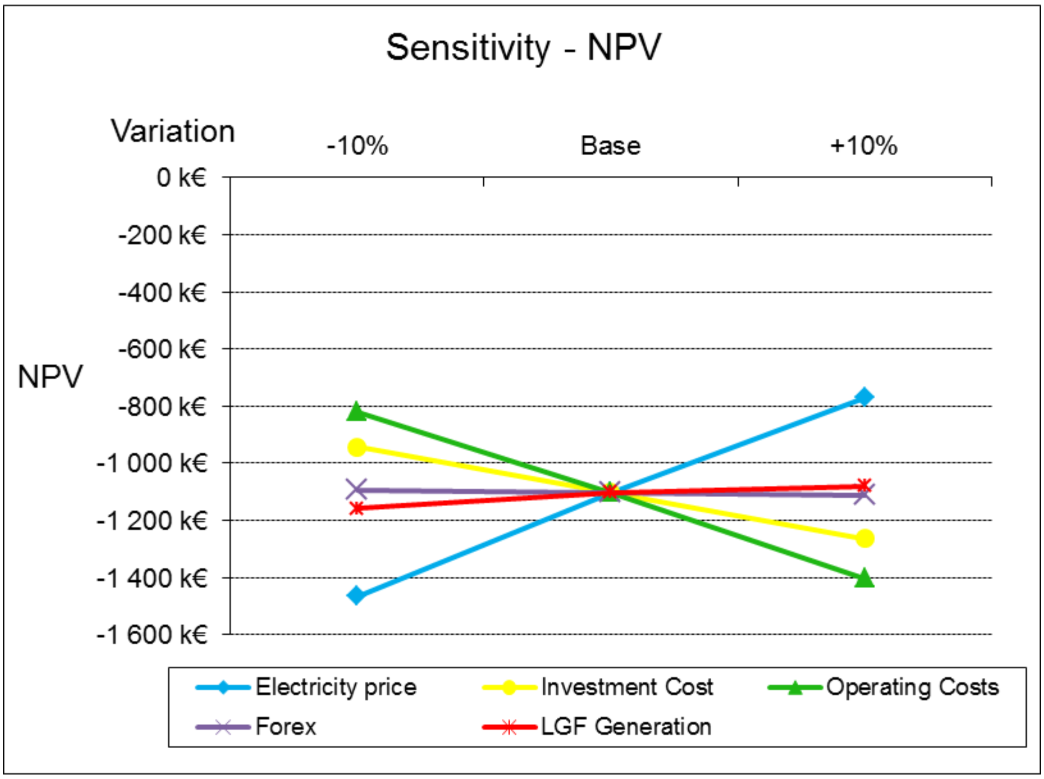
[27] Detailed analysis provided in financial spread sheet that contains the sources of the budgets obtained from suppliers to the equipment's that are expected to be installed as part of the project activity.

[28] Availability was estimated based on professional experience of LFG to electricity experts hired by the project participants.

The next table shows a sensitivity analysis of the project's NPV calculation, by individually changing key parameters such as electricity price, investment costs, operating costs, forex and LFG generation in a -10%, base scenario, and +10% ranges.

Sensitivity analysis

Parameter	Variation	Electricity price	Investment Cost	Operating Costs	Forex	LFG Generation
NPV	-10%	-1 464 724 €	-942 073 €	-818 813 €	-1 093 687 €	-1 159 019 €
	Base	-1 102 883 €	-1 102 883 €	-1 102 883 €	-1 102 883 €	-1 102 883 €
	+10%	-771 218 €	-1 264 820 €	-1 403 854 €	-1 111 735 €	-1 079 827 €



The project's NPV reaches zero if electricity price is increased in 36%, or if the required capital investment is decreased in 71%, or if total annual maintenance costs are decreased by 43 %[29]. Variations of the exchange rate and variations in the amount of methane generated in order to have the project NPV reaching the value zero does not lead to plausible results.

<u>LFG2 and E3</u>

As per the application of the investment analysis by following applicable guidance of the "Combined tool to identify the baseline scenario and demonstrate additionality" the NPV for the scenario LFG2 and E3 is 0[30].

Conclusion

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[29] Details provided in financial spread sheet in NPV I, II and III.

[30] As per the "Combined tool to identify the baseline scenario and demonstrate additionality" for alternative scenarios that correspond to the situation described in S2 or S3 and that do not involve/require any investment capital, operational costs or revenues, and if the financial indicator is the NPV, a value of zero is assumed to the NPV.

Based on this analysis the alternative scenarios ranked by NPV decreasing order:

Alternative scenarios by NPV decreasing order	NPV
LFG2 + E3	0 €
LFG1 + E1 (Base scenario of the sensitivity analysis)	- 1,102,883 - 1,102,883 €

The figures presented in the table above confirm that the most attractive scenario is the baseline scenario (alternative LFG2 + E3) (no investment is undertaken by the project participants but third parties undertake investments or actions which provide the same output to users of the project activity).

According to the "Combined tool to identify the baseline scenario and demonstrate additionality" the baseline scenario is not the project activity being undertaken without being registered as a CDM project.

Outcome of step 3: The baseline scenario is the most attractive scenario and the baseline scenario is not the project activity being undertaken without being registered as a CDM project, and the project without the CDM revenues is demonstrated to be not economically attractive.

Step 4. Common practice analysis

The proposed CDM project activity comprises methane destruction and its utilization as gaseous fuel for electricity generation. Methane Destruction is listed in the definitions section of the the "Combined tool to identify the baseline scenario and demonstrate additionality", therefore we proceed to Step 4a.

Step 4a . The proposed CDM project activity(s) applies measure(s) that are listed in the definitions section above

The second Brazilian Greenhouse Gases Emissions Inventory Report (published in July/2010)[31], states that from 1990 to 2002 the total amount of recovered methane in Brazilian landfills were considered as zero. Furthermore, from 2003 onwards, all flared/recovered methane considered in the Inventory came from CDM landfill projects in Brazil.

A recent study[32] developed by the regional section of Santa Catarina State of the Brazilian Environmental Engineering Association (ABES) mentions that only existing landfill located at Santa Catarina State where the LFG is collected and destructed by flaring is the Biguaçú landfill which actually hosts a project activity promoting collection and destruction of LFG, the "Proactiva Tijuquinhas Landfill Gas Capture and Flaring Project" currently registered as an UNFCCC CDM project activity under registration number 1506.

Through the performance of a search query on the ANEEL[33] database[34] for power generation plants using LFG as fuel and by also searching at the UNFCCC's CDM website project search interface for similar project activities registered or under validation [35], the project participant finds the following registered projects, thus confirming that all the power generation plants using LFG as fuel are also initiatives registered as CDM projects:

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[31] Source: Ministry of Science and Technology. The second Brazilian Greenhouse Gases Emissions Inventory Report. Page 62. http://www.mct.gov.br/upd_blob/0213/213909.pdf, accessed on 10/10/2012.

[32] http://www.fatma.sc.gov.br/images/stories/Documentos/relatrio_abes-mp_verso_final.pdf, accessed on 10/10/2012.

[33] ANEEL - Brazilian Electricity Regulatory Agency

[34] http://www.aneel.gov.br/aplicacoes/autorizacoes/default_aplicacao_acompanhamento.cfm?IDACOMPANHAMENTOTIPO=1 accessed on 10/10/2012.

[35] http://cdm.unfccc.int/Projects/projsearch.html, accessed on 10/10/2012.

Plant	Company	Power (MW)	City	State	CDM UNFCCC Project	
UTE Sapopemba	Ecourbis Ambiental S.A.	25.60	São Paulo	SP	5947	CTL Landfill Gas Project
UTE Bandeirante	Biogás Energia Ambiental S.A.	20.00	São Paulo	SP	164	Bandeirantes Landfill Gas to Energy Project (BLFGE)
UTE São João Biogás	Enterpa Ambiental S.A.	20.00	São Paulo	SP	373	São João Landfill Gas to Energy Project (SJ)

As a conclusion, there are no initiatives similar to the proposed project activity being implemented or previously implemented in Brazil without CDM benefits being considered. All landfills that are currently hosting initiatives promoting LFG capture and electricity generation using LFG as gaseous fuel are being developed or were developed as CDM project activities.

Sub-step 4a(1): Not required since as previously demonstrated $N_{all} = 0$;

Sub-step 4a(2): $N_{all} = 0$;

Sub-step 4a(3): $N_{diff} = 0$;

Sub-step 4a(4): $F=1 - N_{diff} / N_{all}$;

The applicable values for N_{all} and N_{diff} are determined as zero as in Brazil apart from the above-listed registered CDM project activities, LFG is currently not used as gaseous fuel under any type of energy valorization initiative (fuel for electricity generation using turbines or fuel cells; combustion in boilers, etc.) Thus, the value for factor F (calculated as "$F = 1 - N_{diff}/N_{all}$") is thus directly assumed as not determinable (1 minus an undeterminable ratio (0/0)).

By taking into account the non-determined value for factor F, the following conditions of the methodological tool for having the proposed project activity being regarded as common practice within a sector in the applicable geographical area are therefore not simultaneously met:

- Factor F > 0.2
- N_{all}-N_{diff} > 3.0

As per the "Combined tool to identify the baseline scenario and demonstrate additionality", both conditions should be simultaneously fulfilled in order to have the proposed project activity being regarded as common practice within the sector in the applicable geographical area. While no value for Factor F is determinable the proposed project activity is not regarded as common practice.

If outcome of Step 4 is that the proposed project activity is not regarded as common practice, then the proposed project activity is additional

Conclusion: The project activity is additional.

Chronology of events

The timeline below summarizes the chronology of relevant events that demonstrates prior CDM consideration for the project activity.

Date	Event
15/10/ 2012	Constitution of the Specific Purpose Company named “Itajaí Biogás e Energia S.A.” with the objective of developing, implementing and operating a potential CDM project activity encompassing LFG collection and destruction/utilization at the Canhanduba landfill.
30/10/2012	Submission of the communication letters to UNFCCC and to the DNA of Brazil (Prior consideration of the CDM form (Version 02.0)), informing the intention of “Itajaí Biogás e Energia S.A.” to seek CDM status for the project activity.
23/11/2012	Finalization of the initial draft validation version of the Project Design Document (PDD) (Version 2, dated 15/11/2012) and its webhosting at UNFCCC’s CDM website.
01/04/2014	Expected starting date of the project activity.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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In accordance with ACM0001 (version 13.0.0) and applicable methodological tools, yearly emission reductions (ER_y) to be achieved by the project activity during the 7-year renewable crediting period are determined (in tCO_2e) as follows:

Determination of Emission Reductions

$$ER_y = BE_y - PE_y \quad \textbf{(0)}$$

Where:

BE_y	=	Baseline emissions in year *y* (in tCO_{2e}/yr)
PE_y	=	Project emissions in year *y* (in tCO_{2e}/yr)

Determination of Baseline Emissions

Baseline emissions (BE_y) are determined according to the following equation and comprise the following sources:

(A) Methane emissions from anaerobic waste decomposition in the considered solid waste disposal site (SWDS) in the absence of the project activity;

(B) Electricity generation (in amount equivalent to the amount of electricity generated by the project’s electricity generation component) using existing fossil fuel energy sources

connected to the National Electricity Grid of Brazil and new additions of power generation sources in the absence of the project activity;

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

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

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

Where:

$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (in tCO_2e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year *y* (in tCO_2e/yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year *y* (in tCO_2e/yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year *y* (in tCO_2e/yr)

In the particular case of the project activity, as no collected LFG is expected to be used as gaseous fuel for heat generation purposes and as no collected LFG is expected to be injected in a natural gas distribution pipeline or even displace/complement the use of natural gas, $BE_{HG,}$y and $BE_{NG,y}$ are not applicable in the context of the determination of baseline emissions.

Thus, in accordance with ACM0001 (version 13.0.0) the baseline emissions are calculated as follows and in accordance to the following stepwise approach:

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad \textbf{(2)}$$

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

Baseline emissions of methane from the anaerobic waste decomposition in the considered SWDS ($BE_{CH4,y}$) are determined (in tCO_2e/yr) as per the formulas presented below, based on the amount of methane that is actually captured and combusted under the project activity and also by taking in account the amount of methane that would be captured and destroyed in the landfill in the absence of the project activity (baseline scenario). In addition, the effect of methane oxidation that is assumed as existing in the baseline and not in the project scenario is taken into account:[36]

$$BE_{CH4,y} = (1 - OX_{top\_layer}) * (F_{CH4,PJ,y} - F_{CH4,BL,y}) * GWP_{CH4} \quad \textbf{(3)}$$

Where:

[36] As established by ACM0001 (version 13.0.0), the ex-ante determined parameter $OX_{top\text{-}layer}$ is the fraction of the methane that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool “Emissions from solid waste disposal sites”. In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive to main a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

OX_{top_layer}	=	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline scenario (dimensionless)
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (in tCH_4/yr)
$F_{CH4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline (absence of project activity) in year *y* (in tCH_4/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (in tCO_2e/tCH_4)

Step A.1: Ex post determination of $F_{CH4,PJ,y}$

As per ACM0001 (version 13.0.0), during the crediting period, the amount of methane in the LFG which is flared and/or utilized by the project activity, $F_{CH4,PJ,y}$, is to be determined (in tCH_4/yr) as the sum of the measured quantities of methane flared and used in power plant(s), boiler(s), air heater(s), glass meting furnace, kiln(s) and natural gas distribution network (whenever applicable), as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad \textbf{(4)}$$

Where:

$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (in tCH_4)
$F_{CH4,EL,y}$	=	Amount of methane in the LFG which is used for electricity generation in year *y* (in tCH_4/yr)
$F_{CH4,HG,y}$	=	Amount of methane in the LFG which is used for heat generation in year *y* (in tCH_4/yr), zero under the current project activity
$F_{CH4,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network in year *y* (in tCH_4/yr), zero under the current project activity

As also established by ACM0001 (version 13.0.0), $F_{CH4,EL,y}$, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are determined by using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, and by monitoring the working hours of the power plant(s), boiler(s), air heater(s), glass melting furnace(s) and kiln(s) (if applicable), so that no emission reduction are claimed for methane destruction during non-working hours of the LFG utilization source in question. This is taken into account by monitoring the hours, *h*, that the equipment, *j*, utilizing the LFG is operating in year *y* ($Op_{j,h,y}$).

In the particular case of the project activity, as no collected LFG is expected to be used as gaseous fuel for heat generation purposes and as no collected LFG is expected to be injected in a natural gas distribution pipeline or even displace/complement the use of natural gas, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are not applicable in the context of the determination of $F_{CH4,PJ,y}$., thus the amount of methane in the LFG which is flared and/or utilized by the project activity will be determined by:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} \quad \textbf{(5)}$$

Where:

$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (in tCH_4)
$F_{CH4,EL,y}$	=	Amount of methane in the LFG which is used for electricity generation in year *y* (in tCH_4/yr)

Determination of the amount of methane in collected LFG which is destroyed by flaring ($F_{CH4,flared,y}$)

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

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}} \quad (6)$$

Where:

$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (in tCH_4/yr)
$F_{CH4,sent\_flare,y}$	=	Amount of methane in the LFG which is sent to the flare in year *y* (in tCH_4/yr)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year *y* (in tCO_2e/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (in t CO_2e/t CH_4)

$F_{CH4,sent\_flare,y}$ is determined directly using applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", by applying the requirements defined in ACM0001 (version 13.0.0) where the gaseous stream the tool shall be applied to is the LFG delivery pipeline to the flare(s).

- The gaseous streams the methodological tool shall be applied to are the streams of LFG which are delivery to flaring (in the project's LFG destruction facility) and to each item of electricity generation equipment *j* (in the project's electricity generation component).
- CH_4 is the greenhouse gas for which the mass flow is determined;
- The flows of the gaseous stream directed to flaring and to utilization in the project's electricity generation facility are to 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 flows should be calculated on a an hourly basis for each hour *h* in year *y*;

Determination of the amount of methane in collected LFG which is used for electricity generation ($F_{CH4,EL,y}$)

$F_{CH4,EL,y}$ is determined directly using applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", by applying the following requirements defined in ACM0001 (version 13.0.0):

- The gaseous streams the methodological tool shall be applied to is the streams of LFG to each item of electricity generation equipment *j* (in the project's electricity generation component).
- CH_4 is the greenhouse gas for which the mass flow is determined;
- The flows of the gaseous stream directed to flaring and to utilization in the project's electricity generation facility are to 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 flows should be calculated on a an hourly basis for each hour *h* in year *y*;
- The mass flows calculated for hour *h* is 0 if the equipment is not working in hour *h* ($Op_{j,h}$ = not working), the accumulated hourly values are then summed to a yearly unit basis.

The mentioned "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" will be applied to determine $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$ using Option 2: *Simplified calculation without measurement of the moisture content*, and one of the options A, C or D, depending on project conditions and equipment, stated in the following table will be applied to the greenhouse gas

measured by the methodology (CH_4). In the tool the mass flow of greenhouse gas in a gaseous stream, as $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$, are represented as $F_{i,t}$.

Option 2: Simplified calculation without measurement of the moisture content

This option provides a simple and conservative approach to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. If it is conservative to assume that the gaseous stream is dry, then $m_{H2O,t,db}$ is assumed to equal 0. If it is conservative to assume that the gaseous stream is saturated, then $m_{H2O,t,db}$ is assumed to equal the saturation absolute humidity ($m_{H2O,t,db,sat}$) and calculated using equation (5).

$$m_{H_2O,t,db,SAT} = \frac{p_{H2O,t,Sat} * MM_{H2O}}{(P_t - p_{H2O,t,Sat}) * MM_{t,db}} \quad \textbf{(7)}$$

Where:

$m_{H2O,t,db,sat}$	= Saturation absolute humidity in time interval *t* on a dry basis (in kg H_2O/kg dry gas)
$p_{H20,t,sat}$	= Saturation pressure of H_2O at temperature T_t in time interval *t* (in Pa)
T_t	= Temperature of the gaseous stream in time interval *t* (in K)
P_t	= Absolute pressure of the gaseous stream in time interval *t* (in Pa)
MM_{H2O}	= Molecular mass of H_2O (in kg H_2O/kmol H_2O)
$MM_{t,db}$	= Molecular mass of the gaseous stream in a time interval *t* on a dry basis (in kg dry gas/kmol dry gas) with $MM_{t,db}$ is estimated using the following equation.

$$MM_{t,db} = \sum_i (v_{i,t,db} * MM_k) \quad \textbf{(8)}$$

Where:

$MM_{t,db}$	= Molecular mass of the gaseous stream in time interval *t* on a dry basis (in kg dry gas/kmol dry gas)
$v_{k,t,db}$	= Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis (in m³ gas k/m³ dry gas)
MM_k	= Molecular mass of gas *k* (in kg/kmol)
k	= All gases, except H_2O, contained in the gaseous stream (e.g. N_2, CO_2, O_2, CO, H_2, CH_4, N_2O, NO, NO_2, SO_2, SF_6 and PFCs). See available simplification below

The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (*k*) in the gaseous stream. However as a simplification, the volumetric fraction of only the gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen. The simplification is not acceptable if it is differently specified in the underlying methodology.

Depending on the project conditions and equipment one of the following measurement options will be chosen and the following formulas applied:

Option	Flow of gaseous stream	Volumetric fraction
A	Volume flow dry basis	Dry or wet basis[37]
C	Volume flow wet basis	Wet basis
D	Mass flow dry basis	Dry or wet basis

Option A

Flow measurement on a dry basis is not doable for a wet gaseous stream. Therefore, it is necessary to demonstrate that the gaseous stream is dry to use this option. There are two ways to do this:

- Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H_2O/m^3 dry gas; or
- Demonstrate that the temperature of the gaseous stream (T_t) is less than 60ºC (333.15 K) at the flow measurement point.

If it cannot be demonstrated that the gaseous stream is dry, then the flow measurement should be assumed to be on a wet basis and the corresponding option from the table above should be applied instead.

The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad \textbf{(9)}$$

with

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad \textbf{(10)}$$

Where:

$F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (in kg gas/h)
$V_{t,db,n}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis at normal conditions (in m³ dry gas/h)
$v_{i,t,db}$ = Volumetric fraction of greenhouse gas *i* in the gaseous stream in time interval *t* on a dry basis (in m³ gas *i*/m³ dry gas)
$\rho_{i,t}$ = Density of greenhouse gas *i* in the gaseous stream (in kg gas *i*/m³ gas *i*)
P_t = Absolute pressure of the gaseous stream in time interval *t* (in Pa)
MM_i = Molecular mass of greenhouse gas *i* (in kg/kmol)
R_u = Universal ideal gases constant (in Pa.m³/kmol.K)
T_t = Temperature of the gaseous stream in time interval *t* (in K)

[37] Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analysers and dry basis analysers and both types can be used indistinctly for calculation Options A and D.

Option C

The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,wb,n} * v_{i,t,wb} * \rho_{i,n} \quad \textbf{(11)}$$

with

$$\rho_{i,n} = \frac{P_n * MM_i}{R_u * T_n} \quad \textbf{(12)}$$

Where:

$F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (in kg gas/h)
$V_{t,wb,n}$ = Volumetric flow of the gaseous stream in time interval *t* on a wet basis at normal conditions (in m³ wet gas/h)
$v_{i,t,wb}$ = Volumetric fraction of greenhouse gas *i* in the gaseous stream in time interval *t* on a wet basis (in m³ gas *i*/m³ wet gas)
$\rho_{i,n}$ = Density of greenhouse gas *i* in the gaseous stream at normal conditions (in kg gas *i*/m³ wet gas *i*)
P_n = Absolute pressure at normal conditions (in Pa)
T_n = Temperature at normal conditions (in K)
MM_i = Molecular mass of greenhouse gas *i* (in kg/kmol)
R_u = Universal ideal gases constant (in Pa.m^3/kmol.K)

The following equation should be used to convert the volumetric flow of the gaseous stream from actual conditions to normal conditions of temperature and pressure:

$$V_{t,wb,n} = V_{t,wb} * (T_n/T_t) * (P_t/P_n) \quad \textbf{(13)}$$

Where:

$V_{t,wb,n}$ = Volumetric flow of the gaseous stream in a time interval *t* on a wet basis at normal conditions (in m^3 wet gas/h)
$V_{t,wb}$ = Volumetric flow of the gaseous stream in time interval *t* on a wet basis (in m³ wet gas/h)
P_t = Pressure of the gaseous stream in time interval *t* (in Pa)
T_t = Temperature of the gaseous stream in time interval *t* (in K)
P_n = Absolute pressure at normal conditions (in Pa)
T_n = Temperature at normal conditions (in K)

Option D

Flow measurement on a dry basis is not doable for a wet gaseous stream. Therefore, it is necessary to demonstrate that the gaseous stream is dry to use this option. There are two ways to do this:

- Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H_2O/m^3 dry gas; or
- Demonstrate that the temperature of the gaseous stream (T_t) is less than 60ºC (333.15 K) at the flow measurement point.

If it cannot be demonstrated that the gaseous stream is dry, then the flow measurement should be assumed to be on a wet basis and the corresponding option from the above table should be applied instead.

The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined using equations (7) and (8). The volumetric flow of the gaseous stream in time interval *t* on a dry basis ($V_{t,db}$) is determined by converting the mass flow of the gaseous stream to a volumetric flow as follows:

$$V_{t,db} = M_{t,db} / \rho_{t,db} \quad \textbf{(14)}$$

Where:

$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (in m^3 dry gas/h)
$M_{t,db}$ = Mass flow of the gaseous stream in time interval *t* on a dry basis (in kg/h)
$\rho_{t,db}$ = Density of the gaseous stream in time interval *t* on a dry basis (in kg dry gas/m^3 dry gas)

The density of the gaseous stream ($\rho_{t,db}$) should be determined as follows:

$$\rho_{t,db} = \frac{P_t * MM_{t,db}}{R_u * T_t} \quad \textbf{(15)}$$

Where:

$\rho_{t,db}$ = Density of the gaseous stream in a time interval *t* on a dry basis (in kg dry gas/m^3 dry gas)
$MM_{t,db}$ = Molecular mass of the gaseous stream in a time interval *t* on a dry basis (in kg dry gas/kmol dry gas)
P_t = Pressure of the gaseous stream in time interval *t* (in Pa)
T_t = Temperature of the gaseous stream in time interval *t* (in K)

The molecular mass of the gaseous stream ($MM_{t,db}$) is estimated using equation (6).

The option selected will be one of the options A, C or D as stated, however the selected option will depend on the environmental conditions (atmospheric and climatic conditions, humidity of the site etc.) and the choice of equipment (mass flow meter, gas dryer, etc.). So this option can be changed in a future stage, and will be address ex-post.

Determination of $PE_{flare,y}$ (required for the determination of $F_{CH4,flared,y}$)

$PE_{flare,y}$ will be determined using the methodological tool "Project emissions from flaring". If LFG is flared through more than one flare, then $PE_{flare,y}$ is the sum of the emissions for each flare determined separately.

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$)[38]. The flare efficiency is determined for each minute *m* of year *y* based either on monitored data or default values.

The project emissions calculation procedure is given in the following steps:

STEP 1: Determination of the methane mass flow of the residual gas;

STEP 2: Determination of the flare efficiency;

STEP 3: Calculation of project emissions from flaring.

[38] While for each individual flare, the mass flow of methane to the flare ($F_{CH4,RG,m}$) is to be monitored, in case more than one flare is installed as part of the project activity, a LFG flow meter will be installed in the LFG pipeline to each individual flare.

Step 1: Determination of the methane mass flow in the residual gas

The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be used to determine, in kg, the mass flow of methane in the residual gaseous stream in the minute *m*: $F_{CH4,m}$

The following requirements apply:

- The gaseous stream tool shall be applied to the residual gas;
- The flow of the gaseous stream shall be measured continuously;
- CH_4 is the greenhouse gas *i* for which the mass flow should be determined;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and
- The time interval *t* for which mass flow should be calculated is every minute *m*.

$F_{CH4,m}$, which is measured as the mass flow during minute *m*, shall then be used to determine the mass of methane in kilograms fed to the flare in minute *m* ($F_{CH4,RG,m}$). $F_{CH4,m}$ shall be determined on a dry basis.

Step 2: Determination of flare efficiency

The flare efficiency depends on the efficiency of combustion in the flare and the time that the flare is operating. For determining the efficiency of combustion of enclosed flares there is the option to apply a default value or determine the efficiency based on monitored data. The time the flare is operating is determined by monitoring the flame using a flame detector and, for the case of enclosed flares, in addition the monitoring requirements provided by the manufacturer's specifications for operating conditions shall be met.

In the present project activity the flare efficiency for minute *m* ($\eta_{flare,m}$) will be determined by Option B.1 of the methodological tool "Project emissions from flaring", where the flare efficiency is measured in a biannual basis or, if the biannual measurements are not available, Option A of the methodological tool "Project emissions from flaring" will be used. Both options are described below:

Option A: Apply a default value for flare efficiency[39].

Option B: Measure the flare efficiency.

Option A: Default value

The flare efficiency for the minute *m* ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

(1) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute *m*;
(2) The flame is detected in minute *m* ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

[39] For enclosed flares that are defined as low height flares, the flare efficiency in the minute m (□$_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Options A or B. For example, the default value applied should be 80%, rather than 90%, and if for example the measured value was 99%, then the value to be used shall correspond to 89%.

Option B: Measured flare efficiency

The flare efficiency in the minute *m* is a measured value ($\eta_{flare,m} = \eta_{flare,calc,m}$) when the following three conditions are met to demonstrate that the flare is operating:

(1) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute *m*;
(2) The flame is detected in minute *m* ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

In applying Option B, the project participants choose to determine $\eta_{flare,calc,m}$ by using Option B.1 where related measurements are to be performed by an accredited third party entity on a biannual basis and by applying the following formula for the determination of $\eta_{flare,calc,m}$:

Option B.1: Biannual measurement of the flare efficiency

The calculated flare efficiency $\eta_{flare,calc,m}$ is determined as the average of two performed related measurements made in year *y.* $\eta_{flare,calc,y}$ is thus determined as follows:

$$\eta_{flare,calc,y} = 1 - \frac{1}{2}\sum_{t=1}^{2}\left(\frac{F_{CH4,EG,t}}{F_{CH4,RG,t}}\right) \quad \textbf{(16)}$$

Where:

$\eta_{flare,calc,y}$ = Flare efficiency in the year y

$F_{CH4,EG,t}$ = Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t (in kg)

$F_{CH4,RG,t}$ = Mass flow of methane in the residual gas (flow of LFG to the flare in the particular case of the project activity) on a dry basis at reference conditions in the time period *t* (in kg)

t = The two time periods in year y during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months

$F_{CH4,\ EG,t}$ is measured according to an appropriate national or international standard. $F_{CH4,RG,t}$ is calculated according to Step 1[40], and consists of the sum of methane flow in the minutes *m* that make up the time period *t*.

Step 3: Calculation of project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions for each minute *m* in year *y*, based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525600} F_{CH4,RG,m} * \left(1 - \eta_{flare,m}\right) * 10^{-3} \quad \textbf{(17)}$$

Where:
$PE_{flare,y}$ = Project emissions from flaring of the residual gas in year *y* (in tCO_{2e})
GWP_{CH4} = Global warming potential of methane valid for the commitment period (in tCO_{2e}/tCH_4)

[40] As per Step 1 $F_{CH4,RG,t}$ is equal to the sum of methane flow values $F_{CH4,sent\_flare,y}$, in the minutes m that make up the time period t.

$F_{CH4,RG,m}$ = Mass flow of methane in the residual gas in the minute *m* (in kg)
$\eta_{flare,m}$ = Flare efficiency in minute *m*

Step A.1.1: Ex ante estimation of $F_{CH4,PJ,y}$

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

$$F_{CH4,PJ,y} = \eta_{PJ} * BE_{CH4,SWDS,y} / GWP_{CH4} \quad \textbf{(18)}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (in tCH_4)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (in tCO_2e)
η_{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH4}	=	Global warming potential of CH_4 (in tCO_2e/tCH_4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool "Emissions from solid waste disposal sites". The following guidance should be taken into account when applying the tool:

- f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology;
- In the tool, *x* begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and
- Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

Thus, For the ex-ante estimation of the amount of methane destroyed/combusted during the year, in ton of methane ($F_{CH4,\ PJ,y}$) the calculation of $BE_{CH_4,SWDS,y}$ is given by:

$$BE_{CH4,SWDS,y} = \varphi_y * (1-f_y) * GWP_{CH4} * (1-OX) * \frac{16}{12} * F * DOC_{f,y} * MCF_y * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-k_j.(y-x)} * (1-e^{-k_j}) \quad \textbf{(TW.1[41])}$$

Where:

$BE_{CH4,SWDS,y}$	Baseline methane emissions occurring in year *y* generated from waste disposal at a SWDS during a time period ending in year *y* (in t CO_2e / yr)
x	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (*x* = 1) to year *y* (*x* = *y*)
y	Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months)
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y* (weight fraction)
$W_{j,x}$	Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (t)

[41] Equation numbers from the "Emissions from solid waste disposal sites" are prefixed with the letter "TW" to distinguish them from equations from the methodology.

φ_y	Model correction factor to account for model uncertainties for year y The default value (as per Option 1 of applicable guidance in the methodological tool) is selected. Thus, $\varphi_y = \varphi_{default}$
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*[42]
GWP_{CH4}	Global Warming Potential of methane
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	Methane correction factor for year *y*
DOC_j	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
k_j	Decay rate for the waste type *j* (1 / yr)
j	Type of residual waste or types of waste in the MSW

The value and source of information for each of the variables above are given in section B.6.2. The project participants wish to emphasize that the characteristics of the waste used as inputs for this ex-ante estimation are the ones recommended by IPCC. Due to that, no sampling of waste is necessary. Furthermore, the project activity does not prevent any waste from being deposited at the landfill.

Step A.2: Determination of $F_{CH4,BL,y}$

As required by ACM0001 (version 13.0.0), this step provides a stepwise procedure for the determination of the amount of methane that would have been captured and destroyed in the baseline scenario (absence of the project) due to regulatory or contractual requirements, or to address safety and odors concerns (collectively referred to as requirement under this step). The four cases summarized in the table below are distinguished in ACM0001 (version 13.0.0). The appropriate case is identified and justified below:

Cases for determining methane captured and destroyed in the baseline

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

<u>Requirement to destroy methane</u>

Non-existence of regional or national regulatory or contractual requirements related to LFG management in the region of the project site and in Brazil: There is no legal obligation to capture and destroy the LFG at the Canhanduba landfill.

[42] As per ACM0001 (version 13.0.0) f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for when applying ACM0001 (version 13.0.0). While) as per the methodological tool "Emissions from solid waste disposal sites". Moreover, f_y is presented as a parameter to be monitored *ex-post*; by considering the related methodological approach of ACM0001 (version 13.0.0) and ex-ante assigned value for fy, this parameter will thus not be monitored e*x-post*.

Non-existence of requirements to destroy methane due to safety or odor concerns: In the case of the project activity, there are no requirements to destroy methane due to safety or odor concerns either.

In the particular case of the Canhanduba landfill, as per the project design and licensing requirements, no LFG is to be destroyed by combustion in LFG venting drains in order to address odors or safety concerns. Direct venting of LFG through LFG venting drains (with no combustion) is enough to prevent dangerous accumulation of LFG in the inner section of the landfill. While as per the methodological approach of ACM0001 (version 13.0.0) for determination of $F_{CH4,BL,y}$ any destruction of LFG to address safety and/or odor concerns would be regarded as an existing requirement to destroy methane, it is thus assumed that, in the particular case of the Canhanduba landfill, there is no requirement to destroy methane.

By taking this assumption into account, thus, Case 2 and Case 4 are not applicable for the determination of $F_{CH4,BL,y}$.

Existing LFG capture and destruction system

Non-Existence of LFG capture and destruction system at the Canhanduba landfill: By taking into account the definitions of "LFG capture system" and "existing LFG capture system" as per ACM0001 (version 13.0.0)[43], it is thus assumed that there is a LFG capture system at the Canhanduba landfill. While combustion of LFG is not a practice, no destruction of methane occurs. Thus, it is assumed that there is no LFG capture and destruction system at the Canhanduba landfill. Therefore, Case 3 is not applicable either. Thus, the only remaining and applicable case for the project activity is Case 1 (Requirement to destroy methane = No; Existing LFG capture and destruction system = No).

No LFG capture and destruction system would be implemented in the absence of the project (baseline scenario) at the Canhanduba landfill. As per the design of this landfill, a set of LFG conventional venting drains are available in the site in order to have LFG being only vented (freely emitted into the atmosphere) through these drains (with no combustion) and such limited LFG management practice would remain being applied in the baseline scenario (absence of the project activity). The design of the available conventional venting drains that woud also remain being unchanged in the absence of the project activity. Such design is somehow rudimentary and does not allow continuous combustion of LFG as the LFG venting drains are not be conceived for combustion of LFG. Due to aspects and conditions such as the diameter of the LFG venting drains, typical pressure of LFG in these drains, influence of wind and other climate aspects (e.g. rain), as well as the existing operational conditions at the landfill (no working staff has ever been required to attempt to promote combustion LFG in the venting drains and/or to promote any type of monitoring of conditions of the LFG venting drains); it is thus assumed that no LFG would ever be combusted in the existing LFG venting drains (plus additional LFG venting drains that would be implemented) in the baseline scenario (absence of the project activity). In the absence of the proposed CDM project activity, freely venting of LFG through the LFG venting drains (existing ones plus additional venting drains that would otherwise be built) would continue to occur as there is no legal requirement to promote destruction of methane in landfill and the operator of this landfill does not have any incentive or requirement to install passive conventional LFG flares instead of LFG venting drains in order make combustion of LFG technically feasible.

It is important to note that venting of LFG through conventional LFG venting drains (without any combustion of LFG) has been the practice in several others landfills and dump sites in Brazil and other countries in Latin America where no legal requirements for destruction of LFG exists and LFG does not need to be destroyed due to safety or environmental concerns (e.g. odor) either. In most of

[43] As per ACM0001 (version 13.0,0), "LFG capture system" is defined as follows: "*A system to capture LFG. The system may be passive, active or a combination of both active and passive components. Passive systems capture LFG by means of natural pressure, concentration, and density gradients. Active systems use mechanical equipment to capture LFG by providing pressure gradients. Captured LFG can be vented, flared or used."*
As per ACM0001 (version 13.0,0), "existing LFG capture system" is defined as follows: "*An existing active LFG capture system is a system that has been in operation in the last calendar year prior to the start of the operation of the project activity."*

the cases, where combustion of LFG to address odors requirements is not an issue, LFG is normally directly and freely vented through the drains (without any LFG being combusted).

In the absence of the project activity (baseline scenario), installing and monitoring passive LFG flares (instead of keeping the existing LFG venting drains and/or installing additional ones with no monitoring at all) would require investments, operational costs and extra work from the landfill operational team.

Thus, as per ACM0001 (version 13.0) in this situation:

$$F_{CH4,BL,R,y} = 0 \quad \textbf{(19)}$$

Step (B): Baseline emissions associated with electricity generation ($BE_{EC,y}$)

Baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) shall be calculated by applying applicable guidance of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. When applying this methodological 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 using LFG in year *y*.

This Tool declares:

“In the generic approach, project, baseline and leakage emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses (…)”

Specifically for baseline emissions we have:

$$BE_{EC,y} = \sum_{j} EC_{BL,k,y} * EF_{EL,k,y} * (1 + TDL_{k,y}) \quad \textbf{(TE.1[44])}$$

Where:

$BE_{EC,y}$	=	Baseline emissions associated with electricity generation (in tCO_2/yr).
$EC_{BL,k,y}$	=	Net amount of electricity generated using LFG in year *y* (in MWh)
$EF_{EL,k,,y}$	=	Emission factor for electricity generation for source *k* in year *y* (in tCO_2/MWh). $EF_{EL,j/k/l,y}$ represents the combined margin (CM) emission factor for the electricity grid to which the project activity is connected to ($EF_{grid,CM,y} = EF_{EL,grid,y}$).
$TDL_{k,y}$	=	Average technical transmission and distribution losses for providing electricity to source *k* in year *y*
k	=	sources of electricity generated identified in the selection of the most plausible baseline scenario

By following the above-quoted applicable guidance of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, baseline emissions for electricity generation by the project activity ($BE_{EC,y}$), are determined as follows:

[44] Equation numbers from the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” are prefixed with the letters “TE” to distinguish them from equations from the main methodology ACM0001, and from other methodological tools.

$BE_{EC,grid,y} = EC_{BL,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$ **(TE.1.1)**

Where:

$EC_{PJ,grid,y}$	=	Net amount of electricity generated using LFG in year y (in MWh).
$EF_{EL,grid,y}$	=	Emission factor for grid sourced electricity in year *y* (in tCO_2/MWh). $EF_{EL,grid,y}$ is determined as the combined margin (CM) emission factor ($EF_{grid,CM,y}$).
$TDL_{grid,y}$	=	Average technical transmission and/or distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity.

Determination of combined margin (CM) emission factor ($EF_{grid,CM,y} = EF_{EL,grid,y}$):

Option A.1 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is selected for determining $EF_{EL,k,,y}$. thus according to the selected option, the following is applicable:

> *"Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$)."*

The "Tool to calculate the emission factor for an electric system" indicates that the emission factor of the grid is determined by the following six steps:

Calculation of $EF_{grid,CM,y}$

1. Identify the relevant electric systems;
2. Choose whether to include off-grid power plants in the project electricity system;
3. Select a method to determine the operating margin (OM);
4. Calculate the operating margin emission factor according to the selected method;
5. Identify the group of power units to be included in the build margin (BM).
6. Calculate the build margin (BM) emission factor;

Step 1: Identify the relevant electric systems

For the purpose of determining the electricity emission factors, a project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without signification transmission constraints.

The MCT has published a resolution (number 08 on 26/05/2008[45]) which establishes a unique emission factor for the entire national interconnected system.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

[45] http://www.mct.gov.br/upd_blob/0024/24719.pdf accessed on 10/10/2012

Option I: Only grid power plants are included in the calculation;
Option II: Both grid power plants and off-grid power plants are included in the calculation;

The Brazilian DNA is responsible for calculating the emission factors and it is not included in calculation the off-grid power plants, therefore Option I is used.

Step 3: Select a method to determine the operating margin (OM)

Calculate the Operating Margin emission factor(s) ($EF_{grid,OM,y}$) based on one of the following four methods:

(a) Simple OM
(b) Simple adjusted OM
(c) Dispatch Data Analysis OM
(d) Average OM.

The $EF_{grid,OM,y}$ is given by the MCT and calculated under the method: ***Dispatch data analysis OM.***

All the emission factor calculation and explanation documents can be found on MCT website: www.mct.gov.br.[46]

For the option chosen: **Dispatch data analysis OM**, as per the tool project participants will *"…use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring.*"

Step 4: Calculate the operating margin emission factor according to the selected method

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour h where the project is displacing grid electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

The emission factor is provided by the brazilin DNA:

Operating Margin Emission Factor of Brazilian Integrated Electric System for the year 2012

Operating Margin												
Average Emission Factor (tCO_2/MWh)												
Year	**Month**											
2012	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.2935	0.3218	0.4050	0.6236	0.5943	0.5056	0.3942	0.4490	0.6433	0.6573	0.6641	0.6597

Average $EF_{grid,OM-DD,2012}$ is then 0.5176 tCO_2/MWh

Step 5. Calculate the build margin (BM) emission factor.

The Brazilian DNA is responsible for calculating the BM emission factor in Brazil.

[46] Calculation of Grid Emission Factor: Source ONS
(http://www.mct.gov.br/index.php/content/view/338047.html#ancora) accessed on 01/06/2013

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor should be updated annually, ex- post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin factor shall be calculated ex- ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The **Option 2** was chosen for the proposed project.

Step 6: Calculate the Combined Margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available. The build margin is supplied by the DNA as follows:

Build Margin Emission Factor of Brazilian Integrated Electric System

Build Margin	
Average Emission Factor (tCO_2/MWh)	
Year	**2012**
0.2010	

$EF_{grid,BM,2012} = 0.2010$ tCO_2/MWh

$EF_{grid,BM}$ is given by the MCT and explanation documents can be found on its website (www.mct.gov.br).

The baseline emission factor is calculated as the weighted average of the operating margin and builds margin emission factors. To weight these two factors apply the 50% default value to both, the operating margin and build margin emission factors; the combined margin emission factor is obtained as follows:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y} \quad \textbf{(T.E.3)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (in tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (in tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (in %)
w_{BM}	=	Weighting of build margin emissions factor (in %)

The values for w_{OM} and w_{BM} are selected as per the “Tool to calculate the emission factor for an electric system” as follow:

$w_{OM} = w_{BM} = 0.5$ (for the first crediting period)[47].

For the first crediting period, the build margin CO_2 emission factor will be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available.

Step C: Baseline emissions associated with heat generation ($BE_{HG,y}$)

As the project design does not encompass utilization of collected LFG for heat generation, (in boiler, air heater, glass melting furnace(s) and/or kiln), baseline emissions associated with heat generation in year *y* ($BE_{HG,y}$) are not considered. Thus, this step is not applicable.

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

As the project design does not encompass utilization of collected LFG displacing the use of natural gas or injection of collected LFG into a natural gas distribution network, baseline emissions associated with natural gas use in year *y* ($BE_{NG,y}$) are not considered. Thus, this step is not applicable.

Finally:

$$BE_y = (1 - OX_{top\_layer}) * (\eta_{PJ} * BE_{CH4,SWDS,y}/GWP_{CH4} - 0) * GWP_{CH4} + \sum_j EC_{BL,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \textbf{(20)}$$

Monitoring of the management of the landfill:

The design and operational conditions of the landfill will be annually monitored on the basis of different sources, including *inter alia*:

- Original design of the landfill;
- Technical specifications for the management of the Canhanduba landfill landfill;
- Applicable local or national regulations

Original design of the landfill should be confirmed not to be modified in order to ensure that no practice to increase methane generation have been occurring prior or after the implementation of the project activity. Any change in the management of the landfill after the implementation of the project activity should be justified by referring to technical or regulatory specifications. Such monitoring procedure will be used for the determination of baseline emissions and/or confirmation of the project's implementation as described in the registered PDD (in terms of conditions of the landfill from which LFG is combusted).

<u>Project emissions</u>

Project emissions are calculated as follows:

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

[47] The calculation of the grid emission factor is presented in section B.6.3.

Where:

PE_y = Project emissions in year *y* (in tCO_2/yr)

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year *y* (in tCO_2/yr)

$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (in tCO_2/yr)

a) Since the project activity will not consume any fossil fuel for purpose other than electricity generation, there will be no project emissions from fossil fuel consumption ($PE_{FC,y}$ = 0).

b) The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". When applying the tool:

- Electricity sources *j* in the tool corresponds to the sources of electricity consumed due to the project activity. This shall include, where applicable, electricity consumed for the operation of the LFG capture system, for any processing and upgrading of the LFG, for transportation of the LFG to the flare or other applications (boilers, power generators), for the compression of the LFG into the natural gas network, etc.;
- If in the baseline a proportion of LFG is destroyed ($F_{CH4,BL,y}$> 0), then the electricity consumption in the tool ($EC_{PJ,j,y}$) should refer to the net quantity of electricity consumption (i.e. the increase due to the project activity). The determination of the amount of electricity consumed in the baseline shall be transparently documented in the CDM-PDD.

Project emissions due to electricity consumption by the project activity, $PE_{EC,y}$, are determined as follows:

$$PE_{EC,y} = \sum_j EC_{PJ\,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \textbf{(22)}$$

Where:

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year *y* (in $t\,CO_2/yr$)

$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (in MWh)

$EF_{EL,j,,y}$ = Emission factor for electricity generation for source *j* in year *y* (in tCO_2/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

j = Sources of electricity consumption in the project

In the specific case of the emissions from consumption of sources grid and captive the following formula is used:

$$PE_{EC,y} = PE_{EC,grid,y} + PE_{EC,captive,y} \quad \textbf{(23)}$$

Where:

$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year *y* (in tCO_2/yr)
$PE_{EC,grid,y}$	=	Emissions from consumption of grid electricity due to the project activity in year *y* (in tCO_2/yr)
$PE_{EC,captive,y}$	=	Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year *y* (in tCO2/yr)

Where $PE_{EC,grid,y}$ and $PE_{EC,captive,y}$ are calculated according to the following approach:

<u>Project emissions due to the consumption of electricity by the project activity from the grid:</u>

In the case of electricity consumption from the grid, project emissions will be accounted by applying the previous equations with index *j=grid* as follows:

$$PE_{EC,grid,y} = EC_{PJ,grid,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y}) \quad \textbf{(24)}$$

Where:

$PE_{EC,grid,y}$	=	Emissions from consumption of grid electricity due to the project activity in year y (in tCO_2/yr)
$EC_{PJ,grid,y}$	=	Quantity of electricity consumed by the project electricity from the grid in year y (in MWh)
$EF_{EL,grid,,y}$	=	Emission factor for grid electricity generation in year y (in tCO_2/MWh)
$TDL_{grid,y}$	=	Average technical transmission and distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity in year y. In accordance with the applicable provisions of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, $TDL_{grid,y}$ is ex-ante determined as 20% (conservative fixed value along the whole crediting period).

<u>Project emissions due to the consumption of electricity by the project activity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel):</u>

Project emissions from related to backup electricity generation using diesel as fuel will be accounted by using options B2 or B4 as presented below of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” are applied.

As per Option B2 of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, $PE_{EC,captive,y}$ is calculated as follows:

$$PE_{EC,captive,y} = EC_{PJ,captive,y} * EF_{EL,captive,y} * (1 + TDL_{captive,y}) \quad \textbf{(25)}$$

Where:

$EC_{PJ,captive,y}$	=	Quantity of electricity sourced by the captive electricity generator (fuelled by diesel) and consumed by the project activity. $EC_{captive,y}$ will be measured and monitored in MWh/year as per the provisions of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.
$TDL_{captive,y}$	=	Average technical transmission and distribution losses for electricity sourced by the captive electricity generator. In accordance with the applicable provisions of

the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", as a simplification, $TDL_{captive,y}$ is ex-ante determined as zero (fixed value along the whole crediting period).

$EF_{EL,captive,y}$ = CO_2 emission factor for electricity sourced by the captive off-grid electricity generator (in tCO_2/MWh).

As an alternative calculation approach, by taking into account Option B4 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", $PE_{EC,captive,y}$ is calculated based on the rated capacity of the captive off-grid electricity generator to be eventually installed and by assuming a CO_2 emission factor of 1.3 tCO_2/MWh for electricity generated by the captive off-grid electricity generator (which is conservatively assumed as being under operation of 8,760 hours per year) as follows:

$$PE_{EC,captive,y} = 11{,}400\ tCO_2/MWh * PP_{CP,Diesel\text{-}generator} \quad \textbf{(26)}$$

Where:

$PP_{CP,Diesel\text{-}generator}$ = Rated capacity of the installed captive off-grid electricity generator (fuelled by diesel) (in MW)

<u>Leakage emissions</u>

No leakage emissions are expected to occur. Moreover, no leakage effects are accounted for under ACM0001 (version 13.0.0).

B.6.2. Data and parameters fixed ex ante

Data/Parameter	**OX_{top_layer}**
Data unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites” (version 06.0.
Value(s) applied	0.1
Choice of data or measurement methods and procedures	Default value as per ACM0001“Flaring or use of landfill gas”, Version 13.0.0
Purpose of data	Data is use for determination of baseline emissions
Additional comment	-

Data/Parameter	**GWP_{CH4}**
Data unit	tCO_2e/tCH_4
Description	Global Warming Potential of CH4
Source of data	“Global Warming Potential for Given Time Horizon” in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon. Available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14 , on 29/01/2013
Value(s) applied	25
Choice of data or measurement methods and procedures	-
Purpose of data	Data is use for determination of baseline emissions
Additional comment	The applied value shall be updated according to any future COP/MOP decisions and/or decision by the CDM-EB. The current value of 25 is applied according to the “Standard for application of the global warming potentials to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol”.

Data/Parameter	R_u
Data unit	$Pa.m^3/kmol.K$
Description	Universal ideal gases constant
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)
Value(s) applied	8,314
Choice of data or measurement methods and procedures	-
Purpose of data	Data is use for determination of baseline emissions
Additional comment	-

Data/Parameter	**MM_k**
Data unit	kg/kmol
Description	Molecular mass of gas *k*
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)
Value(s) applied	For considered gases *k* that are greenhouse gases, the values below are applied for MM_k. As per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream": *"The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the considered gaseous stream. However as a simplification, only the volumetric fraction of gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen. The simplification is not acceptable if it is differently specified in the underlying methodology.* ACM0001 (version 13.0.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) and the difference to 100% is just considered as pure nitrogen. Compound: Nitrogen; Structure: N_2; Molecular mass (kg/kmol): 28.01
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for determination of baseline emissions
Additional comment	-

Compound	Structure	Molecular mass (kg/kmol)
Nitrogen	N_2	28.01

Data/Parameter	**MM_i**
Data unit	kg/kmol
Description	Molecular mass of greenhouse gas *i*
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)
Value(s) applied	The following values of molecular mass are applicable for CH_4 (the only GHG which is considered): Compound / Structure / Molecular mass (kg/kmol) Methane / CH_4 / 16.04
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for determination of baseline emissions
Additional comment	-

Data/Parameter	**P_n**
Data unit	Pa
Description	Total pressure at normal conditions
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)
Value(s) applied	101,325
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for determination of baseline emissions
Additional comment	-

Data/Parameter	**MM_{H2O}**
Data unit	kg/kmol
Description	Molecular mass of water
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)
Value(s) applied	18.0152
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for determination of baseline emissions
Additional comment	-

Data/Parameter	**T_n**
Data unit	K
Description	Temperature at normal conditions
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)
Value(s) applied	273.15
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for determination of baseline emissions
Additional comment	-

Data/Parameter	η_{PJ}
Data unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	Value obtained from recent technical literature
Value(s) applied	0.9280
Choice of data or measurement methods and procedures	Value obtained from the mentioned literature[48] by taking into consideration the design and operational characteristics/aspects of the Canhanduba landfill and forecasted design of the project's LFG collection network.
Purpose of data	Data is used for determination of baseline emissions
Additional comment	Selected value can also be represented as percentage, since 0.9280 = 92.80%

[48] The paper "*Measuring landfill gas collection efficiency using surface methane concentration*" by Raymond L. Huitric and Dung Kong, from the Solid Waste Management Department of the Los Angeles County Sanitation Districts, states that: *"Measuring landfill gas collection efficiency is important for gauging emission control effectiveness and energy recovery opportunities. Though researched for years, practical measures of collection efficiency are lacking. Instead, a default efficiency of 75% based on surveys of industry estimates is commonly used, for example, by the United States Environmental Protection Agency (US EPA). Though few, actual emission measurements indicate substantially higher efficiencies ranging from 85 to 98%.".* This document mentions that *"(…) landfill gas collection efficiencies should routinely reach 100%."* Practical results, shown on table 4 of the study: Weighted average collection efficiency, show a collection efficiency of 92.8 to 96.1% on well-engineered landfills with vacuum systems to extract LFG. The present landfill is a well-engineered landfill as shown by the maximum classification obtained in IQR in 2009, 2010 and 2011 (Page 57 of the 2011 edition of the "*Inventário dos resíduos sólidos domiciliares*"), the index annually published by CETESB, the environmental state agency, to evaluate landfill characteristics.

"*Measuring landfill gas collection efficiency using surface methane concentration*" is available at http://www.arb.ca.gov/cc/ccea/comments/april/huitric_kong.pdf, accessed on 10/10/2012, and *"Inventário dos resíduos sólidos domiciliares, 2011 edition"* was delivered to the DOE as part of the evidences of the validation process of the project activity.

Data/Parameter	**$TDL_{grid,y}$**
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity.
Source of data	Applicable default as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01)
Value(s) applied	3% (for generated electricity exported through the electricity grid the project activity is connected to ($TDL_{grid,export,y}$)) 20% (for electricity imported by the project activity through the electricity grid the project activity is connected to ($TDL_{grid,import,y}$))
Choice of data or measurement methods and procedures	The “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) defines, as alternative, default value of 20% for project consumption sources (applicable for determination of project emissions due to consumption of grid-sourced electricity by the project activity) and default value of 3% for baseline electricity consumption sources (applicable for the determination of baseline emissions for electricity generation by the project activity). The selection of these default values are under conformance with applicable guidance of ACM0001 (version 13.0.0). While transmission and distribution sources applicable for both grid-sourced electricity to be consumed by the project activity and for electricity generation by the project activity (equivalent to electricity consumption of baseline electricity consumption sources when applying the underlaying tool) do not fit under Scenario B and/or Scenario C (case II) of the such tool, the selected 20% value for $TDL_{grid,import,y}$ and 3% values for $TDL_{grid,export,y}$ are thus under conformance with applicable guidance of the tool. The selection of 20% value for $TDL_{grid,import,y}$ and 3% values for $TDL_{grid,export,y}$ meets applicable guidance for Scenarios A and C (cases I and III) of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) (whichever of these scenarios are applicable for the particular case of the project activity, where, as per the tool, in the case of doubts, case C.III should be identified as a conservative approach). It is relevant to note that as per the project design, the amount of electricity to be consumed by the project activity (project electricity consumption sources) to which scenario C of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) refers is smaller than the so-called electricity consumption of baseline electricity consumption sources ($EC_{BL,k,y}$) as per such tool (where $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$) as defined by ACM0001 (version 13.0.0)). In summary, the project activity generates more electricity than it requires for its operation, with the largest amount of generated electricity being exported through the electricity grid the project activity is connected to. Under these particular conditions, also considering the 3% default value for electricity imported by the project activity (through the electricity grid the project activity is connected to) in thesis would represent an acceptable alternative. However, as a conservative approach, the generic 20% default value of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) applicable for project consumption sources is selected. This approach results in higher project emissions, thus reducing emission reductions to be achieved by the project activity accordingly.

Purpose of data	Data is used for the determination of project emissions due to the consumption of grid electricity by the project activity.
Additional comment	-

Data/Parameter	**$TDL_{captive,y}$**
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to the off-grid captive generator fuelled by diesel in year *y*.
Source of data	Applicable default value when scenario B of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 1), is selected by the project participants.
Value(s) applied	0%
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for the determination of project emissions due to eventual consumption of electricity sourced by a captive off-grid backup electricity generator (fuelled by diesel) by the project activity.
Additional comment	-

Data/Parameter	**$EF_{El,captive,y}$**
Data unit	tCO_2/MWh
Description	Emission factor for electricity sourced by the captive diesel off-grid electricity generator in year *y*
Source of data	Applicable default value as established by the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” for scenario B2.
Value(s) applied	1.3
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system”.
Purpose of data	Data is used for the determination of project emissions due to eventual consumption of electricity sourced by a captive off-grid backup electricity generator (fuelled by diesel) by the project activity.
Additional comment	-

Data/Parameter	w_{BM}
Data unit	%
Description	Weighting of build margin emissions factor
Source of data	Applicable default value as per the “Tool to calculate the emission factor for an electricity system” (Version 03.0.0)
Value(s) applied	0.5 (50%) during the 1st 7-year crediting period
Choice of data or measurement methods and procedures	The applicable value valid for 1st crediting period as per the “Tool to calculate the emission factor for an electricity system” (version 3.0.0) is selected.
Purpose of data	Data is used for the determination of project emissions due to the consumption of grid electricity by the project activity.
Additional comment	-

Data/Parameter	w_{OM}
Data unit	%
Description	Weighting of operating margin emissions factor
Source of data	Applicable default value as per the “Tool to calculate the emission factor for an electricity system” (version 3.0.0)
Value(s) applied	0.5 (50%) during the 1st 7-year crediting period
Choice of data or measurement methods and procedures	The applicable value for the 1st crediting period as per the “Tool to calculate the emission factor for an electricity system” (version 3.0.0) is selected.
Purpose of data	Data is used for the determination of project emissions due to the consumption of grid electricity by the project activity.
Additional comment	-

Data/Parameter	$\varphi_{default}$
Data unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Applicable default value as per the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1)
Value(s) applied	0.75
Choice of data or measurement methods and procedures	Determined based on default value of table 3 of the referred methodological tool as per Option 1, Application A when determining the model correction factor. Value applicable for humid/wet conditions as per Application A is selected (based on the climate conditions valid for the location of the project activity). Source of data of Mean Annual Temperature (MAT) and Mean Annual Precipitation (MAP): Tempo Agora (http://www.tempoagora.com.br/previsaodotempo.html/brasil/climatologia/Itajai-SC/)
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	-

Data/Parameter	**OX**
Data unit	-
Description	Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste))
Source of data	Applicable default value as per the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1)
Value(s) applied	0.1
Choice of data or measurement methods and procedures	-
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	-

Data/Parameter	**F**
Data unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	Applicable default value as per the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1)
Value(s) applied	0.5
Choice of data or measurement methods and procedures	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the considered SWDS. A default value of 0.5 is recommended by IPCC.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	-

Data/Parameter	**$DOC_{f,default}$**
Data unit	Weight fraction
Description	Fraction of degradable organic carbon (DOC) in MSW that decomposes in the considered SWDS.
Source of data	Applicable default value as per the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1), which refers to applicable value as per IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or measurement methods and procedures	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. The default value was applied as per Application A of the tool: “*The CDM project activity mitigates methane emissions from a specific existing SWDS”.*
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	Application A is the case of the current project activity.

Data/Parameter	**$MCF_{default}$**
Data unit	-
Description	Methane correction factor
Source of data	Value is sourced by the methodological tool “Emissions from solid waste disposal sites”, that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	1.0
Choice of data or measurement methods and procedures	Value is selected as per Application A of the methodological tool, under the following conditions: “*1.0: for anaerobic managed solid waste disposal sites. These must 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 will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste;”* The day-to-day MSW disposal activities at the Canhanduba landfill encompasses utilization of appropriate MSW landfilling practices (covering, leveling and mechanical compacting of disposed material) as part of the operations of this landfill. The Canhanduba landfill is regarded as a well-managed landfill site.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	-

Data/Parameter	**DOC_j**
Data unit	-
Description	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
Source of data	Values are selected as per applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1), that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories, (adapted from Volume 5, Tables 2.4 and 2.5).
Value(s) applied	(see table below)
Choice of data or measurement methods and procedures	The selected values are based on wet waste basis (moisture concentrations in the waste streams as waste is delivered to the SWDS). The IPCC 2006 Guidelines also specify DOC values on a dry waste basis, which refers to the moisture concentrations after complete removal of all moisture from the waste. However, this is not believed practical for this situation.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.
Additional comment	-

Waste type *j*	**DOC_j (% wet waste)**
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

<table>
<tr><td>Data/Parameter</td><td>k_j</td></tr>
<tr><td>Data unit</td><td>1/yr</td></tr>
<tr><td>Description</td><td>Decay rate for the waste type j</td></tr>
<tr><td>Source of data</td><td>Values are selected as per applicable guidance of the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1), that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3).

Source of data of Mean Annual Temperature (MAT) and Mean Annual Precipitation (MAP): Tempo Agora (http://www.tempoagora.com.br/previsaodotempo.html/brasil/climatologia/Itajai-SC/)</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Degradation speed</th><th>Waste Type</th><th>k_j</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Wood, wood products</td><td>0.035</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge), textiles</td><td>0.07</td></tr>
<tr><td>Moderately Degrading</td><td>other (non-food) organic putrescible
Garden, yard and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.40</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>Parameters are selected in accordance to the climate zone of the project site:
Mean Annual Temperature (MAT) = 20.03 ºC - Tropical climate
Mean Annual Precipitation (MAP) = 1,525 mm – Wet climate.</td></tr>
<tr><td>Purpose of data</td><td>Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period.</td></tr>
<tr><td>Additional comment</td><td>Domestic sludge was assumed to be rapidly degrading and rubber and leather slowly degrading waste.</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>W_j</td></tr>
<tr><td>Data unit</td><td>-</td></tr>
<tr><td>Description</td><td>Weight fraction of the waste type j</td></tr>
<tr><td>Source of data</td><td>Values are selected as per applicable guidance of IPCC 2006 Guidelines for National Greenhouse Gas, Volume 5, Chapter 2, tables 2.3-2.5, MSW composition regional default values for South-America.</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Waste type j</th><th>W_j
(% wet waste)</th></tr>
<tr><td>Wood and wood products</td><td>4.7</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>17.1</td></tr>
<tr><td>Food, food waste, beverages and tobacco
(other than sludge)</td><td>44.9</td></tr>
<tr><td>Textiles</td><td>2.6</td></tr>
<tr><td>Garden, yard and park waste</td><td>0.0</td></tr>
<tr><td>Glass, plastic, metal, other inert waste</td><td>30.7</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Data is used for the ex-ante estimation of the amount of methane in the LFG which is destroyed or utilized by the project activity ($F_{CH4,PJ,y}$) in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period.</td></tr>
<tr><td>Additional comment</td><td>No analysis of the waste composition available for this landfill.</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$SPEC_{flare}$</td></tr>
<tr><td>Data unit</td><td>Temperature - °C
Flow rate or heat flux - kg/h or m^3/h
Maintenance schedule interval - number of days</td></tr>
<tr><td>Description</td><td>Manufacturer’s flare specifications for temperature, flow rate and maintenance schedule interval.</td></tr>
<tr><td>Source of data</td><td>Probable flaring equipment manufacturer</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>$SPEC_{flare}$</th><th>Min</th><th>Max</th></tr>
<tr><td>Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency): - °C</td><td>850</td><td>1,000</td></tr>
<tr><td>Operational LFG flow (for continuous operation) - m^3/h</td><td>240</td><td>1,200</td></tr>
<tr><td>Required minimum frequency for inspection and maintenance service (incl. inspection in the conditions of the flare isolation ceramics revetment material) - number of days</td><td colspan="2">365</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>As established by the methodological tool “Project emissions from flaring”, the flare specifications and operational + maintenance requirements (as set/recommended by the equipment manufacturer) are documented and considered for the ex-ante determination of applicable values for the parameter $SPEC_{flare}$. During the 1st 7-year crediting period, ex-ante selected data will be compared against monitored data related to the operation of the flares, including:
a) Minimum and maximum monitoring records for data regarding inlet LFG flow rate,
(b) Minimum and maximum monitoring records for data of temperature in the exhaust gas of each individual high temperature enclosed flare; and
(c) Duration in days of time periods between maintenance events for each individual high temperature enclosed flare.</td></tr>
<tr><td>Purpose of data</td><td>Data is used for the calculation of the flare efficiency ($\eta_{flare,m}$) in the context of determination of baseline emissions[49].</td></tr>
<tr><td>Additional comment</td><td>While the project’s engineering phase is not yet performed, the manufacturer for the flare is thus not yet selected. Due to that, information for the ex-ante selected parameter $SPEC_{flare}$ is indicated by considering a high temperature enclosed flare with nameplate LFG flaring installed capacity of 1,200 Nm^3/h model BTG133/09 manufactured by Biotecnogas s.r.l. as the probable flaring equipment to be installed as part of the implementation of the project activity. In case different flaring equipment is later installed, information available in the PDD will be corrected as per applicable CDM procedures and rules to address post-registration changes in registered CDM project activities.</td></tr>
</table>

Data/Parameter	$PP_{CP,Diesel-generator}$
Data unit	MW
Description	Rated capacity of the captive backup diesel generator fuel by diesel
Source of data	Name plate capacity of the captive generator, manufacturer's specifications or catalogue references
Value(s) applied	0.060
Choice of data or measurement methods and procedures	Not applicable
Purpose of data	Calculation of project emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

As presented in Section B.6.1, while emission reductions to be achieved by the project activity are determined as the difference between baseline emissions (BE_y) and project emissions (PE_y), as established by ACM0001 (version 13), the following relevant equations and conditions are applied for the ex-ante estimation of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period:

<u>Determination of ex-ante estimations for baseline emissions (BE_y):</u>

While the project activity encompasses collection and destruction of LFG in high temperature enclosed flares and utilization of collected LFG as gaseous fuel for electricity generation in a grid connected electricity generation facility (to be implemented as part of the project activity), baseline emissions (BE_y) are thus determined as follows:

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad \textbf{(27)}$$

For the 1st 7-year crediting period $BE_{CH4,y}$ is determined as follows:

$$BE_{CH4,y} = (1 - OX_{top\_layer}) * (F_{CH4,PJ,y} - F_{CH4,BL,y}) * GWP_{CH4} \quad \textbf{(28)}$$

[49] As also highlighted in Section B.3, it is important to note that residual project emissions of CH_4 due to the combustion of LFG in enclosed flares are considered in the context of the determination of baseline emissions (although ACM0001 (version 13.0.0) refers to the term "project emissions from flaring".

Where:

OX_{top_layer}	=	0.1
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (in t CH_4/yr)
$F_{CH4,BL,y}$	=	0
GWP_{CH4}	=	25

$$F_{CH4,PJ,y} = \eta_{PJ} * BE_{CH4,SWDS,y} / GWP_{CH4} \quad \textbf{(29)}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (in tCH_4/yr)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (in tCO_2e/yr)
η_{PJ}	=	0.9280
GWP_{CH4}	=	Global warming potential of CH_4 (in t CO_2e/t CH_4)

$$BE_{CH4,SWDS,y} = \varphi_y * (1 - f_y) * GWP_{CH4} * (1 - OX) * \frac{16}{12} * F * DOC_f * MCF * \sum_{x=1}^{y} \sum_j W_{j,x} * DOC_j * e^{-k(y-x)} * (1 - e^{-kj}) \quad \textbf{(30)}$$

With the values mentioned in the previous section.

Regarding project's electricity generation component, $BE_{EC,y}$ is determined as follows:

$$BE_{EC,y} = EC_{BL,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y}) \quad \textbf{(31)}$$

Thus, the resulting grid emission factor for the year 2012 is:

$$EF_{grid,CM} = 0.5 * 0.2010 + 0.5 * 0.5176 = 0.3593 \ \ tCO_2e/MWh \quad \textbf{(32)}$$

For $TDL_{j,y}$. we use a default value of 3%, so that the transmission and distribution losses also reduce to a single value TDL valid at least for the first crediting period.

Therefore:

$$BE_{EC,y} = EC_{BL,y} * 0.3593 * (1 + 3\%) \quad \textbf{(33)}$$

Therefore, the ex-ante estimation of the baseline emissions[50] is

BE_y	Estimation of $BE_{CH4,SWDS,y}$ (tCO_2e)	Estimation of $F_{CH4,PJ,Y}$ (tCH4)	Estimation of $F_{CH4,BL,y}$ (tCH4)	Estimation of $EC_{BL,y}$ (MWh)	Estimation of $BE_{EC,y}$ (tCO_2e)	Estimation of $BE_{CH4,y}$ (tCO_2e)	Estimation of baseline emissions (tCO_2e)
Year	$BE_{CH4,SWDS,y} = \varphi\ (1-f) * GWP_{CH4} * (1-OX) * 16/12 * F * DOC_f * MCF * \sum\sum w_{j,x} * DOC_j * e^{-kj(y-x)} * (1-e^{-kj})$	$F_{CH4,PJ,y} = n_{PJ}*BE_{CH4,SWDS,y}/GWP_{CH4}$	$F_{CH4,BL,y} = F_{CH4,BL,r,y} = 0$	$EC_{BL,y}$	$BE_{EC,y} = EC_{BL,y}* EF_{EL,grid,y} * (1+TDL_{grid,y})$	$BE_{CH4,y} = (1-OX_{top\_layer})(F_{CH4,PJ,y}-F_{CH4,BL,y})*GWP_{CH4}$	$BE_y = BE_{CH4,y}+ BE_{EC,y}$
2014	35,416	1,315	0	3,946	1,461	29,579	31,040
2015	75,499	2,803	0	7,893	2,921	63,057	65,978
2016	79,986	2,969	0	15,786	5,842	66,804	72,646
2017	84,361	3,131	0	15,786	5,842	70,458	76,300
2018	88,671	3,291	0	15,786	5,842	74,058	79,900
2019	92,953	3,450	0	15,786	5,842	77,634	83,476
2020	97,229	3,609	0	15,786	5,842	81,206	87,048
2021	50,760	1,884	0	10,517	3,892	42,395	46,287
Total	**604,875**	**22,452**	**0**	**101,283**	**37,483**	**505,191**	**542,675**

Determination of ex-ante estimations for project emissions (PE_y):

As outlined *in* Section B.6.1, *the* sources of project emissions to be considered in the context of the determination of emission reductions to be achieved by *the project activity are* those due to the consumption of both grid electricity (and electricity sourced by a captive off-grid backup electricity generator fuelled by diesel in emergency situations) by the project activity. The related ex-ante estimations of the corresponding project emissions are determined as follows:

Determination of ex-ante estimations of project emissions due to consumption electricity by the project activity (PE_{ECy}):

As presented in Section B.6.1, PE_{ECy} is determined as follows:

$$PE_{EC,y} = PE_{EC,grid,y} + PE_{EC,captive,y} \quad \textbf{(34)}$$

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \textbf{(35)}$$

$$EF_{grid,CM} = 0.5 * 0.2010 + 0.5 * 0.5176 = 0.3593 \ tCO_2/MWh \quad \textbf{(36)}$$

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} * 0.3593 * (1 + 20\%) \quad \textbf{(37)}$$

[50] In this section of the PDD the calculations presented for **BEy**, **PEy** and **ERy** refer to the period starting in 01/07/2014 to 30/06/2021

Electricity required by the project activity will be sourced by the grid under normal circumstances. During emergency situations, such as grid electricity failures, a backup captive off-grid electricity generator (fuelled by diesel) for emergency purposes will supply the electricity to the project activity. These emergency situations should rarely occur, thus ex-ante project emission arising from electricity sourced by the backup captive off-grid electricity generator (fuelled by diesel) are considered zero. Nevertheless these emissions will be monitored ex-post[51]. Thus, in the context of ex-ante determination of project emissions due to consumption electricity by the project activity, $PE_{EC,Captive,y} = 0$.

By following Option B2 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", $EF_{EL,captive,y}$ is determined as 1.3 tCO_2/MWh and, as a simplification, $TDL_{captive,y}$ is ex-ante determined as zero (fixed value along the whole crediting period). Thus, the ex-ante estimations of project emissions due to consumption of grid electricity by the project activity are as follows:

PE_y	Electricity consumed from the grid (MWh)	Electricity supplied by the captive diesel backup generator (MWh)	Project emissions due to electricity consumption (tCO_2e)
Year	$EC_{PJ,grid,y}$	$EC_{PJ,captive,y}$	$PE_{EC,y} = (EC_{PJ,grid,y} * EF_{EL,grid,y} * (1+TDL_{grid,y}))+ (EC_{PJ,captive,y} * EF_{EL,captive,y} * (1+TDL_{captive,y}))$
2014	163	0	70
2015	325	0	140
2016	325	0	140
2017	325	0	140
2018	325	0	140
2019	325	0	140
2020	325	0	140
2021	163	0	70
Total	**2,275**	**0**	**981**

[51] The captive off-grid backup electricity generator (fuelled by diesel) is expected to be used only for emergency purposes (whenever supply of grid electricity to the project activity is temporarily interrupted). Thus, in the context of ex-ante estimates of emission reductions to be achieved by the project activity, there is estimated amount of electricity to be generated this generator and/or amount of fossil fuel diesel to be consumed by the generator either. Project emissions due to the consumption of electricity sourced by this generator are thus estimated as zero (null) in the context of ex-ante estimates of emission reductions to be achieved by the project activity . However, such project emissions will be determined ex-post along the crediting period (based on applicable monitoring and calculation requirements as presented in Section B.6.1) and will be accounted for the determination of emission reductions.

Therefore the ex-ante estimation of the emission reductions is:

ER_y	Emission reductions (tCO_2e)
Year	$ER_y = BE_y - PE_y$
2014	30,970
2015	65,838
2016	72,506
2017	76,160
2018	79,760
2019	83,336
2020	86,908
2021	46,217
Total	**541,694**

The parameters used can be found on the previous section of this document, with the relevant explanations and sources of data used.

B.6.4. Summary of ex ante estimates of emission reductions

Year[52]	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2014	31,040	70	0	30,970
2015	65,978	140	0	65,838
2016	72,646	140	0	72,506
2017	76,300	140	0	76,160
2018	79,900	140	0	79,760
2019	83,476	140	0	83,336
2020	87,048	140	0	86,908
2021	46,287	70	0	46,217
Total	**542,675**	**981**	**0**	**541,694**
Total number of crediting years	7			
Annual average over the crediting period	**77,525**	**140**	**0**	**77,385**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	**Management of SWDS**
Data unit	-
Description	Management of the SWDS

52 The calculations presented in this table refer to the period starting in 01/07/2014 and ending in 30/06/2021.

Source of data	The design and operational conditions of the landfill will be annually monitored on the basis of different sources, including *inter alia*: - Original design of the landfill; - Technical specifications for the management of the landfill; - Applicable local or national regulations Any occurred or planned relevant change in terms of management of the landfill will be reported and justified.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Original design of the landfill should be confirmed not to be modified in order to ensure that no practice to increase methane generation have been occurring prior or after the implementation of the project activity. Any change in the management of the landfill after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Monitoring frequency	Annually.
QA/QC procedures	Not applicable.
Purpose of data	Data / information will be used for the determination of baseline emissions (+ confirmation of the project's implementation as described in the registered PDD (in terms of conditions of the landfill from which generated LFG is captured and destroyed/utilized)).
Additional comment	-

Data/Parameter	$V_{t,wb,j}$
Data unit	m^3wet gas/h
Description	Volumetric flow of LFG stream in time interval *t* on a wet basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s))
Source of data	Measured as part of the operation of the project activity by applying appropriate LFG flow meter(s). One individual LFG flow meter will be used for each available high temperature enclosed flare and for each item of the electricity generation equipment. Use of measuring instrument/equipment with recordable electronic signal (analogical or digital) is required.

Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Volumetric flow measurement of collected LFG should always refer to the actual LFG absolute pressure and LFG temperature. Calculated based on the wet basis LFG flow measurement and also by considering water concentration.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events for the LFG flow meter(s) will be performed by using a reference primary device provided by a third party independent accredited calibration laboratory. Calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	This parameter will be monitored only in case option C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) is applied for the determination of $F_{CH4,flared,y.}$ and $F_{CH4,EL,y}$ As required by ACM0001 (version 13.0.0), the gaseous stream the tool shall be applied to is the LFG delivery pipeline to each flare and each item of the electricity generation equipment.

Data/Parameter	$\mathbf{V_{t,db,j}}$
Data unit	m^3dry gas/h
Description	Volumetric flow of LFG stream in time interval *t* on a dry basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s))
Source of data	Measured as part of the operation of the project activity by applying appropriate LFG flow meter(s). One individual LFG flow meter will be used for each available high temperature enclosed flare and for each item of the electricity generation equipment.

Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Volumetric flow measurement of collected LFG should always refer to the actual LFG absolute pressure and LFG temperature. Calculated based on the dry basis LFG flow measurement. Use of measuring instrument/equipment with recordable electronic signal (analogical or digital) is required.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events for the LFG flow meter(s) will be performed by using a reference primary device provided by a third party independent accredited calibration laboratory. Calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	This parameter will be monitored only in case option A of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) is applied for the determination of $F_{CH4,flared,y.}$ and $F_{CH4,EL,y}$ As required by ACM0001 (version 13.0.0), the gaseous stream the tool shall be applied to is the LFG delivery pipeline to each flare and each item of the electricity generation equipment.

Data/Parameter	$v_{CH4,t,db}$
Data unit	m^3CH_4/m^3dry gas
Description	Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a dry basis
Source of data	Measured as part of the operation of the project activity by applying an appropriate continuous CH_4 content gas analyzer.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.

Measurement methods and procedures	Measurements to be continuously performed by appropriate gas analyzer operating in dry-basis. Volumetric flow measurement should always refer to the actual pressure and temperature. Use of measuring instrument/equipment with recordable electronic signal (analogical or digital) is required.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events in the continuous CH_4 content gas analyzer will be performed by utilization of calibration span gas with certified CH_4 content (for span checking/adjustment). Utilization of an inert calibration gas (e.g. N_2) will also occur (for span checking/adjustment). All calibration gases (span gases) must have a certificate provided by the gas supplier and must be under their validity period. Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	This parameter may be monitored only in case option A or D of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) is applied for the determination of $F_{CH4,flared,y.}$ and $F_{CH4,EL,y}$ As required by ACM0001 (version 13.0.0), the gaseous stream the tool shall be applied to is the LFG delivery pipeline to each flare and each item of the electricity generation equipment.

Data/Parameter	$v_{CH4,t,wb}$
Data unit	$m^3 CH_4/m^3$ wet gas
Description	Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis
Source of data	Measured as part of the operation of the project activity by applying appropriate continuous CH_4 content gas analyzer.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Measurements to be continuously performed by appropriate gas analyzer operating in wet-basis. Volumetric flow measurement should always refer to the actual pressure and temperature (calculated based on the dry basis analysis plus water concentration measurement or continuous in-situ analyzers). Use of measuring instrument/equipment with recordable electronic signal (analogical or digital) is required.

Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events in the continuous CH_4 content gas analyzer will be performed by utilization of calibration span gas with certified CH_4 content (for span checking/adjustment). Utilization of an inert calibration gas (e.g. N_2) will also occur (for span checking/adjustment). All calibration gases (span gases) must have a certificate provided by the gas supplier and must be under their validity period. Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	This parameter will be monitored only in case option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) is applied for the determination of $F_{CH4,flared,y.}$ and $F_{CH4,EL,y}$. The parameter may be monitored in case option A or D of the methodological tool is applied instead. As required by ACM0001 (version 13.0.0), the gaseous stream the tool shall be applied to is the LFG delivery pipeline to each flare and each item of the electricity generation equipment.

Data/Parameter	$M_{t,db,j}$
Data unit	kg/h
Description	Mass flow of the LFG stream in time interval *t* on dry basis ($M_{t,db,j}$) for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s))
Source of data	Measured as part of the operation of the project activity by applying appropriate LFG flow meter(s). One individual LFG flow meter will be used for each available high temperature enclosed flare and for each item of the electricity generation equipment.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Continuous measurements to be performed by applying appropriate flow meter operating in dry-basis. Mass flow measurement should always refer to the actual pressure and temperature (calculated based on the wet basis flow measurement plus water concentration measurement). Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.

QA/QC procedures	Periodic calibration events for the LFG flow meter(s) will be performed by using a reference primary device provided by a third party independent accredited calibration laboratory. Calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	This parameter will be monitored only in case option D of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) is applied for the determination of $F_{CH4,flared,y.}$ and $F_{CH4,EL,y}$ As required by ACM0001 (version 13.0.0), the gaseous stream the tool shall be applied to is the LFG delivery pipeline to each flare and each item of the electricity generation equipment.

Data/Parameter	$\mathbf{T_t}$
Data unit	K (measurement records in ^{o}C will be converted and also reported in Kelvin)
Description	Temperature of the LFG stream in time interval *t*
Source of data	Measured as part of the operation of the project activity by applying appropriate LFG temperature sensor.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Measured to determine the density of methane ρ_{CH4}. No separate monitoring of LFG temperature is necessary when using LFG flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (by considering standard temperature and pressure (STP) conditions). Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events will be performed in the LFG temperature sensor by a third party independent accredited calibration laboratory in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice. Spare instrument(s) may be kept.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.

Additional comment	In case of measurements for the applicable LFG flow parameter are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), monitoring of this parameter may not be required (except if the applicability condition related to the gaseous stream flow temperature being below 60ºC is adopted. Under this circumstance, this parameter shall be monitored continuously to assure the applicability condition is indeed met).

Data/Parameter	$\mathbf{P_t}$
Data unit	Pa (measurement records in mbar will be converted and also reported in Pa)
Description	Pressure of the LFG stream in time interval *t*
Source of data	Measured as part of the operation of the project activity by applying appropriate LFG pressure sensor.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year y ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	Measured to determine the density of methane ρ_{CH4}. No separate monitoring of LFG pressure is necessary when using LFG flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (by considering standard temperature and pressure (STP) conditions). Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	Continuous measurements will be recorded and reported with an every-minute frequency.
QA/QC procedures	Periodic calibration events will be performed in the LFG pressure sensor by a third party independent accredited calibration laboratory in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice. Spare instrument(s) may be kept.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	$\mathbf{p_{H20,t,Sat}}$
Data unit	Pa (measurement records in mbar will be converted and also reported in Pa)

Description	Saturation pressure of H_2O at temperature T_t in time interval *t*
Source of data	Data as per the literature "*Fundamentals of Classical Thermodynamics*"; Authors: Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994. Published by John Wiley & Sons, Inc.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared and/or used in the project activity in year *y* ($F_{CH4,PJ,y}$) as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill.
Measurement methods and procedures	This parameter is solely a function of the LFG stream temperature T_t and can be found at above-referenced literature for a total pressure equal to 101,325 Pa.
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	**$EC_{PJ,y}$**
Data unit	MWh
Description	Amount of grid electricity consumed by the project activity during the year *y*
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meter(s). The value considered in the context of the ex-ante estimation of emission reductions was selected based on estimations of the project participant.
Value(s) applied	(see table below)
Measurement methods and procedures	Measurement records will be cross-checked against available electricity consumption receipts/invoices issued by the local electricity distribution company. The parameter $EC_{PJ,grid,y}$ is equivalent to the parameter $EG_{EC,y}$ as indicated in ACM0001 (version 13.0.0).

Year	$EC_{PJ,grid,y}$
2014	163
2015	325
2016	325
2017	325
2018	325
2019	325
2020	325
2021	163
Total	**2,275**

Monitoring frequency	Continuous measurements will be aggregated manually or automatically. Accumulated measurement records will be reported at with a at least every-month frequency.
QA/QC procedures	Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of project emissions.
Additional comment	The ex-ante value was obtained by multiplying the base power of the electrical equipment that encompass the project activity, 37.0 kW, by the 8,760 hours per year.

Data/Parameter	**$EC_{PJ,captive,y}$**
Data unit	MWh
Description	Quantity of electricity generated in captive diesel backup generator during the year *y*
Source of data	Onsite measurements when the captive diesel generator is installed.
Value(s) applied	0 (per year)
Measurement methods and procedures	Use authorized electricity meters.
Monitoring frequency	Measurements will be aggregated manually or automatically. Accumulated measurement records will be reported at with at least every-month frequency.
QA/QC procedures	Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of project emissions.
Additional comment	The captive off-grid backup electricity generator (fuelled by diesel) is expected to be used only for emergency purposes (whenever supply of grid electricity to the project activity is temporarily interrupted). Thus, in the context of ex-ante estimates of emission reductions to be achieved by the project activity, there is estimated amount of electricity to be generated this generator and/or amount of fossil fuel diesel to be consumed by the generator either. Project emissions due to the consumption of electricity sourced by this generator are thus estimated as zero (null) in the context of ex-ante estimates of emission reductions to be achieved by the project activity. However, such project emissions will be determined ex-post along the crediting period (based on applicable monitoring and calculation requirements as presented in Section B.6.1) and will be accounted for the determination of emission reductions.

Data/Parameter	**$EC_{BL,y}$**
Data unit	MWh

Description	Amount of electricity generated using LFG by the project activity in year *y*
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meter(s).
Value(s) applied	<table><tr><th>Year</th><th>$EC_{BL,y}$</th></tr><tr><td>2014</td><td>3,946</td></tr><tr><td>2015</td><td>7,893</td></tr><tr><td>2016</td><td>15,786</td></tr><tr><td>2017</td><td>15,786</td></tr><tr><td>2018</td><td>15,786</td></tr><tr><td>2019</td><td>15,786</td></tr><tr><td>2020</td><td>15,786</td></tr><tr><td>2021</td><td>10,517</td></tr><tr><td>**Total**</td><td>**101,283**</td></tr></table>
Measurement methods and procedures	Use authorized electricity meters.
Monitoring frequency	Continuous measurements will be aggregated manually or automatically. Accumulated measurement records will be reported at with a at least every-month frequency.
QA/QC procedures	Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Monitoring data will be used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	$EF_{grid,OM,y} = EF_{grid,OM-DD,y}$
Data unit	tCO_2/MWh
Description	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y.*
Source of data	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the "Tool to calculate the emission factor for an electricity system". The selected value considered in the context of the ex-ante estimation of emission reductions is the value calculated by the DNA of Brazil and valid for year 2012.
Value(s) applied	0.5176
Measurement methods and procedures	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the "Tool to calculate the emission factor for an electricity system".

Monitoring frequency	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data	Monitoring data will be used for the determination of project emissions.
Additional comment	-

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year *y*
Source of data	Data will be determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system”. The selected value considered in the context of the ex-ante estimation of emission reductions is the value calculated by the DNA of Brazil and valid for year 2012.
Value(s) applied	0.2010
Measurement methods and procedures	Data will be determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system”.
Monitoring frequency	Data will be determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data	Monitoring data will be used for the determination of project emissions.
Additional comment	-

Data/Parameter	$Op_{j,h}$
Data unit	-
Description	Operation of the equipment that consumes the LFG
Source of data	Project participants
Value(s) applied	Not used in ex-ante estimates.

Measurement methods and procedures	For each equipment unit *j* using LFG, monitor that the plant is operating in hour *h* by the monitoring any one or more of the following three parameters: - Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; - Flame. Flame detection system is used to ensure that the equipment is in operation; - Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns) $Op_{j,h}$ = 0 when: - One of more temperature measurements are missing or below the minimum threshold in hour *h* (instantaneous measurements are made at least every minute); - Flame is not detected continuously in hour *h* (instantaneous measurements are made at least every minute); - No products are generated in the hour *h* Otherwise, $Op_{j,h}$ =1
Monitoring frequency	Hourly
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions.
Additional comment	In the context of the project activity the equipment that consumes the LFG is the electricity generation plant, thus, the parameter to monitor is electricity generation in the hour *h*.

Data/Parameter	$\mathbf{F_{CH4,EG,t}}$
Data unit	kg
Description	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*
Source of data	Measurements undertaken by a third party accredited entity
Value(s) applied	-
Measurement methods and procedures	Measure the mass flow of methane in the exhaust gas according to an appropriate national or international standard such as the UK's Technical Guidance LFTGN05 or a similar standard. The time period *t* over which the mass flow is measured must be at least one hour. The average flow rate to the flare during the time period *t* must be greater than the average flow rate observed for the previous six months.
Monitoring frequency	Biannual

QA/QC procedures	QA/QC procedures are to be applied by the entity responsible for performing the related measurements as per requirements of the applied standard. Periodic calibration events in the applied instruments by the third party will be performed by a third party independent accredited calibration laboratory (in a frequency as per instrument specifications and/or instrument manufacturer's recommendations). Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Calculation of baseline emissions
Additional comment	Monitoring of this parameter is required in the case of enclosed flares and if the project participants select Option B.1 to determine flare efficiency.

Data/Parameter	$\mathbf{T_{EG,m}}$
Data unit	ºC
Description	Temperature in the exhaust gas of the enclosed flare in minute *m*
Source of data	Measurements performed by the project participant
Value(s) applied	-
Measurement methods and procedures	Measure the temperature of the exhaust gas in the flare by appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare. Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature.
Monitoring frequency	Once per minute
QA/QC procedures	Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule.
Purpose of data	Calculation of baseline emissions.

Additional comment	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met. Periodic calibration events will be performed in the instruments by a third party independent accredited calibration laboratory in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instruments will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice. Spare instrument(s) may be kept.

Data/Parameter	**$Flame_m$**
Data unit	Flame status "*on*" or flame status "*off*"
Description	Flame detection of flare in the minute *m*.
Source of data	Measurements/monitoring performed by the project participant.
Value(s) applied	-
Measurement methods and procedures	Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red or both.
Monitoring frequency	Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off.
QA/QC procedures	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations.
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to all flares. Periodic calibration events will be performed in the instruments by a third party independent accredited calibration laboratory in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instruments will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice. Spare instrument(s) may be kept.

Data/Parameter	**$Maintenance_y$**
Data unit	Calendar dates
Description	Maintenance events completed in year *y*

Source of data	Project participants
Value(s) applied	Not used on ex-antes estimates.
Measurement methods and procedures	Record the date that maintenance events were completed in year *y*. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates.
Monitoring frequency	Annual
QA/QC procedures	Records must be kept in a maintenance log for two years beyond the life of the flare
Purpose of data	Calculation of baseline emissions
Additional comment	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{flare}$).

B.7.2. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

>>

General monitoring:

The following instruments will monitor the required data, depending on the measurement option chosen[53]:

Instrument or Source of data	Measurement option		Data monitored	
Adequate volumetric or mass flow meter (s)	A	Volume flow – dry basis; Volumetric fraction dry or wet basis	$\mathbf{V_{t,db,j}}$	Volumetric flow of LFG stream in time interval *t* on a dry basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) (m^3 dry gas/h)
	C	Volume flow – wet basis; Volumetric fraction wet basis	$\mathbf{V_{t,wb,j}}$	Volumetric flow of LFG stream in time interval *t* on a wet basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) (m^3 wet gas/h)

[53] Measurement options defined in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) when referring to "Adequate volumetric or mass flow meter (s)" and defined in the methodological tool Project emissions from flaring" (Version 02.0.0) in other cases.

Instrument or Source of data	Measurement option		Data monitored	
	D	Mass flow – dry basis; Volumetric fraction dry or wet basis	**$M_{t,db,j}$**	Mass flow of the LFG stream in time interval *t* on dry basis ($M_{t,db,j}$) for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) (kg/h)
CH_4 Gas analyser	-		**$v_{CH4,t,db/wb,j}$**	Volumetric fraction of methane on the gaseous stream *j* in a time interval t on a dry or wet basis (m^3 CH_4/m^3 dry or wet gas)
Pressure sensor	-		**P_t**	Pressure of the LFG stream in time interval *t* (not monitored when using flowmeter that automatically measures temperature and pressure, expressing LFG volumes in normalised cubic meters) (Pa or mbar)
Temperature sensor	-		**T_t**	Temperature of the LFG stream in time interval *t* (K or ºC)
Electricity meter	-		**$EC_{PJ,y}$**	Amount of electricity consumed by the project activity in year *y* (MWh)
			$EC_{PJ,Captive,y}$	Quantity of electricity supplied by the captive diesel backup generator to the project activity during the year *y* (MWh/yr)
			$EC_{BL,y}$	Amount of electricity generated using LFG by the project activity in year *y* (MWh)
Project participants	-		**$p_{H20,t,Sat}$**	Saturation pressure of H_2O at temperature T_t in time interval *t* This parameter is solely a function of the LFG stream temperature T_t and can be found at referenced literature.
Project participants	-		**Management of SWDS**	Management of SWDS The design and operational conditions of the landfill will be annually monitored on the basis of different sources, including *inter alia*: - Original design of the landfill; - Technical specifications for the management of the landfill; - Applicable local or national regulations
Project participants	-		**$EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$**	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y.* (tCO_2/MWh) Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the “Tool to calculate the emission factor for an electricity system”.
Project participants	-		**$EF_{grid,BM,y}$**	Build margin CO_2 emission factor in year *y* (tCO_2/MWh) Data will be determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system”.

Instrument or Source of data	Measurement option	Data monitored	
Project participants	-	**$EF_{El,captive,y}$**	Emission factor for electricity sourced by the captive diesel off-grid electricity generator in year *y.* (tCO_2/MWh) Data will be determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system".
Project participants	-	**$Op_{j,h}$**	Operation of the equipment that consumes the LFG For each equipment unit *j* using *the LFG* monitor that the plant is operating in hour *h* by the monitoring any one or more of the following three parameters: - Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; - Flame. Flame detection system is used to ensure that the equipment is in operation; $Op_{j,h}$=0 when: - One of more temperature measurements are missing or below the minimum threshold in hour *h* (instantaneous measurements are made at least every minute); - Flame is not detected continuously in hour *h* (instantaneous measurements are made at least every minute); - No products are generated in the hour *h* Otherwise, $Op_{j,h}$=1
Measurements undertaken by a third party accredited entity	**B.1**	**$F_{CH4,EG,t}$**	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t* (kg) Measure the mass flow of methane in the exhaust gas according to an appropriate national or international standard e.g. UKs Technical Guidance LFTGN05. The time period *t* over which the mass flow is measured must be at least one hour. The average flow rate to the flare during the time period *t* must be greater than the average flow rate observed for the previous six months Monitoring of this parameter is required in the case of enclosed flares and if the project participants select Option B.1 of the methodological tool "Project emissions from flaring" to determine flare efficiency.

Instrument or Source of data	Measurement option	Data monitored	
Thermocouple	**A or B.1**	**$T_{EG,m}$**	Temperature in the exhaust gas of the enclosed flare in minute *m* (ºC) Measure the temperature of the exhaust gas in the flare by appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare. Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.
Project participants	**A or B.1**	**$Flame_m$**	Flame detection of flare in the minute *m* (Flame on or Flame off) Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red or both.
Project participants	**B.1**	**$Maintenance_y$**	Maintenance events completed in year *y* (Calendar dates) Record the date that maintenance events were completed in year *y*. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates.

All continuously measured LFG related parameters as well as measurements related to the exhaust gas of the flare(s) (temperature in the exhaust gas of the flare(s), and eventually other parameters related to flare operational conditions) will all be recorded electronically via an appropriate data logger / data acquisition system (to be located within the site boundary) which will have the capability to record all data in a safe manner (thus ensuring the required data reliability and validity). Data recording and reporting frequency for these parameters will be every one minute, unless otherwise required by applicable tool or methodology.

Records of grid electricity consumed and generated by the project activity will be aggregated manually or automatically (depending on the specifications of electricity meter(s)). Accumulated measurement records will be reported at with an at least every-month frequency.

By the use of appropriate software application, recorded monitoring data will be regularly retrieved, aggregated and reported in order to be considered in the context of calculations of emission reduction achieved by the project activity.

Monitoring records available in the data logger / data acquisition system will be regularly retrieved remotely by modem or directly on site. If automatic data logging by the logger / data acquisition system fails, measurement data will be recorded manually (whenever it is possible). If data is not

properly recorded or cannot be retrieved, no emissions reductions will be claimed for the period encompassing such data failure.

All monitoring data will also be recorded or backed-up in a central data base.

Data records will be summarized into emission reduction calculations prior to each periodic CDM verification. All data recorded by the data logger / data acquisition system will be made available to the Designated Operational Entities (DOEs) responsible for each periodic verification. This will ensure that data integrity and reliability for related monitoring data.

Access to monitoring data will be restricted and controlled. All monitoring records will be kept archived until at least two years after the end of the crediting period or at least two years after the last issuance of CER's for the project activity, whichever occurs later.

It will be the responsibility of the monitoring team manager to ensure that all monitoring data is properly measured and recorded.

Technical specifications for monitoring instruments/equipment (e.g. manufacturer, model, serial numbers, accuracy, etc.) will be known only at the time of project's implementation.

Maintenance and calibration for monitoring instruments/equipment and project's equipment/components in general:

Maintenance service and routines will includes all preventive and corrective actions necessary for ensuring good functioning of all project related equipment, such as:

- Visual control of the equipment state and real-time check of displayed parameters,
- Cleaning up the equipment and the sensors,
- Lubrication and greasing,
- Replacement or overhauling of defective parts (including regular welding service in the PE pipelines and manifolds).

Calibration events in monitoring instruments/equipment will be periodically and appropriately performed as per applicable frequency, procedures and methods established or recommended by instrument/ equipment manufacturer, national/international standards and/or best practice, as available.

General malfunction of equipment: if monitoring instruments/equipment or project's equipment/components in general fail, applicable repair or replacement actions will be carried out. Spare units for some of the monitoring instruments/equipment will eventually be kept on site.

Project's operational and management structure:

An appropriate project's operational and management structure will be defined and implemented as part of the implementation of the project.
The project's operational and management structure will rely on staff with responsibilities clearly defined. All collaborators and employees involved with operation of project and/or monitoring will be trained internally and/or externally. Training may include *inter alia*:

a) General competence development about LFG generation and collection;
b) Review of equipment operational principles and captors;
c) Maintenance and calibration requirements for project's related equipment;
d) Procedures for monitoring data gathering and handling;
e) Emergency and safety procedures;

The monitoring plan will be implemented by reflecting the best monitoring practice for LFG collection and destruction projects.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>
Project starting date: 01/04/2014 (estimated).

As per the current forecast, the project starting date is thus forecasted to occur in 01/04/2014. The assumed project starting date corresponds to the foreseen date when initial engineering and construction related work starts or date when ordering (acquisition) of project related main equipment occurs.

C.2. Expected operational lifetime of project activity

>>
At least 20 years and 0 months.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
First 7-year renewable crediting period.

C.3.2. Start date of crediting period

>>
The crediting period will start on 01/07/2014, or on the considered date of the registration of the CDM project activity (whichever is later).

C.3.3. Duration of crediting period

>>
7-year renewable.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
According to the Brazilian laws, the possible environmental impacts are analyzed by the local environmental institution (FATMA - *Fundação do Meio Ambiente*).

The Canhanduba landfill site (where the project activity will be located) received from FATMA the Operational License no.58/2012 on 05/01/2012. This license is valid for 48 months.

The EIA (Environmental Impact Study, or, Estudo de Impacto Ambiental) is regulated by Resolução Conama n° 1/86[54]. That mentions the activities that are subjected to the Environmental Impact Study. Landfill gas flaring is not subjected to the Environmental Impact Study[55], neither power generation plants below 10 MW, which is the case of the current project activity.
Thus, no additional licensing effort is required for the implementation of the proposed CDM project activity.

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[54] Available at http://licenciamento.cetesb.sp.gov.br/legislacao/federal/resolucoes/1986_Res_CONAMA_1_86.pdf, accessed on 10/10/2012.

[55] This is in accordance with the licensing procedure currently adopted by environmental authorities from Santa Catarina state.

There will be no transboundary impacts resulting from this project activity. All the relevant impacts occur within Brazilian borders and have been mitigated to comply with the environmental requirements for project's implementation.

The environmental impact of the project activity on the landfill site can be summarized as follows:

- The project will have a positive influence on the local environment by promoting the destruction of gases like H_2S and derivatives of methane, mercaptenes and other chemical compounds that result in bad odors and sanitary risks in the neighboring populations: such as diseases and asthma due to the air pollution.
- Efficient collection and destruction of LFG will reduce risks of explosion in the landfill site. Indeed, in the presence of a specific proportion of oxygen, the methane contained in the landfill gas can become explosive. Due to that, the project activity will be operated with continuous monitoring and control of the oxygen content of collected LFG which is sent to the flare(s), thus continuously controlling the risk of explosions.

The operation of enclosed high temperature flares can generate noise and vibration in case of operational problems. As part of the operation of the project activity, it will be ensured that the installed flare(s) always operate in accordance with the operational requirements and conditions as established by the equipment manufacturer. That will minimize the occurrence of noise and vibration that could negatively affect working staff of the landfill and people living in the surrounding areas.

D.2. Environmental impact assessment

>>

As mentioned in Section D.1, the development of an Environment Impact Assessment (EIA) is not required for the project activity. Thus, no EIA is expected to be developed.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

The Designated National Authority (DNA) of Brazil has established specific procedures and requirements for project developers to invite local stakeholders of projects proposed under the CDM for making comments about aspects of the projects (including contribution of the project towards sustainable development). Meeting these requirements is a pre-requisite for the issuance of the Letter of Approval (LoA) for the project activity by the DNA of Brazil.

As per Resolutions No. 1, 4 and 7 of the DNA of Brazil, project participant/project developer shall submit written communications (letters) to selected stakeholders at least 15 days prior to the start of the CDM validation assessment of a project activity being proposed under the CDM. Submitted letters should refer to the proposed project (including name and type of the activity project); refer to a web-link where the PDD for the project is made available (in a version translated into Brazilian Portuguese language) and description of how the proposed project activity contributes towards sustainable development in the host country Brazil, by referring to the document named "*Anexo III*".

As per current rules of the DNA of Brazil, the contribution of a CDM project activity being proposed in Brazil towards sustainable development shall be described by the project participants in a separated document commonly named "*Anexo III*" (Annex III). This document shall emphasize contribution of the proposed CDM project activity within 5 main aspects:

- Local environmental sustainability
- Development in local laboring conditions and net generation of employment opportunities
- Income distribution
- Technological development

- Regional integration and articulation with other sectors / actors

Furthermore, the communication shall invite the receivers for providing comments about the proposed project.

The initial version of the PDD and the "*Anexo III*" document for the project activity was made available online at: www.unicarbo.com.br/projetos

The following letters were sent also on 30/10/2012 to the following stakeholders involved and affected by the project activity:

1. Interministerial Commission for the Global Climate Change (DNA of Brazil)
2. FATMA – Santa Catarina State Environmental Agency - Central office in Florianópolis city;
3. FATMA – Santa Catarina State Environmental Agency – Regional office in the Municipality of Itajaí (CODAM);
4. Brazilian Forum of NGO´s;
5. Brazilian Forum of Climate Change;
6. Federal Public Attorney Office - Federal office in Brasilia;
7. Federal Public Attorney Office – Santa Catarina State office in Santa Catarina;
8. Public Attorney Office for Santa Catarina State;
9. Santa Catarina Public State Attorney Environmental office - Centro de Apoio Operacional do Meio Ambiente (CME);
10. City Hall of Itajaí;
11. City Council (local legislative chamber) of Itajaí;
12. Secretary of Municipal Services and Environment of Itajaí

Due to the impossibility of contacting all the local stakeholders, the DNA fo Brazil requested, through the official communication 801/MDL/2013 (dated 18/06/2013) compliance with the Resolution No. 10 of the DNA of Brazil[56]. As per this resolution, all local stakeholders[57] were invited by written communication to a public meeting where the project activity was presented.
Invitations to the public meeting were submitted on 11/07/2013 to the following entities:

1. Interministerial Commission for the Global Climate Change (DNA of Brazil)
2. FATMA – Santa Catarina State Environmental Agency - Central office in Florianópolis city;
3. FATMA – Santa Catarina State Environmental Agency – Regional office in the Municipality of Itajaí (CODAM);

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[56] Available at http://www.mct.gov.br/upd_blob/0226/226477.pdf, accessed on 23/07/2013

[57] As defined per Resolutions No. 1, 4 and 7 of the DNA of Brazil available at:

http://www.mct.gov.br/index.php/content/view/14797/Resolucoes_da_Comissao_Interministerial_na_condicao_de_Autoridade_Nacional_Designada_do_Mecanismo_de_Desenvolvimento_Limpo.html accessed on 23/07/2013

4. Brazilian Forum of NGO´s;

5. Brazilian Forum of Climate Change;

6. Federal Public Attorney Office - Federal office in Brasilia;

7. Federal Public Attorney Office – Santa Catarina State office in Santa Catarina;

8. Public Attorney Office for Santa Catarina State;

9. Santa Catarina Public State Attorney Environmental office - Centro de Apoio Operacional do Meio Ambiente (CME);

10. City Hall of Itajaí;

11. City Council (local legislative chamber) of Itajaí;

12. Secretary of Municipal Services and Environment of Itajaí;

13. FAMAI – Itajaí Municipal Environmental Agency;

14. COOPERFOZ – Recyclable Waste Collectors Association of the Mouth of the Itajaí River;

The public meeting took place at the Canhanduba landfill on the 19/07/2013 at 14:00 hours. The following local stakeholders were present:

Name	Institution
Francisco do Nascimento	FAMAI – Itajaí Municipal Environmental Agency
Rogéria Gregório	FAMAI – Itajaí Municipal Environmental Agency
Graziela Ramos	City Hall of Itajaí
Wagner Fonseca	FATMA – Santa Catarina State Environmental Agency – Regional office in the Municipality of Itajaí (CODAM);

Mr. Eduardo Cabral Covas and Mr. Holdemar Alves were present and represented the project participant. Ms. Juliana Ramos, Mr. Marco Antônio Avila and Mr. Bruno Francisco Muehlbauer were also present and represented the landfill owner and operator Ambiental Limpeza Urbana e Saneamento Ltda..

A detailed presentation of the project activity was performed by Mr. Eduardo Cabral Covas (one of the representatives of the project participant Itajaí Biogás e Energia S.A.). The presentation consisted on a technical description of the project activity, including how the LFG is generated at the landfill and how the project activity will use the LFG in order to generate electricity. It was also presented how the project activity promotes GHG reductions and how such emission reductions are accounted. The presentation also included a description of the environmental aspects of the project activity. Following the presentation all stakeholders were invited by the representative of the project participant for comments and questions about the project activity.

E.2. Summary of comments received

>>

No comments were received as response to the letters sent to local stakeholders inviting for comments, on 30/10/2012, until present time (more than 4 months after the submission of the letters).

During the occurred public meeting (on 19/07/2013) the following comments/questions were received:

1. Ms. Graziela Monteiro emphasized the Canhanduba landfill will become an interesting place to visit when the project activity is implemented.

2. Mr. Franciso do Nascimento highlighted that the Canhanduba landfill is already a positive reference in the State of Santa Catarina and the perception of the conditions and operational practices at the landfill will be positively improved with the implementation of an efficient LFG collection system + destruction and utilization of LFG.

3. Mr. Francisco do Nascimento also mentioned that public institutions are being contacted by several companies offering solutions to use solid waste as energy source (waste incineration). He also mentioned that previous consultation with the local electricity distribution company is important.

4. Mr. Eduardo Cabral Covas mentioned that most of the solutions presented by the companies, mainly the ones that involve waste incineration process are still economically and technically unfeasible in the context of the situation of the Brazilian solid waste sector.

5. Mr. Wagner Fonseca mentioned that it is instrumental that the electricity generation component of the project activity be effectively registered under the Brazilian Agency for Electricity (ANEEL). He also highlighted that registration of the project’s electricity generation component as a grid-connected electricity generation source at ANEEL represents a prerequisite for obtaining its operational license. As a response to the received comment, Mr. Eduardo Cabral Covas confirmed that the registration process of the project’s electricity generation component at ANEEL (and all other applicable procedures) is in progress.

E.3. Consideration of comments received

>>

No comments were received as response to the letters sent to local stakeholders inviting for comments, on 30/10/2012, until present time.

The comments and questions received during the public meeting were unanimously positive. It is not considered that any specific consideration or modification of the project is required.

SECTION F. Approval and authorization

>>

The letter(s) of approval from the Parties for the project activity are not available at this time.

Appendix 1. Contact information of project participants

Organization name	Itajaí Biogás e Energia S.A.
Country	Brazil
Address	Alameda Dr. Carlos de Carvalho, nº 555, Centro, cj 53/54 Curitiba – Paraná CEP 80.430-180
Telephone	+ 55 41 3079 7100
Fax	
E-mail	eduardorccb@jmalucelli.com.br
Website	
Contact person	Mr. Eduardo Covas Barrionuevo

Appendix 2. Affirmation regarding public funding

Not applicable. The implementation and operation of the project do not involve any kind of public funding from Parties included in Annex I.

Appendix 3. Applicability of methodologies and standardized baselines

Information about the applicability of selected methodology and methodological tools is presented in Section B.2.

Appendix 4. Further background information on ex ante calculation of emission reductions

All information about the ex-ante calculation of emission reductions are summarized in Section B.6.3. An emission reduction calculation spreadsheet includes all calculations of figures which are indicated in Section B.6.3. This spreadsheet is enclosed to this PDD.

Appendix 5. Further background information on monitoring plan

All information about the design and operation of the monitoring plan are presented in Section B.7.1.

Appendix 6. Summary report of comments received from local stakeholders

All information regarding comments received from local stakeholders are presented in Section E.2.

Appendix 7. Summary of post-registration changes

The revised version of the PDD (version 6.1, dated 07/11/2018) includes the following permanent post-registration changes:

Corrections (in information that do not affect the project design):

- Missing applicable default value (valid for generated electricity exported through the electricity grid the project activity is connected to) is added under details for the ex-ante determined (fixed) parameter "Average technical transmission and distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity" ($TDL_{grid,y}$) in Section B.6.2. Furthermore, while the previously selected 20% default value became applicable only for grid-sourced electricity imported by the project activity and is termed as $TDL_{grid,import,y}$, the added 3% missing default value is termed as $TDL_{grid,export,y}$. Texts in Sections B.6.1 and B.6.3 are adjusted accordingly.

- Calculations of ex-ante estimates of emission reductions to be achieved by the project activity during the 2nd 7-year crediting period are corrected in both Section B.6.3 and in a revised version of the emission reduction calculation spreadsheet (that is enclosed to the PDD) by taking into account the missing 3% default value for the ex-ante determined (fixed) parameter $TDL_{grid,y}$ (value applicable for generated electricity exported through the electricity grid the project activity is connected to).

- Statements confirming that the project activity (and/or the infrastructure/components it encompasses) were previously included as part of a previously registered CDM project activity or even as a Component Project Activity (CPA) (that has been later excluded from a previously registered CDM Programme of Activities (PoA)) are added in Sections A.1 and A.6.

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Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.

Version	*Date*	*Description*
09.0	24 May 2017	Revision to: • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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